DCN 1003

BASE VISIT REPORT

THURSDAY 6 APRIL 95

BROOKS AIR FORCE BASE
SAN ANTONIO, TEXAS

LEAD COMMISSIONER:

Commissioner Ben Montoya

ACCOMPANYING COMMISSIONERS:

Commissioner Rebecca Cox
Commissioner Joe Robles
Commissioner Wendi Steele

COMMISSION STAFF:

Les Farrington, Cross Service Team
Craig Hall, Air Force Team
Joe Varallo, Cross Service Team

LIST OF ATTENDEES:

Elected officials/staff:
San Antonio Mayor Nelson Wolff
U. S. Senator Phil Gramm's staff: Bill Christian, Scott Keith
U. S. Senator Kay Bailey Hutchison's staff: Arthur Troilo
U. S. Representative Frank Tejeda's staff: Nick Dauster
U. S. Representative Henry Bonilla's staff: Phil Ricks

Brooks employees representatives:
International Association of Fire Fighters: Terry Shippey
AFGE Local 1757: Dino Urdialez

Brooks/HSC staff:

B Gen Belihar	Col Smogur
Mr. Grann	Lt. Col. Hartranft
Col. Irving	Col. Binion
Dr. Godfrey	Col. Pohamus
Col. Jones	
Col. Morlang	A.F. Center for Environmental Excellence: Col. Gorges
Col. Hudson	
Col. Antonio	

PRESENT MISSION OF BASE:

Among its many functions, Brooks is the home of the Human Systems Center (HSC) of the Air Force Material Command. HSC conducts scientific and technical research related to the integration of human factors in Air Force systems. A key component of the HSC is Armstrong Laboratory, one of the four Air Force superlabs, which conducts both in-house and contracted basic, exploratory and advanced development research. In addition, the HSC oversees the USAF School of Aerospace Medicine, the Air Force Center for Environmental Excellence and the Air Force medical support agency, among other tenants and functions at Brooks.

DOD RECOMMENDATION:

Close Brooks AFB. Relocate the Human Systems Center (HSC), including the School of Aerospace Medicine and the Armstrong Laboratory, to Wright-Patterson AFB, Ohio. However, some portion of the Manpower and Personnel function, and the Air Force Drug Test laboratory, may relocate to other locations. The 68th Intelligence Squadron will relocate to Kelly AFB, Texas. The Air Force Center for Environmental Excellence will relocate to Tyndall AFB, Florida. The 71Oth Intelligence Flight (AFRES) will relocate to Lackland AFB, Texas. The hyperbaric chamber operation, including associated personnel, will relocate to Lackland AFB, Texas. All activities and facilities at the base including family housing and the medical facility will close.

DOD JUSTIFICATION:

The Air Force has more laboratory capacity than necessary to support current and projected Air Force research requirements. When compared to the attributes desirable in laboratory activities, the Armstrong Lab and Human Systems Center operations at Brooks AFB contributed less to Air Force needs as measured by such areas as workload requirements, facilities and personnel.. As an installation, Brooks ranked lower than the other categories than the other bases in the Laboratory and Product Center subcategory.

MAIN FACILITIES REVIEWED:
The day began with a briefing by General Belihar and the Command staff at Brooks.
The tour included: (In-between building visits, a windshield tour was conducted of housing areas and new construction, and other areas.)
1) United States Air Force School of Aerospace Medicine (SAM) (Bldg 180)
2) Crew Technology Division (Bldg 170)
3) Aerospace Physiology Department (Bldg 160)
4) Veterinary Sciences Division (Bldg 125)
5) Occupational and Environmental Health Directorate (Bldg 140)
6) Hangar 9 (Museum) for Human Systems display
7) Directed Energy Branch (Bldg 1184)

At the officers' club, the commissioners were briefed by Mayor Wolff and community leaders on an option for cantonment of Armstrong Lab in lieu of complete closure of Brooks. After the community's presentation, the commissioners held a 15-minute press conference.

The day's activities began at approximately 7:00 am, and ended at approximately 11:15 am.

KEY ISSUES IDENTIFIED:

There were no significant issues discovered during the visit that had been previously unknown. The following issues were discussed for clarification:

Military value: The methodology used by DOD for assessing the military value of Brooks as a laboratory is questionable. Brooks does not have an active runway since most of its activities are laboratory related. As a result, Brooks may have been unnecessarily penalized. There are several active runways at military installations in and around San Antonio.

Mission uniqueness: The mission at Brooks is unique and necessary. Its functions can be transferred, but will not disappear. Its research is considered essential in developing human-oriented equipment.

Loss of synergy with San Antonio military community: If the Human Systems Center and Armstrong Laboratory relocates to Wright-Patterson Air Force Base, its synergy with the large San Antonio military and civilian biomedical communities will be lost.

Personnel loss: Key civilian scientific personnel will be lost if the lab relocates as significant turnover is expected. Many of these personnel have advanced degrees and years of specialized experience.

Potential loss of accreditation: It may take many years for the lab to become re-accredited, if it relocates. Merely to obtain basic laboratory re-certification by EPA and other governmental agencies and professional associations and entities will take a minimum of 4 to 5 years. Some of the current lab facilities were "grandfathered" into existing regulatory requirements. Fulfillment of the labs mission will suffer.

Actual military construction costs at Wright-Patterson: Military construction costs at Wright-Patterson will be high as most of Armstrong Lab will have to be replicated at there. Much of the lab equipment requires specialized and expensive facilities. A detailed transition plan has not been completed and a detailed site survey is only now being conducted by Air Force. Brooks officials estimate that it may require more than twice the $103 million originally estimated by the Air Force. Further, there is a potential risk associated with moving some of the sophisticated laboratory equipment and supporting piping due to its age.

COMMUNITY CONCERNS RAISED:

San Antonio synergy--it is a one-of-a-kind biomedical community.

Under the community's cantonment plan, the Armstrong Lab and Human Systems Center would be retained at Brooks, while the remainder of Brooks would close and other tenants would relocate. Base operating support operations would be managed by nearby Kelly Air Force Base. The community argues it is more cost-effective for the lab to remain in San Antonio as cantonment offers an immediate return on investment vs. 7 years under DOD's recommendation. The one-time cost to canton, according to community figures, would be $11 million vs. $185 million if the lab were to relocate.

REQUESTS FOR STAFF AS A RESULT OF VISIT:

Review all options discussed by community.
Obtain COBRAs from Air Force.

Joseph Varallo, Cross Service Team, 10 April 95

DEFENSE BASE CLOSURE AND REALIGNMENT COMMISSION

SUMMARY SHEET

Brooks Air Force Base San Antonio, Texas

INSTALLATION MISSION:

- Brooks Air Force Base is an Air Force Material Command base. It supports a number of activities such as the Human Systems Center and Armstrong Laboratory. The Human Systems Center's mission is to protect and enhance human capabilities and human-systems performance with a scope of impact ranging from the individual to combatant command forces including DOD and Allied Nations Forces. Armstrong Laboratory is the Air Force's center of excellence for human-centered science and technology.

DOD RECOMMENDATION

- Close Brooks Air Force Base. The Human Systems Center, including the School of Aerospace Medicine and Armstrong Laboratory, will relocate to Wright-Patterson Air Force Base, Ohio, however, some portion of the Manpower and Personnel function, and the Air Force Drug Test Laboratory, may relocate to other locations. The 68th Intelligence Squadron will relocate to Kelly Air Force Base, Texas. The Air Force Center for Environmental Excellence will relocate to Tyndall Air Force Base, Florida. The 710th Intelligence Flight (AFRES) will relocate to Lackland Air Force Base, Texas. All activities and facilities at the base including family housing and the medical facility will close.

DOD JUSTIFICATION

- The Air Force has more laboratory capacity than necessary to support current and projected Air Force research requirements. When compared to the attributes desirable in laboratory activities, the Armstrong Lab and Human Systems Center operations at Brooks Air Force Base contributed less to Air Force needs as measured by such areas as workload requirements, facilities, and, personnel. As an installation, Brooks Air Force Base ranked lower than the other bases in the Laboratory and Product Center subcategory.

COST CONSIDERATIONS DEVELOPED BY DOD

- One-Time Cost: $185.5 million
- Net Costs and Savings During Implementation: $ 138.7 million
- Annual Recurring Savings: $ 27.4 million
- Break-Even Year: 7 years
- Net Present Value Over 20 Years: $ 142.1 million

MANPOWER IMPLICATIONS OF THIS RECOMMENDATION (EXCLUDES CONTRACTORS)

	Military	Student	Civilian
Baseline	**3999**	**0**	**11455**
Reductions	237	0	154
Realignments	1717	0	1511
Total	1954	0	1665

MANPOWER IMPLICATIONS OF ALL RECOMMENDATIONS AFFECTING THIS INSTALLATION (INCLUDES ON-BASE CONTRACTORS AND STUDENTS)

	Out		In		Net Gain (Loss)	
Recommendation	Military	Civilian	Military	Civilian	Military	Civilian
TOTAL	1954	1665	0	0	(1954)	(1665)

ENVIRONMENTAL CONSIDERATIONS

- Environmental impact from this action is minimal and ongoing restoration of Brooks will continue.

REPRESENTATION

Governor:	George W. Bush,Jr.
Senators:	Phil Gramm
	Kay Bailey Hutchinson
Representative:	Gonzalez
	Bonilla
	Smith
	Tejeda

ECONOMIC IMPACT

- Potential Employment Loss: 7,879 jobs (3759 direct and 4120 indirect)
- San Antonio MSA Job Base: 730,857
- Percentage: 1.10 percent decrease
- Cumulative Economic Impact (1994-2001): 0.09 percent decrease

MILITARY ISSUES

- None.

COMMUNITY CONCERNS/ISSUES

- Presentation by Greater San Antonio Chamber of Commerce March 27, 1995, identified two options which Air Force did not consider that would retain Brooks' missions in cantonment areas and reduce/eliminate support functions.

ITEMS OF SPECIAL EMPHASIS

- None

Lester C. Farrington/Cross ServiceTeam 3/29/95

COMMISSION BASE VISITS
BROOKS AFB, TX
and
BERGSTROM AFB, TX
Thursday, April 6, 1995

COMMISSIONERS ATTENDING:
Rebecca Cox
Ben Montoya
Joe Robles
Wendi Steele

STAFF ATTENDING:
Charlie Smith
Merrill Beyer (Bergstom)
Craig Hall (Brooks)
Les Farrington (Brooks)
Joe Varallo (Brooks)

ITINERARY

Wednesday, April 5

6:55AM ET Craig Hall and Les Farrington depart DC National en route San Antonio, TX (via Memphis):
Northwest 25.
Craig Hall
Les Farrington
Joe Varallo
* Rental Car (Hall): Budget Confirmation #51656262
* Rental Car (Varallo)Budget Confirmation #51654425

10:40AM CT Craig Hall and Les Farrington arrive San Antonio, TX from DC National (via Memphis):
Northwest flight 1159.

11:00AM to 5:00PM CT Commission staff advances Brooks AFB.

2:41PM CT Merrill Beyer departs Lubbock, TX en route Austin, TX (via Dallas):
American flight 5026.

2:51PM CT Commissioners and staff depart Lubbock, TX en route San Antonio, TX (via Dallas): Delta flight 7622.

Wendi Steele
Ben Montoya
Charlie Smith

6:20PM CT Merrill Beyer arrives Austin, TX airport from Lubbock, TX (via Dallas): American flight 1407.
* Rental car: National Confirmation # 1046328751

6:20PM CT Commissioners and staff arrive San Antonio, TX from Lubbock, TX (via Dallas): Delta 782.

Wendi Steele
Ben Montoya
Charlie Smith

* To be picked up at airport by Craig Hall.

7:45PM CT: Commissioner and staff depart Brooks AFB for dinner at Club Giraud via City of San Antonio transportation.

Commissioner Montoya
Commissioner Steele
Commissioner Robles
Charles Smith
Les Farrington
Craig Hall
Joe Varallo

8:00PM to 9:30PMCT: DINNER AT CLUB GIRAUD

9:00PM CT Rebecca Cox departs Houston, TX en route San Antonio, TX.

10:00PM CT Rebecca Cox arrives San Antonio, TX from Houston, TX.
* Takes taxi to Brooks AFB.
* DIRECTIONS: From the airport take I-281 South. I-281 turns into I-37. Take the Brooks AFB/Military Drive exit. Proceed on Military Road and the Officer Quarters are on the left. Approximately a 30 minute drive.

RON: **Brooks AFB Officers Quarters**
Phone: 210-536-1844
Rebecca Cox
Ben Montoya
Wendi Steele
Charlie Smith
Les Farrington
Craig Hall
Joe Varallo

Bergstom AFB Officer Quarters
Phone: 1-800-589-5200
Merrill Beyer

Thursday, April 6

6:30AM CT Joe Robles is picked up at residence by Craig Hall and proceed to Brooks AFB, TX.
* Allow 30 minute drive time.
* DIRECTIONS TO ROBLES HOUSE: Take interstate 37 North. It will become McAllister Freeway and then become 281 North. Exit at Bitters Road (turn left). Take a right on Blanco Road. Mission Ridge Subdivision will be on right, turn on Mission Ridge Street and stop at guard station. Continue on Mission Ridge Street to 15822 (Robles' House) on right.

7:00AM to 11:00AM CT **Working breakfast and Brooks AFB base visit.**

11:00AM CT Commissioners and staff depart Brooks AFB, TX en route Bergstrom AFB, TX.
Rebecca Cox
Ben Montoya
Joe Robles
Wendi Steele
Charlie Smith
Joe Varallo
* Driven to Bergstrom by Craig Hall and Joe Varallo.
* Allow 1 & 1/2 hour drive time.

12:30PM CT Commissioners and staff arrive Bergstrom, AFB, TX from Brooks, AFB, TX.

12:30PM CT: Joe Varallo arrives Austin Airport and drops off rental car. Craig Hall turns car over to Merrill Beyer.

1:00PM to 5:00PM CT **Working lunch and Bergstrom AFB Base Visit.**

1:55PM ET Les Farrington departs San Antonio, TX en route Philadelphia, PA (via St. Louis):
TWA flight 312.
* Takes taxi to airport from Brooks, AFB.

1:49 PM CT Craig Hall departs Austin, TX en route Phoenix (via Dallas):
American flight 1476.

4:00PM CT Joe Robles and Merrill Beyer depart Bergstrom AFB en route San Antonio, TX.
* Allow 1 & 1/2 hour drive time.

4:24PM CT: Craig Hall Arrives Phoenix (via Dallas):
American flight 2023.

5:30PM CT Arrive Joe Robles' residence from Bergstrom AFB, TX.

6:02PM CT Merrill Beyer departs San Antonio, TX en route DC National (via Dallas):
Ameican flight 761.

6:24PM CT Wendi Steele departs Austin, TX en route Houston, TX (via Dallas):
American flight 536.

6:24PM CT Rebecca Cox departs Austin, TX en route DC National (via Dallas):
American flight 536.

6:24PM CT Ben Montoya departs Austin, TX en route Albuquerque, NM (via Dallas):
American flight 536.

8:32PM ET Les Farrington arrives Philadelphia, PA from San Antonio, TX (via St. Louis):
TWA flight 108.
* Rental car: Hertz Confirmation # 92190378EE1
* ~~Proceeds to Warminster BOQ~~.

RON: ~~**NAWC Warminster Guest House**~~
~~**Phone (215) 441-2000**~~
~~**Les Farrington**~~

HOLIDAY INN TREVOSE, PA
CONF.# 67227816

9:04PM MT Ben Montoya arrives Albuquerque, NM from Austin, TX (via Dallas):
American flight 1123.

11:54PM ET Rebecca Cox arrives DC National from Austin, TX (via Dallas):
American flight 834.

11:54PM ET Merrill Beyer arrives DC National from San Antonio, TX (via Dallas):
American flight 834.

RON: **Bergstom AFB Officer Quarters**
Phone: 1-800-354-6932
Charlie Smith

Thursday, April 7

7:50AM CT Charlie Smith departs Austin, TX en route DC National (via Chicago): United flight 576.

1:53PM ET Charlie Smith arrives DC National from Austin, TX (via Chicago): United flight 610.

7R

DRAFT (X Team - See Cmnty Book & Transcr pp52-74)
h\cirillo\doc\95brac\hearings\dalbrook.doc

REGIONAL HEARING ISSUE SUMMARY
BROOKS AFB, TX
DALLAS REGIONAL HEARING, DALLAS CONVENTION CENTER
APRIL 19, 1995

- Gov Bush - Part of the Air Force Brain Trust. Vital Part of the Community. City has come up with an incredibly common sense proposal.

- Sen Hutchinson - Air Force did not look at the savings of the cantonment concept.
  - Commented later on relationship of Brooks with University of Texas

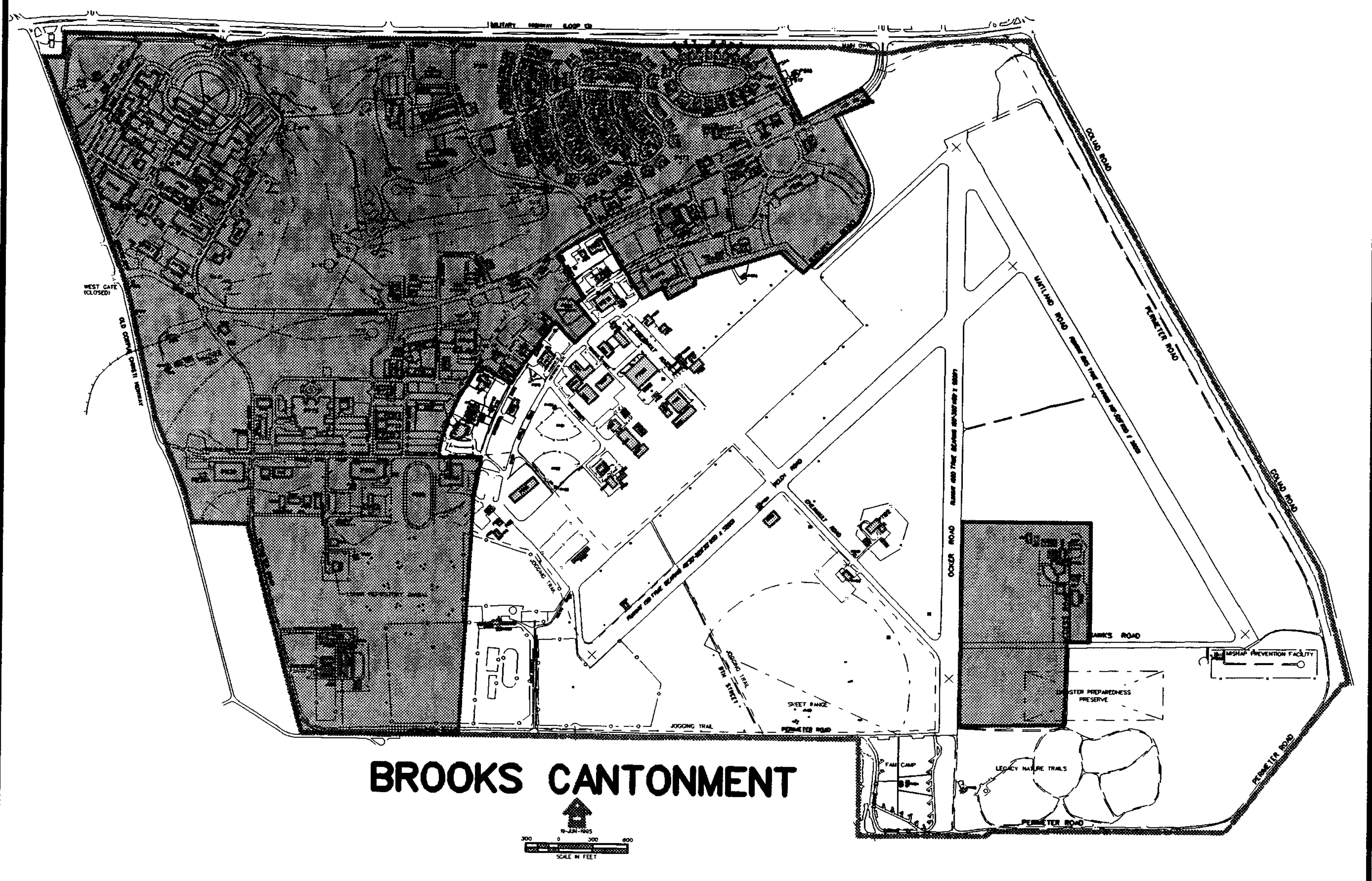
- Mayor Wolff - Noted special City task force created to understand and recognize Brooks. Convinced city of importance of Brooks to USAF due to scientists and the relationship to San Antonio.
  - Scientists will not leave city - thus interruption of research
  - Commission mission is to save money and reduce infrastructure
  - Major Point - Cantonment closes Brooks yet saves taxpayers 2X the DoD proposal
  - Major Point - Concept avoids interruption to research and risk of losing 50-75% of the 3000 professionals

- Judge Cyndi Krier - Reviewed Brooks AFB mission in detail.
  - Unique collection of scientists, researchers, medical doctors and technicians
  - Research mecca with 3000 professionals - 1000 are scientists
  - Noted major research areas and efforts
  - Train 5000 medical students each year
  - Brooks is an integrated research center - noted interrelationships and synergy's to area
  - Nation's military capability will suffer
  - Noted opportunities for interaction and joint venture in San Antonio

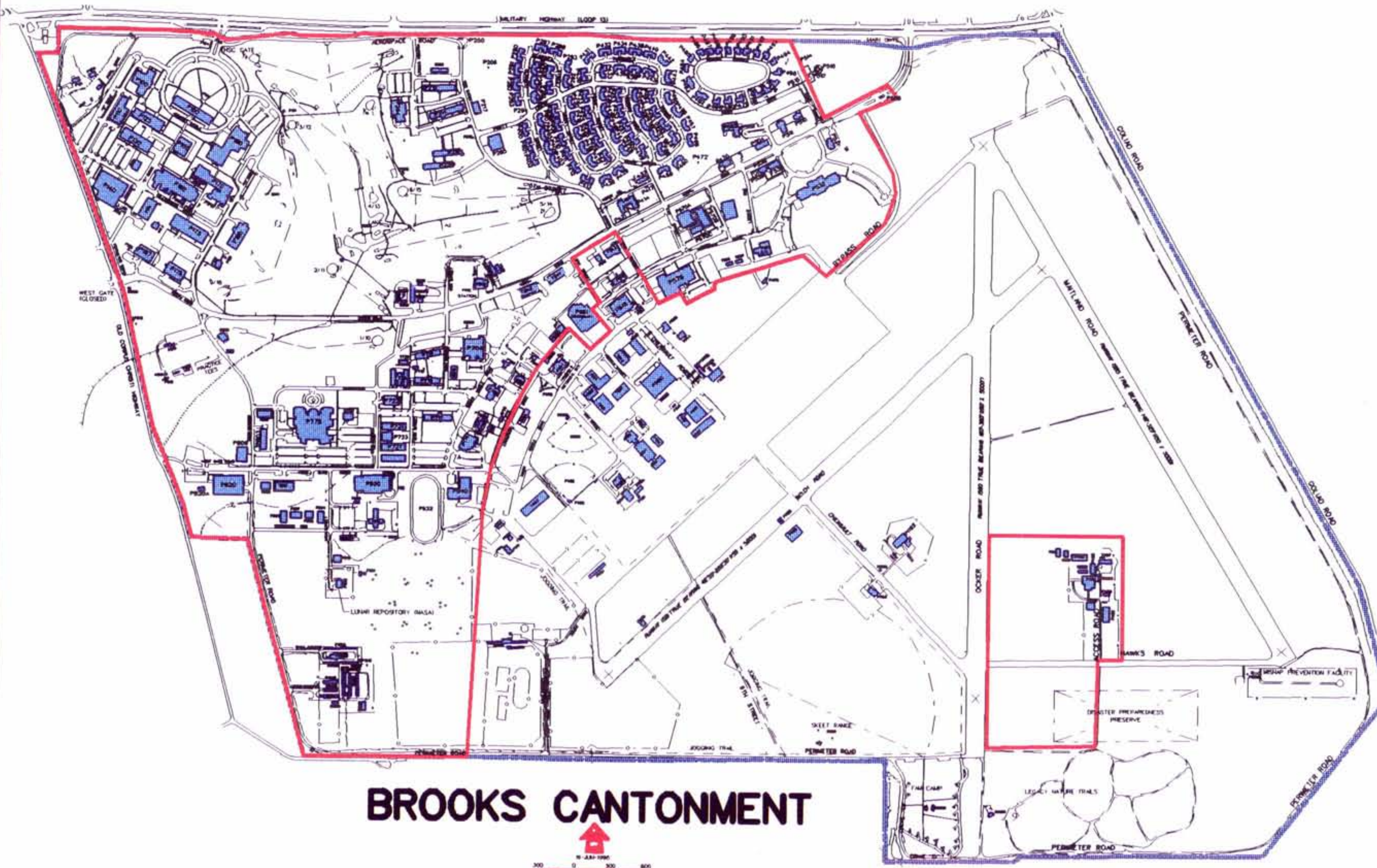
- Jose Villarreal - Made detailed comparison of DoD and City proposals (See Book Provided, includes slides)
  - Proposal costs \$11 Mil vs. \$185 Mil. NPV is \$301 Mil vs. \$142 Mil.
  - Continues to save more than DoD proposal forever (at least the 700 yrs ran on COBRA)

- Tullos Wells - Discussed the "people" - the Nations loss of the professional investment
  - Noted in response to Commissioner Robles' question that either Kelly or Lackland could absorb the workload.

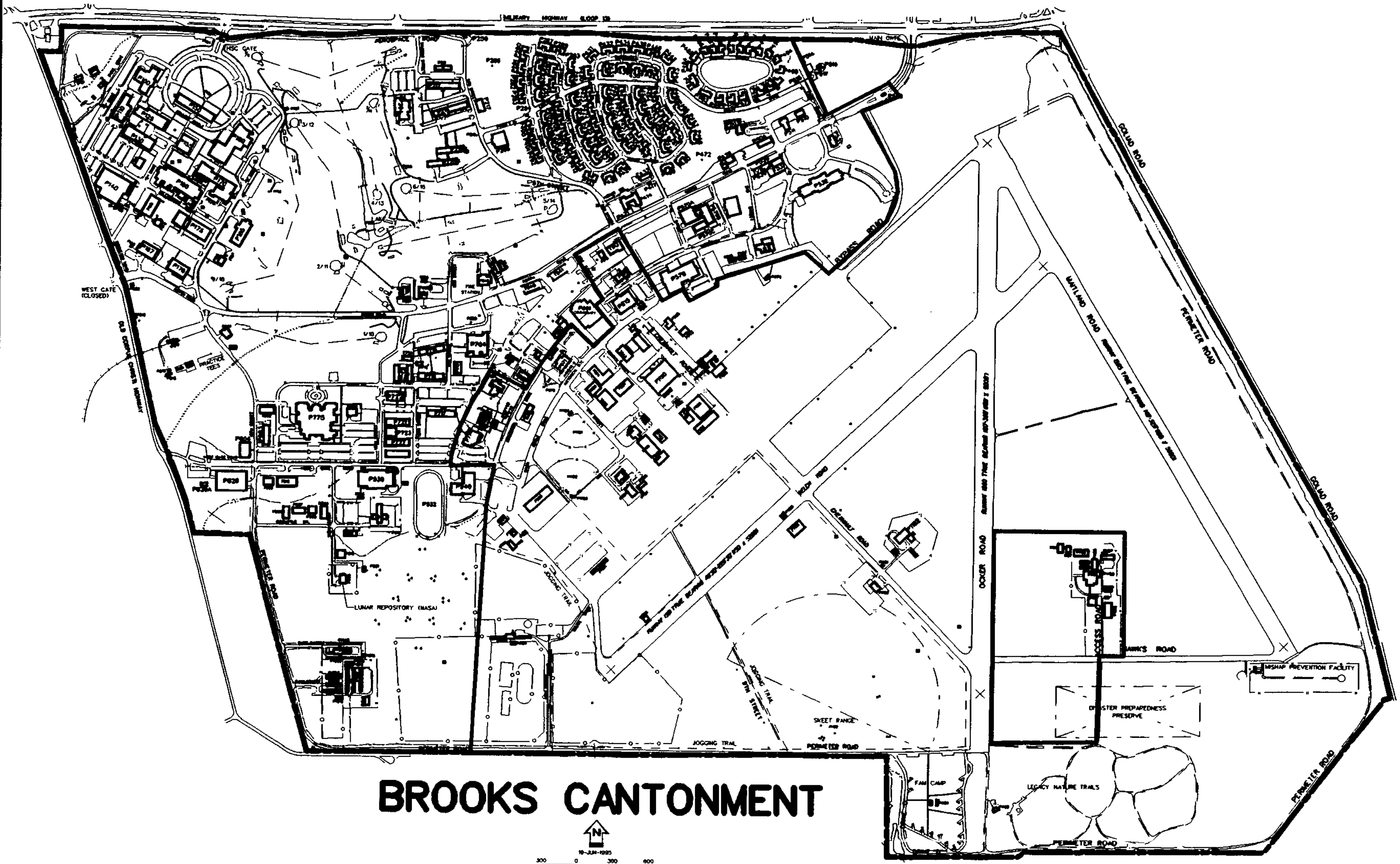
- Congressman Tejeda - Brief recap of issues



BROOKS CANTONMENT

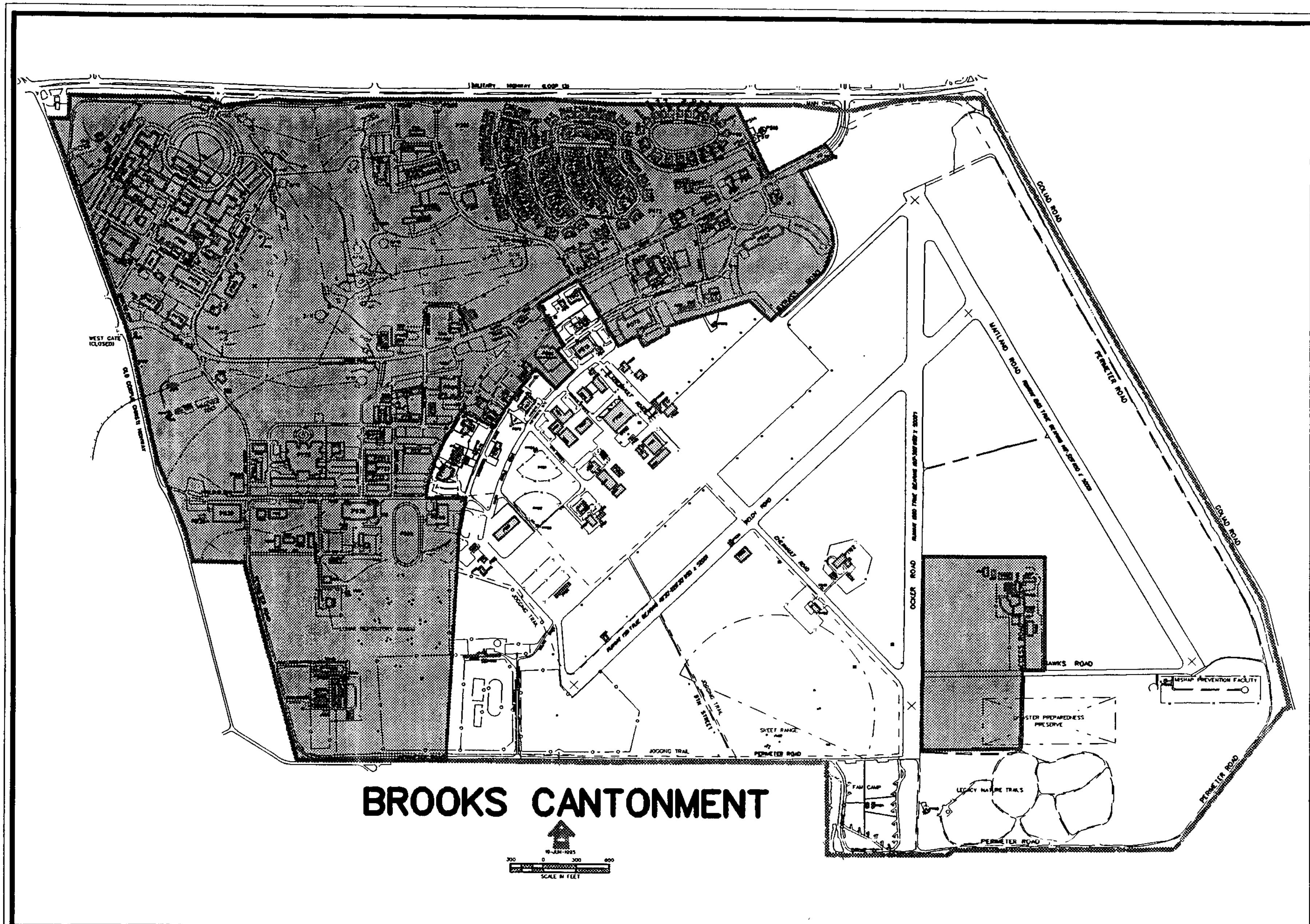


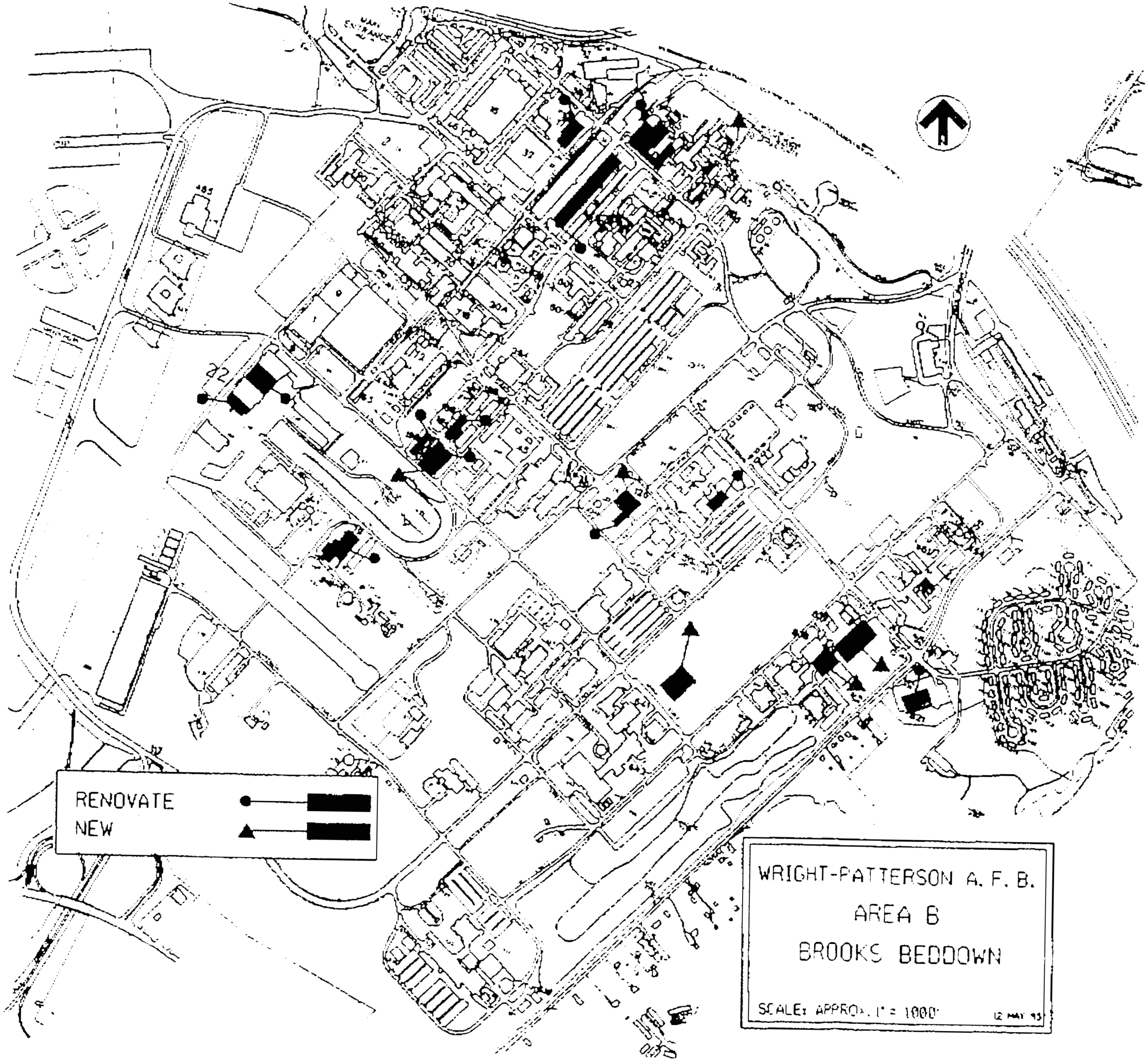
BROOKS CANTONMENT

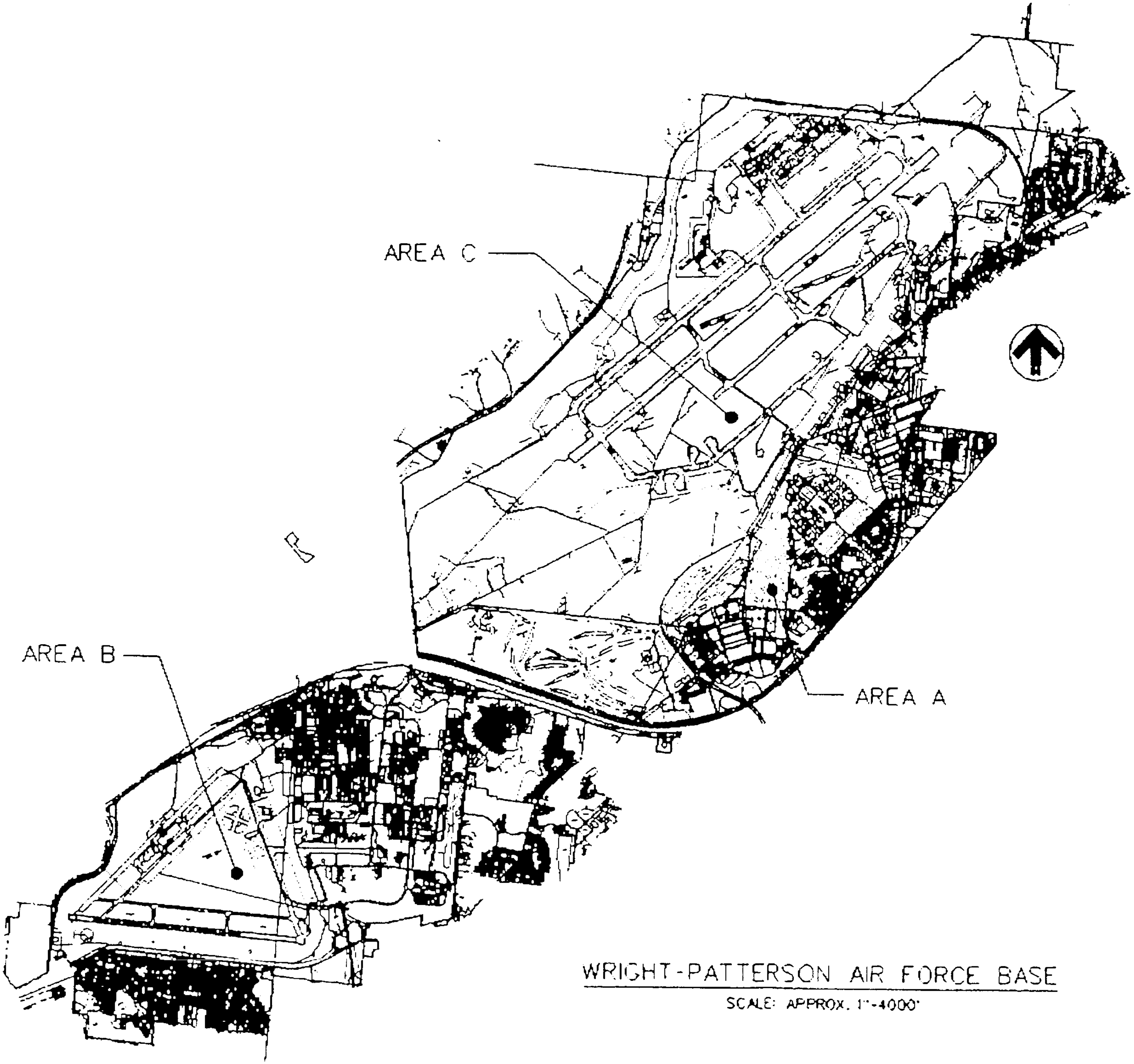


BROOKS CANTONMENT

N
19-JUN-1995
300 0 300 600
SCALE IN FEET


MILITARY HIGHWAY (LOOP 13)
MAIN GATE
WEST GATE (CLOSED)
OLD CORPUS CHRISTI HIGHWAY
GOLIAD ROAD
PERIMETER ROAD
MAITLAND ROAD
OCKER ROAD
HAWKS ROAD
MISHAP PREVENTION FACILITY
DISASTER PREPAREDNESS PRESERVE
LEGACY NATURE TRAILS
FAM CAMP
SKEET RANGE
JOGGING TRAIL
8TH STREET
KELLY ROAD
CHENNAULT ROAD
BROOKS CANTONMENT
19-JUN-1995
300 0 300 600
SCALE IN FEET


RENOVATE
NEW
WRIGHT-PATTERSON A. F. B.
AREA B
BROOKS BEDDOWN
SCALE: APPROX. 1" = 1000'
12 MAY 93



WRIGHT-PATTERSON AIR FORCE BASE

SCALE: APPROX. 1"-4000'

Civil Engineer Group 5151 WRIGHT AVENUE, BUSINESS WPAFB OH 45433-5339 OFFICIAL

FAX

Date: 20 JUN 95

Number of pages including cover sheet: 3

To: JOE VARALLO

Phone:

Fax phone: 703-696-0550

CC:

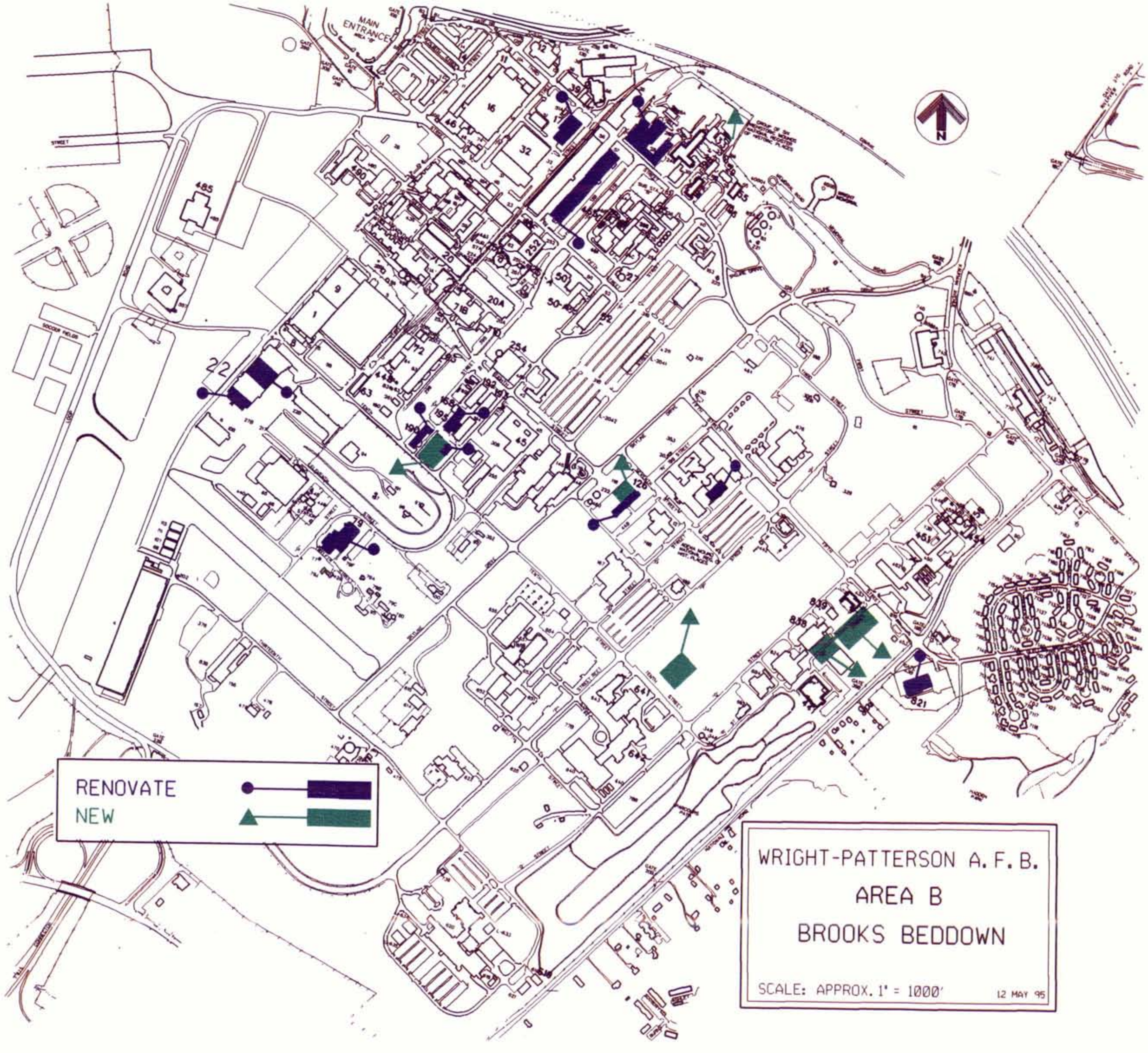
From: Fred

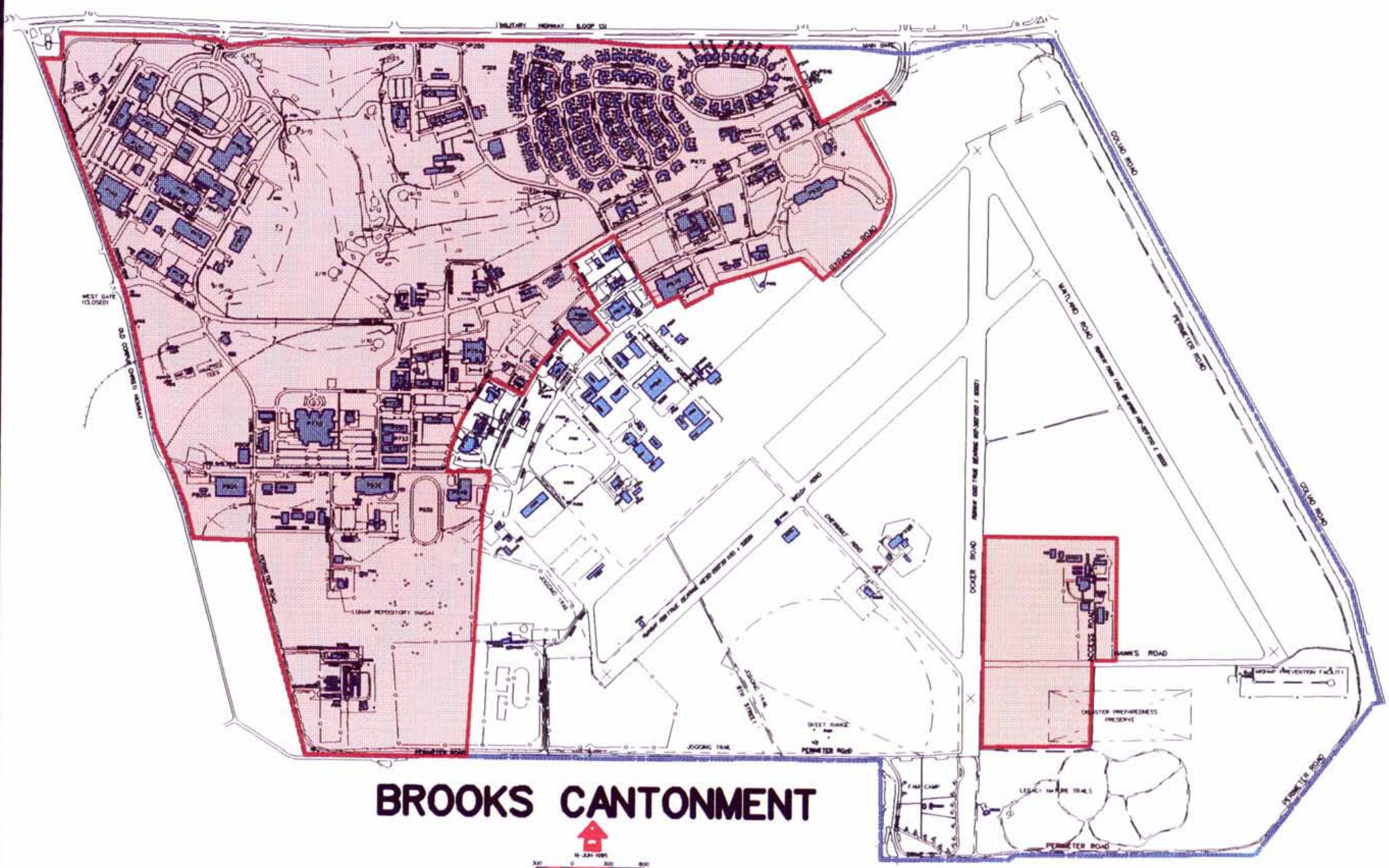
Phone: 74804

Fax phone: 257-5984

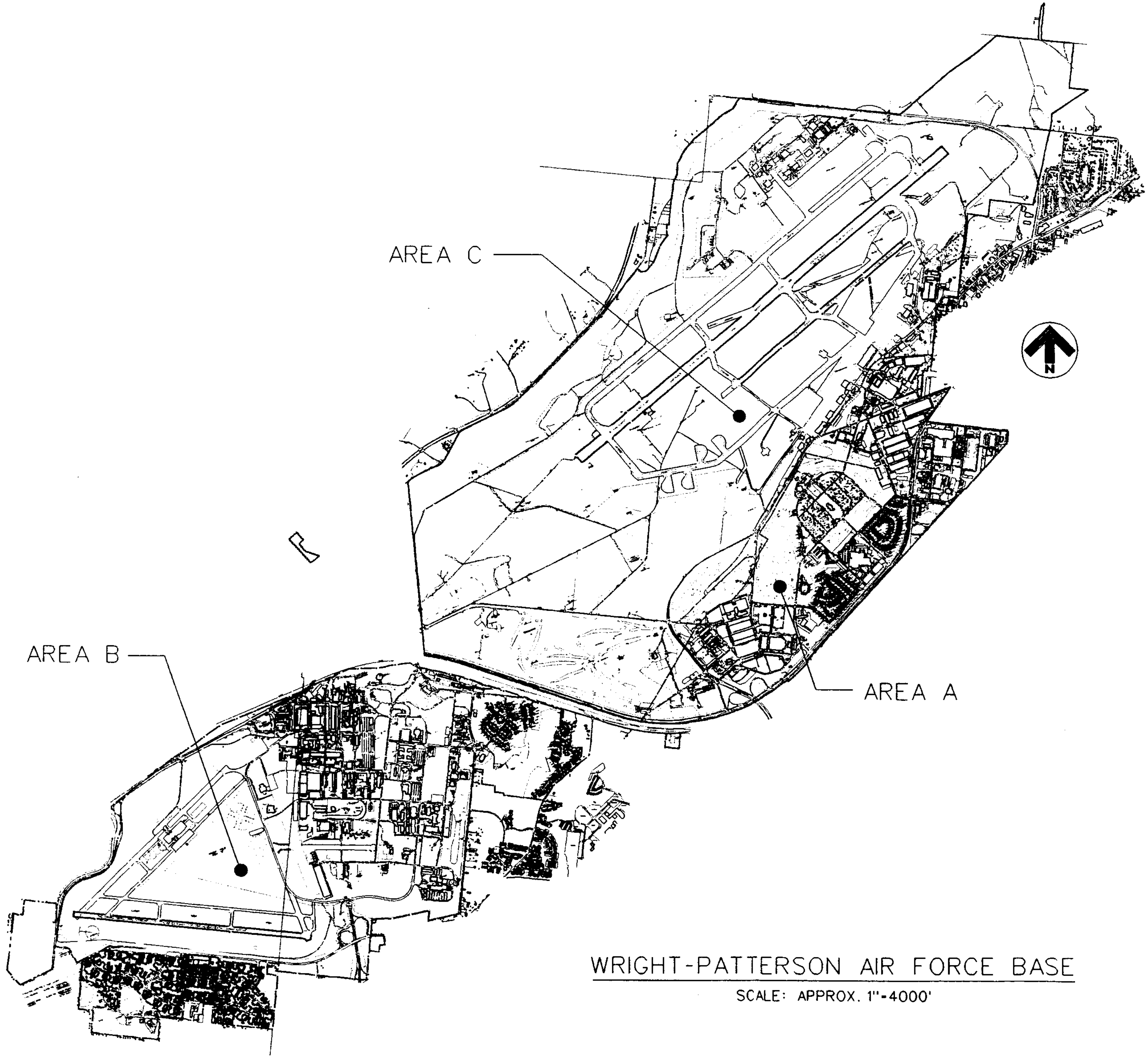
REMARKS: ☒ Urgent ☐ For your review ☐ Reply ASAP ☐ Please comment

BROOKS BEDDOWN MAPS


MAIN ENTRANCE
RENOVATE
NEW
WRIGHT-PATTERSON A. F. B.
AREA B
BROOKS BEDDOWN
SCALE: APPROX. 1" = 1000'
12 MAY 95
N

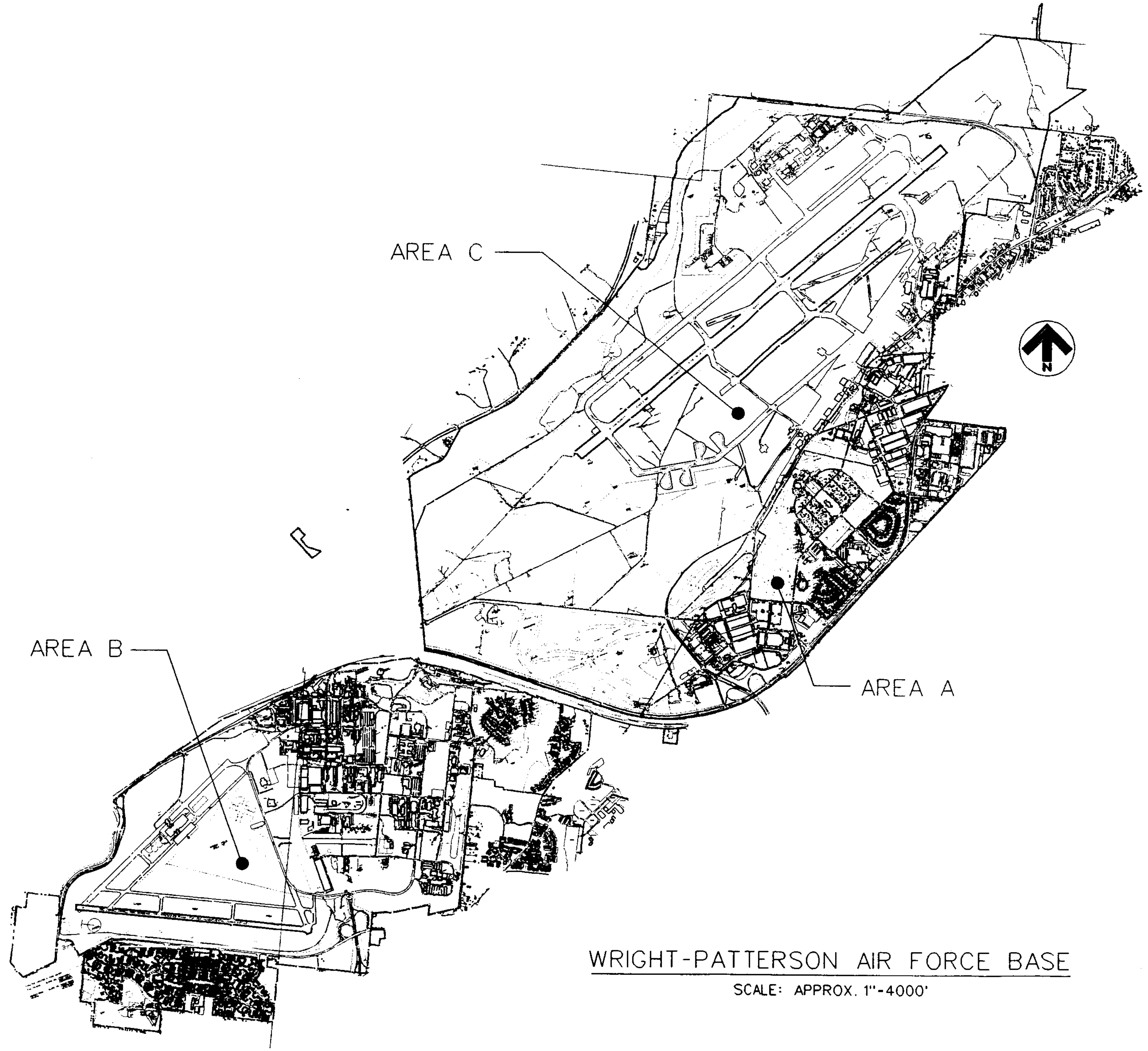


BROOKS CANTONMENT



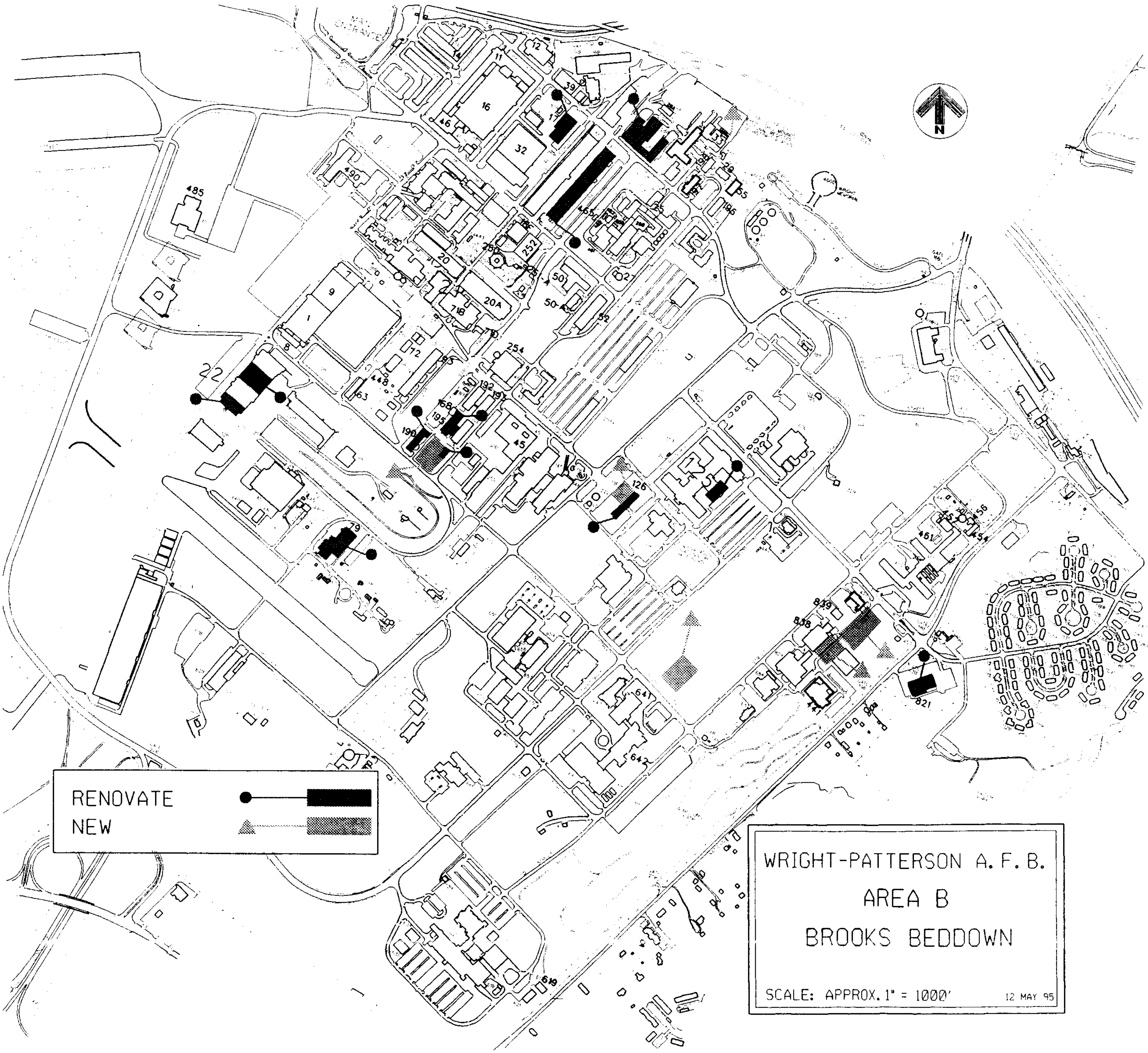
WRIGHT-PATTERSON AIR FORCE BASE

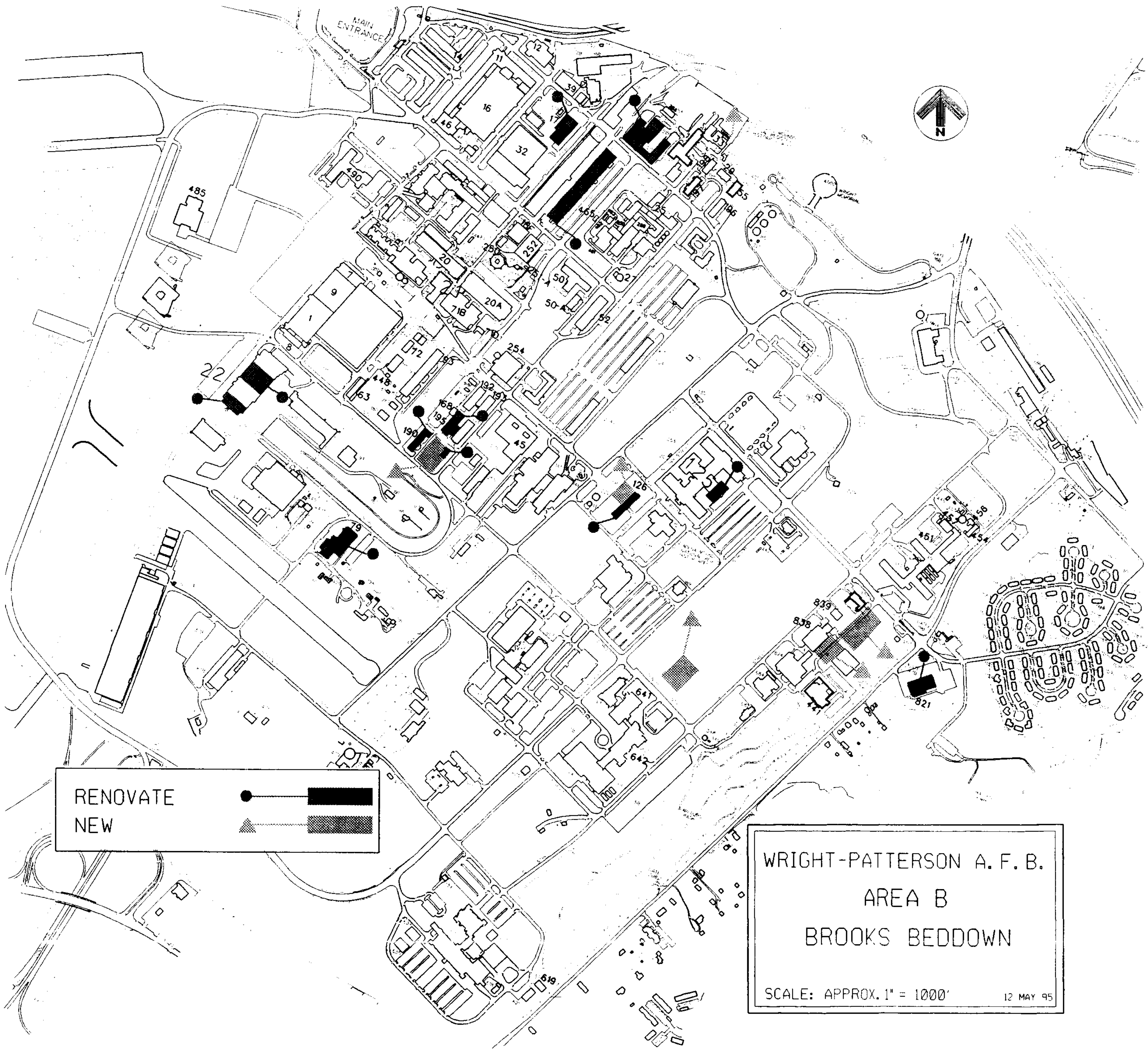
SCALE: APPROX. 1"-4000'



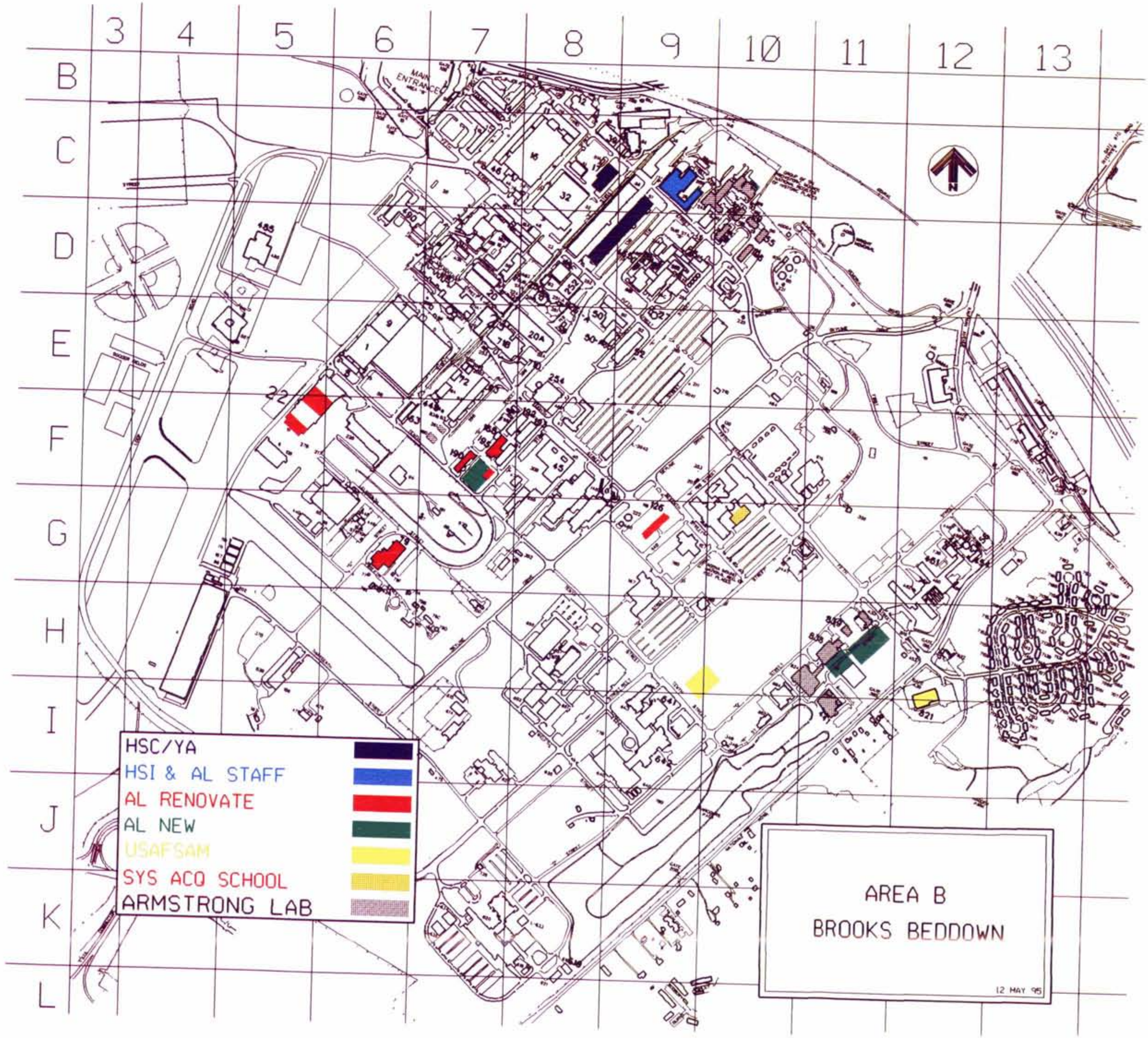
WRIGHT-PATTERSON AIR FORCE BASE

SCALE: APPROX. 1"-4000'


WRIGHT-PATTERSON A. F. B.
AREA B
BROOKS BEDDOWN
SCALE: APPROX. 1" = 1000'
12 MAY 95
RENOVATE
NEW
N
22
485
490
16
32
12
14
11
46
39
17
9
1
8
20
20A
71B
252
250
50
50A
52
21
72
63
448
195
192
193
191
168
190
45
254
126
79
56
54
52
461
821
838
839
641
642
619
196
55
29
194
65



MAIN ENTRANCE
RENOVATE
NEW
N
WRIGHT-PATTERSON A.F.B.
AREA B
BROOKS BEDDOWN
SCALE: APPROX. 1" = 1000'
12 MAY 95


3
4
5
6
7
8
9
10
11
12
13
B
C
D
E
F
G
H
I
J
K
L
MAIN ENTRANCE
N
HSC/YA
HSI & AL STAFF
AL RENOVATE
AL NEW
USAFSAM
SYS ACQ SCHOOL
ARMSTRONG LAB
AREA B
BROOKS BEDDOWN
12 MAY 95

DEFENSE BASE CLOSURE AND REALIGNMENT COMMISSION

SUMMARY SHEET

BROOKS AIR FORCE BASE, SAN ANTONIO, TX

INSTALLATION MISSION

Brooks Air Force Base is an Air Force Material Command base. It supports a number of activities such as the Human Systems Center and Armstrong Laboratory. The Human Systems Center's mission is to protect and enhance human capabilities and human-systems performance with a scope of impact ranging from the individual to combatant command forces including DOD and Allied Nations Forces. Armstrong Laboratory is the Air Force's center of excellence for human-centered science and technology.

DOD RECOMMENDATION

- Close Brooks Air Force Base. The Human Systems Center, including the School of Aerospace Medicine and Armstrong Laboratory, will relocate to Wright-Patterson Air Force Base, Ohio, however, some portion of the Manpower and Personnel function, and the Air Force Drug Test Laboratory, may relocate to other locations. The 68th Intelligence Squadron will relocate to Kelly Air Force Base, Texas. The Air Force Center for Environmental Excellence will relocate to Tyndall Air Force Base, Florida. The 710th Intelligence Flight (AFRES) will relocate to Lackland Air Force Base, Texas. All activities and facilities at the base including family housing and the medical facility will close.

DOD JUSTIFICATION

- The Air Force has more laboratory capacity than necessary to support current and projected Air Force research requirements. When compared to the attributes desirable in laboratory activities, the Armstrong Lab and Human Systems Center operations at Brooks Air Force Base contributed less to Air Force needs as measured by such areas as workload requirements, facilities, and, personnel. As an installation, Brooks Air Force Base ranked lower than the other bases in the Laboratory and Product Center subcategory.

COST CONSIDERATIONS DEVELOPED BY DOD

• One-Time Cost:	$185.5 million
• Net Costs and Savings During Implementation:	$ 138.7 million
• Annual Recurring Savings:	$ 27.4 million
• Break-Even Year:	7 years
• Net Present Value Over 20 Years:	$ 142.1 million

MANPOWER IMPLICATIONS OF THIS RECOMMENDATION (EXCLUDES CONTRACTORS)

	Military	Student	Civilian
Baseline	**3999**	**0**	**11455**
Reductions	237	0	154
Realignments	1717	0	1511
Total	1954	0	1665

MANPOWER IMPLICATIONS OF ALL RECOMMENDATIONS AFFECTING THIS INSTALLATION (INCLUDES ON-BASE CONTRACTORS AND STUDENTS)

	Out		In		Net Gain (Loss)	
Recommendation	Military	Civilian	Military	Civilian	Military	Civilian
TOTAL	1954	1665	0	0	(1954)	(1665)

ENVIRONMENTAL CONSIDERATIONS

- Environmental impact from this action is minimal and ongoing restoration of Brooks will continue.

REPRESENTATION

Governor:	George W. Bush,Jr.
Senators:	Phil Gramm
	Kay Bailey Hutchinson
Representatives:	Gonzalez
	Bonilla
	Smith
	Tejeda

ECONOMIC IMPACT

- Potential Employment Loss: 7,879 jobs (3759 direct and 4120 indirect)
- San Antonio MSA Job Base: 730,857
- Percentage: 1.10 percent decrease
- Cumulative Economic Impact (1994-2001): 0.09 percent decrease

MILITARY ISSUES

- Loss of synergy with San Antonio military community with movement of Human Systems Center and Armstrong Laboratory to Wright-Patterson Air Force Base.
- Mission cannot be maintained at Wright-Patterson because only 25-30% of key scientific personnel will actually move from the biomedically rich San Antonio area.
- Potential loss of accrediation in the scientific community because of the extensive time it will take to become re-accrediated. (missions will suffer)
- Significant underestimate of military construction costs at Wright-Patterson. No transition plan available and site survey only now being conducted by Air Force. Estimates of $103 million per Air Force vs. $250-300 per Brooks.
- High risk in moving some of the large laboratory equipment and supporting piping due to its age. Re-certification at new location may also present a problem (some of current lab equipment was "grandfathered" some time ago.

COMMUNITY CONCERNS/ISSUES

- The Greater San Antonio Chamber of Commerce has a proposal to close Brooks Air Force Base and retain certain Brooks' missions in cantonment in San Antonio (Human Systems Center, Human Systems Program Office, Armstrong Laboratory, School of Aerospace Medicine and the Center for Environmental Excellence). The proposal relocates Intelligence Squadrons to Kelly and Lackland assumes base operations support from Kelly. Lower costs and greater savings are projected with this cantonment approach as compared to the DOD proposal.
- Community proposal considered Kelly and not nearby Lackland. DBCRC to pursue with Air Force cost data on Lackland providing base support.

ITEMS OF SPECIAL EMPHASIS

- Use and support of family housing at Brooks may be an issue.

Lester C. Farrington/Cross Service/07/21/95 10:07 AM

Brooks Air Force Base, Texas

Recommendation: Close Brooks AFB. The Human Systems Center, including the School of Aerospace Medicine and Armstrong Laboratory, will relocate to Wright-Patterson AFB, Ohio, however, some portion of the Manpower and Personnel function, and the Air Force Drug Test laboratory, may relocate to other locations. The 68th Intelligence Squadron will relocate to Kelly AFB, Texas. The Air Force Center for Environmental Excellence will relocate to Tyndall AFB, Florida. The 710th Intelligence Flight (AFRES) will relocate to Lackland AFB, Texas. The hyperbaric chamber operation, including associated personnel, will relocate to Lackland AFB, Texas. All activities and facilities at the base including family housing and the medical facility will close.

Justification: The Air Force has more laboratory capacity than necessary to support current and projected Air Force research requirements. When compared to the attributes desirable in laboratory activities, the Armstrong Lab and Human Systems Center operations at Brooks AFB contributed less to Air Force needs as measured by such areas as workload requirements, facilities, and personnel. As an installation, Brooks AFB ranked lower than the other bases in the Laboratory and Product Center subcategory.

Return on Investment: The total estimated one-time cost to implement this recommendation is $185.5 million. The net of all costs and savings during the implementation period is a cost of $138.7 million. Annual recurring savings after implementation are $27.4 million with a return on investment expected in seven years. The net present value of the costs and savings over 20 years is a savings of $142.1 million.

Impacts: Assuming no economic recovery, this recommendation could result in a maximum potential reduction of 7,879 jobs (3,759 direct jobs and 4,120 indirect jobs) over the 1996-to-2001 period in the San Antonio, Texas Metropolitan Statistical Area, which is 1.1 percent of the economic area's employment. The cumulative economic impact of all BRAC 95 recommendations, including the relocation of some Air Force activities into the San Antonio area, and all prior-round BRAC actions in the economic area over the 1994-to-2001 period could result in a maximum potential decrease equal to 0.9 percent of employment in the economic area. Environmental impact from this action is minimal and ongoing restoration of Brooks AFB will continue.

Reese Air Force Base, Texas

Recommendation: Close Reese AFB. The 64th Flying Training Wing will inactivate and its assigned aircraft will be redistributed or retired. All activities and facilities at the base including family housing and the hospital will close.

Commission Tasking

FAX COVER SHEET

HQ USAF/RTR
HQ USAF/RTT
1670 AIR FORCE PENTAGON
WASHINGTON, DC 20330-1670
DSN 225-6766 or (Comm) 703/695-6766
FAX DSN 223-9707 or (Comm) 703/693-9707

DATE: 27 March 95 (NPL)

FROM: AF/RTR
Maj Wallace

TO: Defense BRAC Commission

ATTN: Mr Les Farrington

FAX #: 703 696-0550

NO. OF PAGES 6 + 1 COVER SHEET

REMARKS: Sir,

Attached is the requested fact sheets on HSC and AL-Brooks. This information is sent based on a verbal request on 22 Mar 95 on behalf of the Defense BRAC 95 Commission.

Respy
Maj Wallace

United States Air Force
FACT SHEET

Office of Public Affairs, Human Systems Center, 2510 Kennedy Circle, Suite 1, Brooks AFB TX 78235-5120 Phone (210) 536-3234 Fax (210) 536-3235

HUMAN SYSTEMS CENTER

MISSION

The Human Systems Center of Air Force Materiel Command, headquartered at Brooks Air Force Base, Texas, is the Air Force advocate for integrating and maintaining the human in Air Force systems and operations. People are the key to all Air Force operations. HSC is the systems-independent product center for human-centered research, development, acquisition and specialized operational support.

Its mission is to protect and enhance human capabilities and human-systems performance with a scope of impact ranging from the individual to combatant command forces including DOD and Allied Nations Forces. The Armstrong Laboratory, the USAF School of Aerospace Medicine, the HSC Program Office (YA), the 70th Medical Squadron and an air base group are the major units of HSC.

HISTORY

HSC's origins go back to Jan. 19, 1918, when the Medical Research Laboratory was formed at Hazelhurst Field, N.Y. In 1922, this Laboratory was redesignated the School of Aviation Medicine, and four years later it moved to Brooks Field which was a center for primary flight training. Both organizations moved to Randolph Field in October 1931. The school moved back to Brooks during the summer of 1959 and the base became the headquarters for the Aerospace Medical Center the same year.

The Center represented the initial step in placing the management of aerospace medical research, education and clinical medicine under one command. Both the school and center were reassigned from Air Training Command to Air Force Systems Command in November 1961 and assigned to the new organization, Aerospace Medical Division (now HSC).

(Current as of Oct. 1994)

On Nov. 21, 1963, President John F. Kennedy dedicated four new buildings of USAFSAM in the complex that housed the Aerospace Medical Division. This was his last official act before his assassination in Dallas the following day.

In 1986, the Department of Defense began streamlining its organization as a result of the Packard Commission recommendations. This division's acquisition mission emphasized its human-centered technologies. It restructured its functional areas and was renamed the Human Systems Division on Feb. 6, 1987.

In December 1990, the Air Force Systems Command underwent a major restructuring which consolidated 16 laboratories nationwide into four. Brooks Air Force Base and the Human Systems Division became home of one of the "super labs." The new lab, named the Armstrong Laboratory, is a world-class center in science and technology for protecting the human in Air Force systems.

On July 1, 1992, the Human Systems Division was renamed the Human Systems Center as part of the structuring of the new Air Force Materiel Command. The command was activated July 1, 1992, when the Air Force Logistics Command and Air Force Systems Command were integrated.

ORGANIZATIONS

The Human Systems Center headquarters supports its subordinate organizations with administration, command and control, and logistics.

U.S. Air Force School of Aerospace Medicine

As the center for aerospace medicine education, the USAF School of Aerospace Medicine is the major provider of educational programs involving aviation, space, and environmental medicine for Air Force, DOD, and Allied Nations personnel. The programs span entry level through graduate medical education in all disciplines encompassed in the aerospace medicine specialty.

70th School Squadron

The 70th Training Squadron advances the education of acquisition professionals to support and sustain all Air Force weapons systems. About 1,600 students are trained annually.

Human Systems Center Program Office

The program office is responsible for the engineering and manufacturing development, production, evolution and sustainment of life support, chemical defense, aeromedical, human resource, and operational analysis systems, and the design and test of Air Force uniforms. The program office demonstrates technology concepts in prototype systems to reduce technical, cost, and schedule risk, and to accelerate the transition arm of the Human Systems Center.

It is responsible for proper execution of engineering and manufacturing development and production programs and coordinates acquisition efforts with other agencies and the using MAJCOMs. The program office is also responsible for the Human Systems Center staff functional work in the areas of engineering, manufacturing/quality assurance, configuration/data management, test and evaluation, and acquisition logistics.

70th Air Base Group

The 70th Air Base Group operates and maintains Brooks Air Force Base in support of HSC and tenant units.

The Armstrong Laboratory

The Armstrong Laboratory, as one of the four Air Force "Super Laboratories," is the Air Force's center of excellence for human-centered science and technology. The laboratory provides the science and technology base and the direct operational support needed to enhance human performance in Air Force systems and operations. The research, development, and support activities of the laboratory address current and future needs in the areas of human resources, crew systems, aerospace medicine, and occupational and environmental health to enhance crew protection and performance, training and logistics, and force management, health and safety.

70th Medical Squadron

The 70th Medical Squadron provides personalized outpatient medical and dental care for the Brooks Air force Base community in a total quality environment. Services include primary care, aerospace medicine, optometry, military health, pharmacy, radiology, immunology, military public health, bioenvironmental engineering, and clinical laboratory. Approximately 25,000 patients per year are treated here.

FACT SHEET

United States Air Force

AIR FORCE MATERIEL COMMAND
Human Systems Center
2509 Kennedy Circle, Brooks AFB TX 78235-5118
(210) 536-3136

ARMSTRONG LABORATORY

The Armstrong Laboratory (AL), headquartered at Brooks AFB, Texas, is the Air Force center of excellence for human-focused science and technology. Unique in the DOD, the Laboratory brings together in one organization the biological, behavioral, medical, physical, and computational science and engineering disciplines, and specialized research facilities required to address the tough human challenges facing the Air Force warfighters of today and tomorrow.

The Armstrong Laboratory has approximately 1600 military and civilian employees (57% civilian, 20% officer, 23% enlisted), with the highest percentage of doctoral degrees among the four AF Superlabs. With a budget of more than $200 million this year, the Armstrong Laboratory conducts its research through five technical directorates: aerospace medicine, crew systems, environics, human resources, and occupational and environmental health, at four principal locations: Brooks AFB TX, Wright Patterson AFB OH, Tyndall AFB FL, and Williams-Gateway Airport, Mesa AZ.

AL provides a single face to the customer for human systems expertise through a combination of science and technology (MFP-6) and defense health programs (MFP-8). Customers include the Air Force war-fighting commands, AFMC SPOs and ALCs, Air Staff (SG, DP, CE), DOD, and other agencies (NASA, FAA, DOT).

- Requirements are documented via Mission Area Plans and the AFMC Technology Master Process (TMP).
- Close connections with users generate many short-suspense requests from operational units, such as:
  - Joint effort with 8th AF to develop countermeasures for crew fatigue during long duration bombing missions from CONUS.
  - -- Measurement of G-susceptibility or "G-layoff effect" for return of aircrew to high performance aircraft following a non-flying assignment (DNIF), at specific request of HQ ACC/CC.
- Periodic customer satisfaction surveys are used to assess and improve responsiveness to customer needs.

Armstrong Laboratory products are developed using an integrated, multidisciplinary approach. Recent examples include:

- Situation Awareness Integration Team (SAINT) answered CSAF question concerning ability to measure and train aircrew situation awareness skills. AL team was established with experts in behavioral psychology, human factors and cognitive sciences, aircrew training, and aerospace medicine. Study results are being incorporated into future pilot selection and aircrew training procedures.

- Human factors vision evaluation supported Board investigation of F-15 shoot-down of Blackhawk helicopters over Iraq. Experts in experimental psychology, optometry, ophthalmology, and optical physics provided quick-look report to Board within 48 hours of request. Detailed technical report evaluating effects of real-world conditions for target/terrain luminance, contrast visibility, visor distortion, airspeed, and target distance on pilot vision completed within ten days of request.

- Advanced Technology Anti-G Suit (ATAGS) developed to increase pilot endurance to high, sustained acceleration by 50 percent over current anti-G suit. Product is the result of close collaboration among laboratory physiologists, engineers, life support specialists, and the Human Systems Program Office. Operational payoffs include increased pilot protection, improved performance, and decreased aircraft/pilot losses due to acceleration-induced loss of consciousness.

- Large rocket motor disposal program has developed technologies and processes to safely remove, treat and dispose of aged rocket propellants. This AL-led program has successfully leveraged over $25M in Air Force, DOD and ARPA technology programs, and has integrated technologies to reduce duplication of effort and compress the project schedule. Full-scale demonstration on a Minuteman II stage III solid rocket motor will be done in FY95.

Other recent success stories include:
- Integrated Maintenance Information System (IMIS) field demonstration on F-16s at Luke AFB AZ.
- Rapid optical scanning and bioventing technologies for hazardous waste site characterization/remediation.
- Multitask trainer: a cost-effective, realistic aircrew trainer that can be deployed with the squadron.
- Miniature color display to provide high resolution/high luminance images for helmet-mounted systems.
- Foreign Comparative Technology evaluation of Russian K-36D aircraft ejection seat.

AL products also have strong dual-use potential. A few examples are:
- Fundamental skill tutors for high school mathematics students.
- Force reflective control stick for wheelchair control in motor-imparied individuals.
- Laser device for deep ophthalmic surgery.
- Advanced molecular sieve oxygen generation and storage systems to replace LOX transport and storage.

Armstrong Laboratory provides a critical focal point for DOD human systems technology:

- Extensive collaboration with parent Human Systems Center organization and Air Force Center for Environmental Excellence, both with headquarters at Brooks AFB TX.

- Defense Reliance centers of excellence established with Army/Navy personnel collocated under AL lead for bioeffects of directed energy (at Brooks AFB TX), and for Toxicology (at Wright-Patterson AFB OH). DOD biodynamics also collocated with AL at Wright-Patterson AFB. AL chemical/biological defense program collocated with the Army at Edgewood Research, Development and Engineering Center, Edgewood MD.

- AL technical excellence recognized through many recent awards, including Theodore C. Lyster and Harry G. Moseley Awards from the Aerospace Medical Association, Fred Hitchcock Award for Excellence in Aerospace Physiology, Distinguished Member Award from the IEEE, General Spruance Award for Flying Safety from SAFE, Engineering Educator's Award from the American Society of Civil Engineers, JCS Award for Excellence in Military Medicine, Air Force Harold Brown Award, R&D 100 Award, CSAF Team Quality Award, Harold Metcalf Award for Technology Transfer, and four AFOSR Star Team Awards.

- Major facilities used to support the AL research programs include the Biocommunications Laboratory, Centrifuge, Impact Acceleration and Vibration Facilities, Directed Energy Bioeffects Facilities, Drug Testing Laboratory, Environmental/Occupational Toxicology Facilities, Environics Laboratories, Secure Simulator Facilities and Full Field of View Dome Display, and Hyperbaric and Hypobaric Research Chambers.

Funding for AL human systems research and technology programs is robust:
- Total FY94 budget was $207.6M from a variety of sources: $125.8M MFP-6, $39.7M MFP-8, $10.2M SBIR, $7.3M SERDP, and $24.6M Other.
- Steady increases in AL budget reflected in FY96 POM.

Summary

- The human will remain the most critical component of weapon systems well into the 21st century. People costs represent over 40 percent of the Air Force operating budget.

- The Armstrong Laboratory, as the prime developer of human systems technology, is dedicated to assuring that Air Force personnel are properly selected, trained, equipped, and protected in current and future Air Force operations.

Current as of 15 Dec 94

USAF BASE FACT SHEET
BROOKS AIR FORCE BASE, TEXAS

MAJCOM/LOCATION/SIZE: AFMC base in southeastern San Antonio with 1,310 acres

MAJOR UNITS/FORCE STRUCTURE:

- Human Systems Center
  -- Armstrong Laboratory
  -- USAF School of Aerospace Medicine
- 70th Air Base Group
- Air Force Center for Environmental Excellence (FOA)
- Air Force Medical Support Agency (FOA)
- 68th Intelligence Squadron (AIA)
- 710th Intelligence Flight (AFR)

USAF MANPOWER AUTHORIZATIONS: (As of FY 95/2)

MILITARY--ACTIVE	1,678
RESERVE	38
CIVILIAN	1,631
TOTAL	**3,347**

ANNOUNCED ACTIONS:

- The Air Force will reduce approximately 11,700 civilian authorizations in fiscal year 1995. These reductions are a result of the Federal Workforce Restructuring Act of 1994, the National Performance Review, and depot workload reductions. This action helps bring Department of Defense civilian employment levels in line with overall force reductions and results in a decrease of 62 civilian manpower authorizations at Brooks AFB.

Basing Manager: Maj Brackett/XOOB/77357
Editor: Ms Wright/XOOBD/46675/16 Feb 95

BROOKS AIR FORCE BASE, TEXAS (Cont'd)

MILITARY CONSTRUCTION PROGRAM ($000):

FISCAL YEAR 94:

Center for Environmental Compliance (Congress Insert)	8,400

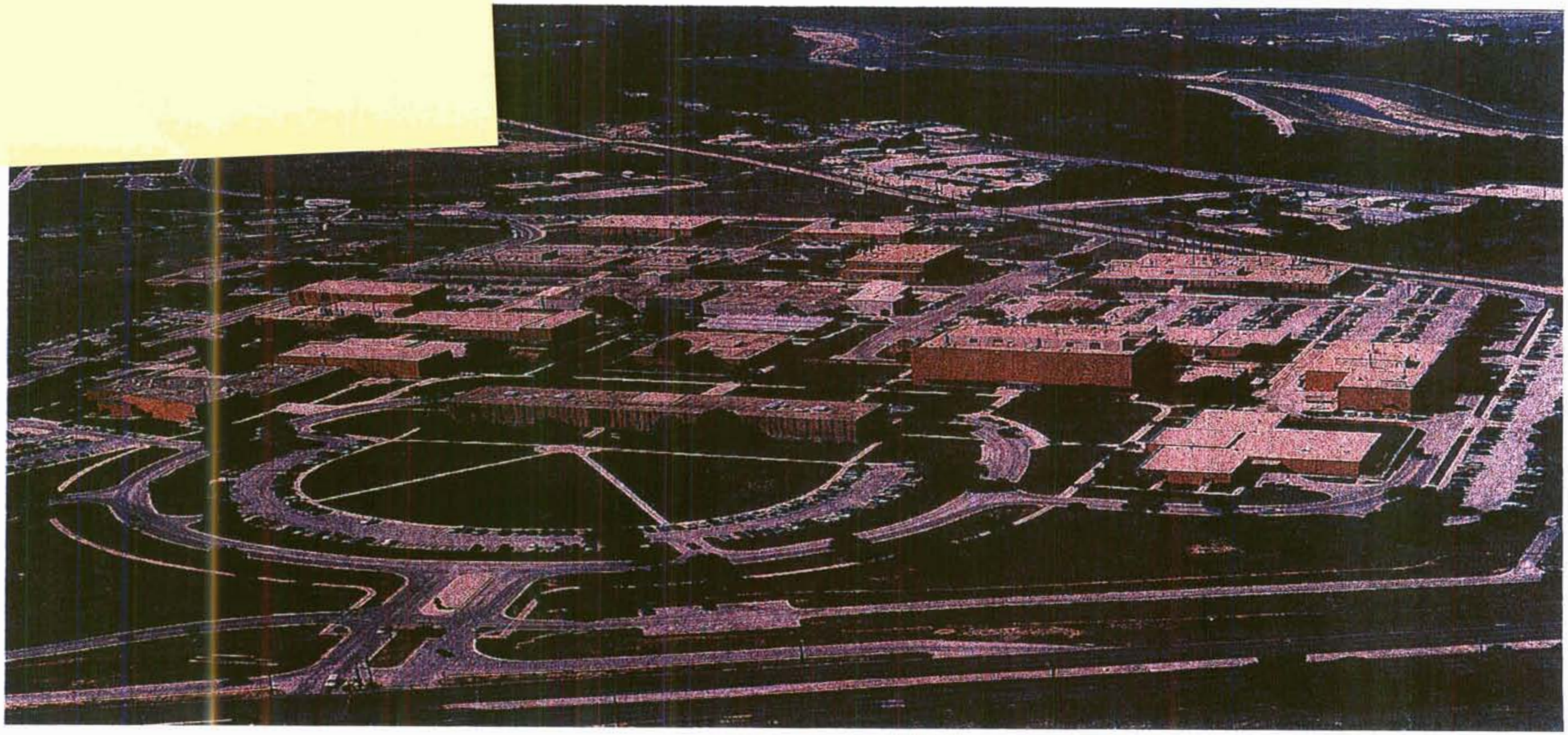
FISCAL YEAR 95:

Directed Energy Facility (Congress Insert)	6,500

SIGNIFICANT INSTALLATION ISSUES/PROBLEMS: None

Presentation at
Dallas

BROOKS
R FORCE BASE



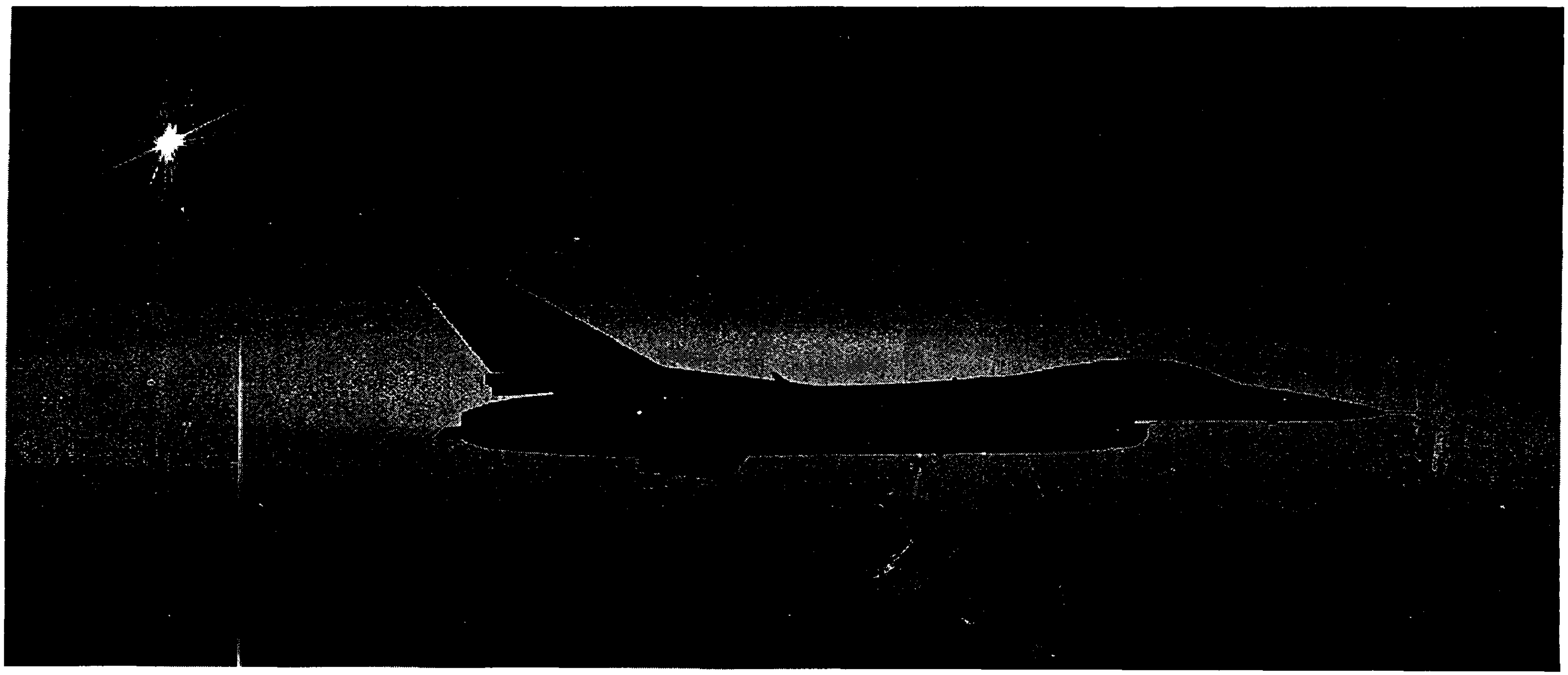
BROOKS AFB

OVERVIEW

- MISSION
- THE PROPOSALS
  - DoD PROPOSAL
  - ALTERNATIVE
  - COMPARISONS
- SUMMARY

BROOKS AFB
THE HUMAN SYSTEMS CENTER

THE HUMAN IS THE HEART OF AEROSPACE SYSTEMS AND OPERATIONS



BROOKS AFB

ARMSTRONG LABORATORY

HUMAN SYSTEMS CENTER

AF CENTER FOR ENVIRONMENTAL EXCELLENCE

HUMAN SYSTEMS PROGRAM OFFICE

TRANSFORMING POTENTIAL TO REALITY

Volanti Subvenimus

BROOKS AFB SNAPSHOT

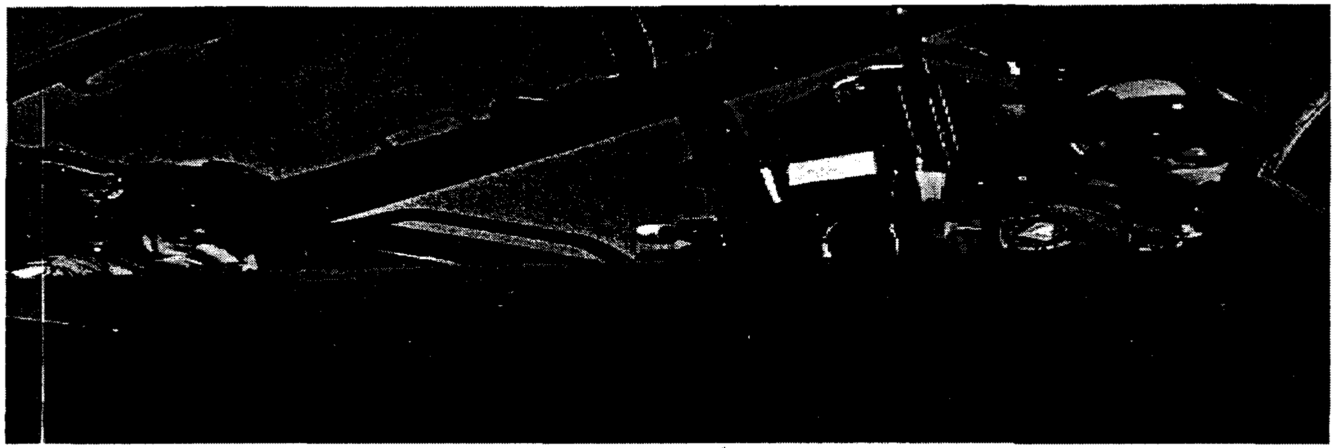
- 3,619 People Managing $608 Million Annually

- 2,215 Degrees Held
  - Scientists
  - Researchers
  - Medical Doctors
  - Research Technicians

- 400 Acquisition Professionals

- 128 Education/Training Instructors
  - 61 Aerospace Medicine Courses Graduating 4,678 Students
  - 8 System Acquisition Courses Graduating 1,385 Students

BROOKS AFB



THE WARFIGHTER

AIR FORCE COMBAT COMMAND

AIR FORCE MOBILITY COMMAND

AIR FORCE SPACE COMMAND

AIR FORCE SPECIAL OPERATIONS COMMAND

PACAF

USAFE

DELIVER KNOWLEDGE & SKILLS

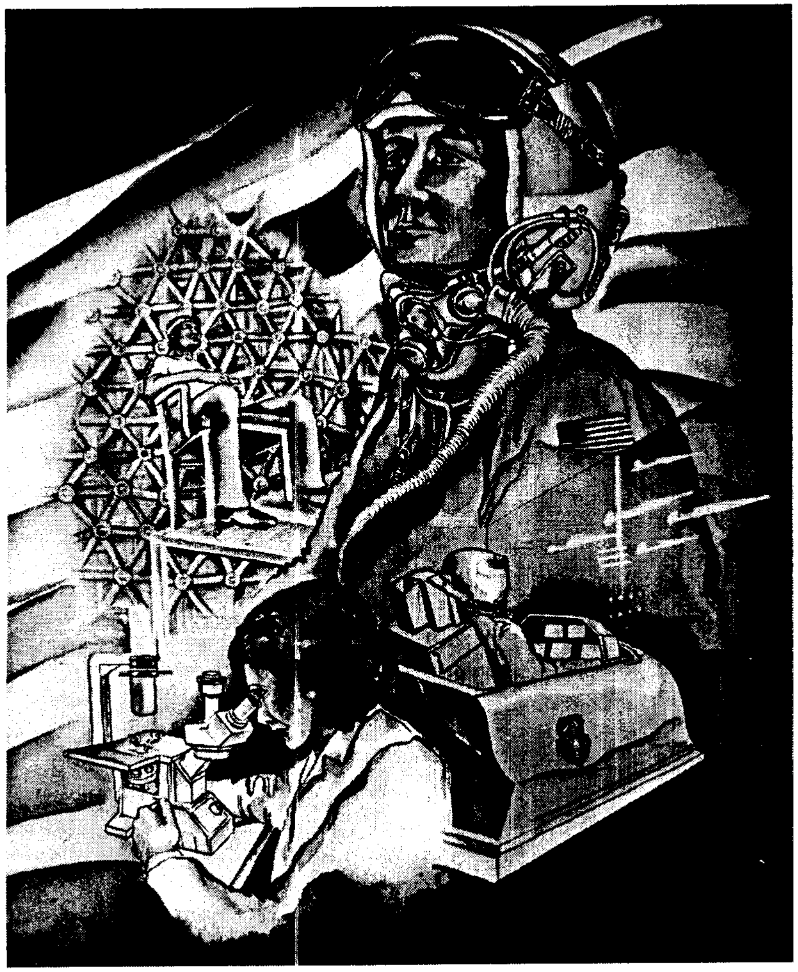
SUPPORT OPERATIONAL SYSTEMS

DELIVER HUMAN SYSTEMS

SUPPORT WEAPONS SYSTEMS DEVELOPMENT

DELIVER HUMAN-CENTERED SCIENCE & TECHNOLOGY

BROOKS AFB



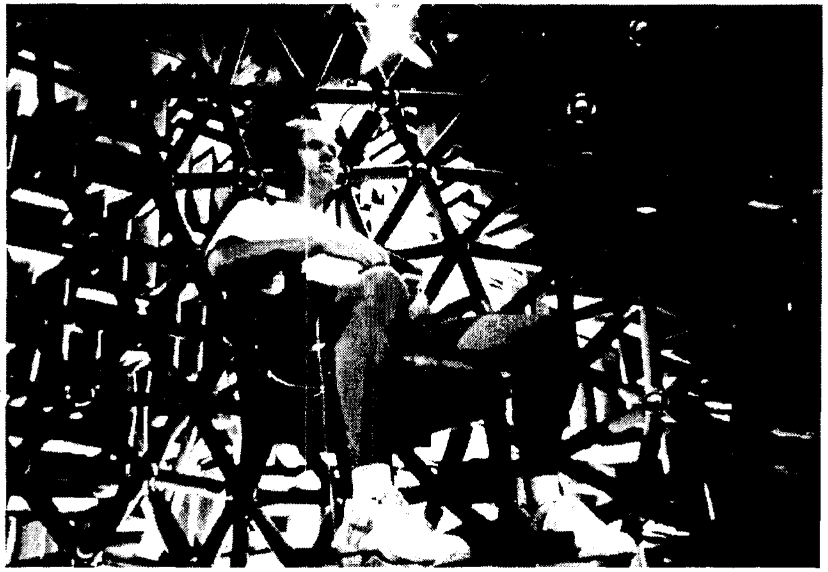
HUMAN SYSTEMS CENTER
Products and Progress

MISSIONS & PRODUCTS

- CREW SYSTEMS
- HUMAN RESOURCES
- AEROSPACE MEDICINE
- OCCUPATIONAL & ENVIRONMENTAL HEALTH
- ENVIRONICS

BROOKS AFB

Crew Systems

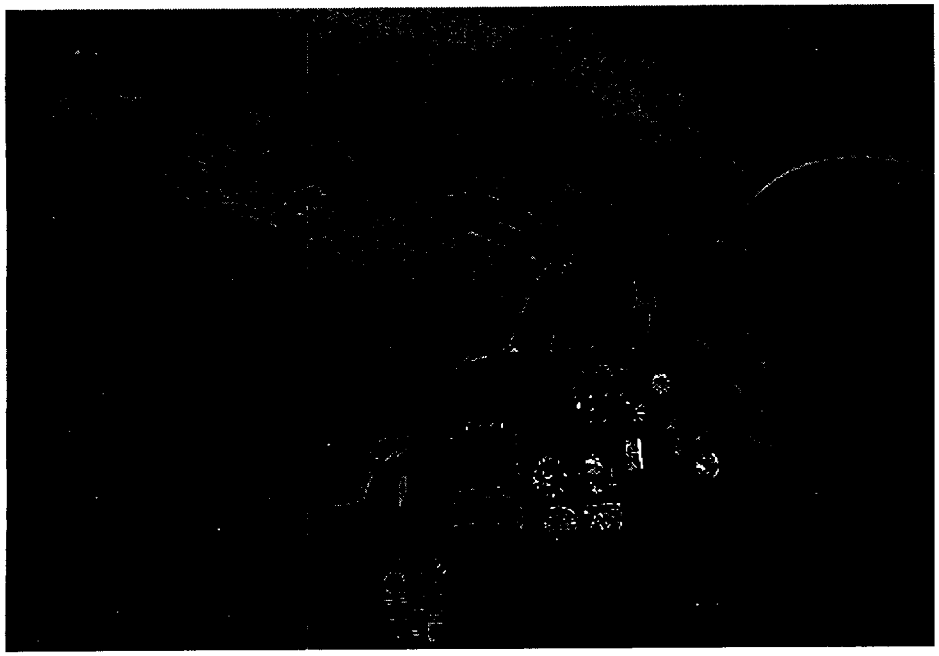


This Human Systems Center product area accomplishes research and develops, fields, and supports technology and systems to optimize human combat performance and survivability to ensure weapons systems configurations are compatible with human operator requirements.

- **NUCLEAR - BIOLOGICAL - CHEMICAL DEFENSE**
- **LIFE SUPPORT**
- **CREW INTERFACE TECHNOLOGY**
- **OPERATIONAL PERFORMANCE**
- **HUMAN - CENTERED DESIGN**

BROOKS AFB

Human Resources

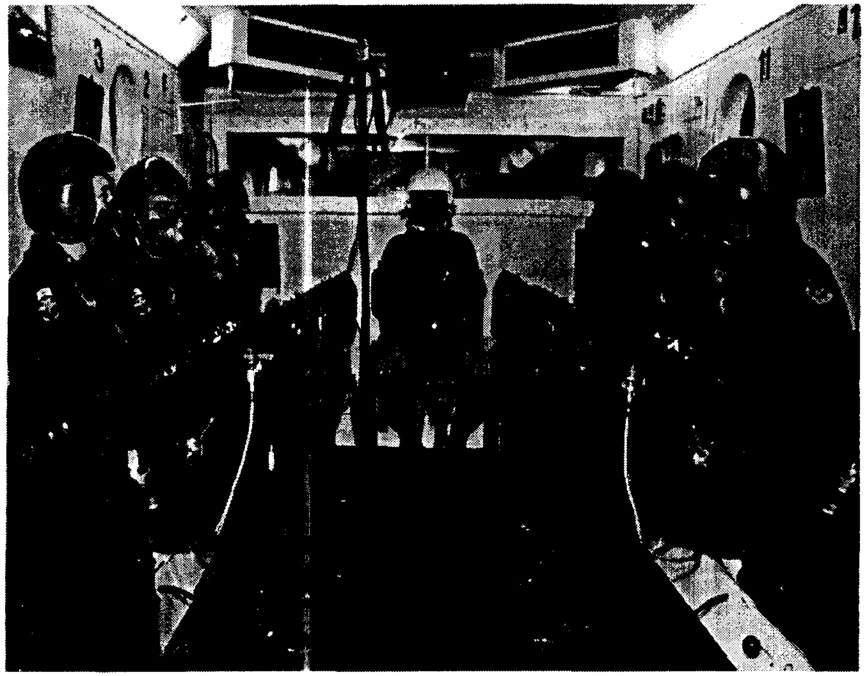


This Human Systems Center product area accomplishes research and develops, fields, and supports unique Manpower, Personnel, and Training technology and systems.

- **FORCE MANAGEMENT**
- **AIRCREW TRAINING**
- **TRAINING SYSTEMS**
- **LOGISTICS SUPPORT**

BROOKS AFB

Aerospace Medicine

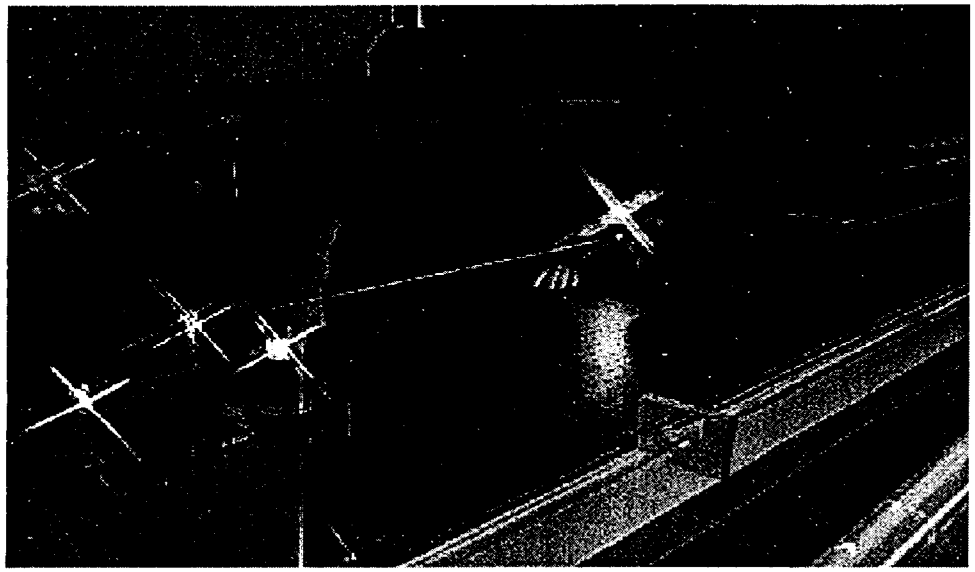


This Human Systems Center product area provides research and specialized operational support in aeromedical consultation, epidemiolgy, drug testing, and hyperbaric medicine, as well as development, fielding, and support of aeromedical systems and equipment.

- **AEROMEDICAL CASUALTY CARE**
- **OPERATIONAL APPLICATIONS**
- **AEROMEDICAL EDUCATION**

BROOKS AFB

Occupational and Environmental Health



This Human Systems Center product area assesses risks to personnel from hazardous materials, noise, electromagnetic radiation, and occupational processes in USAF operations. The work combines human-centered research and development in these emphasis areas with broad field consultation responsibilities to measure and reduce occupational illness and environmental hazards.

- OCCUPATIONAL HEALTH
- HAZARDOUS MATERIALS
- RADIATION

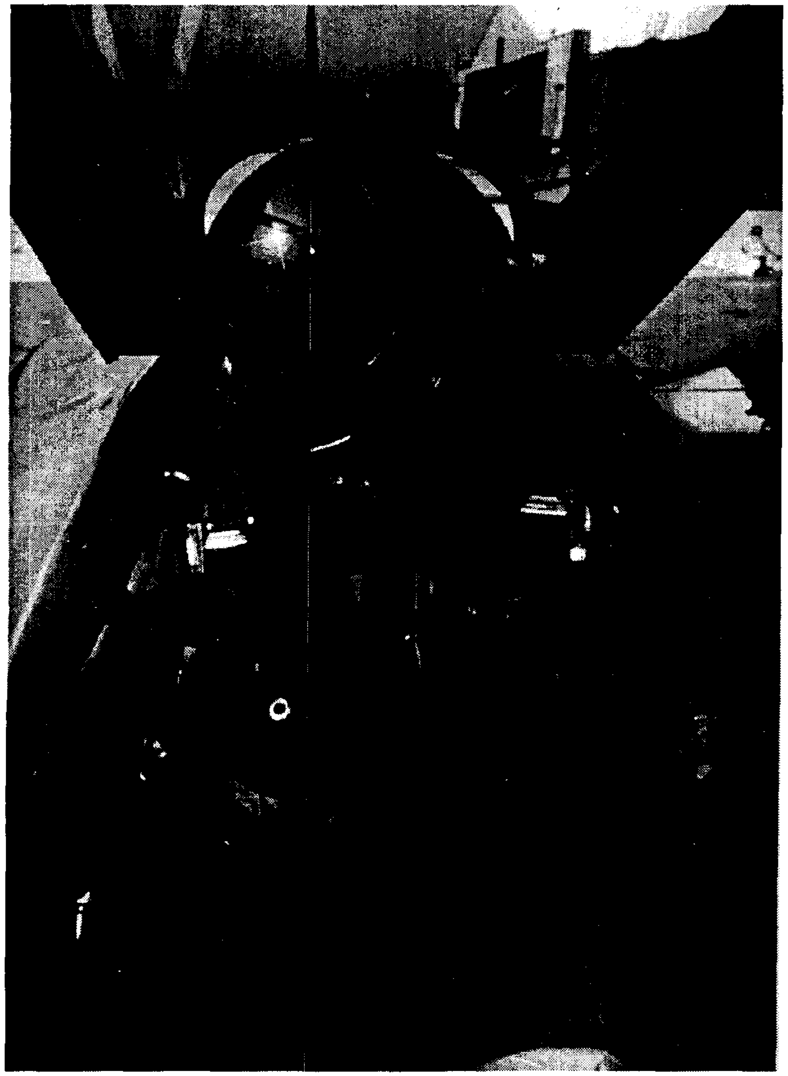
BROOKS AFB

Environics and Environment Clean-up

This Human Systems Center product area provides environmental quality technology that supports the Air Force mission by reducing the cost of cleaning up past waste sites while assuring, through compliance, the completion of critical wartime and peacetime missions. The Air Force Center for Environmental Excellence applies these leading edge technologies to environmental clean-up projects.

- **BIODEGRADATION**
- **BIODEGRADABLE SOLVENTS AND CLEANERS**
- **ROCKET PROPELLANT DISPOSAL**

BROOKS AFB



THE AIR FORCE HUMAN SYSTEMS CENTER

- **ENHANCE WARFIGHTER'S COMBAT CAPABILITY**
- **ADVOCATE FOR THE HUMAN**
  - **DESIGN**
  - **DEPLOYMENT**
  - **OPERATIONS**

BROOKS AFB

MISSIONS

- HUMAN SYSTEMS CENTER
- HUMAN SYSTEMS PROGRAM OFFICE
- ARMSTRONG LABORATORY
- SCHOOL OF AEROSPACE MEDICINE
- CENTER FOR ENVIRONMENTAL EXCELLENCE

AN INTEGRATED HUMAN SYSTEMS CENTER

BROOKS AFB

THE BOTTOM LINE

- THE BROOKS MISSIONS WILL BE RETAINED
- THEY WILL BE CONDUCTED SOMEWHERE
- MORE COST-EFFECTIVE IN SAN ANTONIO

SAN ANTONIO SYNERGY

UNIQUE MILITARY HUMAN SYSTEMS COMMUNITY

- HUMAN SYSTEMS CENTER
- ARMSTRONG LAB
- USAF SCHOOL OF AEROSPACE MEDICINE
- AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
- HUMAN SYSTEMS PROGRAM OFFICE
- AIR EDUCATION AND TRAINING COMMAND
- AIR FORCE MILITARY PERSONNEL CENTER
- LACKLAND AFB
- KELLY AFB

SAN ANTONIO SYNERGY

ONE-OF-A-KIND BIOMEDICAL COMMUNITY

- UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER
- TEXAS RESEARCH AND TECHNOLOGY FOUNDATION
- SOUTHWEST RESEARCH INSTITUTE
- SOUTHWEST FOUNDATION FOR BIOMEDICAL RESEARCH
- WILFORD HALL MEDICAL CENTER
- BROOKE ARMY MEDICAL CENTER
- UNIVERSITY OF TEXAS AT SAN ANTONIO
- AIR EDUCATION AND TRAINING COMMAND

BROOKS AFB

THE PROPOSALS

BROOKS AFB

COMPARISONS

	DoD Proposal	Alternative
• SCENARIO	RELOCATE	CANTONMENT
• BROOKS AFB	CLOSE	CLOSE
• PEOPLE		
•Eliminate	391	391
•Relocate	3,228	518
• ONE TIME COST	$ 185 Million	$ 11 Million
• 20 YEAR NET PRESENT VALUE	$ 142 Million	$ 301 Million
• RETURN ON INVESTMENT	7 Years	Immediate

BROOKS AFB
DoD PROPOSAL

- CLOSE BROOKS AFB

- RELOCATE TO WRIGHT PATTERSON AFB
  * Human Systems Center
  * Armstrong Laboratory
  * School of Aerospace Medicine

- RELOCATE TO TYNDALL AFB
  * Air Force Center for Environmental Excellence

- RELOCATE TO KELLY AFB
  * 68th Intelligence Squadron

- RELOCATE TO LACKLAND
  * 710th Intelligence Flight
  * Hyperbaric Chamber Operation

- RELOCATE TO BASE X
  * Air Force Drug Test Laboratory

• MOVES		3,228 People
• ONE-TIME COSTS		$185 Million
• Milcon	$ 103 M	
• Movement	47 M	
• Personnel	6 M	
• Overhead	5 M	
• Other	2 M	
• One-Time Unique	21 M	
• NET PRESENT VALUE		$ 142 Million

BROOKS AFB

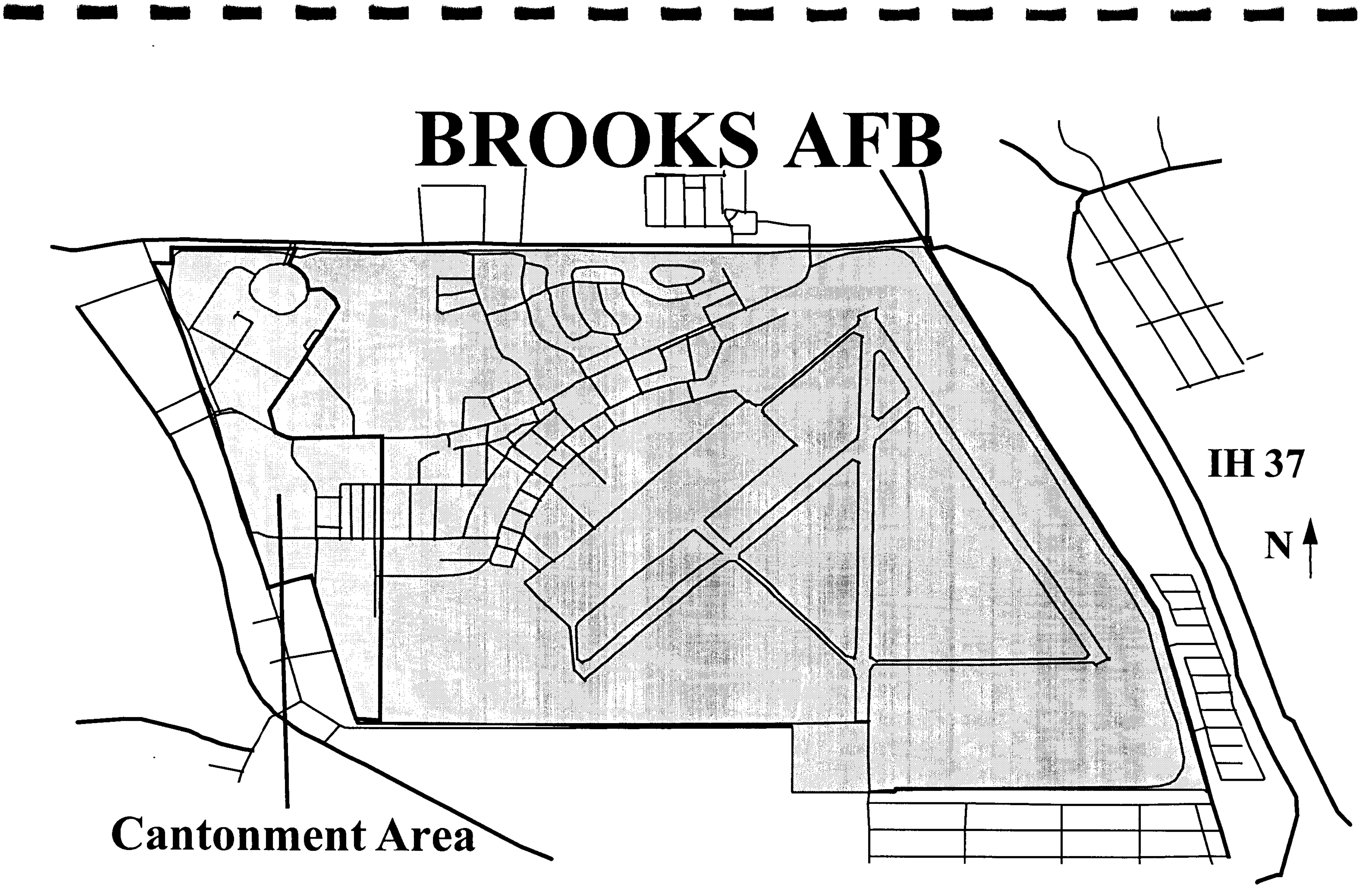
AN ALTERNATIVE - *CANTONMENT*

- CLOSE BROOKS AFB

- RETAIN MISSIONS IN CANTONMENT IN SAN ANTONIO
  - Human Systems Center
  - Human Systems Program Office
  - Armstrong Laboratory
  - School of Aerospace Medicine
  - Center for Environmental Excellence

- RELOCATE TO KELLY AFB & LACKLAND AFB
  - 68th Intelligence Squadron
  - 710th Intelligence Flight

- BOS & RPM PROVIDED BY KELLY AFB OR LACKLAND AFB


BROOKS AFB
IH 37
N
Cantonment Area

BROOKS AFB

THE RESULTS

- CLOSE BROOKS AFB

- PEOPLE/JOBS
    * Eliminate — 391
    * Relocate — 518 (Across Town)

- ONE TIME COST — $ 11 Million
    * MILCON $ 6 Million

- 20 YEAR NET PRESENT VALUE — $ 301 Million

- RETURN ON INVESTMENT — Immediate

BROOKS AFB

COMPARISONS

	DoD Proposal	Cantonment
• SCENARIO	RELOCATE	CANTONMENT
• BROOKS AFB	CLOSE	CLOSE
• PEOPLE		
•Eliminate	391	391
•Relocate	3,228	518
• ONE TIME COST	$ 185 Million	$ 11 Million
• 20 YEAR NET PRESENT VALUE	$ 142 Million	$ 301 Million
• RETURN ON INVESTMENT	7 Years	Immediate

THE CASE FOR CANTONMENT

- BROOKS MISSIONS AND SCIENTISTS ARE ESSENTIAL
  - THESE MISSIONS WILL BE CONDUCTED SOMEWHERE
- SAN ANTONIO IS THE RIGHT PLACE
  - PRESERVES THE SYNERGIES
  - MORE COST EFFECTIVE
- THERE ARE TWO OPTIONS

THE CASE FOR CANTONMENT

OPTIONS

- DoD PROPOSAL
  - CLOSE BROOKS AFB
  - MOVE MISSIONS & SCIENTISTS

- CANTONMENT
  - CLOSE BROOKS AFB
  - KEEP MISSIONS & SCIENTISTS

COST-BENEFIT ANALYSIS

- COSTS: $185 MILLION
- SAVES: $142 MILLION
- RISKS LOSING SCIENTISTS
- LOSES SYNERGIES

- COSTS: $11 MILLION
- SAVES: $301 MILLION
- KEEPS SCIENTISTS
- RETAINS SYNERGIES

BROOKS AFB, TX AND BERGSTROM AFB, TX BASE VISITS
APRIL 6, 1995

TABLE OF CONTENTS

70TH
~~648th~~ CIVIL ENGINEERING SQUADRON (AFMC)
8103 9th STREET
BROOKS AIR FORCE BASE, TX 78235-5355

Memo from Office of the Commander

06/19/95

MEMORANDUM FOR COL PURSER

SUBJECT: Brooks Cantonment Viewgraphs

Attached are briefing maps of the Brooks AFB cantonment option for your review as requested of me by Col Gavornik. If you would like any changes, please let us know and we will forward them again by Federal Express.

MICHAEL J. COOK, LtCol, USAF
Commander

Attachments
Briefing Materials

21 0536
3861

210
219-3390 Col Gavornik

UNCLASSIFIED

DoD Base Closure and Realignment
Report to the Commission

DEPARTMENT OF THE AIR FORCE

ANALYSES AND RECOMMENDATIONS

(Volume V)

February 1995

UNCLASSIFIED

BROOKS AIR FORCE BASE, TEXAS

Recommendation: Close Brooks AFB. The Human Systems Center, including the School of Aerospace Medicine and Armstrong Laboratory, will relocate to Wright-Patterson AFB, Ohio, however, some portion of the Manpower and Personnel function, and the Air Force Drug Test laboratory, may relocate to other locations. The 68th Intelligence Squadron will relocate to Kelly AFB, Texas. The Air Force Center for Environmental Excellence will relocate to Tyndall AFB, Florida. The 710th Intelligence Flight (AFRES) will relocate to Lackland AFB, Texas. The hyperbaric chamber operation, including associated personnel, will relocate to Lackland AFB, Texas. All activities and facilities at the base including family housing, the medical facility, commissary, and base exchange will close.

Justification: The Air Force has more laboratory capacity than necessary to support current and projected Air Force research requirements. When compared to the attributes desirable in laboratory activities, the Armstrong Lab and Human Systems Center operations at Brooks AFB contributed less to Air Force needs as measured by such areas as workload requirements, facilities, and personnel. As an installation, Brooks AFB ranked lower than the other bases in the Laboratory and Product Center subcategory.

Return on Investment: The total estimated one-time cost to implement this recommendation is $185.5 million. The net of all costs and savings during the implementation period is a cost of $138.7 million. Annual recurring savings after implementation are $27.4 million with a return on investment expected in seven years. The net present value of the costs and savings over 20 years is a savings of $142.1 million.

Impact: Assuming no economic recovery, this recommendation could result in a maximum potential reduction of 7,879 jobs (3,759 direct jobs and 4,120 indirect jobs) over the 1996-to-2001 period in the San Antonio, Texas Metropolitan Statistical Area, which is 1.1 percent of the economic area's employment. The cumulative economic impact of all BRAC 95 recommendations, including the relocation of some Air Force activities into the San Antonio area, and all prior-round BRAC actions in the economic area over the 1994-to-2001 period could result in a maximum potential decrease equal to 0.9 percent of employment in the economic area. Environmental impact from this action is minimal and ongoing restoration of Brooks AFB will continue.

Category Descriptions

Operations

The primary purpose of bases in this category is to support operational missions based on predominant use and mission suitability. This category is divided into three subcategories - Missiles, Large Aircraft and Small Aircraft.

Missiles: Bases with missile fields

Francis E. Warren AFB, Wyoming
Minot AFB, North Dakota*
Grand Forks AFB, North Dakota*
Malmstrom AFB, Montana*

*Also considered under Large Aircraft subcategory

Large Aircraft: Bases with large aircraft units and potential to beddown small aircraft units

Altus AFB, Oklahoma
Andrews AFB, Maryland
Beale AFB, California
Dover AFB, Delaware
Ellsworth AFB, South Dakota
Grand Forks AFB, North Dakota*
Little Rock AFB, Arkansas
McChord AFB, Washington
McGuire AFB, New Jersey
Offutt AFB, Nebraska
Travis AFB, California
Andersen AFB, Guam
Barksdale AFB, Louisiana
Charleston AFB, South Carolina
Dyess AFB, Texas
Fairchild AFB, Washington
Hickam AFB, Hawaii
Malmstrom AFB, Montana*
McConnell AFB, Kansas
Minot AFB, North Dakota*
Scott AFB, Illinois
Whiteman AFB, Missouri

*Also considered under Missile subcategory

Small Aircraft: Bases with fighter type aircraft units; some have potential for a few large aircraft

Cannon AFB, New Mexico
Eielson AFB, Alaska
Holloman AFB, New Mexico
Langley AFB, Virginia
Moody AFB, Georgia
Nellis AFB, Nevada
Seymour Johnson AFB, North Carolina
Tyndall AFB, Florida
Davis-Monthan AFB, Arizona
Elmendorf AFB, Alaska
Hurlburt Field, Florida
Luke AFB, Arizona
Mt Home AFB, Idaho
Pope AFB, North Carolina
Shaw AFB, South Carolina

Undergraduate Flying Training

The primary purpose of installations in this category is to support undergraduate pilot and navigator training as well as instructor pilot training. The installations, airspace, and facilities are optimized for training pilots and navigators.

Columbus AFB, Mississippi
Randolph AFB, Texas
Vance AFB, Oklahoma
Laughlin AFB, Texas
Reese AFB, Texas

Industrial/Technical Support

The primary purpose of installations in this category is to provide highly technical support for depot level maintenance, research, development, test and acquisition. This category is divided into three subcategories: Depots, Product Centers and Laboratories, and Test Facilities.

Depots

Hill AFB, Utah
McClellan AFB, California
Tinker AFB, Oklahoma
Kelly AFB, Texas
Robins AFB, Georgia

Product Centers And Laboratories

Brooks AFB, Texas
Kirtland AFB, New Mexico
Rome Lab, New York
Hanscom AFB, Massachusetts
Los Angeles AFB, California
Wright-Patterson AFB, Ohio

Test And Evaluation

Arnold AS, Tennessee
Eglin AFB, Florida
Edwards AFB, California

Education and Training

The primary purpose of installations in this category is to support training activities. It is divided into the Technical Training and Education subcategories.

Technical Training

Goodfellow AFB, Texas
Lackland AFB, Texas
Keesler AFB, Mississippi
Sheppard AFB, Texas

Education

Maxwell AFB, Alabama
U.S. Air Force Academy, Colorado

Space

The primary purpose of installations in this category is to provide technical support for national space operations. This category is divided into Space Support and Satellite Control subcategories.

Space Support

Patrick AFB, Florida
Vandenberg AFB, California
Peterson AFB, Colorado

Satellite Control

Falcon AFB, Colorado
Onizuka AS, California

Other

The primary purpose of installations in this category is to support administrative functions.

Administrative

Battle Creek Federal Center, Michigan
DFAS/ARPC, Colorado
Bolling AFB, Washington DC
MacDill AFB, Florida

Air Reserve Component

The primary purpose of installations in this category is to support Air National Guard and Air Force Reserve operations.

Air National Guard

Boise Air Terminal AGS, Idaho
Ft Drum Support Airfield, Rome, New York
Lambert Field IAP AGS, Missouri
Otis AGB, Massachusetts
Rickenbacker AGS, Ohio
Selfridge AGB, Michigan **
Tucson IAP AGS, Arizona
Buckley AGB, Colorado
Greater Pittsburgh IAP AGS, PA
Martin State APT AGS, Maryland
Portland IAP AGS, Oregon **
Salt Lake City IAP AGS, Utah
Stewart IAP AGS, New York

Air Force Reserve

Bergstrom ARB, Texas
Dobbins ARB, Georgia*
Greater Pittsburgh IAP, ARS, PA
Homestead ARB, Florida
Minn/St Paul IAP, ARS, Minnesota*
O'Hare IAP, ARS, Illinois*
NAS Willow Grove ARS, PA*
Carswell ARS, NAS Ft Worth, Texas
Gen Mitchell IAP ARS, Michigan *
Grissom ARB, Indiana
March ARB, California*
Niagara Falls IAP, ARS, New York *
Westover ARB, Massachusetts
Youngstown MPT, ARS, Ohio

*Air Reserve host with ANG Tenant
**ANG host with Air Reserve Tenant

USAF BASE FACT SHEET
BROOKS AIR FORCE BASE, TEXAS

MAJCOM/LOCATION/SIZE: AFMC base in southeastern San Antonio with 1,310 acres

MAJOR UNITS/FORCE STRUCTURE:

- Human Systems Center
  -- Armstrong Laboratory
  -- USAF School of Aerospace Medicine
- 70th Air Base Group
- Air Force Center for Environmental Excellence (FOA)
- Air Force Medical Support Agency (FOA)
- 68th Intelligence Squadron (AIA)
- 710th Intelligence Flight (AFR)

USAF MANPOWER AUTHORIZATIONS: (As of FY 95/2)

MILITARY--ACTIVE	1,678
RESERVE	38
CIVILIAN	1,631
TOTAL	3,347

ANNOUNCED ACTIONS:

- The Air Force will reduce approximately 11,700 civilian authorizations in fiscal year 1995. These reductions are a result of the Federal Workforce Restructuring Act of 1994, the National Performance Review, and depot workload reductions. This action helps bring Department of Defense civilian employment levels in line with overall force reductions and results in a decrease of 62 civilian manpower authorizations at Brooks AFB.

Basing Manager: Maj Brackett/XOOB/77357
Editor: Ms Wright/XOOBD/46675/16 Feb 95

BROOKS AIR FORCE BASE, TEXAS (Cont'd)

MILITARY CONSTRUCTION PROGRAM ($000):

FISCAL YEAR 94:	
Center for Environmental Compliance (Congress Insert)	8,400
FISCAL YEAR 95:	
Directed Energy Facility (Congress Insert)	6,500

SIGNIFICANT INSTALLATION ISSUES/PROBLEMS: None

United States Air Force

FACT SHEET

Office of Public Affairs, Human Systems Center, 2510 Kennedy Circle, Suite 1, Brooks AFB TX 78235-5120 Phone (210) 536-3234 Fax (210) 536-3235

HUMAN SYSTEMS CENTER

MISSION

The Human Systems Center of Air Force Materiel Command, headquartered at Brooks Air Force Base, Texas, is the Air Force advocate for integrating and maintaining the human in Air Force systems and operations. People are the key to all Air Force operations. HSC is the systems-independent product center for human-centered research, development, acquisition and specialized operational support.

Its mission is to protect and enhance human capabilities and human-systems performance with a scope of impact ranging from the individual to combatant command forces including DOD and Allied Nations Forces. The Armstrong Laboratory, the USAF School of Aerospace Medicine, the HSC Program Office (YA), the 70th Medical Squadron and an air base group are the major units of HSC.

HISTORY

HSC's origins go back to Jan. 19, 1918, when the Medical Research Laboratory was formed at Hazelhurst Field, N.Y. In 1922, this Laboratory was redesignated the School of Aviation Medicine, and four years later it moved to Brooks Field which was a center for primary flight training. Both organizations moved to Randolph Field in October 1931. The school moved back to Brooks during the summer of 1959 and the base became the headquarters for the Aerospace Medical Center the same year.

The Center represented the initial step in placing the management of aerospace medical research, education and clinical medicine under one command. Both the school and center were reassigned from Air Training Command to Air Force Systems Command in November 1961 and assigned to the new organization, Aerospace Medical Division (now HSC).

(Current as of Oct. 1994)

On Nov. 21, 1963, President John F. Kennedy dedicated four new buildings of USAFSAM in the complex that housed the Aerospace Medical Division. This was his last official act before his assassination in Dallas the following day.

In 1986, the Department of Defense began streamlining its organization as a result of the Packard Commission recommendations. This division's acquisition mission emphasized its human-centered technologies. It restructured its functional areas and was renamed the Human Systems Division on Feb. 6, 1987.

In December 1990, the Air Force Systems Command underwent a major restructuring which consolidated 16 laboratories nationwide into four. Brooks Air Force Base and the Human Systems Division became home of one of the "super labs." The new lab, named the Armstrong Laboratory, is a world-class center in science and technology for protecting the human in Air Force systems.

On July 1, 1992, the Human Systems Division was renamed the Human Systems Center as part of the structuring of the new Air Force Materiel Command. The command was activated July 1, 1992, when the Air Force Logistics Command and Air Force Systems Command were integrated.

ORGANIZATIONS

The Human Systems Center headquarters supports its subordinate organizations with administration, command and control, and logistics.

U.S. Air Force School of Aerospace Medicine

As the center for aerospace medicine education, the USAF School of Aerospace Medicine is the major provider of educational programs involving aviation, space, and environmental medicine for Air Force, DOD, and Allied Nations personnel. The programs span entry level through graduate medical education in all disciplines encompassed in the aerospace medicine specialty.

70th School Squadron

The 70th Training Squadron advances the education of acquisition professionals to support and sustain all Air Force weapons systems. About 1,600 students are trained annually.

Human Systems Center Program Office

The program office is responsible for the engineering and manufacturing development, production, evolution and sustainment of life support, chemical defense, aeromedical, human resource, and operational analysis systems, and the design and test of Air Force uniforms. The program office demonstrates technology concepts in prototype systems to reduce technical, cost, and schedule risk, and to accelerate the transition arm of the Human Systems Center.

It is responsible for proper execution of engineering and manufacturing development and production programs and coordinates acquisition efforts with other agencies and the using MAJCOMs. The program office is also responsible for the Human Systems Center staff functional work in the areas of engineering, manufacturing/quality assurance, configuration/data management, test and evaluation, and acquisition logistics.

70th Air Base Group

The 70th Air Base Group operates and maintains Brooks Air Force Base in support of HSC and tenant units.

The Armstrong Laboratory

The Armstrong Laboratory, as one of the four Air Force "Super Laboratories," is the Air Force's center of excellence for human-centered science and technology. The laboratory provides the science and technology base and the direct operational support needed to enhance human performance in Air Force systems and operations. The research, development, and support activities of the laboratory address current and future needs in the areas of human resources, crew systems, aerospace medicine, and occupational and environmental health to enhance crew protection and performance, training and logistics, and force management, health and safety.

70th Medical Squadron

The 70th Medical Squadron provides personalized outpatient medical and dental care for the Brooks Air force Base community in a total quality environment. Services include primary care, aerospace medicine, optometry, military health, pharmacy, radiology, immunology, military public health, bioenvironmental engineering, and clinical laboratory. Approximately 25,000 patients per year are treated here.

FACT SHEET

United States Air Force

AIR FORCE MATERIEL COMMAND
Human Systems Center
2509 Kennedy Circle, Brooks AFB TX 78235-5118
(210) 536-3136

ARMSTRONG LABORATORY

The Armstrong Laboratory (AL), headquartered at Brooks AFB, Texas, is the Air Force center of excellence for human-focused science and technology. Unique in the DOD, the Laboratory brings together in one organization the biological, behavioral, medical, physical, and computational science and engineering disciplines, and specialized research facilities required to address the tough human challenges facing the Air Force warfighters of today and tomorrow.

The Armstrong Laboratory has approximately 1600 military and civilian employees (57% civilian, 20% officer, 23% enlisted), with the highest percentage of doctoral degrees among the four AF Superlabs. With a budget of more than $200 million this year, the Armstrong Laboratory conducts its research through five technical directorates: aerospace medicine, crew systems, environics, human resources, and occupational and environmental health, at four principal locations: Brooks AFB TX, Wright Patterson AFB OH, Tyndall AFB FL, and Williams-Gateway Airport, Mesa AZ.

AL provides a single face to the customer for human systems expertise through a combination of science and technology (MFP-6) and defense health programs (MFP-8). Customers include the Air Force war-fighting commands, AFMC SPOs and ALCs, Air Staff (SG, DP, CE), DOD, and other agencies (NASA, FAA, DOT).

- Requirements are documented via Mission Area Plans and the AFMC Technology Master Process (TMP).
- Close connections with users generate many short-suspense requests from operational units, such as:
  - Joint effort with 8th AF to develop countermeasures for crew fatigue during long duration bombing missions from CONUS.
  - Measurement of G-susceptibility or "G-layoff effect" for return of aircrew to high performance aircraft following a non-flying assignment (DNIF), at specific request of HQ ACC/CC.
- Periodic customer satisfaction surveys are used to assess and improve responsiveness to customer needs.

Armstrong Laboratory products are developed using an integrated, multidisciplinary approach. Recent examples include:

- Situation Awareness Integration Team (SAINT) answered CSAF question concerning ability to measure and train aircrew situation awareness skills. AL team was established with experts in behavioral psychology, human factors and cognitive sciences, aircrew training, and aerospace medicine. Study results are being incorporated into future pilot selection and aircrew training procedures.

- Human factors vision evaluation supported Board investigation of F-15 shoot-down of Blackhawk helicopters over Iraq. Experts in experimental psychology, optometry, ophthalmology, and optical physics provided quick-look report to Board within 48 hours of request. Detailed technical report evaluating effects of real-world conditions for target/terrain luminance, contrast visibility, visor distortion, airspeed, and target distance on pilot vision completed within ten days of request.

- Advanced Technology Anti-G Suit (ATAGS) developed to increase pilot endurance to high, sustained acceleration by 50 percent over current anti-G suit. Product is the result of close collaboration among laboratory physiologists, engineers, life support specialists, and the Human Systems Program Office. Operational payoffs include increased pilot protection, improved performance, and decreased aircraft/pilot losses due to acceleration-induced loss of consciousness.

- Large rocket motor disposal program has developed technologies and processes to safely remove, treat and dispose of aged rocket propellants. This AL-led program has successfully leveraged over $25M in Air Force, DOD and ARPA technology programs, and has integrated technologies to reduce duplication of effort and compress the project schedule. Full-scale demonstration on a Minuteman II stage III solid rocket motor will be done in FY95.

Other recent success stories include:
- Integrated Maintenance Information System (IMIS) field demonstration on F-16s at Luke AFB AZ.
- Rapid optical scanning and bioventing technologies for hazardous waste site characterization/remediation.
- Multitask trainer: a cost-effective, realistic aircrew trainer that can be deployed with the squadron.
- Miniature color display to provide high resolution/high luminance images for helmet-mounted systems.
- Foreign Comparative Technology evaluation of Russian K-36D aircraft ejection seat.

AL products also have strong dual-use potential. A few examples are:
- Fundamental skill tutors for high school mathematics students.
- Force reflective control stick for wheelchair control in motor-imparied individuals.
- Laser device for deep ophthalmic surgery.
- Advanced molecular sieve oxygen generation and storage systems to replace LOX transport and storage.

Armstrong Laboratory provides a critical focal point for DOD human systems technology:

- Extensive collaboration with parent Human Systems Center organization and Air Force Center for Environmental Excellence, both with headquarters at Brooks AFB TX.

- Defense Reliance centers of excellence established with Army/Navy personnel collocated under AL lead for bioeffects of directed energy (at Brooks AFB TX), and for Toxicology (at Wright-Patterson AFB OH). DOD biodynamics also collocated with AL at Wright-Patterson AFB. AL chemical/biological defense program collocated with the Army at Edgewood Research, Development and Engineering Center, Edgewood MD.

- AL technical excellence recognized through many recent awards, including Theodore C. Lyster and Harry G. Moseley Awards from the Aerospace Medical Association, Fred Hitchcock Award for Excellence in Aerospace Physiology, Distinguished Member Award from the IEEE, General Spruance Award for Flying Safety from SAFE, Engineering Educator's Award from the American Society of Civil Engineers, JCS Award for Excellence in Military Medicine, Air Force Harold Brown Award, R&D 100 Award, CSAF Team Quality Award, Harold Metcalf Award for Technology Transfer, and four AFOSR Star Team Awards.

- Major facilities used to support the AL research programs include the Biocommunications Laboratory, Centrifuge, Impact Acceleration and Vibration Facilities, Directed Energy Bioeffects Facilities, Drug Testing Laboratory, Environmental/Occupational Toxicology Facilities, Environics Laboratories, Secure Simulator Facilities and Full Field of View Dome Display, and Hyperbaric and Hypobaric Research Chambers.

Funding for AL human systems research and technology programs is robust:
- Total FY94 budget was $207.6M from a variety of sources: $125.8M MFP-6, $39.7M MFP-8, $10.2M SBIR, $7.3M SERDP, and $24.6M Other.
- Steady increases in AL budget reflected in FY96 POM.

Summary

- The human will remain the most critical component of weapon systems well into the 21st century. People costs represent over 40 percent of the Air Force operating budget.

- The Armstrong Laboratory, as the prime developer of human systems technology, is dedicated to assuring that Air Force personnel are properly selected, trained, equipped, and protected in current and future Air Force operations.

Current as of 15 Dec 94

52ND STORY of Level 1 printed in FULL format.

The Dayton Daily News

March 2, 1995, THURSDAY, CITY EDITION

SECTION: NEWS, Pg. 9A

LENGTH: 424 words

HEADLINE: AT BROOKS, DISBELIEF AND ANGER;
SOME SAY MOVE IS JUST POLITICS

BYLINE: Tom Beyerlein; DAYTON DAILY NEWS

DATELINE: SAN ANTONIO, TEXAS

BODY:

Employees of Brooks Air Force Base were still trying to sort out their emotions Wednesday concerning Tuesday's announcement that the Pentagon has recommended closing the 77-year-old base and moving most of its functions to Wright-Patterson Air Force Base.

"I'm upset about it because they're not going by the merit of the base itself (in making the decision to close it)," said Elizabeth Gomez, a clerk at Brooks Armstrong Laboratory. "It's political. 'I'll close one of your bases and you close one of mine.' - that's the game they're playing, but they're playing with people's lives."

Gomez, 34, expresses a common feeling among Brooks' employees: That Brooks was slated for closing because of the heavy concentration of military bases in the San Antonio area, not because it doesn't provide a vital service.

She said the full impact of the announcement "hasn't hit some people." Some of her co-workers say they'll go to Wright-Patterson while others like Gomez plan to look for jobs in the area.

"I personally would not be able to get use to the snow and the cold," she said. "I would not go, no sir."

Dino Urdialez, president of the union that represents 820 primarily non-professional Brooks' employees, said details of the proposed closure are sketchy. Employees may not learn details until August. He said the union's national leadership was still working to try to keep Brooks open. The base-closing recommendations still need to be approved by the Base Closure and Realignment Commission, Congress and President Clinton.

Many of the approximately 2,500 jobs that would come to Wright-Pat from Brooks would be high-tech professional jobs. Armstrong Lab does research and development in aerospace medicine, human factors and occupational and environmental health.

"We're trying to quell any discomfort they may feel," said Urdialez, 43, an air conditioner mechanic at Brooks and president of Local 1757 of the American Federation of Government Employees. "It's a long drawn-out process."

Under the Pentagon's plan Brooks is tentatively scheduled to close by 2001, but Maj. Peter Kirk, Brooks' spokesman, said a specific schedule for beginning the closure has not been set. "It's way too early in the process."

[illegible]dialez said he was shocked by the decision to close Brooks, but "I've been in civil service long enough to know they have to cut somewhere." He said he hopes base closures prompt communities to find new sources of jobs not dependent on the military. "You can't change it, you have to adapt."

NOTES:
Wright-Pat: Looking to the future

GRAPHIC: PHOTO: One of the operations the Pentagon proposes to move to Wright-Pat is the Intelligent Training Systems, where Air Force TSgt. Chuck Lexa works with a virtual reality system on orbital dynamics. The final decision is months away., CREDIT: By RICK HUNTER/SAN ANTONIO EXPRESS-NEWS

LOAD-DATE-MDC: March 4, 1995

DEFENSE BASE CLOSURE AND REALIGNMENT COMMISSION

SUMMARY SHEET

BERGSTROM AIR RESERVE BASE, TEXAS

INSTALLATION MISSION

Air Force Reserves (AFRES) base. 924th Fighter Group (AFRES), F-16A/B operations; Hq. 10th Air Force (AFRES); and Ground Combat Readiness Center (AFRES). Activated as a base Sep 22, 1942. Named for Capt. John A.E. Bergstrom, first Austin serviceman killed in WW II, who died Dec 8, 1941, at Clark Field, the Philippines. City of Austin converting the base to new airport, due to open in 1998. AFRES unit facilities in cantonment area only--no BX or commissary available.

DOD RECOMMENDATION

- Bergstrom Air Reserve Base: Close.
- 924th Fighter Wing (AFRES): Inactivate.
- F-16 aircraft: Redistribute or Retire.
- Hq. 10th Air Force (AFRES): Relocate to Naval Air Station Carswell.

DOD JUSTIFICATION

- Due to AFRES fighter force drawdown, AFRES has an excess of F-16 fighter locations. Closure most cost effective option for AFRES.
- Relocation of Hq. 10th Air Force (AFRES) to Naval Air Station Fort Worth, Joint Reserve Base, Texas, will collocate the headquarters with one of its major subordinate units.
- The move from Bergstrom to Fort Worth provides a cost avoidance of conversion of the Bergstrom AFRES unit to KC-135 aircraft.

COST CONSIDERATIONS DEVELOPED BY DOD

- One-Time Costs: $13.3 million
- Net Costs (Savings) During Implementation: $93.4 million
- Annual Recurring Savings: $20.9 million
- Return on Investment Year: Immediate
- Net Present Value Over 20 Years: $291.4 million

MANPOWER IMPLICATIONS OF THIS RECOMMENDATION (EXCLUDES CONTRACTORS)

	Military	Civilian	Students
Baseline	**0**	**357**	**0**
Reductions	0	263	0
Realignments	0	94	0
Total:	0	357	0

MANPOWER IMPLICATIONS OF ALL RECOMMENDATIONS AFFECTING THIS INSTALLATION (INCLUDES ON-BASE CONTRACTORS AND STUDENTS)

	Out		In		Net Gain (Loss)	
Recommendation	**Military**	**Civilian**	**Military**	**Civilian**	**Military**	**Civilian**
Close Bergstrom	**0**	**(585)**	**0**	**0**	**0**	**(585)**

ENVIRONMENTAL CONSIDERATIONS

- Environmental impact from this action is minimal and ongoing restoration of Bergstrom ARB will continue.
- Air Force closure analysis appears to make Bergstrom a high payoff closure due to the default of the base clean-up contractor. The default has required the Air Force to keep unneeded facilities open, thus increasing base operating costs. If these facilities were closed, the cantonment area operating costs would be less, and thus the closure savings would be decreased.

REPRESENTATION

Senators:	Phil Gramm Kay Bailey Hutchison
Representative:	Lloyd Doggett (10) Greg H. Laughlin (14)
Governor:	George W. Bush, Jr.
Austin Mayor	Bruce Todd

ECONOMIC IMPACT

- Potential Employment Loss (1996-2001): 954 jobs (585 direct/369 indirect)
- Austin-San Marcos, TX MSA Job Base: 558,028
- Job Change: 0.2 percent decrease
- Cumulative Economic Impact (1994-2001): 0.2 percent decrease

MILITARY ISSUES

- Review of demographic data projects no negative impact on recruiting.
- 10th Air Force Commander: Maj Gen David R. Smith.
- Ground Combat Readiness Center (AFRES) is a Security Police training unit. Needs to be located in close proximity to an Army installation to accomplish its training mission: air base defense and counter-narcotics. Bergstrom is 53 miles (2 hours) from Fort Hood, Texas. Air Force is considering transfer of the unit from AFRES to the active component, either ACC or AMC. AFRES wants to maintain the unit to facilitate Reservists training Reservists. Scheduled to be redesignated the 610th Security Police Squadron (ACC) in 2nd Qtr., FY 96.
- Texas Army National Guard wants to relocate to Bergstrom in the cantonment area. Currently at the Austin Municipal Airport which is in the process of moving to Bergstrom.

COMMUNITY CONCERNS/ISSUES

- Austin community is committed to developing Bergstrom as a municipal airport.
  91 Commission recommended AFRES units shall remain in the cantonment area if a decision to convert the base to a municipal airport is made by Jun 93. Austin citizens passed a $400 million bond referendum to fund the project as stipulated on May 1, 93.
- The community suggested in a May 26, 93 report that a more sensible decision would be to not only retain the reserve units at Bergstrom, but to move the AFRES units from Carswell to Bergstrom as well. They contended this would improve operational readiness, provide $57 million in MILCON cost avoidance, provide superior facilities with room to expand, and alleviate airspace congestion in the Dallas-Fort Worth area.

ITEMS OF SPECIAL EMPHASIS

- Austin community is strongly committed to converting the base to a municipal airport, and believes the 924th Fighter Wing (AFRES) should remain in a cantonment area.

Merrill Beyer/Air Force Team/March 29, 1995

DoD Base Closure and Realignment
Report to the Commission

DEPARTMENT OF THE AIR FORCE

ANALYSES AND RECOMMENDATIONS

(Volume V)

February 1995

BERGSTROM AIR RESERVE BASE, TEXAS

Recommendation: Close Bergstrom ARB. The 924th Fighter Wing (AFRES) will inactivate. The Wing's F-16 aircraft will be redistributed or retire. Headquarters 10th Air Force (AFRES), will relocate to Naval Air Station Fort Worth, Joint Reserve Base, Texas.

Justification: Due to Air Force Reserve fighter force drawdown, the Air Force Reserve has an excess of F-16 fighter locations. The closure of Bergstrom ARB is the most cost effective option for the Air Force Reserve. The relocation of Headquarters 10th Air Force to NAS Fort Worth will also collocate the unit with one of its major subordinate units.

Return on Investment: The total estimated one-time cost to implement this recommendation is $13.3 million. The net of all costs and savings during the implementation period is a savings of $93.4 million. Annual recurring savings after implementation are $20.9 million with an immediate return on investment. The net present value of the costs and savings over 20 years is a savings of $291.4 million.

Impact: Assuming no economic recovery, this recommendation could result in a maximum potential reduction of 954 jobs (585 direct jobs and 369 indirect jobs) over the 1996-to-2001 period in the Austin, Texas Metropolitan Statistical Area, which is 0.2 percent of the area's employment. The cumulative economic impact of all BRAC 95 recommendations and all prior-round BRAC actions in the economic area over the 1994-to-2001 period could result in a maximum potential decrease equal to 0.2 percent of employment in the Austin, Texas Metropolitan Statistical Area. Review of demographic data projects no negative impact on recruiting. Environmental impact from this action is minimal and ongoing restoration of Bergstrom ARB will continue.

AIR RESERVE COMPONENT - AIR FORCE RESERVE Subcategory

OVERVIEW: The Air Force Reserve subcategory consists of installations that support the Air Force Reserve in its federal mission to supplement the Air Force active duty missions with combat ready units to support the Air Force major commands. The President mobilizes these units in time of national emergency, at which time they are assigned to their gaining major commands. The Air Forces Reserve manages the day to day recruiting and training of AFRES units. Installations in the Air Force Reserve subcategory are:

Bergstrom ARB, Texas	Carswell ARS, NAS Ft Worth JRB, Texas	Dobbins ARB, Georgia
Gen Mitchell IAP, ARS, Wisconson	Greater Pittsburgh IAP, ARS, Pennsylvania	Grissom ARB, Indiana
Homestead ARS, Florida	March ARB, California	Minneapolis-St Paul IAP, ARS, Minnesota
Niagara Falls IAP, ARS, New York	O'Hare IAP, ARS, Illinois	NAS Willow Grove ARS, Pennsylvania
Westover ARB, Massachusetts	Youngstown-Warren MPT, ARS, Ohio	

ATTRIBUTES: Important attributes of Air Force Reserve bases and stations are:
- Proximity to large recruiting populations
- Proximity to adequate training airspace, ranges, and facilities
- Cost effective basing of force structure

SPECIAL ANALYSIS METHOD: The Air Force Reserve installations were not tiered. The Air Force analyzed the installations by mission type. The installations were divided into four weapon system groups - Fighter, Strategic Airlift, Tankers, and C-130 Tactical Airlift. Each group was analyzed using the eight base closure criteria, then cost effective realignments were analyzed to determine a recommendation.

USAF BASE FACT SHEET
BERGSTROM AIR RESERVE STATION, TEXAS

MAJCOM/LOCATION/SIZE: AFR station seven miles southeast of Austin with 4,073 acres

MAJOR UNITS/FORCE STRUCTURE:

- 10th Air Force
- 924th Fighter Wing
  -- 15 F-16C/D

USAF MANPOWER AUTHORIZATIONS: (As of FY 95/2)

MILITARY--ACTIVE	13
RESERVE	1,189
CIVILIAN	334
TOTAL	**1,536**

ANNOUNCED ACTIONS:

- The 1993 Defense Base Closure and Realignment Commission directed that 924th Fighter Wing and its F-16 aircraft to remain at Bergstrom ARS until at least the end of 1996.

MILITARY CONSTRUCTION PROGRAM ($000):

FISCAL YEAR 94:	
Alter Administrative Facility for Cantonment (Base Closure)*	800
Alter Liquid Oxygen/Paint Booth (Base Closure)*	550
TOTAL	**1,350**

FISCAL YEAR 95:	
Munitions Complex (Base Closure)*	2,100
Alter Base Operations (Base Closure)*	580
Add/Alter Base Engineering Complex (Base Closure)*	2,000
Add/Alter Maintenance Shops (Base Closure)*	2,900
TOTAL	**7,580**

* Projects forecast for funding by the Base Closure Account. Associated with the 1991 Defense Base Closure and Realignment Commission recommendation to realign Bergstrom AFB.

SIGNIFICANT INSTALLATION ISSUES/PROBLEMS: None

Basing Manager: Mr DiCamillo/XOOB/53019
Editor: Ms Wright/XOOBD/46675/1 Mar 95

1ST STORY of Level 1 printed in FULL format.

Austin American-Statesman

April 02, 1995

SECTION: Business; Pg. H1

LENGTH: 1051 words

HEADLINE: Bergstrom development still lagging; Plans for airport spur few investors

BYLINE: Kim Tyson American-Statesman Staff

BODY:

On Texas 71, near the site of Austin-Bergstrom International Airport, a mobile home dealer's signs shouts ''Big Daddy StacksEm Deep, SellsEm Cheap,'' and the Silver Stone Inn Kitchenette offers affordable rooms.

With the exception of a few fast-food franchises, this part of Travis County hasn't changed much since Bergstrom Air Force Base was closed in late 1992.

It's still dominated by farms, planted in hay, sorghum and oats and populated by more cattle than people.

Scattered real estate brokers' signs dot tracts along Texas 71 and U.S. 183, the two main highways bordering the airport.

But there hasn't been a rush to buy land in the area and capitalize on the $[illegible] million airport that is expected to open in 1998.

One reason is that Austin has ample industrial land ready for development; moreover, most lenders recall the lessons of the late 1980s and are not in the mood to lend money that hints of real estate speculation.

Still, the Del Valle area, which surrounds the airport, is attracting attention from disparate sources. There are plans for an 18-hole private golf course about a half mile east of the airport, and one land broker reports feelers from a computer chipmaking company.

Others believe the area is suited for low-cost housing.

''Not everybody can live in a $200,000 house,'' said Robert Tiemann, an Austin investor and cattle rancher who is part of a group that has bought land in the area. ''If the City of Austin is really sincere to move growth away from these environmentally sensitive areas they ought to do what they can to make Southeast Austin grow.''

Dan Berdoll, a rancher whose family owns 800 acres east of the airport, said many longtime residents are just glad to see the airport arriving.

''I don't know that (the airport) makes it worth a whole lot more. But it could have been worse,'' said Berdoll, a board member at Cattlemen's State Bank and a former Del Valle Independent School District trustee.

''It could have been a federal penitentiary or something like that,'' he said of earlier proposals for converting Bergstrom. ''We've already got the sewage treatment plant, the jail and the trash dump -- a few things that don't add a lot to the value of your property and your community.''

Wilburn Heine, who still lives on the farm where he was born in 1921, hopes the airport will generate new revenue to the Del Valle schools, but he has seen speculation before.

Heine, who farms a 77-acre plot, sold 279 acres during the mid-1980s real estate boom, when investors who were betting on Austin's growing need for more housing developments called him night and day.

''At that time we could hardly sleep at night,'' recalled Halger Heine, Wilburn's wife.

He doesn't get those calls now.

Hal Armstrong III, who owns 670 acres just northeast of the airport, said he is getting inquiries.

''There have been small people looking for retail, gas station opportunities, as well as bigger developers looking at master-planned type things.

''It's kind of early in the curve right now, but the interest is definitely out there,'' Armstrong said.

While the new airport has generated renewed interest in the area, it has resulted so far in limited investment, according to brokers.

''There are definitely California mixed-use developers with serious interest in the airport area,'' said land broker Joyce Weedman. ''However, they have not come up to the plate. Their hesitation is the same as others: How quickly will they get (projects) through the city? And how soon will the airport be on the ground?''

While a number of manufacturing companies are eyeing Austin, locating near the new airport isn't high on their list of priorities, said Frank Niendorff, president of Commercial Industrial Properties, an Austin real estate brokerage company.

''I think anybody who speculates on land because they think the airport is going to cause a lot of growth is naive,'' he said. ''Right now I don't see a lot of transactions from speculators. I see a lot of interest and people asking questions.''

Niendorff noted that thousands of acres of land have been zoned for industrial development in the Austin metropolitan area, including land nearBergstrom. Not all of the land in southeast Travis County hasutility service, but the City of Austin system has excess utility capacity and major lines in the area.

''In the southeast section of the city there are probably 1,600 acres of land that are viable sites,'' Niendorff said.

Lockheed Missiles & Space Co., which has a 700-acre tract, has enough developed land for more than a million square feet of industrial space. That is nearly twice what the entire city absorbed in 1994 and represents a five-year supply given the pace of absorption in the southeast sector last year.

''Having an airport does not cause demand for industrial space,'' Niendorff said. ''It facilitates it and it makes it real convenient for companies that locate in and around an airport over the long term.''

Developer Sandy Gottesman, a major owner of industrial properties around Austin, agreed: ''I think the airport will be one factor, but there are many other factors.''

A February report prepared by Espey, Huston & Associates for Bluebonnet Electric Cooperative, the Lower Colorado River Authority and the Association of Wholesale Customers predicted the greatest impact would be in Austin west of the airport. The study also found little real estate speculation so far.

According to plat records at the Travis Central Appraisal District, many large tracts remain in the hands of longtime property owners. Others holding property in the area near the airport include investors who bought foreclosed tracts from the Resolution Trust Corp. or Federal Deposit Insurance Corp. after the real estate bust of the late '80s and investment partnerships that are buying industrial sites.

(from map)

Major property owners and investors near the planned Austin airport

* T.C. 'Buck' Stein er Fmaily

* Bennett Consolidated

* Met Center NYCTEX Ltd.

* Lockheed Missiles & Space Co.

* Mitchel and Rose Wong

* Rovert Carr

* Hal Armstrong III

* Ivy Berdoll Fmaily

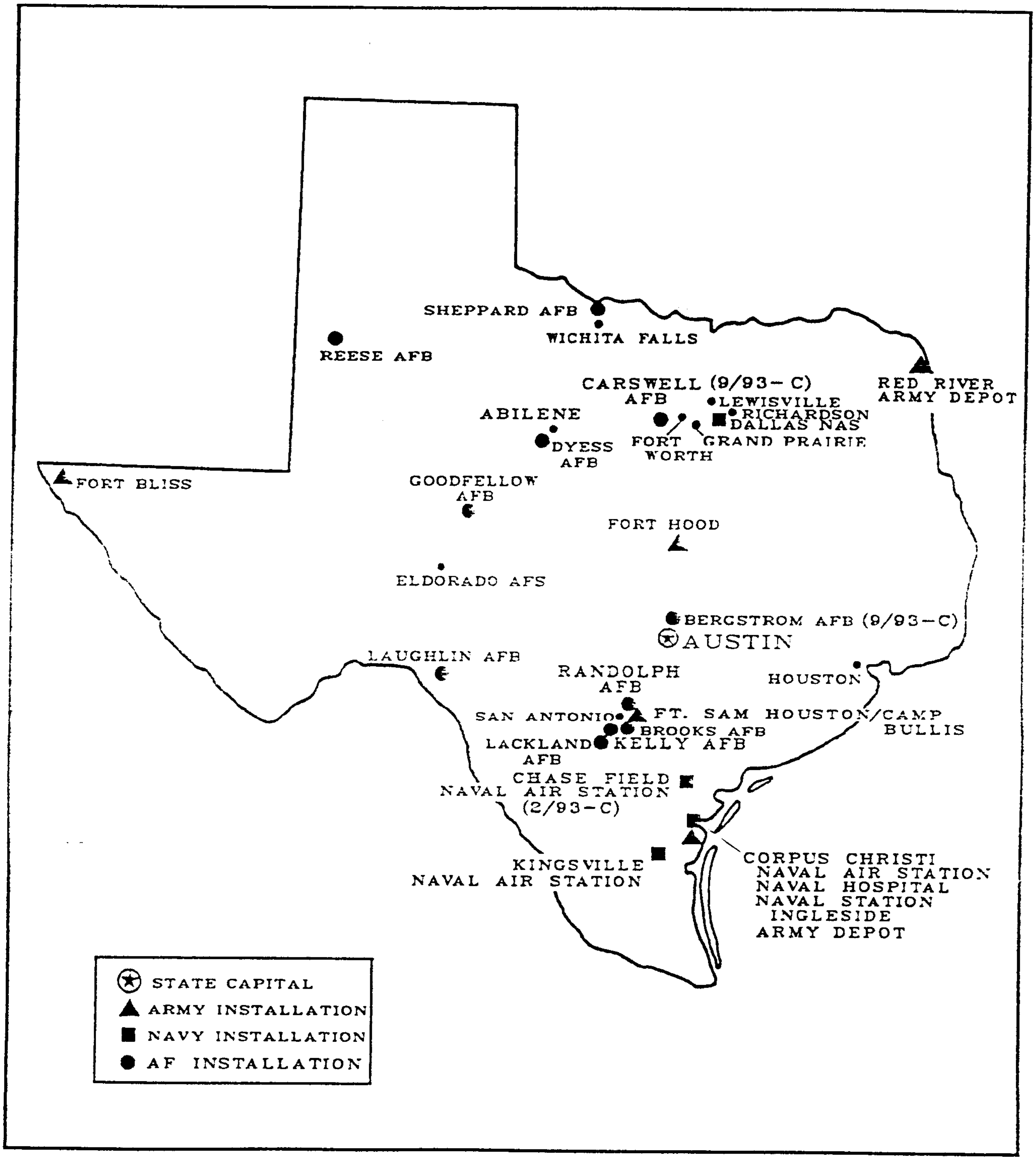
* Bill Gurasich and Tim Chambers

* Robert Tiemann, Robert Jenkins Pension Plan & Trust and Charles Voith

LOAD-DATE-MDC: April 02, 1995

MAP NO. 44

TEXAS



Prepared By: Washington Headquarters Services
Directorate for Information
Operations and Reports

TEXAS

FISCAL YEAR 1994 (DOLLARS IN THOUSANDS)

Personnel/Expenditures	Total	Army	Navy & Marine Corps	Air Force	Other Defense Activities
I. Personnel - Total	271,840	142,401	34,473	88,230	6,736
Active Duty Military	102,544	53,953	6,076	42,515	0
Civilian	54,341	20,281	1,994	25,330	6,736
Reserve & National Guard	114,955	68,167	26,403	20,385	0
II. Expenditures - Total	$15,346,504	$5,587,481	$2,641,691	$5,806,517	$1,310,815
A. Payroll Outlays - Total	7,201,074	3,088,752	710,561	3,183,886	217,875
Active Duty Military Pay	2,585,447	1,319,835	237,585	1,028,027	0
Civilian Pay	1,751,277	705,033	66,018	762,351	217,875
Reserve & National Guard Pay	243,639	150,266	30,949	62,424	0
Retired Military Pay	2,620,711	913,618	376,009	1,331,084	0
B. Prime Contracts Over $25,000 Total	8,145,430	2,498,729	1,931,130	2,622,631	1,092,940
Supply and Equipment Contracts	3,458,801	498,379	543,614	1,376,686	1,040,122
RDT&E Contracts	1,744,152	675,217	840,598	217,862	10,475
Service Contracts	2,292,966	734,965	505,895	1,009,763	42,343
Construction Contracts	522,571	463,228	41,023	18,320	0
Civil Function Contracts	126,940	126,940	0	0	0

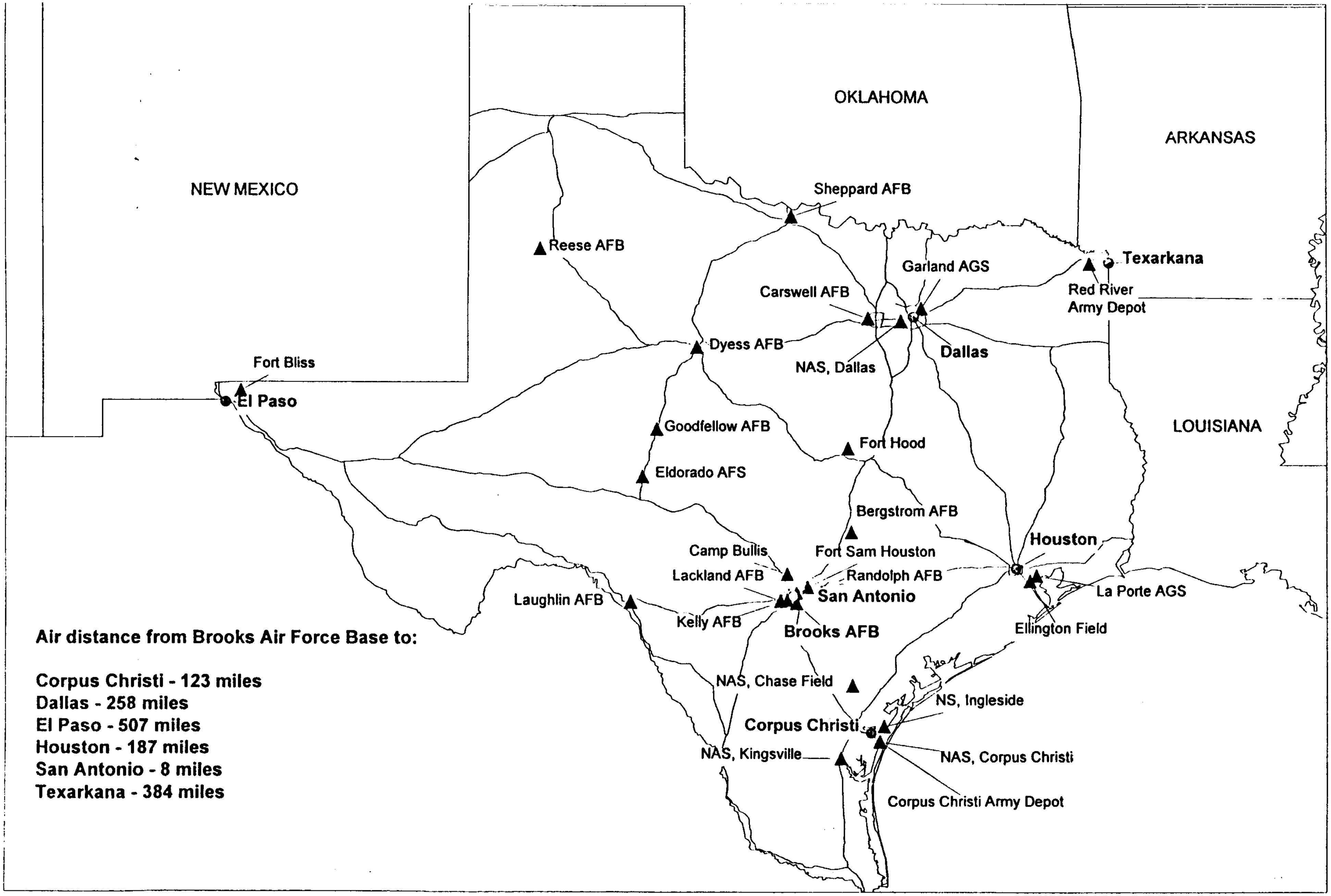
Major Locations of Expenditures	Expenditures			Major Locations of Personnel	Military and Civilian Personnel		
	Total	Payroll Outlays	Prime Contracts		Total	Active Duty Military	Civilian
Fort Worth	$2,491,622	$189,070	$2,302,552	Fort Hood	33,695	29,552	4,143
San Antonio	2,271,483	1,630,004	641,479	Kelly AFB	19,317	4,650	14,667
Fort Hood	1,159,423	857,030	302,393	Fort Bliss	18,175	16,123	2,052
Dallas	939,598	136,735	802,863	Lackland AFB	16,437	13,464	2,973
Corpus Christi	614,491	274,702	339,789	Fort Sam Houston	12,514	8,640	3,874
Fort Bliss	608,710	488,367	120,343	Randolph AFB	8,025	5,165	2,860
Houston	451,397	108,447	342,950	Shep AFB/Wich Falls	7,998	6,519	1,479
Grand Prairie	390,250	23,033	367,217	Corpus Christi	6,019	1,852	4,167
Shep AFB/Wich Falls	383,887	204,525	179,362	Dyess AFB	5,490	5,043	447
Austin	370,752	146,817	223,935	Brooks AFB	3,390	1,798	1,592

Prime Contracts Over $25,000 (Prior Three Years)	Total	Army	Navy & Marine Corps	Air Force	Other Defense Activities
Fiscal Year 1993	$9,010,273	$2,484,013	$1,708,662	$3,701,601	$1,115,997
Fiscal Year 1992	8,671,793	2,695,313	1,454,931	3,311,311	1,210,238
Fiscal Year 1991	10,225,414	2,400,595	1,758,415	4,592,133	1,474,271

Top Five Contractors Receiving the Largest Dollar Volume of Prime Contract Awards in this State	Total Amount	Major Area of Work: FSC or Service Code Description	Amount
1. TEXTRON INC	$984,510	RDTE/Aircraft-Engineering Development	$643,829
2. LOCKHEED CORPORATION	713,483	Aircraft Fixed Wing	410,671
3. TEXAS INSTRUMENTS INCORPORATED	687,808	Guided Missile Components	165,219
4. GENERAL DYNAMICS CORPORATION	611,673	Aircraft Fixed Wing	614,049
5. LTV AEROSPACE AND DEFENSE CO	276,036	RDTE/Missile and Space Systems-Advanced De	211,690
Total of Above	$3,273,510	(40.2% of total awards over $25,000)	

Prepared by: Washington Headquarters Services
Directorate for Information
Operations and Reports

Brooks Air Force Base



Air distance from Brooks Air Force Base to:

Corpus Christi - 123 miles
Dallas - 258 miles
El Paso - 507 miles
Houston - 187 miles
San Antonio - 8 miles
Texarkana - 384 miles

CLOSURE HISTORY - INSTALLATIONS IN TEXAS

24-Mar-95

SVC	INSTALLATION NAME	ACTION YEAR	ACTION SOURCE	ACTION STATUS	ACTION SUMMARY	ACTION DETAIL
A						
	CAMP BULLIS					
	CORPUS CHRISTI ARMY DEPOT	93	DBCRC	ONGOING	REALGNUP	1993 DBCRC: Repair and maintenance capabilities for H-1 and H-60 helicopters realigned from NADEP Pensacola, FL; scheduled FY 95
	FORT BLISS	88	DEFBRAC	COMPLETE	REALGNDN	1988 DEFBRAC: Realign basic training to Fort Jackson, SC; completed FY 91
	FORT HOOD	90/91	PRESS/DBCRC	COMPLETE	REALGNUP	1990 PRESS: Inactivate 2nd Armored Division (one brigade left intact); completed FY 90 1991 DBCRC: 5th Infantry Division (Mechanized) [redesignated 2nd Armored Division] realigned from Fort Polk, LA; completed FY 94
	FORT SAM HOUSTON	90/91	PRESS/DBCRC	COMPLETE	REALGNUP	1990 PRESS: Convert Health Services Command to a Medical Command (Canceled by Army) 1991 DBCRC: Trauma research realigned from Letterman Army Institute of Research, Presidio of San Francisco, CA (Change to 1988 SECDEF Commission recommendation); completed FY 93
	LONE STAR ARMY AMMUNITION PLANT					
	LONGHORN ARMY AMMUNITION PLANT	90	PRESS	ONGOING	LAYAWAY	1990 PRESS: Layaway; scheduled FY 95

CLOSURE HISTORY - INSTALLATIONS IN TEXAS

24-Mar-95

SVC	INSTALLATION NAME	ACTION YEAR	ACTION SOURCE	ACTION STATUS	ACTION SUMMARY	ACTION DETAIL
	RED RIVER ARMY DEPOT	88/90/93	DEFBRAC/PR/DBCRC	ONGOING	REALGNUP	1988 DEFBRAC: Ammunition mission realigned from Pueblo Army Depot, CO; scheduled FY 92-94 1990 PRESS: Realign supply function (Changed by Public Law 101-510) 1993 DBCRC: Realign tactical missile maintenance to Letterkenny Army Depot, PA; scheduled FY 94-97 Wheeled vehicle maintenance realigned from Tooele Army Depot, UT; scheduled FY 94-97 Assume command and control of Tooele Depot Activity; scheduled FY 97
	SAGINAW ARMY AIRCRAFT PLANT					
AF						

CLOSURE HISTORY - INSTALLATIONS IN TEXAS

21-Mar-95

SVC	INSTALLATION NAME	ACTION YEAR	ACTION SOURCE	ACTION STATUS	ACTION SUMMARY	ACTION DETAIL
	BERGSTROM AFB	90/91/93	PR/DBCRC/DBCRC	COMPLETE	REALIGN	1990 Press Release indicated Closure. 1991 DBCRC: CLOSED (Realigned) - retain Reserves. (Completed September 30, 1993) Directed retiring assigned RF-4s and deactivation of the 67th Tactical Reconnaissance Wing. Regional Corrosion Control Facility to remain if economical and the Air Force Reserve units to remain in a cantonment area if the base is converted to a civilian airport. Directed the 12 AF Headquarters, 12th Tactical Intelligence Squadron and the 602nd Tactical Air Control Squadron to relocate to Davis-Monthan AFB, AZ. Directed the 712th Air Support Operations Center Squadron be relocated to Fort Hood, TX (USA). 1993 DBCRC: Commission did not accept DoD recommendation to relocate reserve forces from the cantonement area to Carswell AFB, TX. 704th Fighter Squadron (AFRES) and 924th Fighter Group (AFRES) will remain in cantonement area until at least the end of 1996. Close or relocate the Regional Corrosion Control Facility by September 30, 1994 unless civilian airport authority assumes responsibility for operating and maintaining that facility before that date.
	BROOKS AFB	91	DBCRC	ONGOING	REALGNUP	1991 DBCRC: Directed several realignments to Brooks AFB from U.S.Army Laboratories as follows; Laser bioeffects research from Letterman Army Institute of Research, Persidio of San Francisco, CA. Microwave bioeffects research from Walter Reed Institute of Research, Washington, D.C. Heat Physiology research from U.S.Army Institute of Environmental Medicine, Natick, MA.

CLOSURE HISTORY - INSTALLATIONS IN TEXAS

24-Mar-95

SVC	INSTALLATION NAME	ACTION YEAR	ACTION SOURCE	ACTION STATUS	ACTION SUMMARY	ACTION DETAIL
	CARSWELL AFB	88/91/93	BRAC/DBCRC/DBCR	COMPLETE	REALIGN	1988 DEFBRAC: Directed transfer of KC-135s from Closing Pease AFB, NH to Eaker, Wurtsmith, Fairchild, Plattsburg and Carswell AFB. (See 1991 DBCRC for other bases.) 1991 DBCRC: CLOSED (Realigned) - retain Reserves - Convert to USNR Base. (Completed Sep 30, 1993) Directed transfer of assigned B-52s to Barksdale AFB, LA. Directed transfer of assigned KC-135s to the Air Reserve Component (in a cantonement area). Directed the tranfer of the 436th Strategic Training Squadron to Dyess AFB, TX. Directed existing AFRES units remain in a cantonment area. 1993 DBCRC: Changes transfer of 436TS fabrication function from Dyess to Luke AFB, AZ and the 436TS maintenance training function to Hill AFB, UT. Rest of the 436TS continues to move to Dyess AFB, TX. Also, Carswell will revert to Navy control with movement of Navy Reserve units from NAS Dallas, Detroit, Memphis and Cecil Field. (Net Navy Personnel movement into Carswell is 1487 Mil and 1493 Civ.)
	DYESS AFB	91/93	DBCRC/DBCRC	ONGOING	REALGN	1991 DBCRC: Directed relocating the 436th Strategic Training Squadron from Closing Carswell AFB, TX to Dyess AFB. 1993 DBCRC: Not all functions of 436TW move. Some now go to Hill AFB, UT and some go to Luke AFB, AZ. Net loss of 23 Mil.
	ELDORADO AFS					
	ELLINGTON FIELD AGS					
	GARLAND AGS					

CLOSURE HISTORY - INSTALLATIONS IN TEXAS

21-Mar-95

SVC	INSTALLATION NAME	ACTION YEAR	ACTION SOURCE	ACTION STATUS	ACTION SUMMARY	ACTION DETAIL
	GOODFELLOW AFB	88/91	DEFBRAC/DBCRC	ONGOING	REALGN	1988 DEFBRAC: Directed realignment of 25 courses (including fire fighting, fire truck operation and maintenance, and fuel-inspection training) from Closing Chanute AFB, IL. Other technical training courses also realigned to Sheppard (52), Keesler (22), and Lowry (45) AFBs. (See 1991 DBCRC). 1991 DBCRC: Directed that all technical training from Closing Lowry AFB, CO be redistributed to the remaining technical training centers or relocated to other locations. Directed the realignment of the fuels training from Goodfellow AFB to Sheppard AFB, TX and the realignment of the technical training fire course to Goodfellow AFB unless a satisfactory and cost-effective contract can be arranged.
	KELLY AFB	93	DBCRC	ONGOING	REALIGN	1993 DBCRC: Gained 15 support equipment maintenance personnel from Closing Newark AFB, OH.
	LA PORTE AGS					
	LACKLAND AFB	93	DBCRC	ONGOING	RELIGNUP	1993 DBCRC: Inter-American Air Forces Academy will be relocated from Homestead AFB, FL to Lackland for a net gain of 129 Mil and 22 Civ personnel.
	LAUGHLIN AFB					
	RANDOLPH AFB	91	DBCRC	ONGOING	REALGNUP	1991 DBCRC: Directed movement of 323rd Flying Training Wing from Closing Mather AFB to Randolph AFB rather than to Beale AFB as directed by 90 DEFBRAC.
	REESE AFB					

CLOSURE HISTORY - INSTALLATIONS IN TEXAS

24-Mar-95

SVC	INSTALLATION NAME	ACTION YEAR	ACTION SOURCE	ACTION STATUS	ACTION SUMMARY	ACTION DETAIL
	NAS DALLAS	93	DBCRC	ONGOING	CLOSE	1993 DBCRC: Directed the closure of NAS Dallas and relocation of its aircraft, personnel, equipment, and support to Carswell AFB, TX.
	NAS, CORPUS CHRISTI					
	NAS, KINGSVILLE					
	NAVAL HOSPITAL, CORPUS CHRISTI					
	NAVAL STATION GALVESTON	88	DEFBRAC	CLOSED	CLOSE	1988 DEFBRAC: Recommended stopping construction of the new Naval Station and closing the facility. Ships planned to be homeported there will be relocated to the new Naval Station at Ingleside, TX.
	NAVAL STATION INGLESIDE					
	NRF MIDLAND	93	DBCRC	CLOSED	CLOSE	1993 DBCRC: Recommended closure of NRF Midland, TX because its capacity is in excess of projected requirements.

Human Systems Center
Brooks Air Force Base, Texas 78235-5120

Dear Mr Farrington

Welcome to Brooks Air Force Base, home of the Human Systems Center. It is our pleasure to host you and hope your stay with us is a safe and pleasant one. We're extremely proud of our center and would be delighted to answer any questions you might have regarding our mission. If I can be of any assistance, I can be reached at ext 43652.

Warmest regards

ROBERT P. BELIHAR
Brigadier General, USAF, MC, CFS
Commander

BROOKS' MISSIONS ARE A NATIONAL ASSET

- **The only integrated Human Systems Research program in DoD**
  - Interdisciplinary group of physicians, social, biological, and medical scientists and engineers focused on the extension of human capabilities and enhanced performance
  - Programs cover the spectrum of research and development (Pgms 6.1-6.5) and the Defense Health Program
- **The Armstrong Laboratory is a world leader in its mission area**
  - As one of only four Air Force "super-labs," has a first class, multi-disciplinary capability with critical mass of research scientists and engineers
  - Unique facilities in excellent condition
    - Centrifuge (acceleration tolerance/protection)
    - Hyperbaric Chambers
    - Spatial Disorientation Demonstrator (one of only three in the world)
    - Directed Energy Chambers (radio frequency radiation exposure)
    - *The* Air Force Drug Testing Laboratory
  - Unique interaction with Air Education and Training Command in training concepts and technologies
  - A leader in implementing tri-service programs and co-locations (e.g. Directed Energy Bioeffects program)
  - Unlimited opportunity to absorb additional DoD human research missions and to become a DoD center of Excellence for human systems technology
  - $6.75M directed energy facility under contract for construction (FY'95)
- **USAF School of Aerospace Medicine**
  - The nation's leading aerospace medical training program
  - Internationally known and respected
  - The Armstrong Laboratory provides 30% of the facility A proven vehicle for transitioning the latest medical knowledge from the research lab to USAF operational aerospace flight surgeons, nurses, and technicians
  - $7.2M facility under construction (FY '94)
- **Air Force Center for Environmental Excellence**
  - Absolutely essential to long term Air Force environmental programs in the areas of compliance, hazardous waste cleanup, and environmental planning
  - $7.5M facility under construction (FY '94)

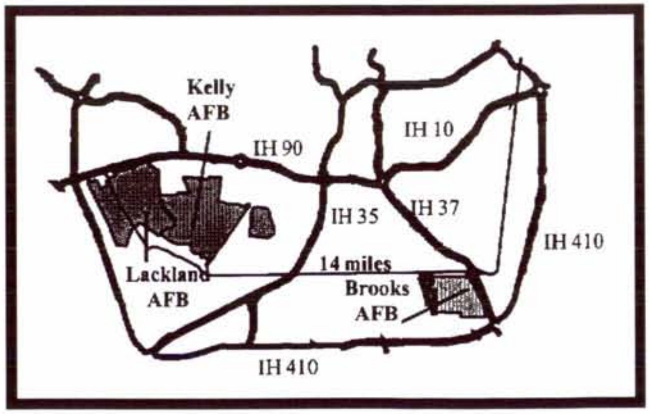
SAN ANTONIO PROVIDES A UNIQUE SYNERGY

- One of a kind configuration of biomedical teaching and research activities
- Significant capability multiplier
  - Interaction and cross fertilization
  - Joint projects

	D.O.D PROPOSAL	CANTONMENT ALTERNATIVE
SCENARIO	Close Brooks; Move Missions to Wright Patterson and Tyndall	Close Brooks; Keep Missions in cantonment; BOS by Kelly
BROOKS AFB	CLOSE	CLOSE
PEOPLE		
• Eliminate	391	391
• Move	3228	518 (local)
1X COST	$185 m	$11 m
20 YR NPV	$142 m	$301 m
ROI	7 years	Immediate

THE CASE FOR CANTONMENT

- Closes Brooks AFB
- Eliminates 391 manpower spaces
- Saves $174 million in one time closure costs
- Saves $159 million more than DOD proposal over 20 years
- Avoids risk to research and teaching missions
- 2710 fewer moves



BROOKS AIR FORCE BASE

***The* Center For Human Systems Technology**

DEFENSE BASE CLOSURE AND REALIGNMENT COMMISSION

Visit To

Human Systems Center, Brooks Air Force Base

6 April 1995

0645	Pick-up at Brooks Billeting and transport to Human Systems Center (Bldg 150) Escorted by: Brigadier General Robert Belihar Commander
0700-0715	Continental Breakfast with General Belihar and staff (Bldg 150, Commander's Conference Room)
0715-0745	Mission Briefing By General Belihar (Bldg 150, Commander's Conference Room)
0745-0750	Walking Tour to The United States Air Force School Of Aerospace Medicine (USAFSAM Bldg 180) Escorted by General Belihar Met by: Colonel John Stepp Commander, USAFSAM
0750-0805	USAFSAM Tour and Mission Briefing By Col Stepp
0805-0810	Walking Tour to Crew Technology Division (Bldg 170) Escorted by General Belihar Met by: Dr. William Storm Research Psychologist
0810-0825	Crew Technology Mission Briefing by Dr Storm and Staff
0825-0830	Walking Tour to Aerospace Physiology Department (Bldg 160) Escorted by General Belihar Met by: Lieutenant Colonel Sam Holoviak Deputy Chairman Aerospace Physiology Department USAFSAM

0830-0845	Anti Spatial Disorientation Demonstrator Briefing Briefing by: Lt Col Holoviak
0845-0900	Hyperbaric Medicine Branch Briefing (Bldg 160) Briefing by: Major George Kemper Chief, Medical Investigations and Research
0900-0905	Walking Tour to Veterinary Sciences Division (Bldg 125) Escorted by General Belihar Met by: Colonel John Golden Chief, Veterinary Sciences Division Armstrong Laboratory
0905-0920	Primate Research Briefing by Colonel Golden
0920-0925	Travel to Occupational and Environmental Health Directorate (Bldg 140) Escorted by General Belihar Met by: Colonel Erik Vermulen Director, Occupational and Environmental Health Directorate, Armstrong Laboratory
0925-0940	Mission and Tour by Col Vermulen
0940-0945	Travel to Hangar 9 (Museum) Escorted by General Belihar Met by: Lieutenant Colonel Tom Hartranft Deputy Program Director Human Systems Program Office
0945-1000	Mission Briefing by Lt Col Hartranft
1000-1005	Travel to Directed Energy Branch (Bldg 1184) Escorted by General Belihar Met by: Bruce Stuck Director, US Army Medical Research Detachment
1005-1020	Mission Briefing by Bruce Stuck
1020-1030	Windshield Tour Escorted by General Belihar

1030-1045	Arrive at Brooks Club for Civic Leaders Briefing (Room 2) Briefing by Paul Robeson, San Antonio Chamber of Commerce
1045-1100	Press Conference at Brooks Club Ballroom
1100	Depart Brooks Air Force Base

DEFENSE BASE CLOSURE AND REALIGNMENT COMMISSION MEETING ATTENDEES
BROOKS AFB TX
6 APRIL 1995

HSC staff

BRIGADIER GENERAL BELIHAR	HSC/CC	210-536-3652
MR GRANN	HSC/CD	210-536-6080
COLONEL IRVING	HSC/CCR	210-536-3654
DR GODFREY	AL/CC	210-536-3116
COLONEL JONES	AL/CD	210-536-3136
COLONEL MORLANG	70 MDS/SG	210-536-2087
COLONEL HUDSON	70 ABG/CC	210-536-3411
COLONEL ANTONIO	USAFSAM/AF	210-536-2844
COLONEL SMOGUR	HSC/CCX	210-536-2369
LT COLONEL HARTRANFT	HSC/YA	210-536-3475
COLONEL BINION	AL/OE	210-536-2001
COLONEL POLHAMUS	AL/XP	210-536-2091
COL GORGES	AFCEE/CC	210-536-2162

Commissioners and staffers

REBECCA COX
BEN MONTOYA
JOE ROBLES
WENDI STEEKE

CRAIG HALL (BROOKS)
LES FARRINGTON (BROOKS)
JOE VARALLO (BROOKS)

Congressional Staffers

Senator Phil Gramm's Staff:
Scott Keith 210-366-9494
Bill Christian

Senator Kay Bailey Hutchison's Staff:
Arthur Troilo III 210-340-2885

Congressman Frank Tejeda's Staff:
Nick Dauster 210-924-7387

Congressman Henry Bonilla's Staff:
Phil Ricks 210-697-9055

Brooks Staff:
Terry Shippey
International Association of Fire Fighters
Dino Urdialez
AFGE Local 1757

SAN ANTONIO EXPRESS-NEWS
DATE 31 Mar. 95
PAGE 1A

Kelly 'annex' plan would keep 3,000 Brooks AFB jobs in S.A.

City leaders battle to save base's missions

By Don Driver
Express-News Staff Writer

The primary missions and most of the jobs at threatened Brooks AFB would be saved under a unique annexation plan that still calls for the base itself to be closed, Mayor Nelson Wolff said Thursday.

The city's counterattack to a Pentagon recommendation to close the base and move its missions and personnel to installations in Florida and Ohio was unveiled one week before a visit to Brooks by members of the independent Defense Base Closure and Realignment Commission, commonly called BRAC.

Local supporters of Brooks hope to convince BRAC to keep the base's primary research and medical missions at or near their present locations in two, non-contiguous "cantonment" areas, while closing the rest of the facility around them.

The plan would save more than 3,000 jobs at the Southeast Side base.

"We have concluded that it would be futile to argue to retain Brooks AFB as it exists today," Wolff said in a prepared statement.

"We believe we have developed an option which allows the Air Force to close Brooks; realize savings over 20 years which are far greater than their current plan; and, at the same time, retain Brooks' missions in San Antonio," the mayor said.

The Armstrong Laboratory School of Aerospace Medicine and the Air Force Center for Environmental Excellence would be retained, but all base support functions either would be eliminated or relocated to Kelly AFB.

"We could call it the Brooks Annex at Kelly AFB," suggested retired Brig. Gen. Paul Roberson, project director of the Mayor's BRAC '95 Task Force. "It would

See CITY LEADERS/8A

Continued from 1A

collapse Brooks into a small industrial/office complex which will be a skeleton of what's there now."

As an example, there would be no medical clinics, commissary, base exchange or other similar facilities, he said.

The bulk of the base's 1,310 acres, other than the cantonment areas, would become available for reuse as an office or industrial complex, according to the task force.

The plan officially was unveiled Thursday during a news conference at which Wolff and other task force members donned blue T-shirts with white letters reading: "Keep Brooks Working!" The other side of the T-shirt reads: "Brooks, The Knowledge Base."

Under the plan, the base still would lose 391 military and civilian jobs, and 518 others, primarily base support positions, would be relocated to Kelly.

But about 3,000 other threatened jobs would remain, saving moving costs and keeping the base's highly dedicated work force in San Antonio.

The plan, supporters said, would save $301 million over 20 years and would avoid a $185 million upfront cost in closing the installation and relocating its missions and personnel elsewhere.

"This is the best option we have to keep as many jobs as we can in San Antonio," said Dino Urdiales, president of the American Federation of Government Employees at Brooks and a task force member.

Defense Secretary William Perry has recommended to BRAC that Brooks be closed, with the Armstrong Laboratory and the School of Aerospace Medicine relocated to Wright-Patterson AFB, Ohio. The Air Force Center for Environmental Excellence would go to Tyndall AFB, Fla.

An $8 million academic complex for the aerospace medicine facility and a $7.2 million environmental excellence site are both nearing construction at Brooks, projects that began long before the Pentagon recommended closing the base.

The mayor's task force realizes it has a difficult task ahead of it since, historically, only 15 percent of the installations have ever been spared the budget ax by BRAC once they were placed on the Pentagon's hit list.

"We didn't want to get into an argument with the Air Force and Defense Department challenging their data," Wolff said. "We know the odds are tough so let's go with something that makes good sense."

Jose Villarreal, task force co-chair, said: "It's a unique plan. This is something unlike any other community has done. We're not contesting (Defense Department) data, but (are) coming up with a unique approach.

"The result is a win-win situation which results in savings to the Pentagon, and we get the retention of at least 3,000 jobs."

Charles Cheever, another task force co-chairman, said cantonments are not new to the Air Force and some already exist at other installations in the United States.

PHOTO BY STEWART F. HOUSE

Paul Roberson, project director of the local base closure task force, shows his support Thursday of a plan to save key missions at Brooks AFB. Task force co-chairman Charles Cheever (left) and Patty Larsen of the Greater San Antonio Chamber of Commerce joined Roberson in outlining the plan to the San Antonio Express-News Editorial Board.

Ironically, the Pentagon's base closure report proposes to keep the Phillips Laboratory in cantonment at its present site at Kirtland AFB, N.M.

Phillips and Armstrong are two of the Air Force's four "super labs."

Roberson told the San Antonio Express-News Editorial Board that he briefed BRAC staffers about the plan Monday and said: "I sensed they were intrigued with the idea."

Chuck Pizer, a BRAC spokesman, said staff members are reviewing the proposal.

"The technical guys will run all the numbers and take a look at it," he said by phone from Washington. "We'll give it due consideration."

Task force officials already have briefed congressional members on the proposal.

"It's a very sound and very solid strategy," said U.S. Rep. Frank Tejeda, D-San Antonio, in whose district the base is located. "If accepted by BRAC, the strategy presents a win-win situation for all parties involved.

San Antonio Express-News
A division
of The Hearst Corporation

Editorials

Brooks strategy a brilliant option

When Defense Secretary William. Perry recommended to the Base Realignment and Closure Commission on Feb. 28 that Brooks AFB be closed, there was almost a sigh of relief: Better Brooks than Kelly, was the consensus.

Those who subscribed to that way of thinking — with the addendum to start exploring what to do with the 1,300-acre Brooks site — should think again: The local BRAC '95 Task Force has devised a common sense, fiscally sound defense of Brooks that the Air Force, BRAC and taxpayers should find enticing.

Essentially, the local strategy is to allow the Air Force to close Brooks, yet preserve a small cantonment area that would be attached to nearby Kelly AFB.

The plan would eliminate the base administration, the base exchange, golf course, clinic and other support facilities — approximately 400 civilian and military jobs. Seventy-five percent of the base's land would become available for reuse.

What would be preserved in the cantonment area are the Air Force School of Aerospace Medicine, one of its four "super labs," the Armstrong Laboratory, which Perry recommended moving to Ohio, and the Air Force Center for Environmental Excellence, destined for Florida under the '95 base closure plan.

The local option would keep some 3,000 jobs here, many of them well-educated, well-paid people, who face being uprooted under the present base-closure strategy.

More important to taxpayers: Closing Brooks while keeping the missions here would save money. The Air Force estimated the cost of closing Brooks and relocating its missions would be $185 million, resulting in $142 million in savings over 20 years and a $27.4 million annual recurrent saving.

The local BRAC task force contends its plan would cost but $11 million to implement with savings over 20 years of $301 million and $21.6 million in annual savings.

In other words, the plan accomplishes the cost-saving; it maintains these missions in a city that is almost synonymous with the Air Force; and it does so with the least disruption to the missions and the missionaries.

Finally, keeping the missions here will allow the Air Force to use two new buildings presently under construction (which cost taxpayers $15.2 million to build).

The BRAC staff will crunch the numbers and four BRAC commissioners will be here Thursday to tour Brooks. We think the city has done its homework and has given the BRAC a unique, sensible option. If it's a last best shot, it is a brilliant one.

SAN ANTONIO EXPRESS-NEWS
DATE 6 April 95
PAGE 1B

Brooks backers extend welcome to base closure commissioners

By Jim Hutton
Express-News Staff Writer

About 150 supporters sporting blue T-shirts and signs lauding Brooks AFB and chanting, "We want Brooks," welcomed two members of the base closure commission Wednesday night to San Antonio for a brief Thursday inspection of the installation.

Members Benjamin Montoya of New Mexico and Wendi Steele of Houston arrived at San Antonio International Airport, receiving the "red carpet" treatment from the Greater San Antonio Chamber of Commerce after touring Reese AFB in Lubbock.

Brooks, like Reese, has been placed on the closure list by the Defense Department, but additions and deletions to the original Feb. 28 list may be made up to May 17 by the independent Base Closure and Realignment Commission, commonly called BRAC.

Two other BRAC commissioners, San Antonian Joe Robles Jr. and Rebecca Cox of California, are to join Montoya and Steele on Thursday at Brooks.

"We're a long way from talking about death," Montoya said, referring to Brooks and other military facilities that the Pentagon wants to close.

"Our visit is very preliminary, and the community response is a big asset," Steele said, looking down the lengthy airport walkway lined with Brooks AFB supporters.

Regarding the outpouring of support, Montoya added: "We're going to see a lot of people. We came from Lubbock and (the people supporting Reese) brought tears to our eyes."

On Wednesday morning, community leaders and residents rallied to urge San Antonians to show solidarity for city's plan to save the endangered base's mission.

"Our message is that a greater savings can be made by still following the Air Force plan to close the base," Mayor Nelson Wolff told about 30 supporters in attendance in a vacant hardware store parking lot on the corner of Southeast Military Drive and Goliad Road, near Brooks.

A plan by the Mayor's '95 BRAC Task Force would salvage key missions at Brooks and save about 3,000 jobs. Also, it would provide $301 million in savings over 20

Brooks backers extend welcome to base closure panel members

Continued from 1B

years, compared with $165 million in upfront expenses for closing the base and realigning missions and personnel elsewhere.

The base's primary missions — Armstrong Laboratory, School of Aerospace Medicine, Human Systems Center and Center for Environmental Excellence — would become an annex to Kelly AFB under the task force plan.

"When you see the human factor, I've been told by authorities that research programs (at Brooks) might be set back 10 years if they were moved to (Wright-Patterson AFB) in Dayton, Ohio," Wolff said, adding many Brooks civilians would not accept transfers to Dayton.

Wolff will brief commissioners on the task force's plan Thursday.

The four BRAC members will see a human chain of blue T-shirts and signs Thursday along Southeast Military Drive, said City Councilwoman Lynda Billa Burke.

"I feel confident we'll have 3,000 people in T-shirts," Burke said about the commissioners' departure from Brooks at 11 a.m. Thursday along Southeast Military Drive.

A street rally is planned for 9:30 a.m. Thursday in the vacant parking lot in preparation for supporters' lining the roadway for the BRAC members' departure.

The commission members were housed at Brooks overnight before beginning their tour early Thursday morning.

The tour will focus on elements of the Human Systems Center, Armstrong Laboratory and School of Aerospace Medicine.

Supporters are expected to wear free promotional T-shirts stating in white lettering: "Keep BROOKS Working" on one side and "BROOKS The Knowledge Base" on the other side.

"We've even gotten responses (for help to save Brooks) from Floresville and Pleasanton," Burke said.

"Those responses have been unsolicited ...." Saying San Antonio had supported the military through the good times and the bad times historically, Burke added: "The military can't provide for itself without an active and supportive community."

One organizer, Gina Castaneda, said unity was critical to show backing to commission members.

"It's important to see the South Side unite for this thing," said Castaneda, community relations director at Southwest General Hospital.

"I work in the area, grew up in the area, live in the area and my kids go to school in the area," she added.

Saying Thursday's showing of community support is crucial for Brooks to survive in some capacity, Castaneda added: "If they drive out of the gate and see no one here, their attitude will be: 'They don't care.'"

"We've gone out and done intense organizing, and the support will show up," Castaneda said.

Dino Urdialez, president of the American Federation of Government Employees Local 1757 at Brooks, downplayed the human factor Wednesday.

"The people (jobs) issue is not a big issue," Urdialez said. "The economic factor is the only thing that can save Brooks.

"We're not going to get it on cries and tears. ... I'm pretty sure 3,224 jobs will not be moved," he added.

Urdialez said several groups and individuals were not in favor of the task force's plan of "cantonment" or saving specific missions in geographic "pockets" on the base with mission support from Kelly AFB.

"You can grab 100 people and get 100 different ideas," the union president said.

"There's no chance in hell to save Brooks," Urdialez said about the entire base. "We've got to make it worthwhile economically (to the commissioners)."

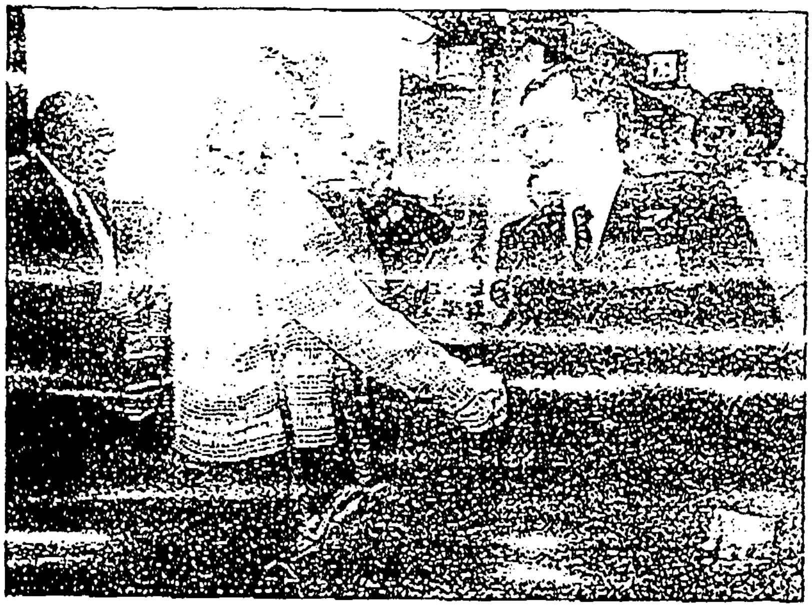


PHOTO BY JERRY LARA

Brig. Gen. Robert Belihar, commander of the Human Systems Center at Brooks AFB, greets base closure panel members Wendi Steele and Benjamin Montoya at San Antonio International Airport on Wednesday night.

> *"We're going to see a lot of people. We came from Lubbock and (the people supporting Reese) brought tears to our eyes."*
>
> — Benjamin Montoya, base closure commission

SAN ANTONIO EXPRESS-NEWS
DATE 7 Apr. 95
PAGE 4H

5,000 rally for Brooks AFB as BRAC members drive by

By Don Driver
Express-News Staff Writer

Tommy Limon was on a personal quest when he went to a rally Thursday to save the jobs at endangered Brooks AFB.

"Brooks gave us computer software for our school and it helped out a lot," the 18-year-old senior in the Harlandale School District said. "They did good for us, and now it's time for us to do good for them."

Limon and 30 classmates joined a vast sea of blue T-shirts lining Southeast Military Drive as a cheering section 5,000 strong screamed their support for the threatened base.

Four base closing panel commissioners leaving the installation after a whirlwind tour probably felt like visiting rock superstars when they saw the quarter-mile long crowd, wearing blue T-shirts plastered with job-saving slogans, stretching down both sides of the road.

"Keep Brooks Working!" the crowd yelled as a bright red antique fire truck, its siren blaring and packed with base supporters using bullhorns to lead the cheers, pulled in to lead the procession.

The commissioners smiled and waved from their cars and silently carried with them the fate of the base and its nearly 4,000 jobs.

"It was fantastic — the turnout far exceeded all our expectations," said Sheila Klein, executive director of the private Brooks Heritage Foundation. "The commissioners were running a bit late and the crowd kept swelling as people driving by got out of their cars to join us."

The massive rally was staged to show community support for Brooks to the visiting members of the Defense Base Closure and Realignment Commission, commonly known as BRAC, who will decide whether Brooks lives or dies.

"The rally definitely makes an impact" on the BRAC panel, said

> **"** *They did good for us, and now it's time for us to do good for them.* **"**
>
> — Tommy Limon, Harlandale student

City Councilwoman Lynda Billa Burke, whose district includes Brooks.

"I think two of them are coming back for a vacation," she said. "They fell in love with San Antonio."

Organizers had expected 3,000 people to show up, but as early-morning fog made way for a sunny sky the crowd swelled to 5,000, according to an estimate by police Capt. Steve Baum.

"It reminds me of a big pep rally," he said of the screaming, cheering crowd that lined Southeast Military from the base's main gate to the intersection with Goliad Road.

So many showed up that organizers ran out of the blue T-shirts that were emblazoned with the slogan "Keep Brooks Working!"

"Honk your horns — keep our jobs," said Howard Bradford, a 49-year-old former civil servant who joined others in yelling to passing vehicles.

Cars, trucks and 18-wheelers all blared their horns, but a passing black hearse drew a momentary pause from some in the crowd.

"It's like an omen passing by if we don't stand up and support Brooks," pointed out Linda Tippins, 45, a member of San Antonio Fighting Back.

Limon and his classmates at Burger King Corporate Academy, a non-traditional educational program at Harlandale, were on an authorized field trip to attend the rally and show their support for Brooks, which has often aided the school's programs, principal Warren Wagner said.

"The software really made a difference in the students' academic lives," he said, adding that Brooks has played a key role in many community efforts.

The enthusiastic crowd ranged from infants in strollers to the elderly and included four busloads of students from Holy Name Catholic School. The 200 students included about 50 who either live on Brooks, or whose parents work at the base.

"I think they should keep Brooks open so no one loses their jobs or homes," said Morgan White, 9, a third-grader.

The crowd included military retirees who had served at Brooks, civil servants from neighboring bases showing their support for their colleagues and just plain neighbors who have grown up with the Southeast Side installation.

Joseph Salas, 43, a worker at nearby Kelly AFB, which had its closure scare two years ago, was standing along the road with his wife and infant daughter to sound off for Brooks.

"They supported us two years ago — so we're going to support them," he summed up.

Tim Baney had his 6-year-old daughter, Staci, perched on his shoulders as he took his place along Southeast Military.

"We need to support this base," said Baney, whose wife works at Brooks. "This is the only thing on this side of town, and we need to keep it open. If it does close, I hope they put the facilities to good use."

Meanwhile, Myra Burton sat near the main gate watching her favorite soap opera on a portable 5-inch television while waiting for the BRAC commissioners to drive by.

"I'm here to help save Brooks, but I don't want to miss 'All My Children,'" she said.

SAN ANTONIO EXPRESS-NEWS
DATE ________
PAGE ________

"we in San Antonio would have several options for reuse of the excess capacity. It would put valuable assets back in the tax base and provide an economic generator for the South Side, which has been needed for many years."

Task force officials are to give a 15-minute presentation on the cantonment plan to four BRAC commissioners during a scheduled April 6 tour of Brooks, Roberson said.

The plan formally will be presented to the BRAC panel at an April 19 regional hearing in Dallas.

The task force plans a massive demonstration of support for Brooks at San Antonio International Airport when the four BRAC commissioners arrive late April 5, and also when they leave the base the next day.

Officials said they were disappointed that the Pentagon chose to put Brooks on the hit list, but the Air Force concluded it has excess capacity, it has to reduce its laboratory infrastructure and Brooks scored lower than the three other "super labs" in terms of priorities.

Additionally, Brooks, which has no operable runway, has limited potential to absorb operational missions, and the Air Force can achieve considerable savings over a 20-year period by closing the installation.

However, the task force claims, even more can be saved under its cantonment plan.

It also claims San Antonio has a unique configuration of biomedical research and teaching facilities that provide a close rapport and association with Brooks and enhances the installation's mission.

The task force proposal would reap twice the savings of the Pentagon shut-down plan over 20 years and would avoid disrupting research and environmental programs by not having to relocate personnel, members claim.

The cantonment plan calls for two separate areas to be set up on the base to house the remaining missions.

The Armstrong Laboratory and the School of Aerospace Medicine, and other related operations, would basically remain where they are in the northwest corner of the base, according to Roberson.

The Air Force Center for Environmental Excellence would be located about one mile east, where construction already is under way.

"That would basically be just another office building in the reuse area," Roberson said.

Wolff said city staffers already are boning up on how other communities handled military installation closures.

He plans to consult with community leaders and his successor after the May 6 election, before appointing a task force to explore options on how to reuse Brooks.

No matter what the BRAC panel decides, it will be about 18 months before any operations will start leaving Brooks, officials said. It will take about two to four years for any relocation to be completed.

"We have adequate time to plan for reuse of the base outside of the cantonment area," Wolff said.

City Councilwoman Lynda Billa Burke, in whose district the base is located, said she leans toward at least some of Brooks' excess acreage being used for educational facilities.

"I'm determined to put higher education out there," she said.

Meanwhile, the task force still is keeping a wary eye on the San Antonio Air Logistics Center at Kelly AFB.

BRAC commissioners have expressed skepticism over the Pentagon's plan to cut personnel at Kelly and the other four Air Force maintenance depots rather than close one or more of the centers.

The Air Force maintains it would cost too much to close one or two of the massive industrial complexes.

Kelly ranked in the bottom tier among the five depots and could be vulnerable if the BRAC panel opts to close one of the facilities.

A key factor will be a General Accounting Office report on methodology used by the Air Force in reaching its conclusions on the five depots. That report is due April 15, followed by a hearing two days later.

The BRAC panel has until May 17 to make changes to the Pentagon's closure list.

The Brooks AFB strategy

Cantonment: Military term for quartering of troops. In case of Brooks AFB, keeping the three primary missions in same or nearby locations, but as annex of Kelly. Majority of military acreage on Brooks is closed and becomes office/industrial complex.

The two plans:

Pentagon recommendation	Cantonment option
■ Close base	■ Close base
■ Move Human Systems Center, Armstrong Laboratory, School of Aerospace Medicine to Wright-Patterson AFB, Ohio	■ Keep the center, laboratory and aerospace medicine school in present or newly constructed sites
■ Move Air Force Center for Environmental Excellence to Tyndall AFB, Fla.	■ Keep center in newly constructed site
■ Eliminate 391 base support jobs	■ Eliminate 391 base support jobs
■ Move 3,228 military and civilians to Ohio and Florida	■ Move 518 military and civilian base support jobs that face elimination to Kelly and keep the remaining 3,228 jobs on Brooks

The cost factor

	Pentagon option	Cantonment option
■ Cost to implement	$185 million	$11 million
■ Savings over 20 years	$142 million	$301 million
■ Annual recurring savings	$27.4 million	$21.6 million
■ Return on investment	7 years	Immediately

The cantonment payoff

- More than 3,000 jobs would be retained in San Antonio
- Saves millions in upfront costs compared with implementing Pentagon plan
- Avoids disruption to research and environmental programs
- No loss of scientists to local community
- Existing cooperative efforts between Brooks and the local biomedical research and teaching community continues

Source: The Mayor's BRAC '95 Task Force

GRAPHIC BY P. ZELLER

SAN ANTONIO EXPRESS-NEWS
DATE 7 Apr 95
PAGE 1A

BRAC members give some hope of saving Brooks

'Cantonment' bid will be studied

By Jim Hutton
Express-News Staff Writer

Four base closure commission members offered city and civic leaders a glimmer of hope Thursday for their plans to keep key missions at Brooks AFB while still closing the base.

After an early morning tour of the installation, the panelists positively cited the city's alternative proposal to the Pentagon's plan to close Brooks and move its key missions to bases in Ohio and Florida.

They noted the difficulty in moving facilities and missions elsewhere and expressed concern about possible refusals by civilian professionals to relocate.

Defense Base Closure and Realignment Commission members Benjamin Montoya, Joe Robles Jr., Wendi Steele and Rebecca Cox listened to a briefing from Mayor Nelson Wolff in conjunction with the Mayor's '95 BRAC Task Force, which is trying to keep San Antonio's military installations open.

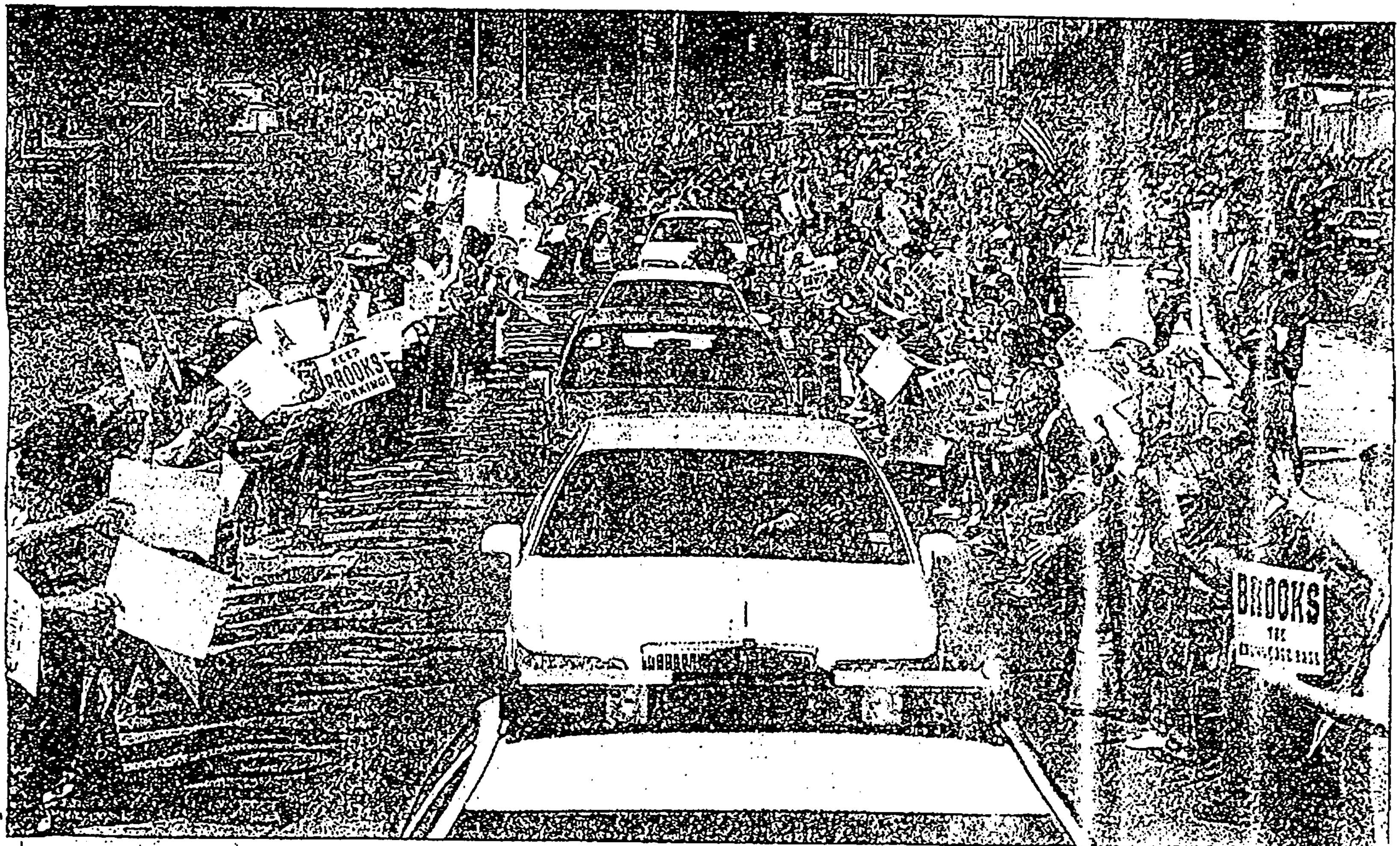
Defense Secretary William Perry announced in late February that Brooks was one of 22 major installations nationwide recommended for closure.

The base closure commission, commonly called BRAC, will make decisions to follow or to change the Pentagon's original plan for restructuring and further downsizing the military.

PHOTOS BY GLORIA FERNIZ

Sara Jay Elizondo, 18 months, stands next to a relative in a 'Keep Brooks Working' T-shirt during a rally Thursday on Southeast Military Drive, put on to show local support for the benefit of visiting members of the base closure commission.

SAN ANTONIO EXPRESS-NEWS
DATE 7 Apr. 95
PAGE 1A



About 5,000 people line Southeast Military Drive as police escort Defense Base Closure and Realignment Commission members Thursday to Brooks AFB.

Montoya said panel members would meet May 9 or 10, to discuss changes to the Pentagon list. May 17 is the deadline for BRAC to announce the changes.

"I'm pleased to see an alternative for Brooks," Montoya said at a news conference at the Brooks Club.

The local task force proposes closing Brooks but keeping chief elements and missions in "cantonment," meaning portions of the base still would house key missions but would be annexed by Kelly AFB as a support component.

The primary missions to be kept would be the Human Systems Center, the School of Aerospace Medicine, the Armstrong Laboratory and the Center for Environmental Excellence. Commissioners saw the facilities on their visit.

The remainder of the base then could be used for private or public entrepreneurial ventures, task force officials said.

"It's extremely helpful to have proposals playing with the same Air Force facts and figures," said Steele, a former U.S. Senate liaison for BRAC in 1991.

Local task force leaders employed the same facts, figures and fi-

See BASE/4A

SAN ANTONIO EXPRESS-NEWS
DATE ________
PAGE ________

Base gets ray of hope during visit

Continued from 1A

nancial data used by the Air Force when it reviewed Brooks.

"It's a bit of a win-win situation with the community if it works with the Department of Defense," Steele added. "We've already sent the proposal to the Air Force and our staff is looking into it."

About moving crucial missions from Brooks to Wright-Patterson AFB in Ohio or Tyndall AFB in Florida, Montoya said: "I see construction here coming from the ground and feel what has to be moved."

More than $20 million in construction is under way, including new buildings for the School of Aerospace Medicine and the Center for Environmental Excellence.

"By the end of the day, I was wondering what the right thing is to do and the cost to move these things," added Montoya, a retired rear admiral and 30-year engineering veteran in the Navy who now is president and chief executive officer of the Public Service Co. of New Mexico.

"This is a one-of-a-kind facility," said Robles, a retired Army major general and chief financial officer-corporate controller for San Antonio-based USAA Financial Services.

"It's not like moving a tank battalion or a squadron from Point A to Point B," he added. "We've got to look at the human and dollar costs, down time, and the possibility of running two places at the same time."

Montoya added: "My vision today was of large (think) tanks, miles of piping, and people in gowns doing important work. That and replication and the loss of brain power."

While Cox, a 1993 BRAC member and a vice president of Continental Airlines, said there are no easy choices, the panel members agreed the biomedical and biotechnological relationships between Brooks and community research and teaching facilities were important.

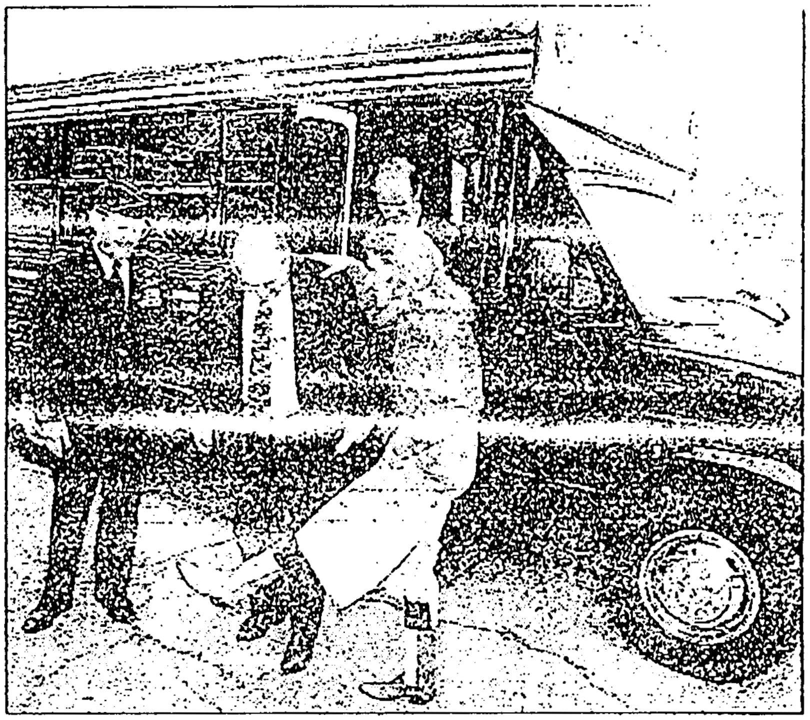


PHOTO BY JOHN DAVENPORT

City Councilwoman Lynda Billa Burke shows her Lone Star boots Thursday to Benjamin Montoya, one of the Defense Base Closure and Realignment Commission members who toured Brooks AFB.

"Synergism is going on here," Montoya said. "The military doesn't have a choice, but civilians have the choice to move. Some will or won't if other (bioresearch) services are in the area.

"The way the medical community has expanded here, people will not move," Montoya added. "We've heard a low end of 10 percent and a high end of 30 percent (of professionals) won't move."

Robles said of San Antonio: "There are synergic benefits of being a bioscience center. The local community and base are the benefactors."

Steele added: "Synergy can relate to military value."

Military value ranks as the first four of eight selection criteria by the Defense Department for installations being considered for closure or realignment.

A majority of city and task force leaders were cautiously optimistic after presenting the 15-minute briefing to the panel members and then listening at the follow-up 15-minute news conference.

"These people (panel members) are charged with saving money and are looking for reasons, and we gave them reasons to do that," Wolff said afterward.

"They were responsive to our proposal," he added.

Paul Roberson, task force project director, said: "Their reaction was one of great interest, and they saw value in the proposal.

"But that doesn't mean they accept it. But we will get a fair hearing," added Roberson, a retired Air Force brigadier general. The regional BRAC hearing is April 19 in Dallas.

"I think we're on the right track with something new and different. We addressed the cost, mission and people issues."

While saying the "community showed they support Brooks, which did not surprise us," Montoya said the panel members would not discuss Kelly AFB and its air logistics center, which escaped the Pentagon's "hit" list.

Panel members in the past reportedly have been skeptical of the Air Force's decision to keep open all five of its huge logistics centers.

LTC Ken Locke
(210)536-3624

Armstrong Laboratory
Analytical Service Division
(AL/OEA)
BROOKS AFB, TX 78235

April 5, 1995

State / Federal Certification Requirements:		
Federal	Drinking water	Waste Water
EPA	40 CFR 141.28	State by State in Region 6
State		
Alabama		
Alaska	Title 18 18AAC 80.250	
Arizona	ARS 36-495 through 36-495.15 (R9-14-600)	
Arkansas		
California	Title 22 Division 4 California Code of Regs Section 64805	
Colorado	Colorado Primary Drinking Water Regulations Section 6.5	
Connecticut		
Delaware		
Florida	10D-41 Florida Adm Code 10D-41.050 thru 10D-41.062	10D-41 Florida Adm Code 10D-41.100 thru 10D-41.113
Georgia	Rules for Safe Drinking Water Chapter 391 3-5.29	
Hawaii		
Indiana		
Idaho		
Kansas	Standards for the Approval of Environmental Analytical Laboratories (Part II)	Standards for the Approval of Environmental Analytical Laboratories (Part II)
Kentucky		
Louisana	Regulations Governing Laboratory Certification and Standards of Performance for Laboratories Conducting Drinking Water Chemical Analysis Section 201	
Maine		
Maryland	Code of Maryland Regulations 10.10.04.15	
Massachusetts		
Michigan		
Nevada		
New Jersey	Regulations Governing Laboratory Certification and Standards of Performance Subchapter 1. (7:18-1.4)	
New Mexico	Water Supply Regulations Section 309.B	
New York	1984 Laboratory Certification Legislation (Chapter 901, Laws of 1984)	1984 Laboratory Certification Legislation (Chapter 901, Laws of 1984)
North Carolina		
North Dakota		
Ohio	Chemical Laboratory Approval Program Policy and Procedures 1982-Current #4 (Section II)	
Oklahoma		
Oregon		
South Carolina		
Tennessee	Regulations for Public Water Systems and Driking Water Quality 1200-5-1-.14	
Texas		
Utah		
Virginia		
Washington		

TALKING PAPER
ON
OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
ARMSTRONG LABORATORY
HUMAN SYSTEMS CENTER
BROOKS AFB TEXAS

TITLE: VISIT TO BLDG 140

BACKGROUND: The Base Realignment and Closure Commission will tour Building 140, Brooks AFB as part of their review of the Department of Defense recommendation on 1995 base closures. This facility is 60,000 sq ft of modern laboratory space housing analytical chemistry for Air Force environmental and occupational health exposure compliance testing, dosimetry for ionizing radiation exposure documentation and related consultant services.

DISCUSSION:

The Occupational and Environmental Health Directorate provides a)research and development in chemical, radiological, laser and radiofrequency radiation bioeffects and b) engineering services for risk analysis and exposure assessment for occupational, environmental and radiological health supporting Air Force units worldwide. We have collocated Army and Navy units in laser and microwave R&D at Brooks AFB and toxicology R&D at Wright-Patterson AFB.

Building 140 and bldg 175W (not being visited) house our engineering services activities. We provide analytical services inhouse for nearly 80,000 samples per year and contract out another 12,000 samples. We expend $2.2M per year in contract analyses for our customers; the equivalent cost for contracting out our in-house efforts is priced at $10.9M. Analytical efforts save our customers $6M per year.

Our professional consultants provide both direct, on-site services for our customers and manage contracted services as the technical project officers for nearly $50M in customer funded environment, safety and occupational health projects. Our personnel are highly trained, most with advanced technical degrees in areas from environmental engineering, industrial hygiene, medicine, epidemiology and toxicology. We estimate the equivalent services from contracted sources would cost another $6M per year.

The military in our organization have readiness tasking to respond worldwide for nuclear material mishaps and several smaller taskings. Our in-house expertise in radioanalytical analyses directly translates to our being the most proficient DoD response team in this area.

PAYOFF:

The Occupational and Environmental Health Directorate's engineering services activities provide critical military readiness response and highly cost-effective operational support insuring Air Force installations are operationally available. Real cost saving of $12M per year result.

as of 30 Mar 95
Col Erik K. Vermulen
(210) 536-2003

Talking Paper for Armstrong Laboratory (AL)
Veterinary Sciences Division's Move to WPAFB

- BRAC tour on 6 Apr 95 will look at one of six OEV buildings (26K sq ft out of 100K sq ft total)

- AL conducts animal research as part of a broad-based R&D program; directed toward the protection of AF ground and aircrew members; primary areas of research are laser, microwave, and space radiation, G-loss of consciousness, effects of acceleration stress on the cardiovascular system and chronobiology.

  •• Majority of animals used are rats and mice; the total number of animals used has steadily decreased over the last decade, by emphasis on alternative methods (e.g., computer modeling, manikins, cell culture, etc.)

  •• Nonhuman primates (NHP) are only used for studies requiring close approximation of the human being and for which computer models have not yet been developed.

- Animal research is very regulated; animal use at AL meets or exceeds all DOD and USAF regulations, the federal Animal Welfare Act (AWA), and the requirements outlined in the National Institutes of Health "Guide for the Care and Use of Laboratory Animals."

  •• The Institutional Animal Care and Use Committee (IACUC) has oversight over entire animal care and use program; reviews all research protocols to ensure humane use and minimum numbers of animals, inspects facilities, etc. AL Commander is the responsible Institutional Official for the animal care and use program.

  •• American Association for Accreditation of Laboratory Animal Care (AAALAC) accreditation; mandated by Congress; AL/Brooks and AL/WPAFB have been accredited since 1967

    ••• AAALAC provides a voluntary, independent, peer-review of animal care programs; AAALAC is the "gold standard" for animal care programs; only 532 research organizations in US are accredited after a rigorous, on-site inspection. Facility construction to meet AAALAC standards is expensive, costing approximately $300 per square foot.

- The AL animal care and use program is under close scrutiny and has had numerous successful program reviews.

  •• <u>May 1991 Special IG Review of AF Use of Animals in Research report:</u> "AF animal research programs are both necessary and being accomplished correctly." Recommended the AF <u>not contract out</u> these programs.

  •• <u>Oct 1993 DOD IG Review of the Use of Animals:</u> AL/Brooks "... aggressively supports all humaneness issues/requirements..."

- BAFB has approximately 720 NHP's which will require housing at WPAFB: WPAFB has facilities for approx. 200. Majority of WPAFB's research animals currently housed are rodents.

  •• BAFB has superior NHP facilities; WPAFB has superior rodent facilities.

  •• If current AL research plus Tri-Service mission are moved to WPAFB, an additional 60,000 sq ft of animal care facility required at an approximate cost of $18M to comply with AAALAC and AWA standards.

- BAFB Veterinary Sciences has close ties to other San Antonio R&D facilities: Southwest Foundation for Biomedical Research; Southwest Research Institute; University of TX Health Science Center, Brooke Army Clinical Investigation Facility; Brooke Army Burn Center; Lackland Clinical Investigation Facility; Lackland Dog Center.

- Our goal is humane biomedical research that will benefit us all.

Colonel Golden/AL/OEV/DSN 240-2825/31 Mar 95

TALKING PAPER ON
TRI-SERVICE DIRECTED ENERGY BIOEFFECTS RESEARCH
OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
ARMSTRONG LABORATORY
HUMAN SYSTEMS CENTER
BROOKS AFB TEXAS

BACKGROUND: Under Project Reliance, Brooks AFB Texas is the collocation of all military research on the health and safety of exposure to directed energy in the electromagnetic spectrum. Army, Navy, and Air Force laser and microwave bioeffects research personnel (approximately 133 professionals) utilize 120,000 sq ft of space and highly specialized equipment to assess the hazards of human exposure to various forms of directed energy. Threat assessments, countermeasures, and applications of directed energy bioeffects are also investigated. Much of the research requires the use of animal models, including primates. The scientists, support personnel, state-of-the art research facilities, and animal vivaria at Brooks AFB constitute a resource that is unique in the Western World. It is in service of a military mission that is ever growing in importance because of the increasing use of directed energy on the modern battlefield.

DISCUSSION:

All Military directed energy bioeffects research was collocated in order to increase efficiency, leverage resources, and produce synergy in research designed to protect personnel from hazardous exposure to microwaves and lasers, which will have a constantly increasing role in both peacetime, war, and special military operations. This highly focused research is conducted by integrated teams of mathematicians, physicists, engineers, physicians, ocular scientists, biologists, physiologists, and behaviorists that have been formed by years of experience. Requirements such as heavy, expensive, and often militarily unique equipment, security classification, cross-disciplinary teams, animal use, and readiness demand that this research be done in-house by military civilian and active duty personnel. University or industrial performance of this research would be incredibly more expensive, and much less flexible.

The team from the BRAC 95 will see 1 of the 17 Tri-Service anechoic chambers and 1 of our more than 40 RFR transmitters, the Transformer Energized Megavolt Pulsed Output (TEMPO). The TEMPO is the perfect example of Tri-Service synergy, since it is an Army transmitter, in an Air Force building, being readied for a Navy research protocol. This TEMPO is the only such device available for biological research in the World. Similar emissions from fielded systems could be a hazard to military personnel. The recent move of the TEMPO from Washington, D. C. to Brooks AFB has caused it to be out of commission for 24 months.

PAYOFF: Tri-Service research at Brooks AFB directly protects military personnel from hazardous exposure to microwave and laser directed energy. Military research in this area also supports national and international civilian standards. Litigation avoidance is a secondary benefit. Protection of this program and its mission should be an important consideration in the deliberations and final decision by BRAC95.

Col Eric K. Vermulen, Armstrong Laboratory, OE, (210) 536-2003

DEFENSE BASE CLOSURE AND REALIGNMENT COMMISSION

Visit To

Human Systems Center, Brooks Air Force Base

6 April 1995

0645	Pick-up at Brooks Billeting and transport to Human Systems Center (Bldg 150) Escorted by: Brigadier General Robert Belihar Commander
0700-0715	Continental Breakfast with General Belihar and staff (Bldg 150, Commander's Conference Room)
0715-0745	Mission Briefing By General Belihar (Bldg 150, Commander's Conference Room)
0745-0750	Walking Tour to The United States Air Force School Of Aerospace Medicine (USAFSAM Bldg 180) Escorted by General Belihar Met by: Colonel John Stepp Commander, USAFSAM
0750-0805	USAFSAM Tour and Mission Briefing By Col Stepp
0805-0810	Walking Tour to Crew Technology Division (Bldg 170) Escorted by General Belihar Met by: Dr. William Storm Research Psychologist
0810-0825	Crew Technology Mission Briefing by Dr Storm and Staff
0825-0830	Walking Tour to Aerospace Physiology Department (Bldg 160) Escorted by General Belihar Met by: Lieutenant Colonel Sam Holoviak Deputy Chairman Aerospace Physiology Department USAFSAM

0830-0845	Anti Spatial Disorientation Demonstrator Briefing Briefing by: Lt Col Holoviak
0845-0900	Hyperbaric Medicine Branch Briefing (Bldg 160) Briefing by: Major George Kemper Chief, Medical Investigations and Research
0900-0905	Walking Tour to Veterinary Sciences Division (Bldg 125) Escorted by General Belihar Met by: Colonel John Golden Chief, Veterinary Sciences Division Armstrong Laboratory
0905-0920	Primate Research Briefing by Colonel Golden
0920-0925	Travel to Occupational and Environmental Health Directorate (Bldg 140) Escorted by General Belihar Met by: Colonel Erik Vermulen Director, Occupational and Environmental Health Directorate, Armstrong Laboratory
0925-0940	Mission and Tour by Col Vermulen
0940-0945	Travel to Hangar 9 (Museum) Escorted by General Belihar Met by: Lieutenant Colonel Tom Hartranft Deputy Program Director Human Systems Program Office
0945-1000	Mission Briefing by Lt Col Hartranft
1000-1005	Travel to Directed Energy Branch (Bldg 1184) Escorted by General Belihar Met by: Bruce Stuck Director, US Army Medical Research Detachment
1005-1020	Mission Briefing by Bruce Stuck
1020-1030	Windshield Tour Escorted by General Belihar

1030-1045	Arrive at Brooks Club for Civic Leaders Briefing (Room 2) Briefing by Paul Robeson, San Antonio Chamber of Commerce
1045-1100	Press Conference at Brooks Club Ballroom
1100	Depart Brooks Air Force Base

HUMAN SYSTEMS CENTER
BROOKS AIR FORCE BASE, TEXAS

Table of Contents

BRAC COMMISSION QUESTIONS
23 March 1995

1. Why does the Training Facility need to stay at Williams AFB?

The 1995 DOD recommendation is to reverse a previous BRAC decision to move the Williams AFB Armstrong Laboratory Operating Location to Orlando FL. Originally, the decision to move the AL-OL to Orlando was based on assumptions regarding Naval Training activities and availability of facilities. Since that time, the Navy has reduced its pilot training activities at the Naval Training Center in Orlando and facilities were not available at the BRAC 91 estimated cost. As such, the AF recommends that the AL-OL remain at Williams AFB. Primarily, the AL-OL at Williams AFB is a civilian operation that is better suited to remain in the current location. The facilities are unique and well suited for research activities and the close proximity to Luke AFB provides a ready source of fighters pilots who can support the function as consultants and research subjects.

2. Why does the Armstrong Laboratory have to go to WPAFB?

The Department of Defense BRAC 95 recommendation to move the Armstrong Laboratory to WPAFB was justified as "the Air Force has more laboratory capacity than necessary to support current and projected AF research requirements." The excess capacity judgment was apparently based on the assertion that WPAFB had, available, adequate administrative and office buildings proposed to accommodate the research activities of the Armstrong Laboratory. It should be noted that not all of Armstrong Laboratory would move to WPAFB. The DOD BRAC 95 recommendation did make allowances to move the AF Drug Testing Laboratory to another location in San Antonio and the Hyperbaric Chambers to Wilford Hall Medical Center.

3. Why can't AL/OE go to Tyndall AFB FL?

The move of AL/OE to Tyndall AFB is not in the best interest of the Air Force. The rationale is as follows:

a. The primary synergism in our various environmental activities is between AL/EQ, which works remediation and compliance technologies and is already at Tyndall AFB, and AFCEE, which serves as technology transition agent for these remediation/compliance technologies and is recommended for relocation to Tyndall AFB under BRAC 95.

b. AL/OE's mission, which includes toxicology studies of new materials and the effects of directed energy systems on crew members, is substantially different from the AL/EQ mission. The Directorate's mission also includes Bioenvironmental Engineering and Occupational Medicine consultation to field units. Thus, there is much more synergism between AL/OE and other Brooks units (i.e. the USAF School of Aerospace Medicine and other AL directorates) moving to WPAFB than there is with AL/EQ or AFCEE.

4. Why can't Pollution Prevention go to Tyndall AFB FL?

Wright Laboratory's Materials Directorate Pollution Prevention Mission (WL/MLSE), which is focused on environmentally benign materials and processes, is also substantially different from the AL/EQ mission. Moving this activity to Tyndall AFB would disrupt the existing synergism with WL/ML's mainstream mission of broad based aerospace materials and processes research, and would also result in significant move costs.

BIOGRAPHY

UNITED STATES AIR FORCE

Secretary of the Air Force
Office of Public Affairs
Washington, D.C. 20330-1690

BRIGADIER GENERAL (DR.) ROBERT P. BELIHAR

Brigadier General (Dr.) Robert P. Belihar is commander of the Human Systems Center (HSC), Air Force Materiel Command, Brooks Air Force Base, Texas. The organization is the Air Force home of science and technology related to the integration of human factors in Air Force systems. Recognizing that people are the key to all Air Force endeavors, HSC is the product center focusing on human-centered research, development, acquisition and aeromedical operational support.

The general was born April 26, 1941, in Santa Monica, Calif., and graduated from Spanish Fork (Utah) High School in 1959. He graduated from Brigham Young University, Utah, receiving a bachelor of science degree in 1963 and a master of science degree in 1968. He earned his doctor of medicine degree from the University of Utah, Salt Lake City, in 1969. He completed Air War College in 1982 and Capstone in 1994.

General Belihar is married to the former Anita Louise Carroll of Jacksonville, N. C. They have three daughters: Jennifer Louise, Lori Lyn and Julia Christine.

EDUCATION:

1963 Bachelor of science degree in zoology, Brigham Young University, Utah
1968 Master of science degree in zoology, Brigham Young University, Utah
1969 Doctor of medicine degree, University of Utah
1970 Aerospace Medicine Primary Course, USAF School of Medicine, Brooks Air Force Base,Texas
1974 Ophthalmology residency, Duke University, North Carolina and University of Tennessee
1982 Air War College, Maxwell Air Force Base, Ala.
1982 Master of public health degree, University of Texas
1983 Aerospace Medicine Residency, USAF School of Medicine, Brooks Air Force Base, Texas

ASSIGNMENTS:

1. July 1970 - May 1971, squadron flight surgeon, Homestead Air Force Base, Fla.
2. May 1971 - June 1974, chief of service, aerospace medicine, USAF Hospital, Zweibrucken Air Base, West Germany
3. January 1977 - November 1978, chief of service, aerospace medicine, USAF Hospital, Myrtle Beach, S.C.
4. November 1978 - October 1981, ophthalmologist and flight surgeon, USAF Hospital, Luke Air Force Base, Ariz.
5. July 1983 - August 1984, chief of service, aerospace medicine, USAF Hospital, Edwards Air Force Base, Calif.
6. August 1984 - August 1986, hospital commander, USAF Hospital, Edwards Air Force Base, Calif.
7. August 1986 - October 1988, chief, aeromedical requirements, and chief, aerospace medicine, Headquarters Tactical Air Command, Langley Air Force Base, Va.

8. October 1988 - August 1991, command surgeon, Headquarters U.S. Central Command, MacDill Air Force Base, Fla.
9. August 1990 - April 1991, deployed to Saudi Arabia, Operations Desert Shield and Desert Storm
10. August 1991 - July 1992, director, medical service officer management, Headquarters Air Force Military Personnel Center, Randolph Air Force Base, Texas
11. July 1992 - August 1994, command surgeon, Headquarters Air Force Materiel Command, Wright-Patterson Air Force Base, Ohio
12. August 1994 - present, commander, Human Systems Center, Air Force Materiel Command, Brooks Air Force Base, Texas

FLIGHT INFORMATION:

Rating: Chief flight surgeon
Flight hours: 1,800
Aircraft flown: 203 models
Flight surgeon wings from: Jordan

MAJOR AWARDS AND DECORATIONS:

Defense Superior Service Medal
Legion of Merit with oak leaf cluster
Meritorious Service Medal with two oak leaf clusters
Aerial Achievement Medal
Air Force Commendation Medal
Joint Meritorious Unit Award
Air Force Outstanding Unit Award with three oak leaf clusters
Air Force Organizational Excellence Award
National Defense Service Medal with service star
Armed Forces Expeditionary Medal
Southwest Asia Service Medal with three service stars
Air Force Overseas Ribbon - Short
Air Force Overseas Ribbon - Long
Air Force Longevity Service Award Ribbon with four oak leaf clusters
Small Arms Expert Marksmanship Ribbon
Air Force Training Ribbon
Republic of Vietnam Gallantry Cross with Palm
Kuwait Liberation Medal

OTHER ACHIEVEMENTS:

Board certified in aerospace medicine and ophthalmology
Fellow, American College of Surgeons
Fellow, American Academy of Ophthalmology
Fellow, Aerospace Medical Association
Society of Air Force Flight Surgeons
Association of Military Surgeons of the United States

EFFECTIVE DATES OF PROMOTION:

Captain	Jun 11, 1969
Major	Jun 11, 1972
Lieutenant Colonel	Feb 8, 1979
Colonel	Jun 7, 1984
Brigadier General	Jul 1, 1993

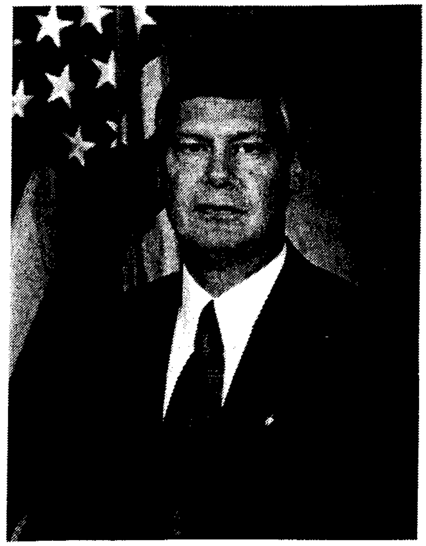
(Current as of October 1994)

United States Air Force

BIOGRAPHY

Office of Public Affairs, Human Systems Center, 2510 Kennedy Circle, Suite 1,
Brooks AFB TX 78235-5120 Phone (210) 536-3234 Fax (210) 536-3235

MR. GARY M. GRANN



Gary M. Grann is a member of the Senior Executive Service and the executive director for the Human Systems Center (HSC), Air Force Materiel Command, Brooks Air Force Base. As such, he is second in command of an organization comprised of more than 3000 military and civil service personnel with an annual budget exceeding $300 million. Recognizing that people are the key to all Air Force endeavors, HSC is the product center focusing on human-centered research, development, acquisition, and aero-medical operational support.

In 1963, he was commissioned a second lieutenant in the Air Force and served four years as a test engineer at the Air Proving Ground Center, Eglin Air Force Base, Florida. Mr. Grann began his civilian career in April 1971 and has held positions of increasing responsibility in three product centers, an Air Force laboratory and two test organizations. He has also served two assignments in Europe to include being named the senior United States representative to the NATO Air Command and Control System Team. In June 1984, he was promoted into the Scientific and Professional Executive Corps (ST) and assigned to Hanscom Air Force Base where he served in several positions to include senior technical advisor to the commander, Electronic Systems Center. Mr. Grann entered the Senior Executive Service in July 1993. He is a graduate of the Harvard University Senior Executive Fellows program and a 1990 graduate of the Federal Executive Institute. He completed the Program Management Course at the Defense Systems Management College in 1993 and is certified Level III in Program Management and Planning, Research, Development, and Engineering.

Mr. Grann is married to the former Jimmie Walley of Hattiesburg, Miss. They have two children, Eric and Michelle.

EDUCATION:

1963	Bachelor of science degree in physics and mathematics, University of Minnesota
1968	Master's degree in mathematical statistics, Florida State University
1986	Senior Executive Fellows, Harvard University
1990	Federal Executive Institute
1993	Program Management Course, Defense Systems Management College

ASSIGNMENTS:

1. October 1963- October 1967, entered active duty as a Project Test Engineer, Air Proving Ground Center, Eglin Air Force Base, Fla.
2. October 1967- August 1968, graduate student, Florida State University, Tallahassee, Fla.
3. August 1968 - April 1971, Project Scientist, Booz Allen Applied Research, Ft Walton Beach, Fla.
4. April 1971 - February 1972, Research Analyst, Air Force Armament Laboratory, Eglin Air Force Base, Fla.
5. February 1972 - September 1976, Operations Research Analyst, United States Air Force Europe, Ramstein Air Base, Germany.
6. September 1977 - May 1979, Supervisory Operations Research Analyst, Tactical Air Warfare Center, Eglin Air Force Base, Fla.
7. May 1979 - November 1981, Technical Director, Electronic Systems Division - Europe, Kapaun Air Station, Germany.
8. November 1981 - June 1984, Head, Systems Design, NATO Air Command and Control System Team, Brussels, Belgium.
9. June 1984 - July 1987, selected for Scientific and Professional Executive Corps (ST) and assigned as the Technical Director, Deputy for Development Plans, Electronic Systems Division, Hanscom Air Force Base, Mass.
10. August 1987 - July 1990, Technical Director and Director of Engineering for the Advanced Technology Systems Program Office, Electronic Systems Division, Hanscom Air Force Base, Mass.
11. July 1990 - July 1993, Senior Technical Advisor to the Commander, Electronic Systems Center, Hanscom Air Force Base, Mass.
12. July 1993 - October 1994, selected for Senior Executive Service with assignment as Director, Plans and Advanced Programs, Electronic Systems Center, Hanscom Air Force Base, Mass.
13. October 1994 - Present, Executive Director, Human Systems Center, Brooks Air Force Base, Texas.

MAJOR AWARDS AND DECORATIONS:

Air Force Commendation Medal
Civilian Meritorious Service Award
Technical/Professional Employee of the Year, Boston Federal Executive Board
Organizational Quality Improvement Prototype Award
Scientific/Professional (ST) Outstanding Performance with Award, 1985-1993

DISCUSSION ITEM
MILITARY VALUE OF
HUMAN SYSTEMS CENTER

1. DESCRIPTION OF TOPIC: This paper presents the Military Value of HSC, i.e., its continuing mission to provide a USAF core technology - HUMAN SYSTEMS, and the management and infrastructure to foster this core technology.

2. RELEVANT FACTS: This paper is based on AFMC 21 strategy, assumptions, constraints, and considerations. The following elements are relevant to this issue:

-IWSM is the primary management and organizational philosophy of AFMC.

-Human Systems was identified as an Air Force and Joint Cross Service core technology.

-AFMC-21 goals were to:

-Maximize collocation of RDT&E, Acquisition, and Sustainment

-Maintain minimum essential core capability in RDT&E Acquisition, & Sustainment

-Achieve representative collocation with the full range of customers supported

-Maintain flexibility to respond to future changes in customers' needs and/or funding

-The USAF core technology called HUMAN SYSTEMS is made up of numerous interrelated scientific and engineering disciplines which may be grouped as follows: LIFE SUPPORT/CREW SYSTEMS; ENVIRONMENTAL, SAFETY, & OCCUPATIONAL HEALTH; PERSONNEL/TRAINING; and MEDICAL/AEROMEDICAL SUPPORT

3. ANALYSIS: HSC manages the HUMAN SYSTEMS core technology across the complete spectrum of the acquisition process following IWSM principles. The Science and Technology mission is carried out by the Armstrong Lab. The program management and sustainment is executed by the Human Systems Program Office, a "basket SPO". HSC's education and training function are performed by the USAF School of Aerospace Medicine and the Systems Acquisition School. The base operating support comes from the 648th Air Base Group, the 615th Medical Squadron, and HSC's Environmental Management Office.

The entity known as the Human Systems Center provides integration and support across all the many scientific and engineering disciplines of the HUMAN SYSTEMS core technology and across the acquisition cycle. HSC management must understand the complete spectrums of both the Human Systems core technology and the acquisition cycle. With this corporate knowledge it can act as the good faith broker and decision-maker empowered by AFMC to nurture, mature, and sustain this USAF core technology. HSC requires a small headquarters staff since its primary corporate management tools are its Quality and Corporate Councils .

HSC was actively involved in all four Reliance Technology Planning Process forums: Armed Services Biomedical Research Evaluation Management, Joint Directors of Laboratories, Training and Personnel Systems Technology Evaluation and Management, and the Joint Engineers. As a result, all DOD work will migrate to HSC in toxicology, laser bioeffects, radio frequency bioeffects, and biodynamics.

Under the command of HSC, the units at Brooks AFB, and all geographically separate portions of HSC, operate today as an integrated team to bring human-centered science to the battlefield and workplace. HSC teams acquire and support assets that train and equip, making Air Force people more effective, productive, and safe.

HSC converts Human Systems requirements into operational systems through cradle-to-grave management, a long-term commitment that enhances teamwork and partnerships. HSC's seamless organization contains processes critical to the maturation and development of products throughout their life cycles. Armstrong Laboratory and the Human Systems Program Office cultivate a specialized infrastructure to support Integrated Product Development teams that use a deliberate, disciplined approach to product development and enhancement. Streamlined processes also simplify customer-supplier relationships. A single business decision authority likewise increases control and flexibility for both development and sustainment activities.

An alternate approach is to align the components of HSC with their like functions, i.e. SPOs, Labs, and Schools. Fragmenting responsibility for these functions and for their day-to-day support removes integration and will severely degrade their performance. The cost of this degradation is difficult to quantify. However, it is apparent that vital IWSM linkages will be broken across the entire HUMAN SYSTEMS core technology.

4. CONCLUSION:

1. It is advantageous to foster core technologies throughout their life cycle, i.e., IWSM principles should be applied to our core technologies.
2. The entity known as HSC should be retained as an IWSM center managing the HUMAN SYSTEMS USAF core technology.
3. AFMC Option 4 will address the feasibility of the physical relocation of this core technology center.

5. RECOMMENDATION: Rather than fragmenting HSC, we should continue to bring like functions together from throughout DoD to form a national center of excellence for environmental matters, aviation medicine, and all aspects of human performance.

ISSUE PAPER
ON
MILITARY VALUE ANALYSIS
OF
BROOKS AFB
(Deliverable 4.1.2.H)

1. **ISSUE:** This paper discusses the interrelated organizations and capabilities, which as an integrated whole, show Brooks AFB to be militarily unique and mission essential.

2. **BACKGROUND:** Brooks AFB is the home of three major USAF organizations with strong mutually beneficial common bonds. These organizations are the Human Systems Center (HSC), the Air Force Medical Support Agency (AFMSA), and the Air Force Center for Environmental Excellence (AFCEE).

a. HSC, the advocate for the human element across all USAF mission areas, is guided by the principle: "THERE ARE NO UNMANNED SYSTEMS." HSC as a corporate entity can be divided into three functional areas: Senior Leadership, Products and Services, and Base Operating Support. The leadership function establishes and integrates the operating environment. HSC strives to maximize human capability, performance, protection, and safety through integration of the disciplines of education, science and technology, acquisition, and preventive medicine. Further, HSC's product/service lines could not exist without the required support functions, which also provide the infrastructure for all three major Brooks organizations.

b. The mission of AFMSA is to assist the Air Force Surgeon General in developing programs, policies, and practices relating to Air Force health care in peace and war. It acts for the Surgeon General to put policies and directives into effect. The office is organized into the directorate of health care support, and selected professional affairs and quality assurance activities.

c. The mission of AFCEE is to provide the Air Force with an in-house capability to handle all aspects of environmental cleanup, planning and compliance. Its three operational directorates are Environmental Services, Construction Management, and the Air Force Design Group.

3. **DISCUSSION:** The missions of the three major organizations have been and will continue to be central to USAF goals and objectives. The missions are complimentary and interrelated.

a. In addition to their responsibilities as Air Staff Separate Operating Agencies, AFMSA and AFCEE are the on-site representatives for two of HSC's major customers: the Air Force Medical Service (AF/SG), and the Air Force Civil Engineering community (AF/CE). This collocation and direct daily interaction with HSC supports the goal of the Air Force Medical Service's Integrated Medical Systems Management (IMSM): to assess current medical technology and information systems acquisition processes and identify future enhancements.

b. HSC is internationally recognized for its human centered research, development, and education. It is a center of excellence in aerospace medical research; clinical consultation; medical and environmental education; hospital planning, construction, and information systems; acquisition of integrated aircrew life support and chemical defense equipment, intelligent tutoring, and medical and environmental systems; drug testing; hazard material handling and sample analysis; and base cleanup and restoration. The Brooks AFB installation has unique, high value, one-of-a-kind man-rated facilities; close proximity to several high-caliber academic and corporate research institutions and professional libraries; and a science and engineering staff of more than 1000 individuals, over 300 with doctoral degrees. A significant synergy exists between tech base research, clinical medicine, acquisition, and the teaching functions that make each more effective.

c. Besides the normal infrastructure responsibilities of a host, the HSC commander has a special role to both AFMSA and AFCEE. As well as being the HSC Designated Acquisition Commander (DAC), he is the decision authority for all major acquisition initiatives. Through his role as the HSC commander, he provides both AFMSA and AFCEE with their required contracting and comptroller functions.

d. The sustainment arm for items developed and fielded at Brooks AFB is located just a short drive across town at Kelly AFB. Aligned with its sustainment arm at Kelly AFB, Brooks AFB fulfills all the goals of AFMC's cornerstone: Integrated Weapon Systems Management (IWSM).

4. **CONCLUSION:** The missions, interrelationships, and synergy of the organizations on Brooks AFB demonstrate it to be militarily unique and mission-essential. Two major Air Staff customers, residing on the same installation with their AFMC supplier, further enhances and enforces IWSM goals. The retention of a human systems single manager and DAC maintains integrated institutes for human centered research, development, acquisition, education, and environmental quality. Brooks AFB incorporates all the IWSM/IMSM organizations and their customers into an interrelated and interactive whole -- the goal of AFMC-21. This consortium of institutes is the best value for the taxpayer and the US Air Force.

United States Air Force

FACT SHEET

Office of Public Affairs, Human Systems Center, 2510 Kennedy Circle, Suite 1, Brooks AFB TX 78235-5120 Phone (210) 536-3234 Fax (210) 536-3235

HUMAN SYSTEMS CENTER

MISSION

The Human Systems Center of Air Force Materiel Command, headquartered at Brooks Air Force Base, Texas, is the Air Force advocate for integrating and maintaining the human in Air Force systems and operations. People are the key to all Air Force operations. HSC is the systems-independent product center for human-centered research, development, acquisition and specialized operational support.

Its mission is to protect and enhance human capabilities and human-systems performance with a scope of impact ranging from the individual to combatant command forces including DOD and Allied Nations Forces. The Armstrong Laboratory, the USAF School of Aerospace Medicine, the HSC Program Office (YA), the 70th Medical Squadron and an air base group are the major units of HSC.

HISTORY

HSC's origins go back to Jan. 19, 1918, when the Medical Research Laboratory was formed at Hazelhurst Field, N.Y. In 1922, this Laboratory was redesignated the School of Aviation Medicine, and four years later it moved to Brooks Field which was a center for primary flight training. Both organizations moved to Randolph Field in October 1931. The school moved back to Brooks during the summer of 1959 and the base became the headquarters for the Aerospace Medical Center the same year.

The Center represented the initial step in placing the management of aerospace medical research, education and clinical medicine under one command. Both the school and center were reassigned from Air Training Command to Air Force Systems Command in November 1961 and assigned to the new organization, Aerospace Medical Division (now HSC).

(Current as of March 1995)

On Nov. 21, 1963, President John F. Kennedy dedicated four new buildings of USAFSAM in the complex that housed the Aerospace Medical Division. This was his last official act before his assassination in Dallas the following day.

In 1986, the Department of Defense began streamlining its organization as a result of the Packard Commission recommendations. This division's acquisition mission emphasized its human-centered technologies. It restructured its functional areas and was renamed the Human Systems Division on Feb. 6, 1987.

In December 1990, the Air Force Systems Command underwent a major restructuring which consolidated 16 laboratories nationwide into four. Brooks Air Force Base and the Human Systems Division became home of one of the "super labs." The new lab, named the Armstrong Laboratory, is a world-class center in science and technology for protecting the human in Air Force systems.

On July 1, 1992, the Human Systems Division was renamed the Human Systems Center as part of the structuring of the new Air Force Materiel Command. The command was activated July 1, 1992, when the Air Force Logistics Command and Air Force Systems Command were integrated.

ORGANIZATIONS

The Human Systems Center headquarters supports its subordinate organizations with administration, command and control, and logistics.

U.S. Air Force School of Aerospace Medicine

As the center for aerospace medicine education, the USAF School of Aerospace Medicine is the major provider of educational programs involving aviation, space, and environmental medicine for Air Force, DOD, and Allied Nations personnel. The programs span entry level through graduate medical education in all disciplines encompassed in the aerospace medicine specialty.

70th School Squadron

The 70th Training Squadron advances the education of acquisition professionals to support and sustain all Air Force weapons systems. About 1,500 students are trained annually.

Human Systems Center Program Office

The program office is responsible for the engineering and manufacturing development, production, evolution and sustainment of life support, chemical defense, aeromedical, human resource, and operational analysis systems, and the design and test of Air Force uniforms. The program office demonstrates technology concepts in prototype systems to reduce technical, cost, and schedule risk, and to accelerate the transition arm of the Human Systems Center.

It is responsible for proper execution of engineering and manufacturing development and production programs and coordinates acquisition efforts with other agencies and the using MAJCOMs. The program office is also responsible for the Human Systems Center staff functional work in the areas of engineering, manufacturing/quality assurance, configuration/data management, test and evaluation, and acquisition logistics.

70th Air Base Group

The 70th Air Base Group operates and maintains Brooks Air Force Base in support of HSC and tenant units.

The Armstrong Laboratory

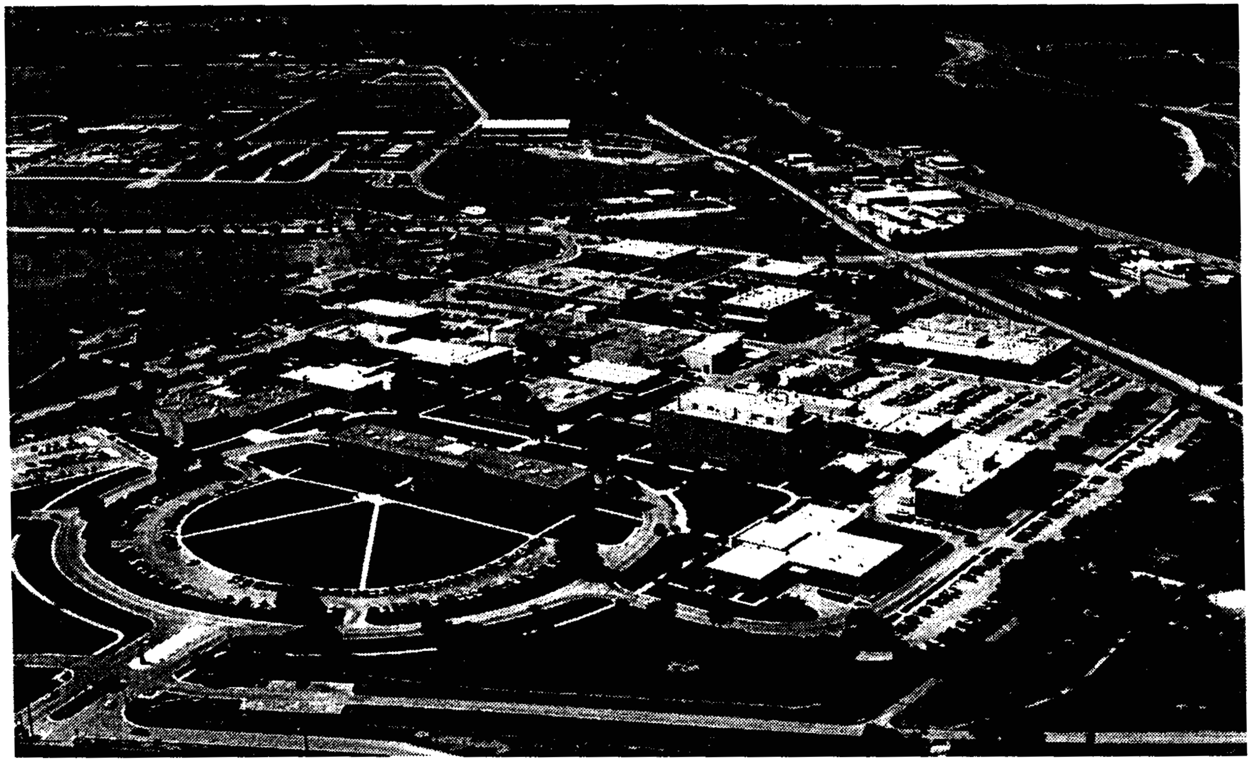
The Armstrong Laboratory, as one of the four Air Force "Super Laboratories," is the Air Force's center of excellence for human-centered science and technology. The laboratory provides the science and technology base and the direct operational support needed to enhance human performance in Air Force systems and operations. The research, development, and support activities of the laboratory address current and future needs in the areas of human resources, crew systems, aerospace medicine, and occupational and environmental health to enhance crew protection and performance, training and logistics, and force management, health and safety.

70th Medical Squadron

The 70th Medical Squadron provides personalized outpatient medical and dental care for the Brooks Air force Base community in a total quality environment. Services include primary care, aerospace medicine, optometry, military health, pharmacy, radiology, immunology, military public health, bioenvironmental engineering, and clinical laboratory. Approximately 25,000 patients per year are treated here.

The 70th Medical Squadron was awarded the Air Force Outstanding Unit Award in 1993, the AFMC Outstanding Clinic, James L. Borders Award in 1993, the Air Training Command Award for Significant Achievement in the Prevention of Ground Mishaps, and the Joint Accreditation of Healthcare Organizations with Commendation award.

HUMAN SYSTEMS CENTER
AIR FORCE MATERIEL COMMAND



AIR FORCE VISION

Air Force PEOPLE Building the World's Most Respected Air and Space Force ... Global Power and Reach for America.

Mission ← ***Systems*** ← ***People***

HSC PURPOSE

THE HUMAN SYSTEMS CENTER TEAM WORKS WITH ITS CUSTOMERS TO ENHANCE OUR WARFIGHTER'S COMPETITIVE EDGE BY PROVIDING SUPERIOR HUMAN CENTERED TECHNOLOGY, SYSTEMS, EDUCATION AND SUPPORT. ***WE ARE THE SYSTEM'S INDEPENDENT ADVOCATE FOR THE HUMAN IN DESIGN, DEPLOYMENT AND OPERATIONS OF AEROSPACE SYSTEMS***

PRODUCT CENTER BASE DESCRIPTION BROOKS AFB

- MAJOR UNITS
  - HUMAN SYSTEMS CENTER TO INCLUDE:
    - ARMSTRONG LAB
    - USAF SCHOOL OF AEROSPACE MEDICINE
    - HUMAN SYSTEMS PROGRAM OFFICE
    - AIR BASE GROUP
      - SYSTEMS ACQUISITION SCHOOL
  - AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
  - AIR FORCE MEDICAL SUPPORT AGENCY

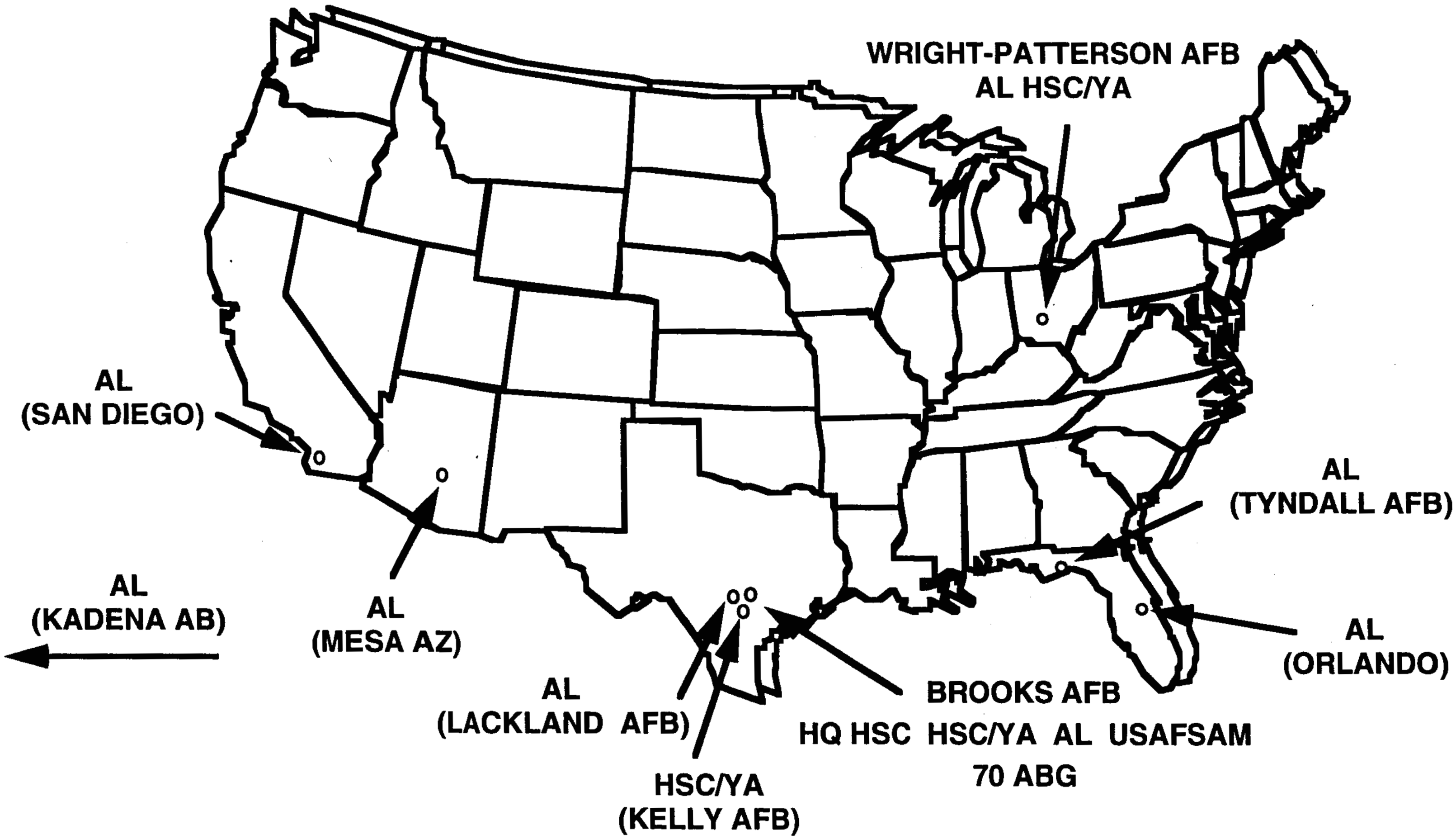
PRODUCT CENTER BASE DESCRIPTION BROOKS AFB (CONT)

- PRODUCT LINES - RESEARCH RELATED TO HUMAN SYSTEMS
  - CREW SYSTEMS INTEGRATION
  - HUMAN RESOURCES
  - AEROSPACE MEDICINE
  - OCCUPATIONAL/ENVIRONMENTAL HEALTH
  - EDUCATION/FORCE READINESS
  - MEDICAL/ENVIRONMENTAL SAMPLE ANALYSIS SERVICE
  - ENVIRONMENTAL COMPLIANCE SERVICES

FY95 HSC SNAPSHOT

- 3,249 People Managing $608 Million Annually
- 962 Scientists & Engineers
  - 400 Published Articles • 27 Patents, Inventions, Disclosures
  - 71 Focused Technology Areas
- 2,215 Degrees Held
  - 242 Doctoral • 570 Masters • 1,403 Bachelors
- 400 Acquisition Professionals
  - 40+ Development / Production Programs
  - 7,000+ Sustainment Items
- 128 Education / Training Instructors
  - 61 Aerospace Medicine Courses Graduating 4,768 Students
  - 8 System Acquisition Courses Graduating 1,385 Students

HSC ORGANIZATIONS



HUMAN SYSTEMS TECHNOLOGY

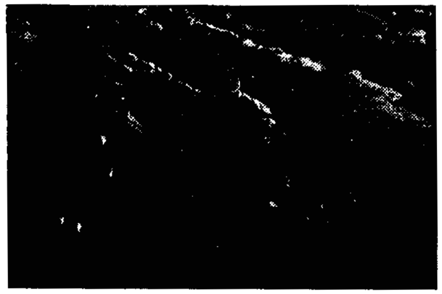
- DOD PERVASIVE, CORE TECHNOLOGY
  - REQUIRES IN-DEPTH FAMILIARITY WITH SERVICE OPERATIONS
  - REQUIRES TIGHT USER INTERFACE
- OFTEN MILITARILY UNIQUE, WITHOUT CIVILIAN COUNTERPART
- ENDORSED TO CSAF BY AFSAB 1994 SUMMER STUDY

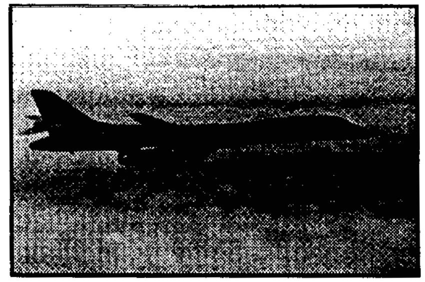
HUMAN SYSTEMS TECHNOLOGY WILL BE OF PARTICULAR VALUE FOR THE FUTURE

- FEWER NEW WEAPONS; AF MUST EXTEND DEMANDS ON CURRENT SYSTEMS AND CREW
- COMPLEX FUTURE WEAPONS SYSTEMS WILL REQUIRE IMPROVED DATA FUSION BY AIRCREW
- NIGHT AND ALL-WEATHER OPS WILL INCREASE DEMANDS ON CREWMEMBERS
- TRAINING AND SELECTION WILL BECOME EVEN MORE CRITICAL
- HUMAN SYSTEMS TECHNOLOGY = LEVER TO MAINTAIN FORCE EFFECTIVENESS DURING DOWNSIZING
- ENVIRONMENTAL LAWS IMPACT AIR BASE OPS, BASE CLOSURES, WASTE STREAMS

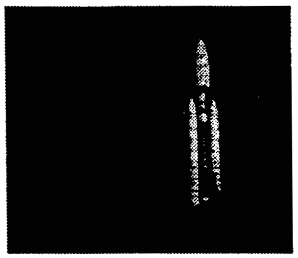
HSC IS LOGICAL ORGANIZATION TO BE FOCAL POINT FOR ALL HUMAN SYSTEMS TECHNOLOGY

- SINGLE MANAGER, ADVOCATE TO PREVENT FRAGMENTATION / ATTRITION
- AL IS ONLY LAB COORDINATING THROUGH MORE THAN TWO RELIANCE PANELS
- 1300 ACRES AT BROOKS AFB FOR FUTURE EXPANSION
- DOWNSIZING OPENS UP ADDITIONAL ROOM FOR FURTHER COLLOCATIONS
- NEW FACILITIES UNDER CONSTRUCTION AT BROOKS AFB
    - USAFSAM ACADEMIC COMPLEX
    - DIRECTED ENERGY LABORATORY
    - AFCEE BUILDING



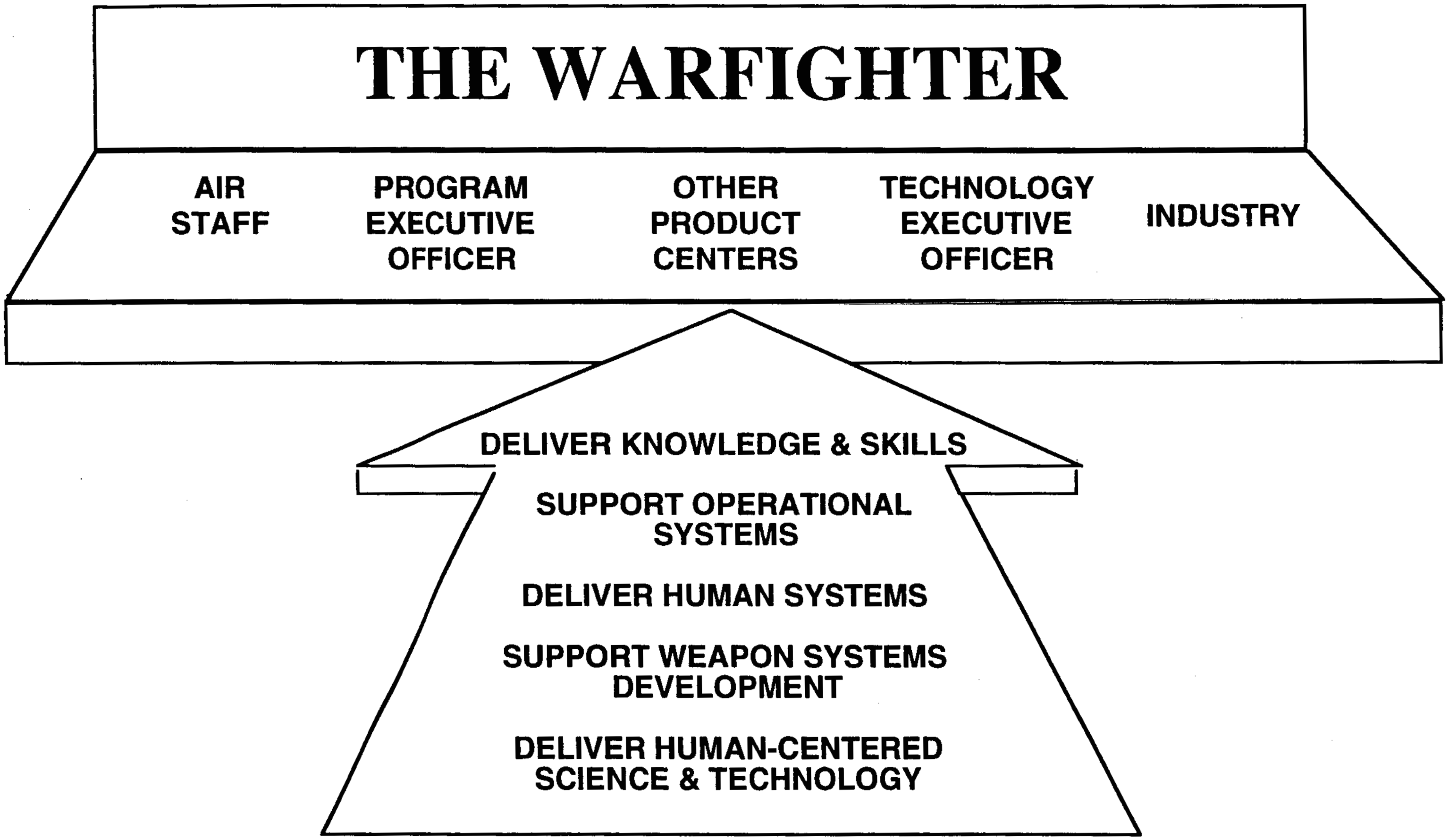


THERE ARE NO



UNMANNED SYSTEMS

HSC'S MISSION



ARMSTRONG LABORATORY TECHNOLOGY TRANSITION TO HUMAN SYSTEMS PROGRAM OFFICE

- COMBINED ADVANCED TECHNOLOGY ENHANCED DESIGN G-ENSEMBLE (COMBAT EDGE)
- NIGHT VISION SYSTEM
- DISPOSABLE EYE / RESPIRATORY PROTECTION SYSTEM
- THERMAL FLASHBLINDNESS PROTECTION DEVICE
- AIRCRAFT MISHAP PREVENTION SYSTEM
- RAPID OPTICAL SCREENING TOOL (ROST)
- ACTIVE NOISE REDUCTION
- MAINTENANCE SKILLS TUTOR
- CIVIL RESERVE AIR FLEET AEROMEDICAL EVACUATION SHIPSETS
- ADVANCED TECHNOLOGY ANTI-G SUIT (ATAGS)
- MICRO COMPUTER INTELLIGENCE FOR TECHNICAL TRAINING (MITT)

INTEGRATION OF RESEARCH AND EDUCATION BETWEEN AL AND USAFSAM

- DEVELOPMENT OF THE ADVANCED SPATIAL DISORIENTATION DEMONSTRATOR
  - TRAINING PROTOCOLS FOR RECOGNITION OF SD AND RECOVERY TECHNIQUES
    - DEVELOPED FOR ACC AND AETC PILOTS
    - USAFSAM LEADS AND AL SUPPORTS
  - DEVELOPMENT OF REALISTIC FLIGHT SIMULATIONS
    - AL LEADS AND USAFSAM SUPPORTS
- COOPERATION IN RESEARCH AND EDUCATION MISSIONS - THE UNIVERSITY MODEL
  - USAFSAM EDUCATORS PARTICIPATE IN RESEARCH MISSION OF AL
  - AL SCIENTISTS AND ENGINEERS SERVE AS FACULTY MEMBERS IN USAFSAM

AL TIGHTLY INTEGRATED WITH SAN ANTONIO MILITARY COMMUNITY

- USAF SCHOOL OF AEROSPACE MEDICINE (SAM)
  - JOINT PROJECTS AND PERSONNEL EXCHANGES
- AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)
  - RECIPIENT AND BROKER OF AL ENVIRONMENTAL TECHNOLOGIES
- HUMAN SYSTEMS PROGRAM OFFICE
  - TRANSITION HUMAN-CENTERED TECHNOLOGY
- AIR EDUCATION AND TRAINING COMMAND (AETC)
  - REQUIREMENTS, EVALUATIONS AND SUBJECTS FOR AIRCREW TRAINING R&D
- AIR FORCE MILITARY PERSONNEL CENTER
  - REPOSITORY FOR MPC DATABASE
- LACKLAND AFB
  - FACILITIES AND SUBJECTS FOR TRAINING AND SELECTION RESEARCH
- KELLY AFB
  - BIOREMEDIATION TEST SITE

GEOGRAPHICALLY-UNIQUE PROFESSIONAL SUPPORT

(WITH CIVILIAN COMMUNITY)

AUDIE MURPHY VETERANS HOSPITAL: CLINICAL HYPERBARIC MEDICINE SERVICES

UTSA: INTELLIGENT TUTORING SYSTEMS IN FUNDAMENTAL SKILLS
MILITARY WOMEN MEDICAL CARE COLLABORATIVE STUDIES

TRINITY UNIVERSITY: BIOEFFECTS OF ELECTROMAGNETIC FIELDS

SOUTHWEST RESEARCH INSTITUTE: VIBRATION TESTING

UTHSC, UTSA, TRINITY, SRI AND SYSTEMS RESEARCH LAB: LASER, MICROWAVE AND ELECTROMAGNETIC ENERGY STUDIES

TEXAS A&M: FOOD AND SAFETY RESEARCH

NASA: ENVIRONMENTAL TECHNOLOGY
RADIOLOGICAL AND TOXICOLOGICAL EFFECTS
ALTITUDE DECOMPRESSION SICKNESS

GEOGRAPHICALLY-UNIQUE PROFESSIONAL SUPPORT

(WITH MILITARY COMMUNITY)

KELLY AFB

- RADIOLOGICAL WASTE SITE CLEANUP AND SAFE MATERIAL DISPOSAL
- OCCUPATIONAL MEDICINE TRAINING

LACKLAND AFB

- TRICARE REGION VI REFERENCE LAB
- CLOSE PROXIMITY TO 30,000 RECRUITS FOR HUMAN-BASED RESEARCH

RANDOLPH AFB

- HIGH-G AWARENESS TRAINING FOR ALL AETC INSTRUCTOR PILOT TRAINEES
- CRITICAL FLYING REQUIREMENTS FOR 100 FLIGHT SURGEONS (ANNUALLY)

JOINT MEDICAL RESOURCE OPPORTUNITIES

- VETERINARY EXPERIENCE FOR RESEARCH IN MEDICAL SAFETY AND EFFICACY (BAMC)
- LOW COST TRAINING IN HEALTH PHYSICS (FORT SAM HOUSTON)

GEOGRAPHICALLY-UNIQUE CIVIC/SOCIAL SUPPORT

EDUCATION :
- SAN ANTONIO 2000 (HSC/CC CHAIRS PROGRESS REPORT COUNCIL)
- MENTORING PROGRAM (100-PLUS VOLUNTEERS)
- HIGHER EDUCATION INSTRUCTORS AT NEARBY UNIVERSITIES (100-PLUS)

MEDICAL :
- AFTER-HOURS MANPOWER SUPPORT TO LOCAL HOSPITALS
- PRACTICAL EXPERIENCE AVAILABILITY FOR LOCAL DOCTORAL STUDENTS

RUNWAY :
- AUTOMOTIVE RESEARCH AND TESTING
- SAFE-DRIVING TRAINING

MONEY / TIME :
- ALAMO FEDERAL EXECUTIVE BOARD
- HUNDREDS OF EMPLOYEES/THOUSANDS OF VOLUNTEER HOURS

USAF SCHOOL OF AEROSPACE MEDICINE

(USAFSAM)

PROVIDES TRAINING, EDUCATION, AND CONSULTATION IN THE AREAS OF HUMAN PERFORMANCE ENHANCEMENT, CONTINGENCY MEDICAL OPERATIONS, OCCUPATIONAL HEALTH, DISEASE PREVENTION, ENVIRONMENTAL QUALITY, AND AEROMEDICAL EVACUATION

USAFSAM

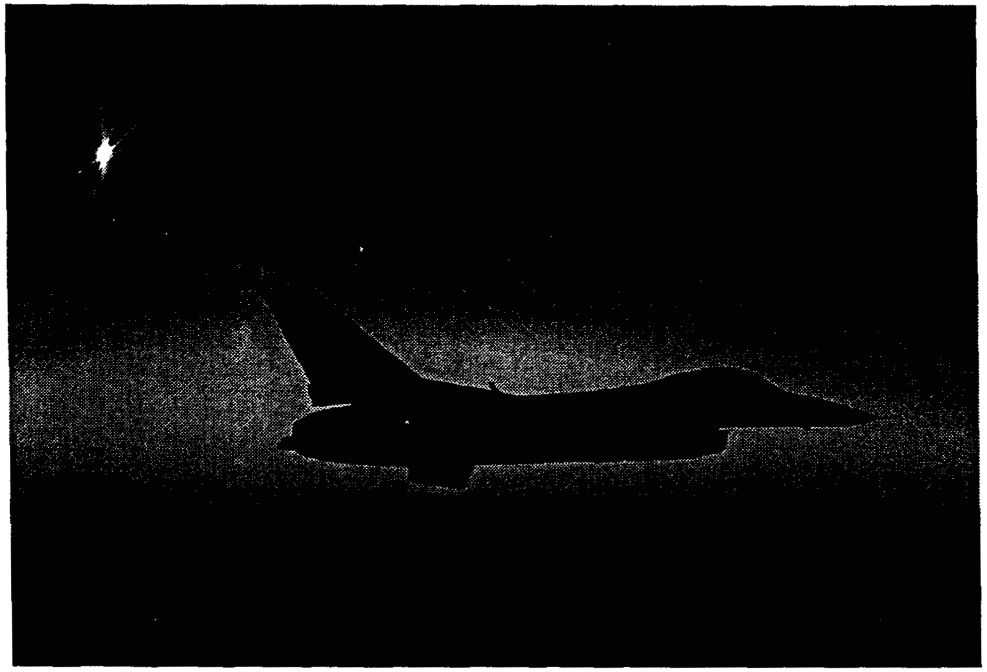
- INTERNATIONALLY RECOGNIZED
- 5000+ STUDENTS PER YEAR
  - AEROSPACE MEDICINE
  - AEROSPACE NURSING
  - AEROSPACE PHYSIOLOGY
  - PUBLIC HEALTH
  - BIOENVIRONMENTAL ENGINEERING
- ENTRY LEVEL THROUGH 4TH YEAR POST M.D.
  - USAF, DOD, AND ALLIED NATIONS

USAFSAM

- HIGHLY SYNERGISTIC RELATIONSHIP WITH AL AND YA
  - 30% OF USAFSAM PODIUM HOURS CONDUCTED BY AL AND YA SUBJECT MATTER EXPERTS
  - AL PROVIDES ESSENTIAL RESEARCH BASE FOR ADVANCED USAFSAM STUDENTS
  - USAFSAM STAFF PROVIDES OPERATIONAL INSIGHT FOR RESEARCHERS, PROGRAM MANAGERS

WE ARE THE HUMAN SYSTEMS CENTER

THE HUMAN IS THE HEART OF AEROSPACE SYSTEMS AND OPERATIONS



THERE ARE NO UNMANNED SYSTEMS

COMPARATIVE LABORATORY FACILITY DATA

WALTER REED ARMY INSTITUTE OF RESEARCH (WRAIR)

- MISSION SIMILAR TO ARMSTRONG LABORATORY
- A&E DESIGN ESTIMATE FOR A BIOMEDICAL RESEARCH FACILITY
  - 1036 RESEARCHERS AND SUPPORT
  - 460,000 SQUARE FEET
  - FACILITY COST: $147.3M
  - $320/SF = $142K/PERSON
- MOST ACCURATE COST DATA AVAILABLE FOR THE TYPE OF FACILITY THAT ARMSTRONG LAB REQUIRES

CATEGORY III ITEM #CFT-01

HUMAN/ANIMAL CENTRIFUGE

- **ISSUE:** RELOCATION OF THE BROOKS AFB HUMAN/ANIMAL CENTRIFUGE TO W-P AFB

- **FACTS:**
  - MOST ACTIVE AND PRODUCTIVE CENTRIFUGE IN WORLD
  - MAXIMUM **30 G** TEST CAPABILTIY
  - ONLY CENTRIFUGE THAT CAN MATCH FIGHTER CAPABILITY
    - **- 9 G; 6 G/SEC ONSET RATE**
  - LOW O&M COSTS COMPARED TO OTHER CENTRIFUGES
  - NAVY CLOSING DOWN WARMINSTER CENTRIFUGE

- **RECOMMENDATIONS:** MOVE THE BROOKS AFB CENTRIFUGE INTO A NEW BUILDING AT WPAFB.

- **IMPACT IF NOT RESOLVED:** LOSS OF A UNIQUE NATIONAL ASSET

ARMSTRONG LABORATORY

FACILITY AND EQUIPMENT OVERVIEW

6 APRIL 1995

AGENDA

- REQUIREMENT
- COST DATA FOR LABORATORY CONSTRUCTION AND MOVES
- ESTIMATE COMPARISON
- EQUIPMENT AND FACILITY ISSUES

REQUIREMENT

- CLOSE BROOKS AFB
- MOVE HSC, SAM, AND AL TO WP-AFB
- HYPERBARIC CHAMBERS RELOCATE TO LACKLAND AFB TX

ARMSTRONG LABORATORY

- 1181 SCIENTISTS, ENGINEERS, AND SUPPORT
- $75M RESEARCH EQUIPMENT AND COMPUTERS: ORIGINAL COST
- 8.5M POUNDS OF EQUIPMENT, LIBRARY, AND FURNITURE
- UNIQUE FACILITY REQUIREMENTS
- 289 CONTRACT SCIENTISTS, ENGINEERS, AND SUPPORT

COMPARATIVE LABORATORY FACILITY DATA

WALTER REED ARMY INSTITUTE OF RESEARCH (WRAIR)

- MISSION SIMILAR TO ARMSTRONG LABORATORY
- A&E DESIGN ESTIMATE FOR A BIOMEDICAL RESEARCH FACILITY
  - 1036 RESEARCHERS AND SUPPORT
  - 460,000 SQUARE FEET
  - FACILITY COST: $147.3M
  - $320/SF = $142K/PERSON
- MOST ACCURATE COST DATA AVAILABLE FOR THE TYPE OF FACILITY THAT ARMSTRONG LAB REQUIRES

COMPARATIVE LABORATORY FACILITY DATA (con't)

KELLY MILCON ESTIMATE

- 1994 AFMC 21 ESTIMATE TO REBUILD AL AT KELLY
- NOT BASED ON A&E DESIGN ESTIMATE
  - $312M TO INCLUDE DORMS, HOUSING, VOQ
  - $255M FOR R&D FACILITY
  - 1,087,000 SF R&D FACILITY
  - $235/SF

THE AUSTIN COMPANY
COMPLETED FACILITY COST SUMMARY

	Total Building Area (SF)	Laboratory Area (SF)	Office & Admin. Area (SF)	Total Project Cost (x $1,000)	$ Per SF (1994 Dollars)
Mobil Oil Beaumont, Tx.	19,850	12,685	7,165	$ 4,320	$ 217.63
Diamond Shamrock Three Rivers, Tx.	10,550	7,492	3,058	$ 2,746	$ 260.25
Citgo Lake Charles, La.	27,636	10,936	16,700	$ 5,382	$ 194.75
Exxon (Remodel) Baton Rouge, La.	5,953	4,559	1,394	$ 1,224	$ 211.78
Mobil Chem. Houston, Tx.	5,832	4,082	1,750	$ 1,850	$ 317.00
Chevron Belle Chasse, La.	12,094	7,620	4,474	$ 2,600	$ 214.98
Rexene Odessa, Tx.	4,262	2,314	1,948	$ 1,154	$ 270.76
Hoechst Celanese Bayport, Tx.	11,100	9,950	1,150	$ 3,771	$ 339.73
Average	12,160			$ 2,881	$ 236.92

Phibro USA
Phibro Energy USA, Inc.

THE AUSTIN COMPANY
ARCHITECTS
ENGINEERS
BUILDERS

LABORATORY FACILITY COST ESTIMATE COMPARISON

	COST/SF	AL SPACE REQUIREMENT (SF)	COST
WRAIR LABORATORY	$320	580,000	$ 185,600,000
AUSTIN CO. AVG.	$237	580,000	$ 137,460,000
KELLY AFB MILCON	$235	580,000	$ 136,300,000
COBRA MODEL	$136	580,000	$ 78,880,000

LABORATORY EQUIPMENT AND FACILITY ISSUE HIGHLIGHTS

HUMAN/ANIMAL CENTRIFUGE
RESEARCH ENVIRONMENTAL CHAMBERS
AEROMEDICAL EQUIPMENT AIRWORTHINESS CERTIFICATION FACILITY
HIGH ALTITUDE RESEARCH SUPPORT FACILITY
DISPOSITION OF LEGACY ANIMALS
CAPACITY OF WPAFB ANIMAL FACILITIES
ANALYTICAL/RADIOANALYTICAL CAPABILITY
RELOCATION OF LASER AND BIOEFFECTS
SECURITY SPACE REQUIREMENTS
RELOCATION OF REFERENCE LABORATORY
RELOCATION OF HYPERBARIC SERVICES
RELOCATION OF ANECHOIC CHAMBERS

CATEGORY III ITEM #CFT-01

HUMAN/ANIMAL CENTRIFUGE

- **ISSUE:** RELOCATION OF THE BROOKS AFB HUMAN/ANIMAL CENTRIFUGE TO W-P AFB

- **FACTS:**
  - MOST ACTIVE AND PRODUCTIVE CENTRIFUGE IN WORLD
  - MAXIMUM **30 G** TEST CAPABILTIY
  - ONLY CENTRIFUGE THAT CAN MATCH FIGHTER CAPABILITY
    - **9 G; 6 G/SEC ONSET RATE**
  - LOW O&M COSTS COMPARED TO OTHER CENTRIFUGES
  - NAVY CLOSING DOWN WARMINSTER CENTRIFUGE

- **RECOMMENDATIONS:** MOVE THE BROOKS AFB CENTRIFUGE INTO A NEW BUILDING AT WPAFB.

- **IMPACT IF NOT RESOLVED:** LOSS OF A UNIQUE NATIONAL ASSET

CATEGORY III ITEMS #CFT-07, 08, 09

RESEARCH ENVIRONMENTAL CHAMBERS
AEROMEDICAL EQUIPMENT AIRWORTHINESS CERTIFICATION FACILITY
HIGH ALTITUDE RESEARCH SUPPORT FACILITY

- **ISSUE:** RESEARCH ALTITUDE CHAMBERS/SUPPORT EQUIPMENT, RELOCATE TO WPAFB

- **FACTS:**

  - 7 SPECIALIZED RESEARCH ALTITUDE AND ONE ENVIRONMENTAL CHAMBERS

  - REQUIRES REMOVAL OF BUILDING WALLS AND SPECIAL EXTRACTION EQUIPMENT

  - 19 HIGH CAPACITY VACUUM PUMPS, THERMAL CONDITIONING SYSTEM (SLED MOUNTED TANKS, PUMPS AND COMPRESSORS, AND HOT GLYCOL CIRCULATION SYSTEM)

- **RECOMMENDATION:**

  - DESIGN/BUILD NEW FACILITY TO ACCOMMODATE RESEARCH/ENVIRONMENTAL CHAMBERS AT W-P AFB

CATEGORY III ITEMS #CFT 07, 08, 09

RESEARCH ENVIRONMENTAL CHAMBERS
AEROMEDICAL EQUIPMENT AIRWORTHINESS CERTIFICATION FACILITY
HIGH ALTITUDE RESEARCH SUPPORT FACILITY

- **IMPACT IF NOT RESOLVED**
  - ONLY AEROSPACE ALTITUDE RESEARCH FACILITY IN DOD
  - LOSS WOULD ELIMINATE:
    - SUPPORT TO ACC, USSOCOM, AND NASA
    - ON BOARD OXYGEN GENERATING SYSTEMS DEVELOPMENT
    - LIFE SUPPORT EQUIPMENT DEVELOPMENT AND MAN-RATING
    - AIRWORTHINESS CERTIFICATION OF AEROMEDICAL EVACUATION EQUIPMENT
    - RESEARCH ON SPECIALIZED REQUIREMENTS FOR HIGH ALTITUDE PROTECTION
  - 1 - 1.5 YEARS DOWN TIME

CATEGORY III ITEM #OE-1
DISPOSITION OF LEGACY ANIMALS

- **ISSUE:** LEGACY ANIMALS REQUIRE LIFETIME CARE
- **FACTS:**
  - MOVE TO WPAFB NOT NEEDED
  - NO FURTHER RESEARCH, JUST SUPPORT
  - AAALAC CARE REQUIRED, SOMEWHERE
- **RECOMMENDATION:**
  - MILCON SPACE AT WPAFB
  - MOVE COLONY TO NEW LOCATION
  - LEASE BROOKS FACILITIES
- **IMPACT IF NOT RESOLVED:** CARE IS REQUIRED FOR 10-15 YEARS

CATEGORY III ITEM #OE-2
CAPACITY OF WPAFB ANIMAL FACILITIES

- **ISSUE:** SHORT FALL IN ANIMAL FACILITIES AT WPAFB EXISTS
- **FACTS:**
  - SPACE REQUIRED BEFORE MOVE OF ANIMALS
  - BAFB HAS 100K SF SPACE, WPAFB HAS 50K SF
  - SHORTFALL OF 60K SF IF CONSOLIDATE
  - SPACE IS EXPENSIVE
- **RECOMMENDATION:** LEASE OR BUILD SPACE AT WPAFB
- **IMPACT IF NOT RESOLVED:** LOSS OF ANIMAL SUPPORT SHUTS DOWN IN-HOUSE BIOEFFECTS WORK

CATEGORY III ITEM #OE-6
ANALYTICAL/RADIOANALYTICAL

- **ISSUE:** ENGINEERING SERVICE MISSION REQUIRES LABORATORY, COLLOCATION WITH CONSULTANTS
- **FACTS:** 60K SF LAB, 14K SF ADMIN, 3K SF HAZMAT
  MEDIUM LABS WITH HVAC (58 HOODS NOW)
  PROVIDE 30% OF AF ESOH ANALYSES, 90K PLUS
  COLLOCATED FOR READINESS MISSION
  EQUIPMENT REQUIRES R/R BY VENDOR
  RECERTIFICATION REQUIRED FOR WPAFB
- **RECOMMENDATION:** MOVE AS UNIT TO WPAFB
- **IMPACT IF NOT RESOLVED:** READINESS MISSION IMPACT. LOSS OF ESOH ANALYTICAL CAPABILITY

CATEGORY III ITEM #OE-7
RELOCATION OF LASER AND RFR BIOEFFECTS

- **ISSUE:** RELOCATION OF RF AND LASER BIOEFFECTS INVOLVES TRISERVICE RELIANCE COLLOCATES
- **FACTS:**
  - AGREEMENTS MAKE USAF RESPONSIBLE FOR MOVE
  - COLLOCATION DEMONSTRATED AS EFFECTIVE
  - 35 XMITERS, 9 CHAMBERS
  - 14 LASERS, 15 OPTICAL BENCHES
  - ALL COLLOCATES NEED ANIMAL MODEL SUPPORT
- **RECOMMENDATION:** STUDY ALL OPTIONS FOR MOVE
- **IMPACT IF NOT RESOLVED:** LOSE BIOEFFECTS R&D

CATEGORY III ITEM #OE-12
SECURITY SPACE REQUIREMENTS

- **ISSUE:** SECURE SPACE FOR MATH PRODUCTS DIVISION
- **FACTS:**
  - 3.4K SF SCIF, 3K NET ADMIN
  - COMPUTER WORKSTATIONS REQUIRE MOVE
  - READY SPACE NEEDED TO FACILITATE, IF MOVED
  - PROVIDES ONLY 1/3 SPACE FOR RELIANCE DETACHMENTS
- **RECOMMENDATION:** LEASE OR BUILD SPACE AT WPAFB
- **IMPACT IF NOT RESOLVED:** DELAYS IN IMPORTANT CLASSIFIED R&D

CATEGORY III ITEM #AO-01
RELOCATION OF REFERENCE LABORATORY

- **ISSUE:** DISRUPTION OF WORLD-WIDE REFERENCE LABORATORY SERVICES PROVIDED BY THE EPIDEMIOLOGIC RESEARCH DIVISION (AOE)

- **FACTS:**
  - RECERTIFICATION REQUIRED
  - 1 YEAR MINIMUM TIME BEFORE CERTIFICATION

- **RECOMMENDATION:** PROVIDE INTERIM CONTRACT SERVICES

- **IMPACT IF NOT RESOLVED:** LOSS OF PATHOGEN SCREENING REQUIRED FOR DEPARTMENT OF DEFENSE MEDICAL TREATMENT FACILITIES.

CATEGORY III ITEM #AO-04
RELOCATION OF HYPERBARIC SERVICES

- **ISSUE:** MAJOR ENGINEERING EFFORT REQUIRED TO RELOCATE HYPERBARIC SERVICES. EXISTING CHAMBERS ARE IN EXCESS OF 30 YEARS OLD.
- **FACTS:**
  - NEW SUPPORT FACILITIES MUST MEET NEW NATIONAL FIRE PREVENTION ASSN (NFPN)
  - PRESSURE VESSELS MUST MEET HUMAN OCCUPANCY (PUHO) STANDARDS.
- **RECOMMENDATION:**
  - RELOCATE EXISTING CHAMBERS IN NEW SUPPORT FACILITY
- **IMPACT IF NOT RESOLVED:** LACK OF TREATMENT CAPABILITY

CATEGORY III ITEM #AO-05
RELOCATION OF ANECHOIC CHAMBER

- **ISSUE:** RELOCATION OF ANECHOIC CHAMBER

- **FACTS:**
  - CHAMBERS ARE CUSTOM MADE
  - CONSTRUCTED INTO BUILDING

- **RECOMMENDATION:** BUILD ANECHOIC CHAMBER AT WPAFB

- **IMPACT IF NOT RESOLVED:** AIRCREWS CANNOT BE TESTED FOR RESEARCH IN HUMAN SYSTEMS PROGRAMS.

United States Air Force

FACT SHEET

Office of Public Affairs, Human Systems Center, 2510 Kennedy Circle, Suite 1, Brooks AFB TX 78235-5120 Phone (210) 536-3234 Fax (210) 536-3235

ARMSTRONG LABORATORY

MISSION

The Armstrong Laboratory plans, manages, and conducts research, exploratory and advanced development, and specialized operational support, all focused on the readiness, maintenance, protection and enhancement of human capabilities. The laboratory is an integral element of the Human Systems Center (HSC), the prime systems-independent advocate for the human-centered concerns in Air Force weapon systems design, development and deployment. Laboratory research and development efforts complement, are coordinated with, and link HSC programs in development planning and human systems acquisition.

Laboratory products assure human system performance at individual, crew, team and force levels, enabling the Air Force to meet current and future operational requirements in the functional areas of aerospace medicine, disease prevention and health services assessment, crew systems, human resources, and occupational and environmental health. Highlighting man as the ultimate enabling factor in Air Force weapon systems, the Armstrong Laboratory sponsors and conducts research and development in the fields of biodynamics, biocommunications, toxic hazards, radiation/directed energy bioeffects, aeromedical selection/retention, human engineering, crew protection/life support, logistics and human factors, force acquisition and management, instructional strategies, job skill development and retention, and training systems/simulator developments.

Responding to customer needs and maintaining our superiority in the human systems technology area, the laboratory builds the technological framework upon which systems acquisition excellence is based.

The laboratory consists of a command section, plans function, operations and support, financial management, contracting staff, and six functional technical directorates. The functional directorates are interdisciplinary entities structures to address Air Force future capability needs in aerospace medicine, disease prevention and health services assessment, environics, crew systems, human resources, and occupational and environmental health.

The Plans Directorate is responsible for program and process analysis and integration, planning and decision support for the Armstrong Laboratory's scientific, technical, and operational support programs. This Directorate reviews mission and planning documents as well as systems under development to identify relevant human systems technology needs and objectives which meet user's needs. The plans directorate coordinates dual use (defense conversion) activities and develops advocacy products for the Armstrong Laboratory.

The Aerospace Medicine Directorate conducts research, development, and operational support applying medical principles to the selection, retention, and maintenance of aircrew in Air Force operations. It is responsible for monitoring various disease study groups in the flying population and maintaining associated databases. Findings from these studies support the early detection of disease in this critical Air Force personnel resource, enabling more successful treatment and return to the cockpit where flight safety is not compromised. Within this directorate are specialized laboratory programs in epidemiologic research and field support, dental service equipment evaluation, hyperbaric medicine, and certified substance abuse testing.

The Office for Prevention and Health Services Assessment enhances the readiness of the fighting force through effective disease/injury prevention, and health promotion programs. This office provides operational commanders and managers of health programs with improved capabilities to make evidence-based decisions on fitness programs, dietary habits, and lifestyle change recommendations. By focusing preventive medicine programs on Air Force specific issues, this office provides capability to measure the impact of specialized programs on the airman, squadron, mission, wing, and Air Force community at large.

The Occupational and Environmental Health Directorate assesses risks to personnel from exposure to hazardous materials, noise, electromagnetic radiation, and occupational processes in Air Force operations; and conducts research and development to reduce such risks. The Directorate works with all echelons of USAF commanders to acquire, operate, maintain, and dispose of weapons systems within the guidelines of environmental law and regulation. Through broad field consultation responsibilities, it captures and maintains an extensive data base of observed occupational illnesses and environmental exposures. It studies interactions between environmental hazards, USAF operations and personnel, and applies the resulting knowledge to mitigate impacts on health and maintain technological superiority concerning the biological effects of radiation/directed energy.

The Crew Systems Directorate conducts research, development, and field support to integrate human operators with weapon systems and to optimize human combat performance, protection, and survivability.. It researches human physical, physiological, and behavioral characteristics and stress tolerance to develop permissible crew exposure limits, crew station and equipment design criteria, and protective countermeasures. The Directorate develops design tools and prototype crew stations and equipment to provide a competitive advantage to military combat crews. It manages laboratory programs in anthropometry, sustained acceleration, workload analysis, helmet mounted systems, bioacoustics and biocommunications, biodynamic modeling, escape systems, life support, chemical and biological defense, aeromedical evacuation equipment, high altitude protection, sustained operations, spatial orientation countermeasures, and crew vulnerability reduction. It provides field support to solve related problems encountered in operational systems.

The Human Resources Directorate performs scientific research and develops technologies and methods to acquire, classify, train, integrate, manage, and retain Air Force human resources for maximum combat effectiveness. Human resources studies seek to match people with the most appropriate jobs, to enhance productivity through understanding the elements of job performance, to model and predict force-wide career flow options, and to analyze manpower, personnel and training components to reduce weapon systems life cycle costs. It develops training devices, systems and instructional strategies with particular emphasis on aircrew skills enhancement. It develops methods, processes, and tools to facilitate early incorporation of supportability considerations in the acquisition process, thereby improving weapon systems affordability and sustainability as well as by reducing operational resource requirements. Also, it develops methods to assess aircraft battle damage, thus improving combat logistics and repair performance.

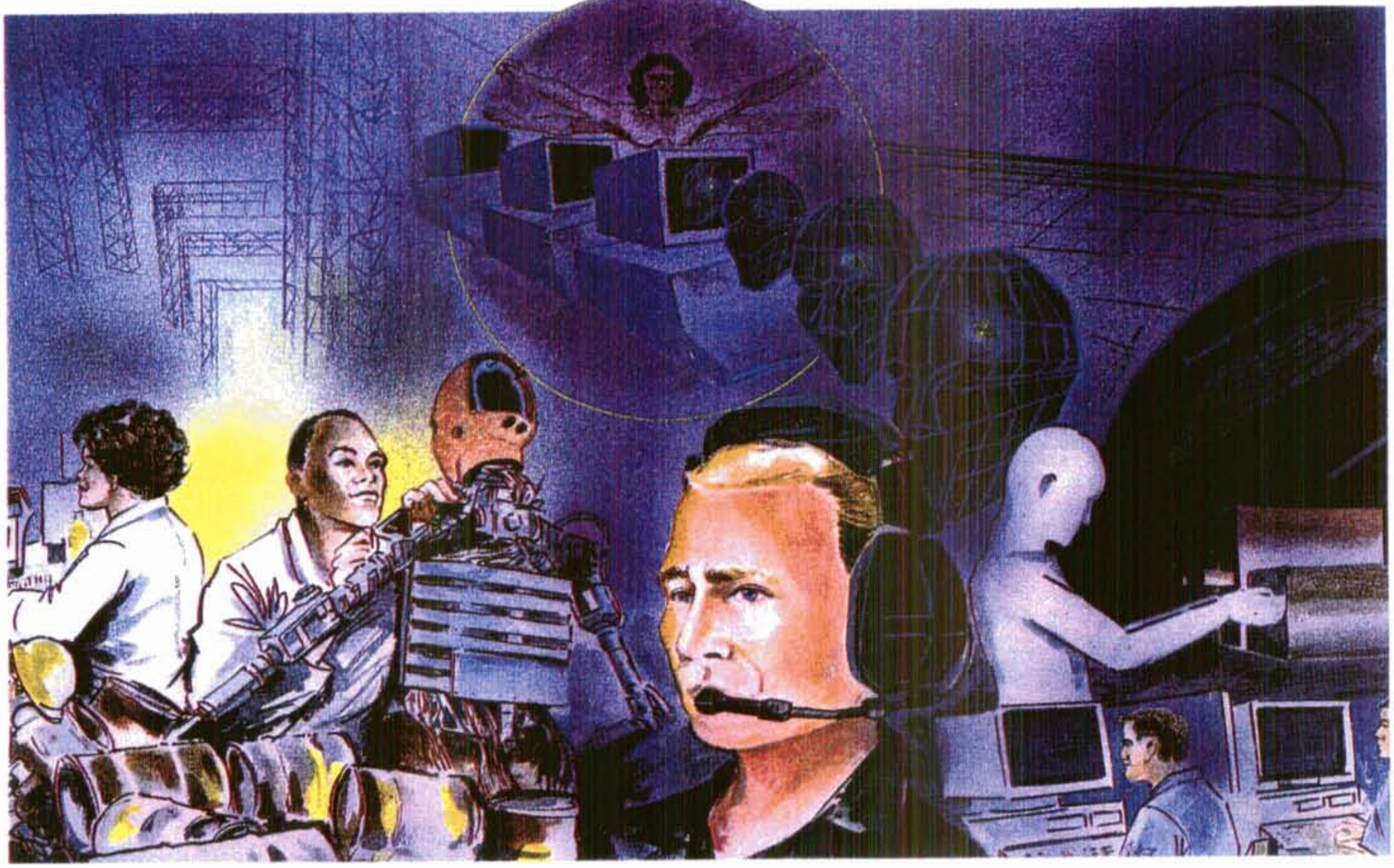
The Environics Directorate supports the Air Force mission by reducing the costs of cleaning up past waste sites while assuring, through compliance, the completion of critical wartime and peacetime flying. Environmental quality efforts at Tyndall Air Force Base, Fla., center on low-cost, highly effective ways to prevent environmental problems and to restore existing facilities. The Directorate has state-of-the-art analytical laboratories, staffed by engineers, chemists, microbiologists, other scientists, and technicians. The extended research base that supports this laboratory includes investigators from colleges and universities throughout the United States as well as cooperating research partners in private institutions, industry and other federal laboratories.

As part of its special relationship with the U.S. Air Force School of Aerospace Medicine, the Armstrong Laboratory provides instructional expertise and access to its vast aeromedical databases, information resources and laboratory facilities.

ARMSTRONG LABORATORY

MEETING THE HUMAN CHALLENGE
GLOBAL POWER - GLOBAL REACH

ARMSTRONG LABORATORY



Human-Centered Technologies Now Available for Licensing, as a Service, or under Collaborative Research Programs

Some Examples

- ✔ Crash Impact Protection Devices
- ✔ Gene Probes
- ✔ Computer-aided Human-Machine Interfaces
- ✔ Interactive Computer Tutoring Programs
- ✔ Auditory Displays
- ✔ Virtual Environments
- ✔ Logistics Management
- ✔ Laser Eye Protection

Tap into these and other technologies developed by Armstrong Lab's 700 scientists and engineers

Call, mail or fax your request

Office of Research and
Technology Applications (ORTA)
Mr. Douglas Blair or Major Bruce Pollock
AL/XPTT
2509 Kennedy Circle
Brooks Air Force Base
TX 78235-5118
210-536-3817 • FAX 210-536-2810

- ❐ Human Engineering
- ❐ Computer-Based Training
- ❐ Simulation/Synthethic Environments
- ❐ Personal Protective Devices
- ❐ Man-Machine Interface
- ❐ Dental Equipment/Materials Testing
- ❐ Selection & Classification Systems - Personnel
- ❐ Directed Energy Bioeffects
- ❐ Environmental Toxicology
- ❐ Health Risk Assessment
- ❐ Drug Testing
- ❐ Selection/Retention Standards - Medical

Name__________ Title__________

Company__________ Office Phone__________

Address__________ Fax#__________

City__________ State_____ Zip Code__________

CALL OUR ORTA OFFICE AND FIND THE RIGHT PERSON IN ARMSTRONG LAB TO HELP **YOU**

United States Air Force

FACT SHEET

Office of Public Affairs, Human Systems Center, 2510 Kennedy Circle, Suite 1,
Brooks AFB TX 78235-5120 Phone (210) 536-3234 Fax (210) 536-3235

HUMAN SYSTEMS PROGRAM OFFICE

The Human Systems Program Office (HSC/YA) provides advanced performance, survival, and training technologies to U.S. and allied air and ground crews through development, production and sustainment of human-centered systems and services including life support; aircraft escape; computer-based training; chemical defense; aeromedical; Air Force uniforms; mishap analysis; and environmental technology. The program office demonstrates technology concepts in prototype systems to reduce technical, cost, and schedule risk, and to accelerate the transition of laboratory technologies to fielded systems. As the single acquisition arm of the Human Systems Center, the program office is responsible for proper execution of engineering and manufacturing development and production programs and coordinates acquisition efforts with other agencies and the using major commands. The Human Systems Program Office is also responsible for the Human Systems Center staff functional work in the areas of engineering, manufacturing/quality assurance, configuration/data management, test and evaluation, and acquisition logistics.

The program office was awarded the Air Force Materiel Command's General Bernard Schriever Award for Program Excellence in 1993, and the Department of Defense Superior Management Award in 1994.

HISTORY

Aeromedical casualty development and acquisition began in the early 1980s under the Aerospace Medical Division (AMD). In 1987, AMD was chartered the Human Systems Division (HSC) with expanded development and acquisition responsibilities in the areas of manpower/personnel/training and some life support programs. In April 1989, the life support, chemical warfare defense, and clothing divisions of Aeronautical Systems Division (ASD) were organizationally aligned under the HSD deputy commander for development and acquisition. The objective was to transition the HSD laboratories for these product areas to acquisition agencies under the leadership of one product division commander to better serve the using major commands. In the fall of 1989, the deputy commander for development and acquisition was designated a program director and the

(Current as of March 1995)

organization renamed the Human Systems Program Office. In July 1991, HSD/YA was identified one of the 21 selected programs to begin operation under the Integrated Weapon System Management (IWSM) concept and became the first IWSM office to reach full operational capability with the addition of a 60-person sustainment operating location at Kelly Air Force Base. On Jul. 1, 1992, the Human Systems Division became the Human Systems Center (HSC). The Program Office's primary mission is to conduct HSC's development, acquisition, evolution and sustainment programs in response to major commands' stated needs. The Program Office is organized into five product divisions with matrixed functional support divisions. The organization works with the other DOD components in fielding Department of Defense and Air Force systems.

The Life Support Systems Division develops equipment for aircraft air and ground escape, descent, survival and recovery; USAF uniforms/clothing; aircrew, passenger/ground support equipment and aircraft installed systems; along with the development of procedures and training requirements to assure proper utilization of such systems. The Chemical/Biological Defense Systems Division develops equipment for aircrew, passenger and ground support personnel protection, including both personal and collective protective equipment. The division also develops procedures and training requirements to assure proper utilization of the systems. The Aeromedical Systems Division develops Air Force-unique medical field equipment and systems, as well as all tactical and strategic aeromedical evacuation systems for the Department of Defense and develops decision-support models to assist war planners' understanding of the causes and circumstances resulting from the loss of combat forces to facilitate war and mobilization planning of combat personnel and logistical requirements.

The Human Resource System Division develops and produces computer-based training and intelligent tutoring systems to enhance the capabilities within the manpower, personnel, training, and safety arenas to improve personnel capabilities and force readiness. The Medical Systems Training Division directly supports the automation goals of the Air Force Surgeon General by conducting all aspects of implementation, to include, but not limited to, site surveys, statements of work, system manager training, applications training, and direct onsite implementation support of the Composite Health Care System, Ambulatory Data Collection System, Provider Work Station, and the Defense Medical Human Resources System.

The Environmental Systems Division is responsible for demonstrating environmental systems and technology concepts in prototype systems to reduce technical, cost, and schedule risk and to accelerate transition of laboratory technologies to fielded systems. Within these activities are site remediation systems, compliance systems, and pollution prevention, along with development of procedures and training requirements to assure proper utilization of the systems. The Life Support System Support Management at the System Support Division has the worldwide management and technical responsibility for fielded USAF/FMS aircrew personal equipment and aircraft escape systems which includes ejection seats, personal equipment items, articles, systems and subsystems used in air, ground and space operations for human-centered protection. The The Life Support mission is accomplished through Inventory Management Specialists and Logistic Management Specialists.

HUMAN SYSTEMS PROGRAM OFFICE
(A/O Apr 95)

1990 AFSC Commander's Trophy for Program Excellence, Systems Program Office of the Year
1993 AFMC General Bernard A. Schriever System Program Office of the Year Award
1994 DoD Superior Management Award

MISSION

Provide advanced performance, survival, and training technologies to US and allied air and groundcrews through development, production, and sustainment of human centered systems and services including life support; aircraft escape; computer based training; chemical defense; aeromedical; AF uniforms; mishap analysis; and environmental technology.

PROGRAM DIRECTOR

Mahlon H. Long III, Colonel

TALKING PAPER

ON

HUMAN SYSTEMS PROGRAM OFFICE (SPO)

PURPOSE
- Provide a snapshot of SPO mission, structure, personnel, through-put

MISSION
- Provide advanced performance, survival, and training technologies to US and allied forces through cradle-to-grave development, production, and sustainment of human centered systems and services

PRODUCT AREAS (Selected examples described in attached fact sheets)
- SPO consists of AF-unique product-focused divisions and functional support
  -- Aircrew Life Support Systems
    --- Ejection seats, survival gear, anti-G equipment, helmets, night vision, etc.
  -- Nuclear, Biological, and Chemical Warfare Defense Systems
    --- Individual and collective protection, detectors, decontamination
  -- Aeromedical Systems
    --- Casualty care, chemically hardened medical systems, medical simulation and modeling, aeromedical, etc.
  -- Training Systems
    --- Intelligent tutoring, training development, and management aids, etc.
  -- Environmental Systems
    --- Site characterization, clean up, prevention
  -- Medical Systems Implementation and Training
    --- Deploying automated integrated hospital patient administration system
  -- Air Force Uniforms
    --- Design, test, and specify all AF uniforms

PERSONNEL (Authorized)

- Military personnel:	BAFB: 167	WPAFB: 1	KAFB: 4	
- Civilian personnel:	BAFB: 153	WPAFB: 12	KAFB: 34	Philadelphia: 7
- TEAMS/FFRDC:	BAFB: 82/8			

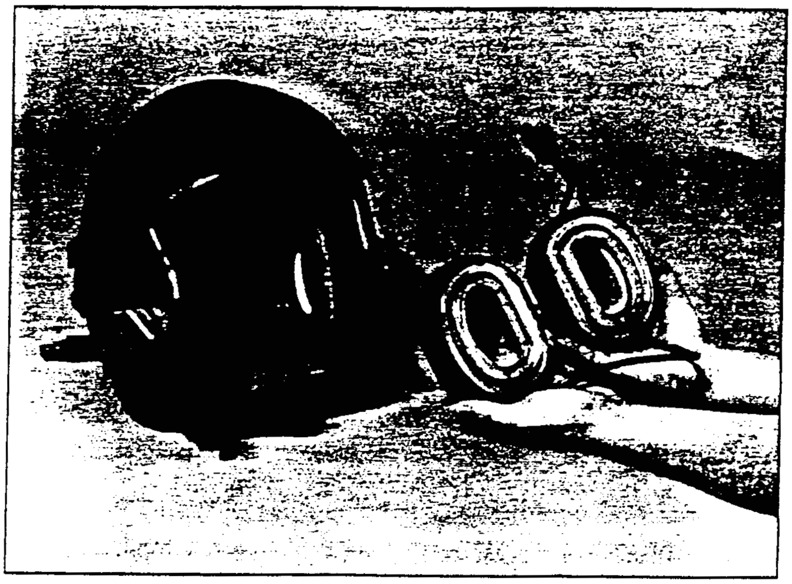
1994 $ MANAGED THROUGH-PUT: $38M development; approx $100M production

CUSTOMERS
- All Air Force major commands and Air Staff
- Other Air Force Materiel Command Product and Logistics Centers
- Other DoD services
- Other US government agencies
- Foreign countries

HSC/YA/4-3475/3 Apr 95

ANR
(Active Noise Reduction)

Program Objective: To investigate a new electronic approach to noise attenuation in aircrew helmets to reduce hearing loss, reduce fatigue to the crew member caused by the noise and improve communications capability.
(See Page 37 in HSC's "Products and Progress" report)



The Active Noise Reduction earcups, as installed in an aircrew helmet (HGU-55/P), will electronically reduce annoying or distracting background noise.

COMBAT EDGE
(Combined Advanced Technology Enhanced Design G-Ensemble)

Equipped with COMBAT EDGE, pilots can tolerat greater levels of "G" force.

Program Objective: Provide fighter pilots with enhance protection against the effects of Gs and improve pilot endurance using a Pressure Breathing for G system that reduces dependence on the anti-G straining maneuver.
(See Page 20 in HSC's "Products and Progress" report)

UWARS
(Universal Water-Activated Release System)

Program Objective: To provide the crew member with an automatic backup parachute release capability that will release the parachute canopy upon entry into saltwater.
(See Page 26 in HSC's "Products and Progress" report)

Compared to the AFSEAWARS, the new UWARS is significantly more streamlined and comfortable to wear.

CHEMICAL DEFENSE SYSTEMS
HSC/YAC

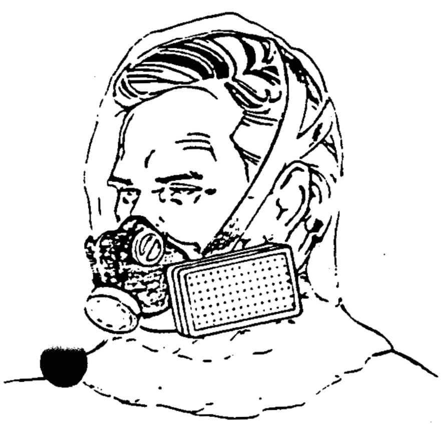
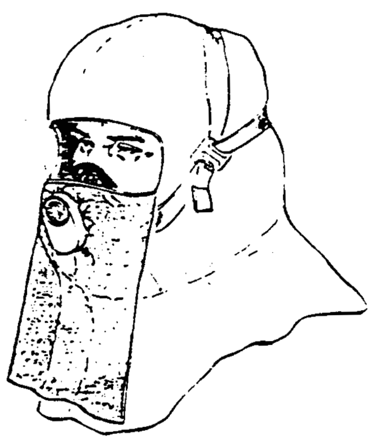
AERP
(Aircrew Eye-Respiratory Protection)

Program Objective: To replace the MBU-13/P chemical/biological oxygen mask. Final objective is equip all crew members in all aircraft with a chemical defense capability. System enhanced capabilities include better chemical/biological protection, under-the-helmet design, drinking capability, and ability to perform a valsalva maneuver.
(See Page 14 in HSC's "Products and Progress" report)

An F-16 pilot prepares for a mission while wearing Aircrew Eye/Respiratory Protection.

DERP
(Disposable Eye/Respiratory Protection)

Program Objective: To develop an inexpensive, compact, disposable mask to provide emergency protection in a chemical warfare environment. Provide head, eye, neck, and respiratory protection in an environment contaminated with chemical nerve and blister agent vapors, aerosols, and liquids.
(See Page 13 in HSC's "Products and Progress" report)


Three prototypes are currently being considered.

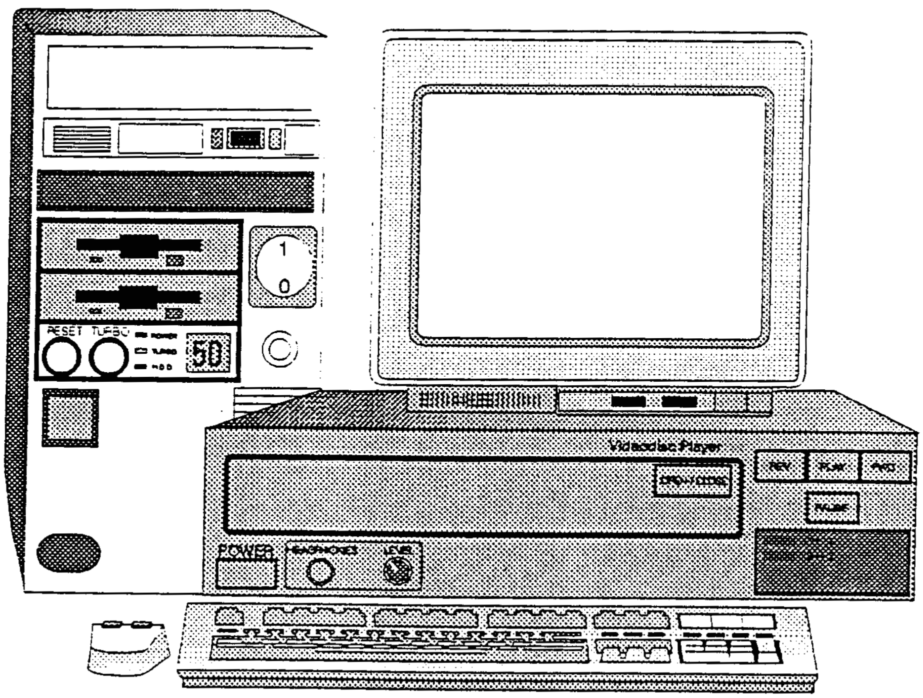
GCE
(Ground Crew Ensemble)

Program Objective: To design and develop a one- or two-piece clothing configuration with hood to provide liquid vapor, and aerosol chemical protection. It provides a reduction in the thermal burden as compared to the current ensemble and is washable. (See Page 9 in HSC's "Products and Progress" report)

Even when life threatening chemicals are present, the ground crew will be able to perform their mission with minimal discomfort.

MST
(Maintenance Skills Tutors)

Program Objective: To develop computer-based training systems that use artificial intelligence to teach advanced trouble-shooting skills to improve tactical air forces maintenance.
(See Page 76 in HSC's "Products and Progress" report)

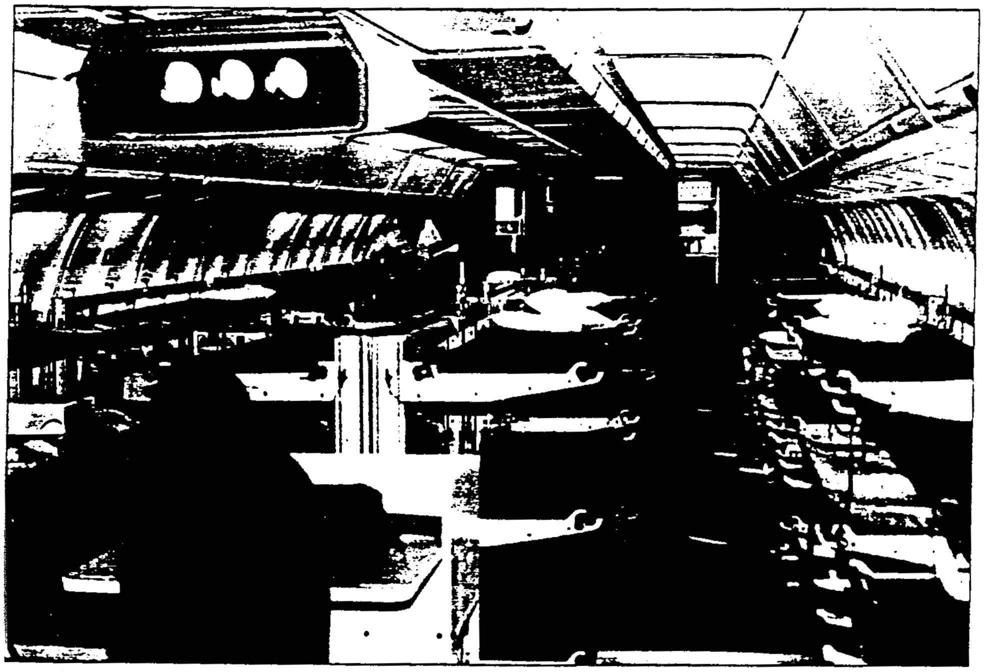


AEROMEDICAL SYSTEMS
HSC/YAM

CRAF-AES

(Civil Reserve Air Fleet Aeromedical Evacuation Shipsets)

Program Objective: To convert commercial Boeing B-767 aircraft to aeromedical evacuation platforms by removing airline interiors and installing litter stanchions. liquid oxygen converters, and electrical power converters.
(See Page 86 in HSC's "Products and Progress" report)



Installation of these shipsets in existing commercial B-767s will enhance our wartime capability to evacuate the injured.

United States Air Force

FACT SHEET

Office of Public Affairs, Human Systems Center, Brooks AFB TX 78235-5120
(210) 536-3234

USAF SCHOOL OF AEROSPACE MEDICINE (AFMC)

The U.S. Air Force School of Aerospace Medicine at Brooks Air Force Base is noted internationally as a premier center of aerospace medical learning.

The cornerstone of the school and the historical reason for the importance of the word "school" in the name is the aerospace medicine education program. Approximately 5,000 people per year are trained at the school.

This training is conducted for all of the entry level aeromedical specialties, officer and enlisted. Specialized training is provided, usually at the graduate level, for flight surgeons, flight nurses, bioenvironmental engineers, aerospace physiologists and public health officers.

The USAF School of Aerospace Medicine had its inception in 1918 as the Medical Research Laboratory of the Air Service, U.S. Army Signal Corps, Hazelhurst Field, New York. In 1922, it was redesignated the School of Aviation Medicine and four years later, was moved to Brooks Field, Texas.

In 1931, the school was relocated at Randolph Field, Texas, where on Feb. 9, 1949, the Department of Space Medicine was established by Brigadier General Harry G. Armstrong, school commandant. Dr. Hubertus Strughold was appointed the first permanent chief of the department in May 1949.

Expansion of the school's mission was responsible for its move back to Brooks Air Force Base in 1959 and redesignation as the USAF School of Aerospace Medicine, which is now a part of Air Force Materiel Command Human Systems Center.

As part of its special relationship with the Air Force School of Aerospace Medicine, the Armstrong Laboratory provides instructional expertise and access to its vast aeromedical databases, information resources and laboratory facilities.

(Current as of March 1995)

United States Air Force

Air Force Center for Environmental Excellence, Brooks AFB, TX 78235, (210) 536-3066

March 1994 Fact Sheet No. 1

The Air Force Center for Environmental Excellence

The Air Force Center for Environmental Excellence, with headquarters at Brooks AFB, Texas, was established on July 23, 1991, to spearhead the Air Force's overall environmental program.

The Center, which has a staff consisting primarily of scientific and technical professionals, provides the service with an in-house capability to handle all aspects of environmental cleanup, planning and compliance, pollution prevention, and design and construction management.

AFCEE's five operational directorates and their responsibilities are:

■Construction Management provides design and construction management (DM/CM) services for all Military Construction (MILCON) projects for designated commands, including AF Space Command, Air Force Academy, AF Special Operations Command, AF Reserve, and AF field operating agencies.

The directorate also provides DM/CM services for all AF MILCON-funded industrial and domestic waste treatment facilities and all AF MILCON medical facilities within the continental United States (CONUS).

Finally, the directorate provides cradle-to-grave execution services for the AF Military Family Housing construction programs.

■Design Group provides commanders with a variety of professional services, including architectural, interior and landscape design; and base planning. The directorate fosters planning and design excellence by formulating policy, setting standards and executing sound planning and design principles.

■Environmental Conservation and Planning develops environmental impact statements and environmental assessments for Air Force bases associated with base closure and other selected programs.

It also provides expertise to non-closing installations on land-use planning and conservation of historical, archeological and biological resources. These include wetlands, threatened and endangered species, native American archeological sites and a variety of other specialty areas.

■Environmental Restoration provides management of all environmental restoration activities such as remedial investigations, remedial design, remedial actions and long-term operations for designated closure and non-closure bases.

The directorate also: provides technical oversight of environmental programs; laboratory quality assurance assessments; document reviews; assistance in selecting remediation technologies; and serves as the focal point for technology evaluation, application and transfer from the laboratory to the field.

■Pollution Prevention supports pollution-prevention and compliance programs worldwide. It also identifies pollution/compliance opportunities; provides contract management services; develops and executes strategic initiatives to identify and implement solutions to common Air Force pollution-prevention and compliance problems; and cross feeds information on successful programs, good ideas and "best available" technologies from throughout the Air Force and federal government.

The Center has three regional compliance offices located in Dallas, Atlanta and San Francisco. They are responsible for keeping Air Force commanders advised of and in compliance with all applicable environmental laws and regulations.

As a whole, the Center forms a comprehensive, professional team dedicated to providing a full range of design, construction and environmental services to Air Force commanders.

United States Air Force

FACT SHEET

Office of Public Affairs, Human Systems Center, 2510 Kennedy Circle, Suite 1,
Brooks AFB TX 78235-5120 Phone (210) 536-3234 Fax (210) 536-3235

AIR FORCE MEDICAL SUPPORT AGENCY

The Air Force Medical Support Agency (AFMSA) is a field operating agency with headquarters at Brooks Air Force Base, Texas. The AFMSA, formerly the Air Force Office of Medical Support, was organized and became operational on July 1, 1992. The AFMSA commander reports to the director, Medical Programs and Resources, Office of the Surgeon General.

The Air Force Medical Support Agency mission is to improve global performance and capability of the Medical Service in supporting combat forces and maintaining the health of beneficiaries. It is the Air Force Surgeon General's primary focal point for policy development, strategies, plans, consultant services, and validated requirements dealing with facilities, supplies, equipment, acquisition, information systems and resources, and patient administration. This is accomplished through its four divisions: patient administration, medical facilities, medical information systems, and medical logistics. The Air Force Medical Logistics Office located at Fort Detrick, Md., is also assigned to AFMSA.

The patient administration division manages policies and procedures for patient administration, clinical records and outpatient records activities within all medical treatment facilities.

The medical facilities division serves as focal point for Air Staff management and coordination of all matters pertaining to medical and dental treatment facilities through the Military Construction Program, facilities maintenance and improvements and medical facility design. It provides consultation and advisory services to the major command surgeons and medical treatment facilities' commanders on all medical/dental facility-related issues. Three regional health facilities offices support construction activities throughout the Medical Service. These include the western region office in San Francisco, the central region office in Dallas and the eastern region office in Atlanta.

(Current as of March 1995)

The medical information systems division is the focal point for plans, policies, programs, and consultation dealing with information engineering, technology, and management within the Surgeon General's staff and the Air Force Medical Service. The division is responsible for worldwide deployment program management of all automated information systems in the Air Force Medical Service. It also serves as the central data repository for biostatistical data in support of the USAF Medical Service worldwide.

The medical logistics division develops plans and policies concerning medical materiel (both supply and equipment), biomedical equipment maintenance and repair, service contracts, medical materiel support and medical facilities management. The Air Force Medical Logistics Office is an operational element of the medical logistics division. It functions as an operational control center for medical materiel in direct support of all base medical facilities, major commands, Air Force Reserve, Air National Guard and various defense supply centers. It is the direct contact point with Defense Personnel Support Center and all Air Force materiel activities. It is the Air Force's single manager of war reserve materiel, medical commodities and provides technical operational guidance and surveillance of base and major command medical materiel maintenance activities.

AFMSA is directly involved with the Air Force Surgeon General, other Air Staff directorates, major commands, Air Force medical treatment facilities, and other federal agencies on a daily basis. A continuing interchange is required as operational policy and practices for medical support are developed and implemented.

Point Paper
on
HSC Projects Supported By
Defense Health Program (DHP) Funding

In FY95 Human Systems Center received DHP funding to support programs at the Armstrong Laboratory, USAF School of Aerospace Medicine, 70th Medical Squadron, and the Human Systems Program Office

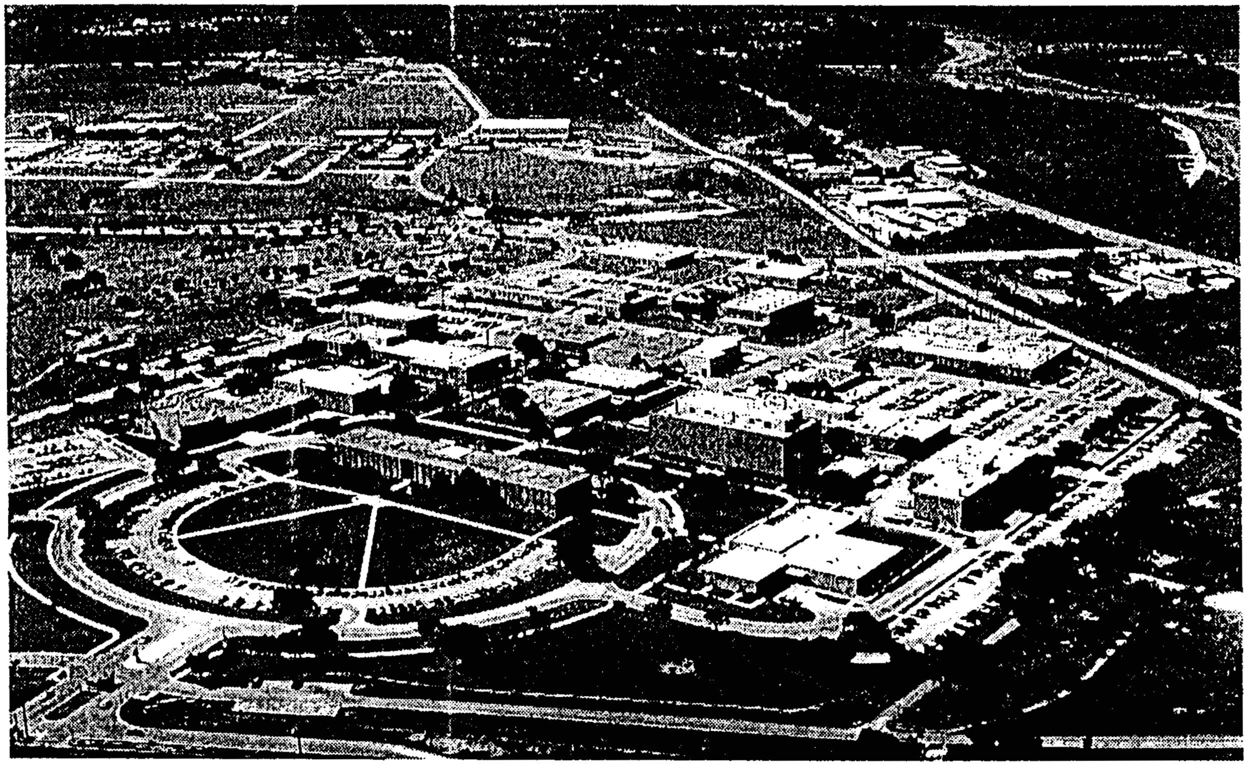
- Armstrong Laboratory received DHP funds to support the following programs
  -- Epidemiology Laboratory, Dental Investigations, Preventive Services Initiative Hyperbaric Medicine, Occupational Medicine

- USAF School of Aerospace Medicine used DHP funding
  -- Conduct 61 Aerospace Medicine courses, graduating 4,768 students
    --- aerospace medicine, aerospace nursing, aerospace physiology, public health, bioenvironmental engineering
  -- Provide training education and consultation
    --- Human performance enhancement, contingency medical operations, occupational health, disease prevention, environmental quality, and aeromedical evacuation

- 70th Medical Squadron received DHP funds to provide the following services
  -- Primary medical services, dental care, aeromedical services, family advocacy, mental health for eligible beneficiaries

- Human Systems Program Office received DHP funding for the implementation of the Composite Health Care System (CHCS) in each Air Force Medical Treatment Facility

HUMAN SYSTEMS CENTER
AIR FORCE MATERIEL COMMAND



BRIG GEN ROBERT BeLihAR BRIEF 4/6/95

AIR FORCE VISION

Air Force PEOPLE Building the World's Most Respected Air and Space Force ... Global Power and Reach for America.

Mission ***Systems*** ***People***

HSC PURPOSE

THE HUMAN SYSTEMS CENTER TEAM WORKS WITH ITS CUSTOMERS TO ENHANCE OUR WARFIGHTER'S COMPETITIVE EDGE BY PROVIDING SUPERIOR HUMAN CENTERED TECHNOLOGY, SYSTEMS, EDUCATION AND SUPPORT. ***WE ARE THE SYSTEM'S INDEPENDENT ADVOCATE FOR THE HUMAN IN DESIGN, DEPLOYMENT AND OPERATIONS OF AEROSPACE SYSTEMS***

PRODUCT CENTER BASE DESCRIPTION BROOKS AFB

- MAJOR UNITS
  - HUMAN SYSTEMS CENTER TO INCLUDE:
    - ARMSTRONG LAB
    - USAF SCHOOL OF AEROSPACE MEDICINE
    - HUMAN SYSTEMS PROGRAM OFFICE
    - AIR BASE GROUP
      - SYSTEMS ACQUISITION SCHOOL
  - AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
  - AIR FORCE MEDICAL SUPPORT AGENCY

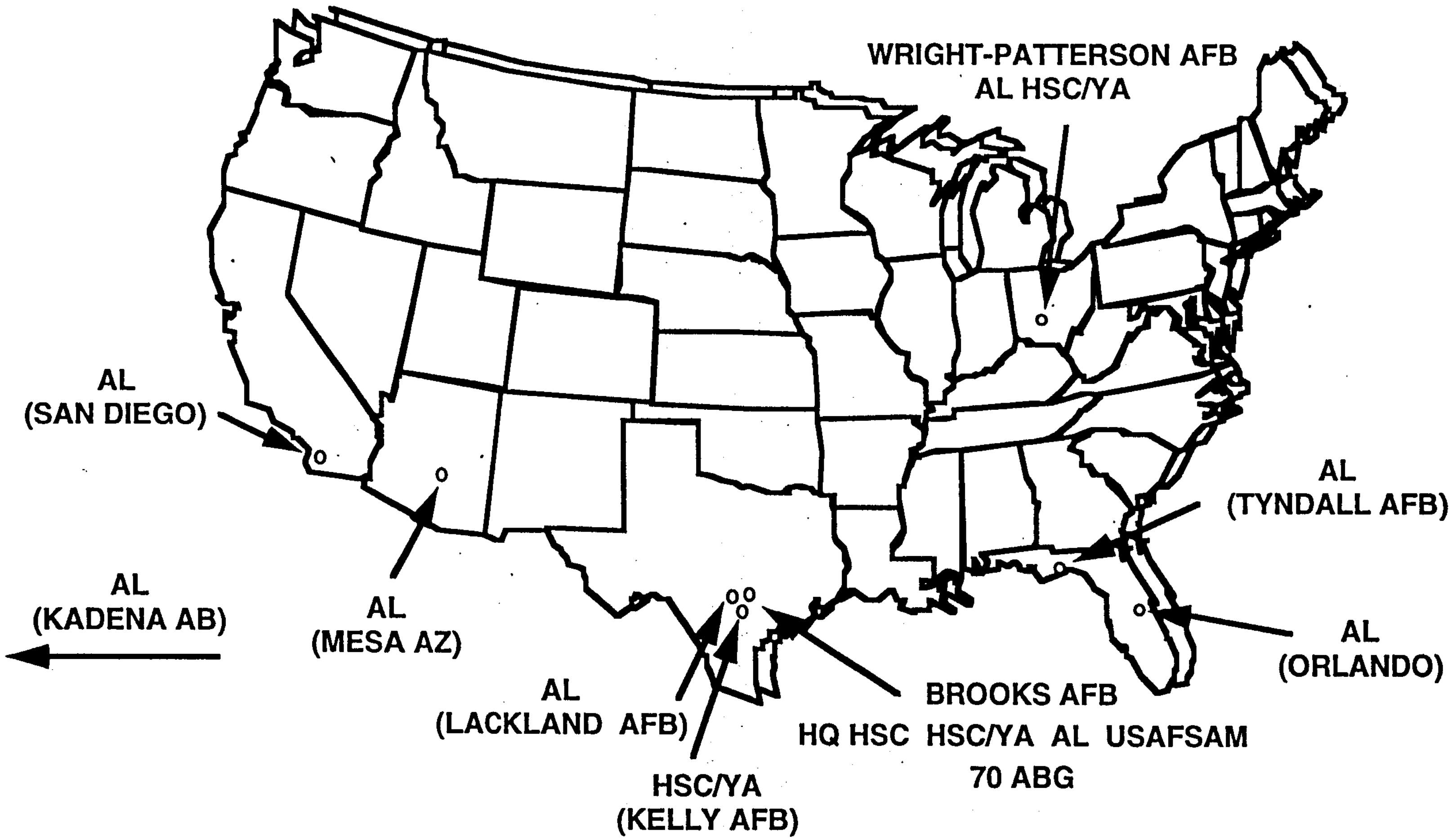
PRODUCT CENTER BASE DESCRIPTION BROOKS AFB (CONT)

- PRODUCT LINES - RESEARCH RELATED TO HUMAN SYSTEMS
  - CREW SYSTEMS INTEGRATION
  - HUMAN RESOURCES
  - AEROSPACE MEDICINE
  - OCCUPATIONAL/ENVIRONMENTAL HEALTH
  - EDUCATION/FORCE READINESS
  - MEDICAL/ENVIRONMENTAL SAMPLE ANALYSIS SERVICE
  - ENVIRONMENTAL COMPLIANCE SERVICES

FY95 HSC SNAPSHOT

- 3,249 People Managing $608 Million Annually
- 962 Scientists & Engineers
  - 400 Published Articles • 27 Patents, Inventions, Disclosures
  - 71 Focused Technology Areas
- 2,215 Degrees Held
  - 242 Doctoral • 570 Masters • 1,403 Bachelors
- 400 Acquisition Professionals
  - 40+ Development / Production Programs
  - 7,000+ Sustainment Items
- 128 Education / Training Instructors
  - 61 Aerospace Medicine Courses Graduating 4,768 Students
  - 8 System Acquisition Courses Graduating 1,385 Students

HSC ORGANIZATIONS



HUMAN SYSTEMS TECHNOLOGY

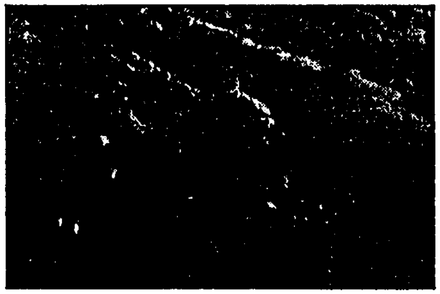
- DOD PERVASIVE, CORE TECHNOLOGY
  - REQUIRES IN-DEPTH FAMILIARITY WITH SERVICE OPERATIONS
  - REQUIRES TIGHT USER INTERFACE
- OFTEN MILITARILY UNIQUE, WITHOUT CIVILIAN COUNTERPART
- ENDORSED TO CSAF BY AFSAB 1994 SUMMER STUDY

HUMAN SYSTEMS TECHNOLOGY WILL BE OF PARTICULAR VALUE FOR THE FUTURE

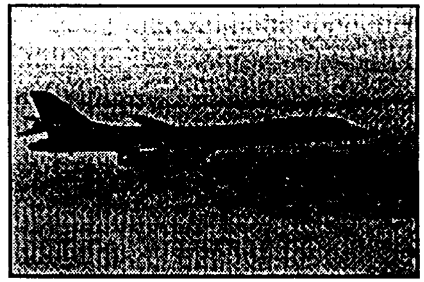
- FEWER NEW WEAPONS; AF MUST EXTEND DEMANDS ON CURRENT SYSTEMS AND CREW
- COMPLEX FUTURE WEAPONS SYSTEMS WILL REQUIRE IMPROVED DATA FUSION BY AIRCREW
- NIGHT AND ALL-WEATHER OPS WILL INCREASE DEMANDS ON CREWMEMBERS
- TRAINING AND SELECTION WILL BECOME EVEN MORE CRITICAL
- HUMAN SYSTEMS TECHNOLOGY = LEVER TO MAINTAIN FORCE EFFECTIVENESS DURING DOWNSIZING
- ENVIRONMENTAL LAWS IMPACT AIR BASE OPS, BASE CLOSURES, WASTE STREAMS

HSC IS LOGICAL ORGANIZATION TO BE FOCAL POINT FOR ALL HUMAN SYSTEMS TECHNOLOGY

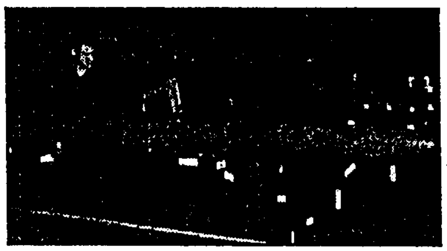
- SINGLE MANAGER, ADVOCATE TO PREVENT FRAGMENTATION / ATTRITION
- AL IS ONLY LAB COORDINATING THROUGH MORE THAN TWO RELIANCE PANELS
- 1300 ACRES AT BROOKS AFB FOR FUTURE EXPANSION
- DOWNSIZING OPENS UP ADDITIONAL ROOM FOR FURTHER COLLOCATIONS
- NEW FACILITIES UNDER CONSTRUCTION AT BROOKS AFB
  - USAFSAM ACADEMIC COMPLEX
  - DIRECTED ENERGY LABORATORY
  - AFCEE BUILDING

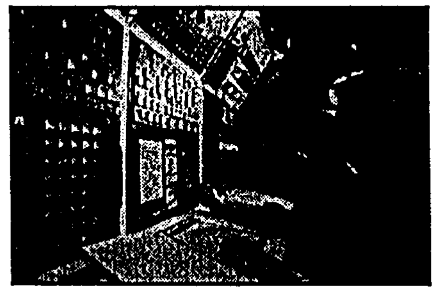


THERE ARE NO

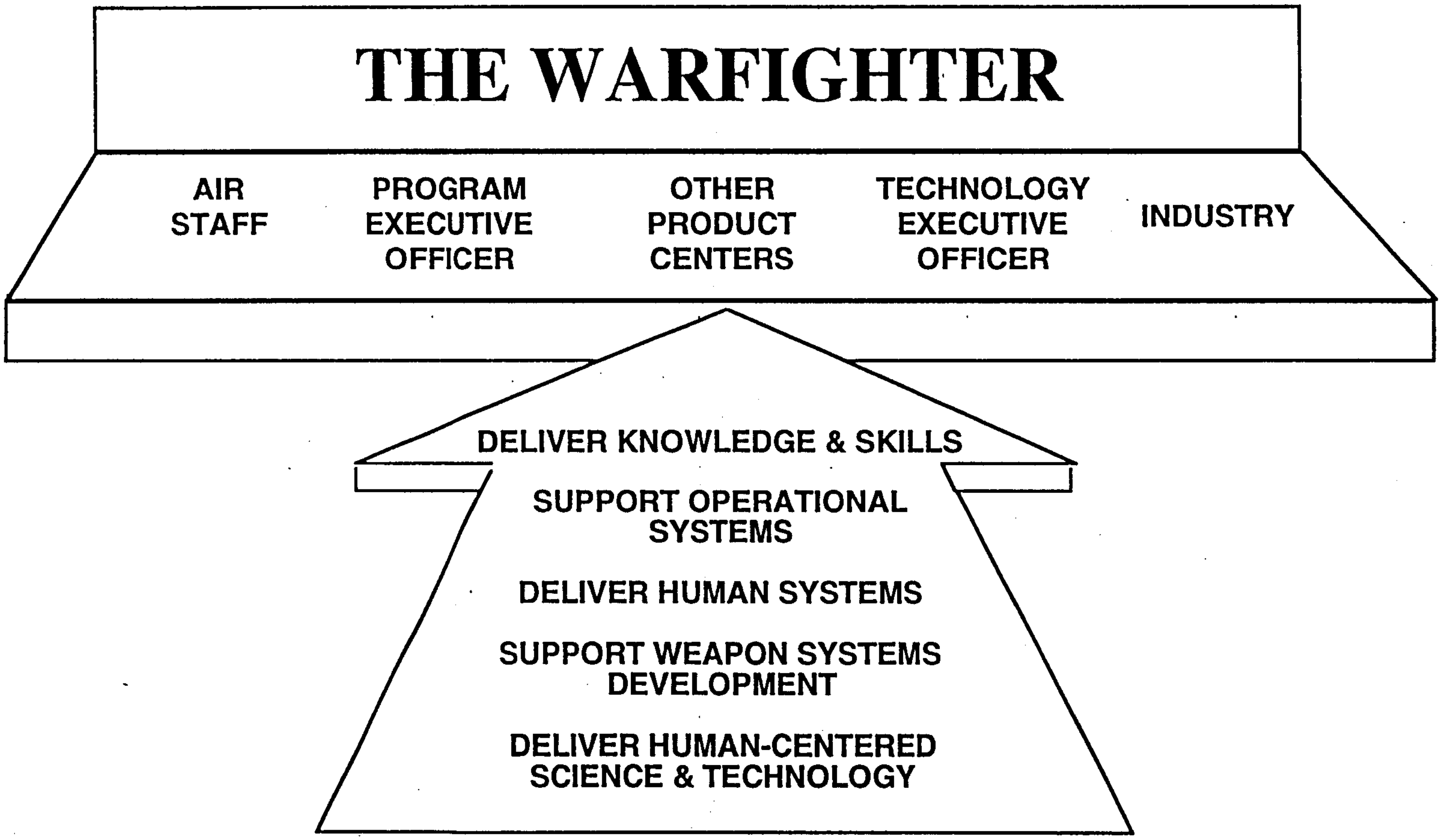


UNMANNED SYSTEMS





HSC'S MISSION



ARMSTRONG LABORATORY TECHNOLOGY TRANSITION TO HUMAN SYSTEMS PROGRAM OFFICE

- COMBINED ADVANCED TECHNOLOGY ENHANCED DESIGN G-ENSEMBLE (COMBAT EDGE)
- NIGHT VISION SYSTEM
- DISPOSABLE EYE / RESPIRATORY PROTECTION SYSTEM
- THERMAL FLASHBLINDNESS PROTECTION DEVICE
- AIRCRAFT MISHAP PREVENTION SYSTEM
- RAPID OPTICAL SCREENING TOOL (ROST)
- ACTIVE NOISE REDUCTION
- MAINTENANCE SKILLS TUTOR
- CIVIL RESERVE AIR FLEET AEROMEDICAL EVACUATION SHIPSETS
- ADVANCED TECHNOLOGY ANTI-G SUIT (ATAGS)
- MICRO COMPUTER INTELLIGENCE FOR TECHNICAL TRAINING (MITT)

INTEGRATION OF RESEARCH AND EDUCATION BETWEEN AL AND USAFSAM

- DEVELOPMENT OF THE ADVANCED SPATIAL DISORIENTATION DEMONSTRATOR
  - TRAINING PROTOCOLS FOR RECOGNITION OF SD AND RECOVERY TECHNIQUES
    - DEVELOPED FOR ACC AND AETC PILOTS
    - USAFSAM LEADS AND AL SUPPORTS
  - DEVELOPMENT OF REALISTIC FLIGHT SIMULATIONS
    - AL LEADS AND USAFSAM SUPPORTS
- COOPERATION IN RESEARCH AND EDUCATION MISSIONS - THE UNIVERSITY MODEL
  - USAFSAM EDUCATORS PARTICIPATE IN RESEARCH MISSION OF AL
  - AL SCIENTISTS AND ENGINEERS SERVE AS FACULTY MEMBERS IN USAFSAM

AL TIGHTLY INTEGRATED WITH SAN ANTONIO MILITARY COMMUNITY

- USAF SCHOOL OF AEROSPACE MEDICINE (SAM)
  - JOINT PROJECTS AND PERSONNEL EXCHANGES
- AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)
  - RECIPIENT AND BROKER OF AL ENVIRONMENTAL TECHNOLOGIES
- HUMAN SYSTEMS PROGRAM OFFICE
  - TRANSITION HUMAN-CENTERED TECHNOLOGY
- AIR EDUCATION AND TRAINING COMMAND (AETC)
  - REQUIREMENTS, EVALUATIONS AND SUBJECTS FOR AIRCREW TRAINING R&D
- AIR FORCE MILITARY PERSONNEL CENTER
  - REPOSITORY FOR MPC DATABASE
- LACKLAND AFB
  - FACILITIES AND SUBJECTS FOR TRAINING AND SELECTION RESEARCH
- KELLY AFB
  - BIOREMEDIATION TEST SITE

GEOGRAPHICALLY-UNIQUE PROFESSIONAL SUPPORT

(WITH CIVILIAN COMMUNITY)

AUDIE MURPHY VETERANS HOSPITAL: CLINICAL HYPERBARIC MEDICINE SERVICES

UTSA: INTELLIGENT TUTORING SYSTEMS IN FUNDAMENTAL SKILLS
MILITARY WOMEN MEDICAL CARE COLLABORATIVE STUDIES

TRINITY UNIVERSITY: BIOEFFECTS OF ELECTROMAGNETIC FIELDS

SOUTHWEST RESEARCH INSTITUTE: VIBRATION TESTING

UTHSC, UTSA, TRINITY, SRI AND SYSTEMS RESEARCH LAB: LASER, MICROWAVE AND ELECTROMAGNETIC ENERGY STUDIES

TEXAS A&M: FOOD AND SAFETY RESEARCH

NASA: ENVIRONMENTAL TECHNOLOGY
RADIOLOGICAL AND TOXICOLOGICAL EFFECTS
ALTITUDE DECOMPRESSION SICKNESS

GEOGRAPHICALLY-UNIQUE PROFESSIONAL SUPPORT

(WITH MILITARY COMMUNITY)

KELLY AFB
- RADIOLOGICAL WASTE SITE CLEANUP AND SAFE MATERIAL DISPOSAL
- OCCUPATIONAL MEDICINE TRAINING

LACKLAND AFB
- TRICARE REGION VI REFERENCE LAB
- CLOSE PROXIMITY TO 30,000 RECRUITS FOR HUMAN-BASED RESEARCH

RANDOLPH AFB
- HIGH-G AWARENESS TRAINING FOR ALL AETC INSTRUCTOR PILOT TRAINEES
- CRITICAL FLYING REQUIREMENTS FOR 100 FLIGHT SURGEONS (ANNUALLY)

JOINT MEDICAL RESOURCE OPPORTUNITIES
- VETERINARY EXPERIENCE FOR RESEARCH IN MEDICAL SAFETY AND EFFICACY (BAMC)
- LOW COST TRAINING IN HEALTH PHYSICS (FORT SAM HOUSTON)

GEOGRAPHICALLY-UNIQUE CIVIC/SOCIAL SUPPORT

EDUCATION :

- SAN ANTONIO 2000 (HSC/CC CHAIRS PROGRESS REPORT COUNCIL)
- MENTORING PROGRAM (100-PLUS VOLUNTEERS)
- HIGHER EDUCATION INSTRUCTORS AT NEARBY UNIVERSITIES (100-PLUS)

MEDICAL :

- AFTER-HOURS MANPOWER SUPPORT TO LOCAL HOSPITALS
- PRACTICAL EXPERIENCE AVAILABILITY FOR LOCAL DOCTORAL STUDENTS

RUNWAY :

- AUTOMOTIVE RESEARCH AND TESTING
- SAFE-DRIVING TRAINING

MONEY / TIME :

- ALAMO FEDERAL EXECUTIVE BOARD
- HUNDREDS OF EMPLOYEES/THOUSANDS OF VOLUNTEER HOURS

USAF SCHOOL OF AEROSPACE MEDICINE

(USAFSAM)

PROVIDES TRAINING, EDUCATION, AND CONSULTATION IN THE AREAS OF HUMAN PERFORMANCE ENHANCEMENT, CONTINGENCY MEDICAL OPERATIONS, OCCUPATIONAL HEALTH, DISEASE PREVENTION, ENVIRONMENTAL QUALITY, AND AEROMEDICAL EVACUATION

USAFSAM

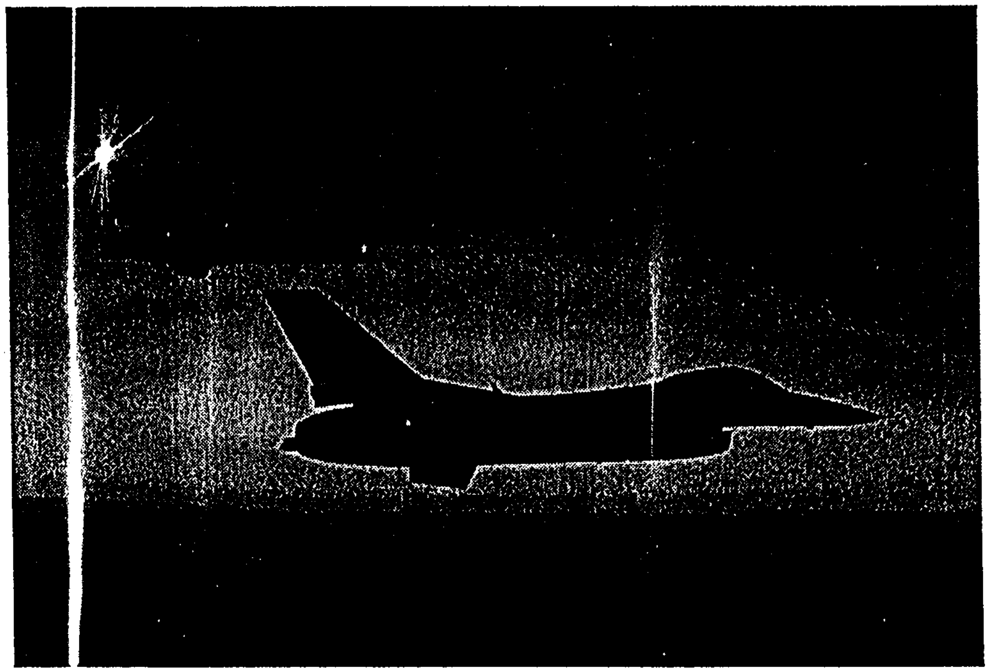
- INTERNATIONALLY RECOGNIZED
- 5000+ STUDENTS PER YEAR
    - AEROSPACE MEDICINE
    - AEROSPACE NURSING
    - AEROSPACE PHYSIOLOGY
    - PUBLIC HEALTH
    - BIOENVIRONMENTAL ENGINEERING
- ENTRY LEVEL THROUGH 4TH YEAR POST M.D.
    - USAF, DOD, AND ALLIED NATIONS

USAFSAM

- HIGHLY SYNERGISTIC RELATIONSHIP WITH AL AND YA
  - 30% OF USAFSAM PODIUM HOURS CONDUCTED BY AL AND YA SUBJECT MATTER EXPERTS
  - AL PROVIDES ESSENTIAL RESEARCH BASE FOR ADVANCED USAFSAM STUDENTS
  - USAFSAM STAFF PROVIDES OPERATIONAL INSIGHT FOR RESEARCHERS, PROGRAM MANAGERS

WE ARE THE HUMAN SYSTEMS CENTER

THE HUMAN IS THE HEART OF AEROSPACE
SYSTEMS AND OPERATIONS



THERE ARE NO UNMANNED SYSTEMS

ARMSTRONG LABORATORY

OVERVIEW

HUMAN-CENTERED SCIENCE & TECHNOLOGY

Dr Brendan Godfrey
Director

ARMSTRONG LABORATORY

ARMSTRONG LABORATORY

provides integrated, interdisciplinary technologies to enhance human military performance while protecting people and the environment.

Personnel assigned: 1539
FY95 budget: $196M

ARMSTRONG LABORATORY

AL PROVIDES BROAD RANGE OF HUMAN-CENTERED RESEARCH AND SERVICES

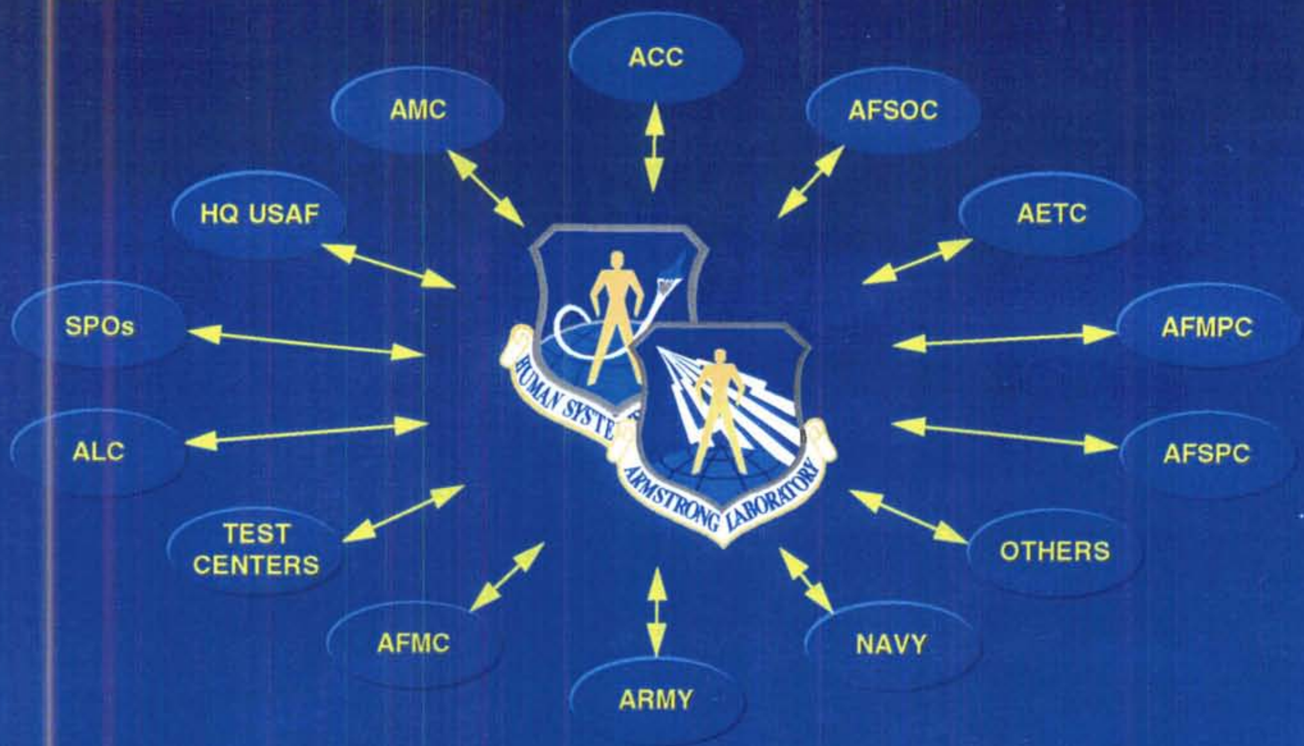
Research and Development (MFP6)

- Aircrew Performance and Protection
- Enhanced Aircrew Selection & Retention
- Manpower, Personnel, Training and Logistics
- Directed Energy Bioeffects
- Environmental Compliance and Remediation
- Occupational and Environmental Toxicology

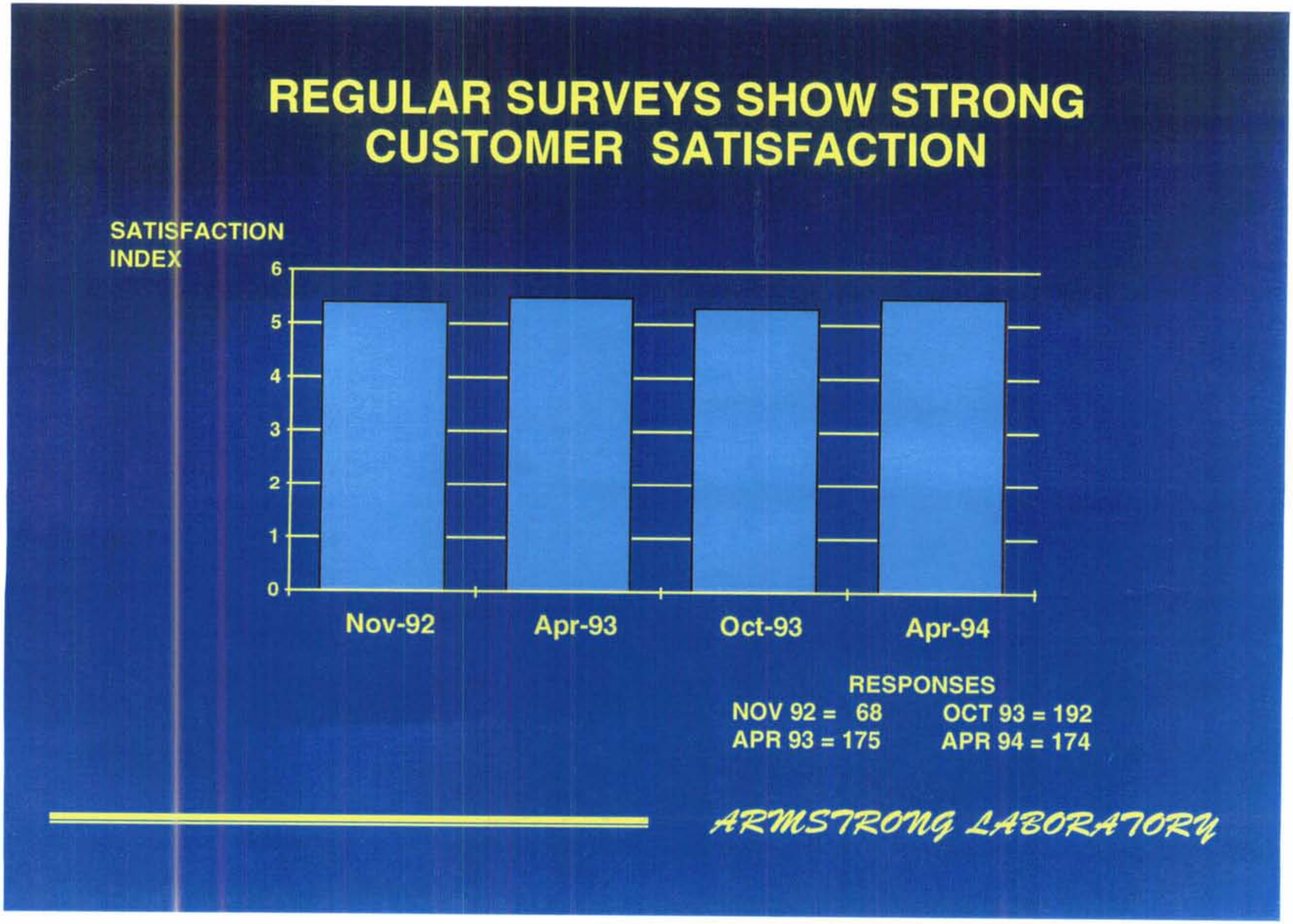
Defense Health Program (MFP7/8)

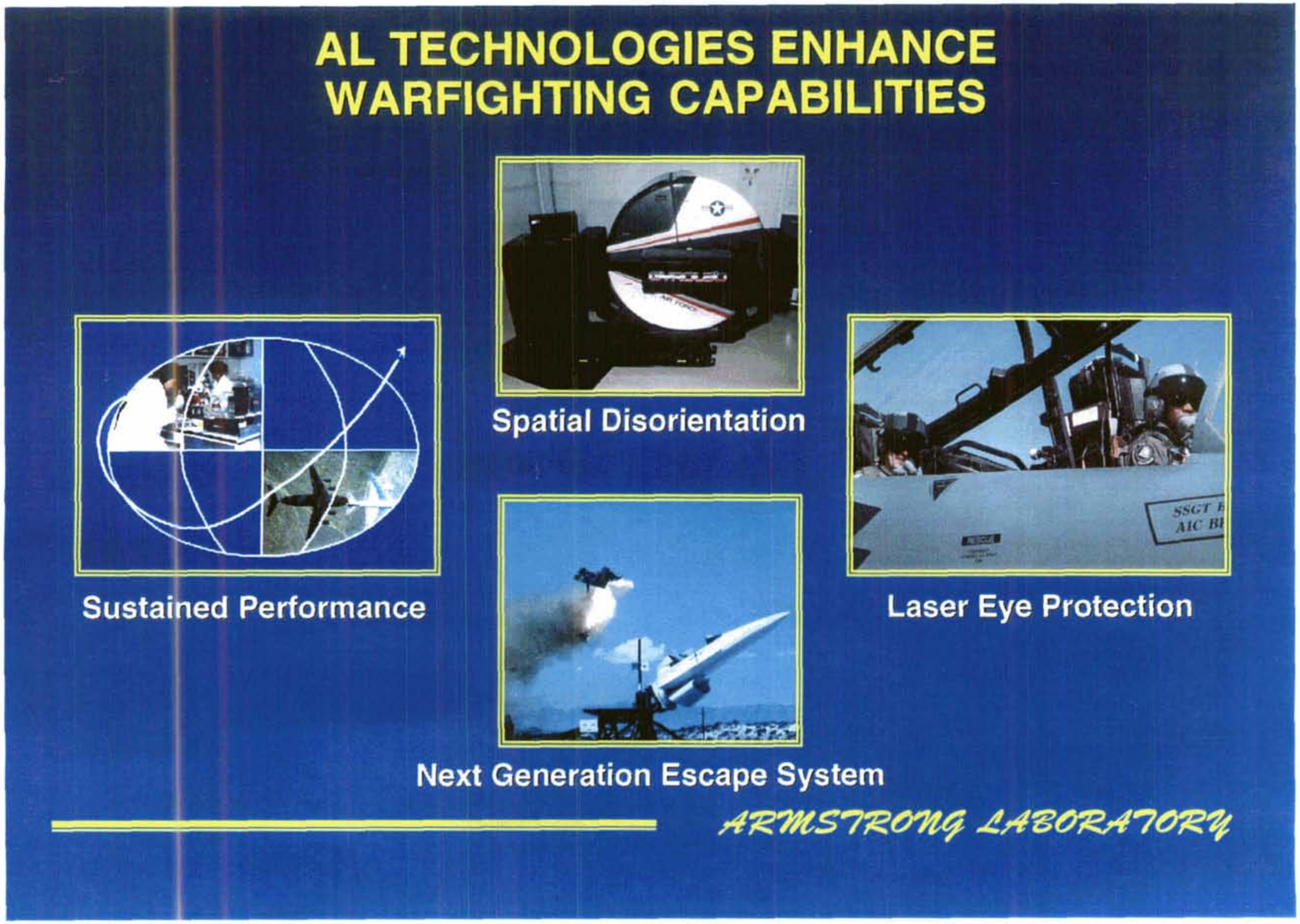
- Preventive & Health Services Assessment
- Occupational & Environmental Health Services
- Drug Testing and Epidemiological Reference Labs
- Hyperbaric Medicine

AL R&D MEETS PERVASIVE NEEDS OF AIR FORCE AND OTHERS



ARMSTRONG LABORATORY


REGULAR SURVEYS SHOW STRONG CUSTOMER SATISFACTION
SATISFACTION INDEX
6
5
4
3
2
1
0
Nov-92
Apr-93
Oct-93
Apr-94
RESPONSES
NOV 92 = 68
OCT 93 = 192
APR 93 = 175
APR 94 = 174
ARMSTRONG LABORATORY


AL TECHNOLOGIES ENHANCE
WARFIGHTING CAPABILITIES
Spatial Disorientation
Sustained Performance
Laser Eye Protection
Next Generation Escape System
ARMSTRONG LABORATORY

AL TECHNOLOGIES SAVE DEFENSE DOLLARS

Integrated Maintenance Information System

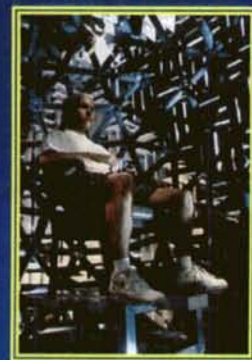
Advanced Hybrid Oxygen System

Bioventing

Aircrew Standards Research

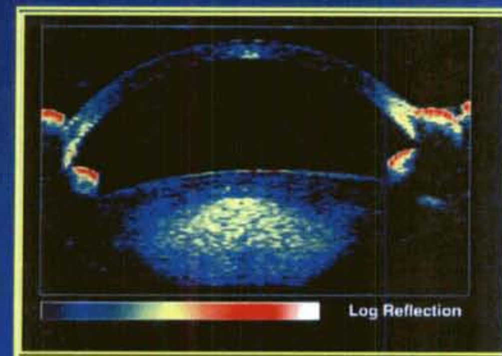
ARMSTRONG LABORATORY

AL TECHNOLOGY ENHANCES U.S. ECONOMIC COMPETITIVENESS



3-D Audio

Fundamental Skills Tutor



Optical Coherence Tomography

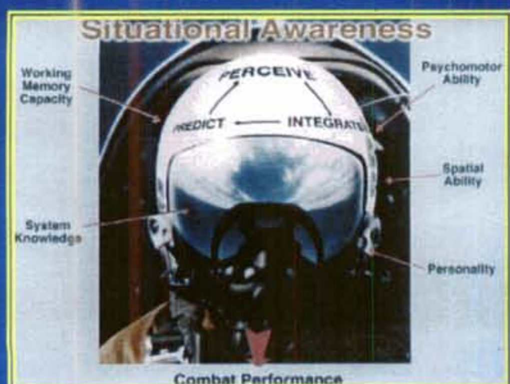
Electroless Nickel Plating

ARMSTRONG LABORATORY

AL UNIQUE INTERDISCIPLINARY CAPABILITIES CRITICAL TO MANY ACCOMPLISHMENTS

Advanced High-G Protection

- Human Physiology
- Suit Design
- Cockpit Compatibility
- Training
- Crew Selection

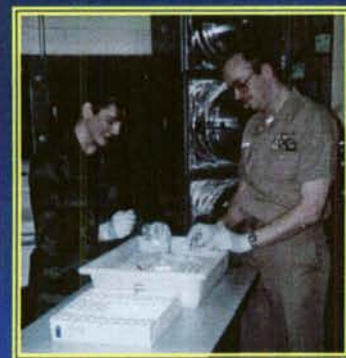


Situational Awareness

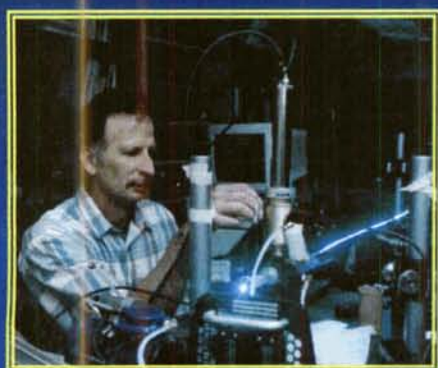
- Display Design
- Control Technology
- Performance Measurement
- Training
- Crew Selection

ARMSTRONG LABORATORY

RELIANCE LEADERSHIP ENHANCES AL PERFORMANCE



Toxicology

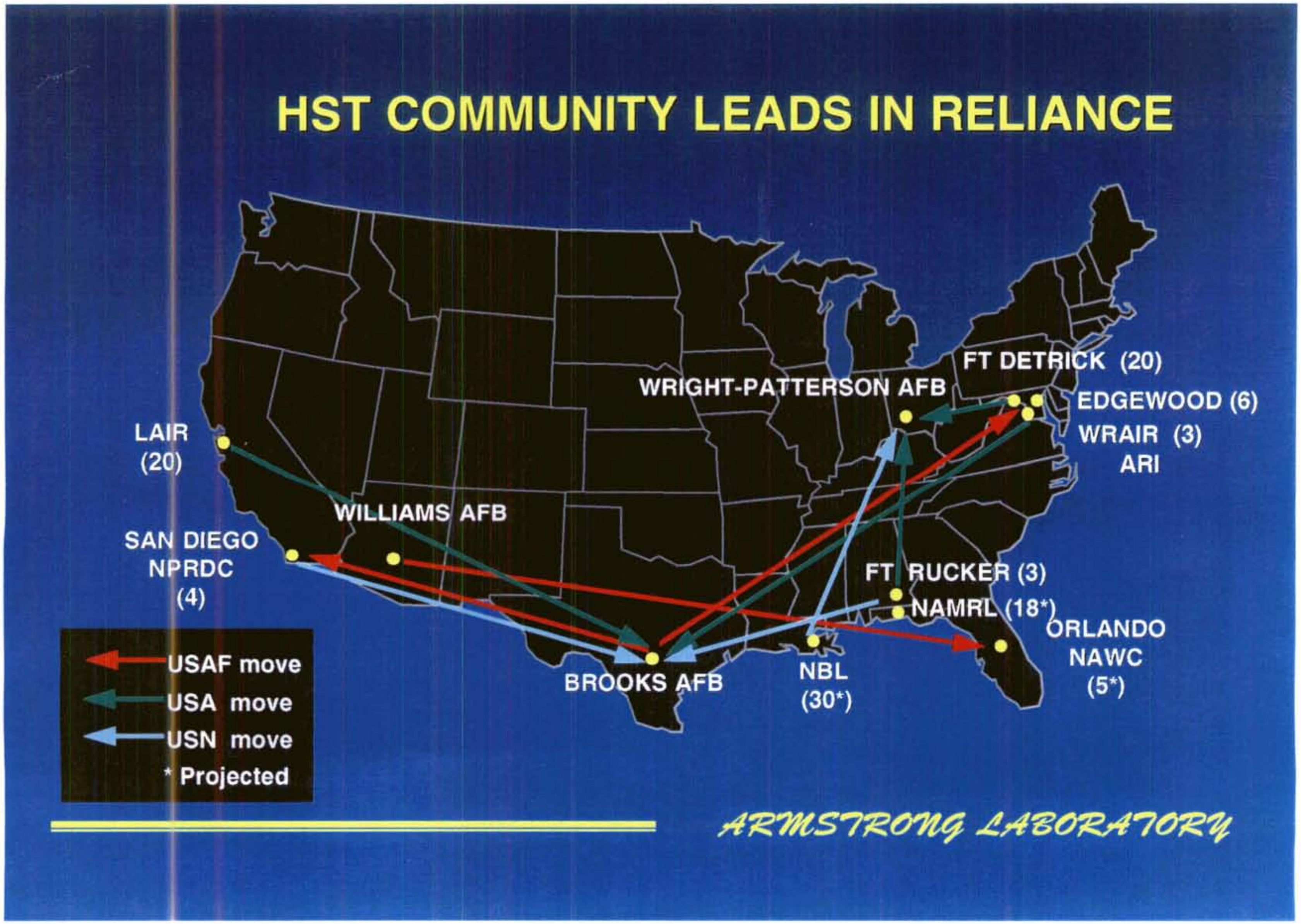


Chem-Bio

Directed Energy Bioeffects

Biodynamics

ARMSTRONG LABORATORY



HST COMMUNITY LEADS IN RELIANCE
FT DETRICK (20)
WRIGHT-PATTERSON AFB
EDGEWOOD (6)
WRAIR (3)
ARI
LAIR
(20)
WILLIAMS AFB
SAN DIEGO
NPRDC
(4)
FT RUCKER (3)
NAMRL (18*)
ORLANDO
NAWC
(5*)
BROOKS AFB
NBL
(30*)
USAF move
USA move
USN move
* Projected
ARMSTRONG LABORATORY

AL TIGHTLY INTEGRATED WITH SAN ANTONIO MILITARY COMMUNITY

USAF School of Aerospace Medicine (SAM)
- *Joint projects and personnel exchanges*

Air Force Center for Environmental Excellence (AFCEE)
- *Recipient and broker of AL environmental technologies*

Human Systems Program Office
- *Transition human-centered technology*

Air Education and Training Command (AETC)
- *Requirements, evaluations and subjects for aircrew training R&D*

Air Force Military Personnel Center
- *Repository for MPC database*

Lackland AFB
- *Facilities and subjects for training and selection research*

Kelly AFB
- *Bioremediation Test Site*

ARMSTRONG LABORATORY

AL TIGHTLY INTEGRATED WITH DAYTON MILITARY COMMUNITY

- Wright Laboratory
  - *Sensor/Windscreen Development*
  - *Laser Eye Protection*
  - *Environmentally Conscious Manufacturing*
- Aircraft SPOs
  - *IMIS Transition*
  - *Anthropometry*
  - *Helmet-Mounted Display*
- Joint Cockpit Office
  - *Joint Advanced Strike Technology (JAST)*
  - *Advanced Life Support*
- HQ AFMC
  - *Logistics Support Requirements*
  - *Technology Transfer*

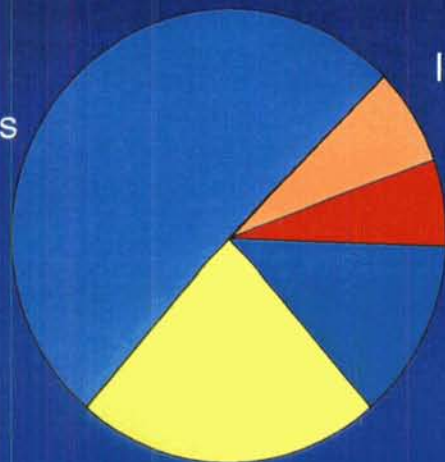
ARMSTRONG LABORATORY

AL TIGHTLY INTEGRATED WITH CIVILIAN COMMUNITY

- Collaborations and Faculty Appointments
  - University of Texas Health Science Center
  - Southwest Research Institute
  - University of Texas-San Antonio
  - St Mary's University
  - Wright State University
  - Ohio University
- Linkage to Community Economic Development
  - Texas Research Park
  - San Antonio 2000
  - Forum Entrepreneur

ARMSTRONG LABORATORY

AL WORKS CLOSELY WITH INDUSTRY AND ACADEMIA

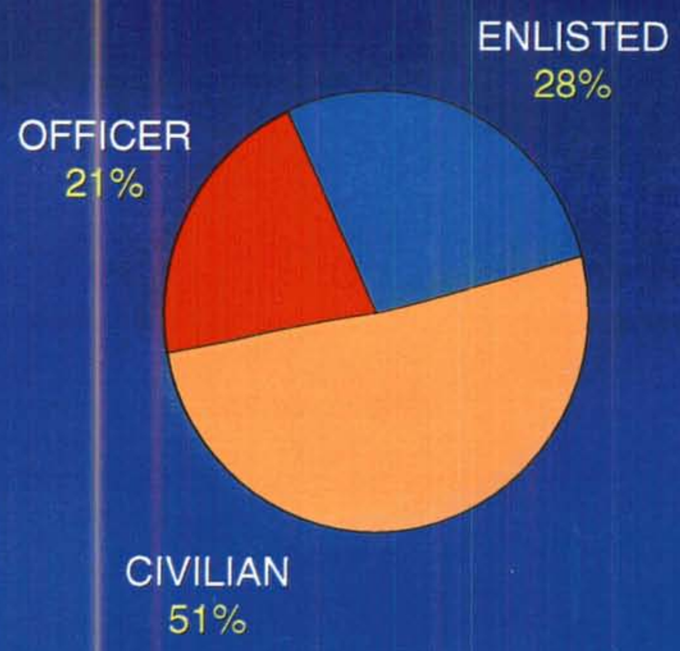


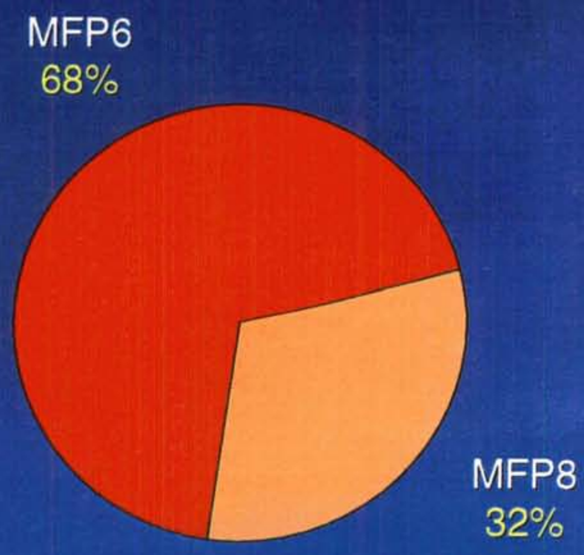
Out-source fraction is 74% and growing

ARMSTRONG LABORATORY

Based on total of FY 94 MFP 6 funds

AL HAS EFFECTIVE MIX OF MILITARY/CIVILIAN AND MFP6/MFP8 PERSONNEL

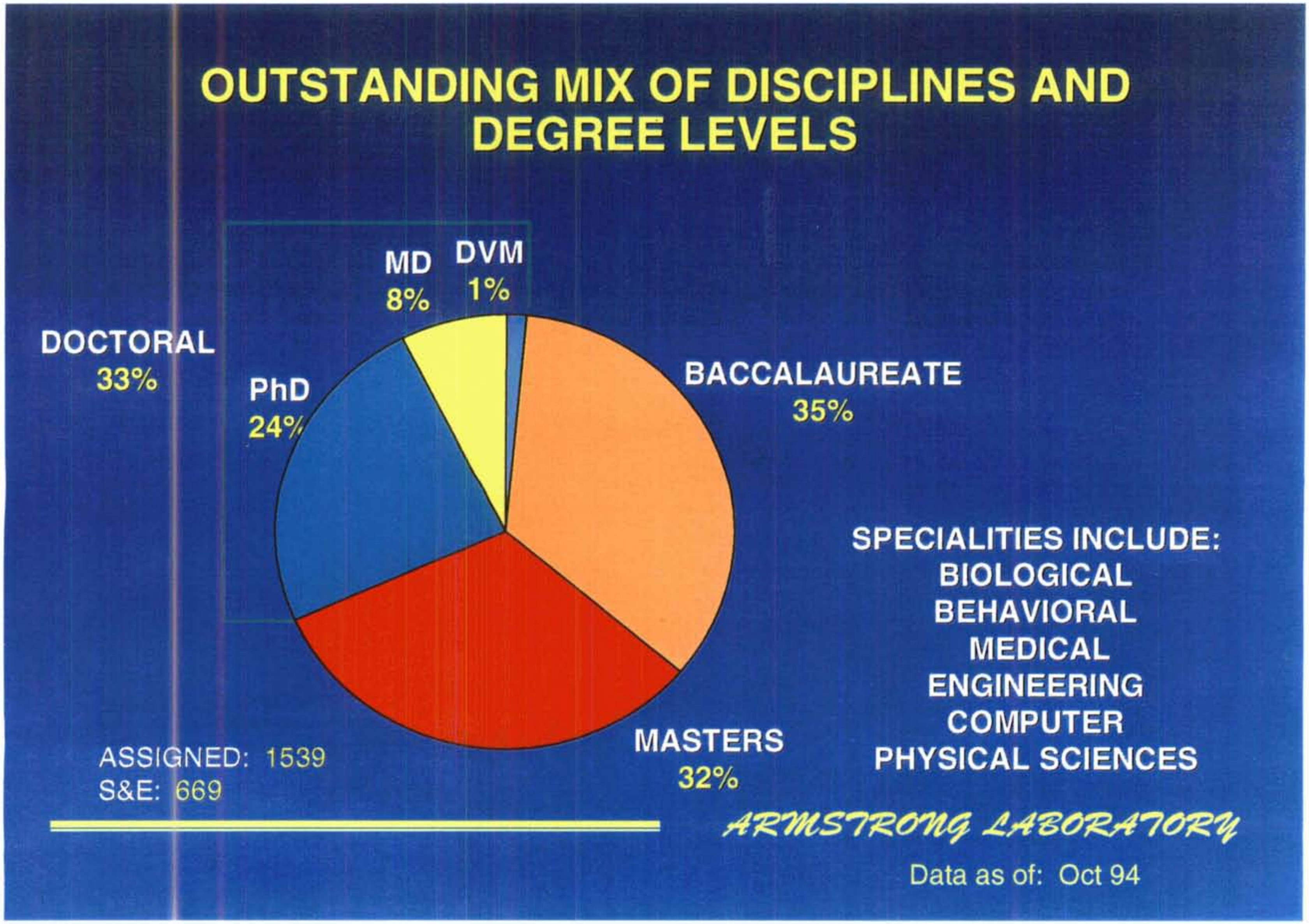




TOTAL AUTHORIZED: **1588**

ARMSTRONG LABORATORY

Data as of: Oct 94


OUTSTANDING MIX OF DISCIPLINES AND DEGREE LEVELS
MD 8%
DVM 1%
DOCTORAL 33%
PhD 24%
BACCALAUREATE 35%
MASTERS 32%
SPECIALITIES INCLUDE:
BIOLOGICAL
BEHAVIORAL
MEDICAL
ENGINEERING
COMPUTER
PHYSICAL SCIENCES
ASSIGNED: 1539
S&E: 669
ARMSTRONG LABORATORY
Data as of: Oct 94

AL RECOGNIZED FOR TECHNICAL EXCELLENCE

Major Awards	13
Fellows (New)	10
Other Professional & Community Recognitions	35
Professional Society Officers	74
University Adjunct Faculty Appointments	52
Refereed Journal Articles & Book Chapters	164
Other Reports & Presentations	639
Patent & Invention Disclosures	27
Cooperative R&D Agreements	28

ARMSTRONG LABORATORY

Totals for FY94

SEVERAL FY94 MAJOR AWARD WINNERS

Excellence in Military Medicine - LtCol Paul Morton

Harold Brown Award
Col Ronald Hill

AF Basic Research Award
Dr Johnathan Kiel

AsMA H. G. Moseley Award
Dr William Albery

R&D 100 AWARD
Lt Phillip Brown

IEEE Distinguished MemberAward
Dr Daniel Repperger

ARMSTRONG LABORATORY

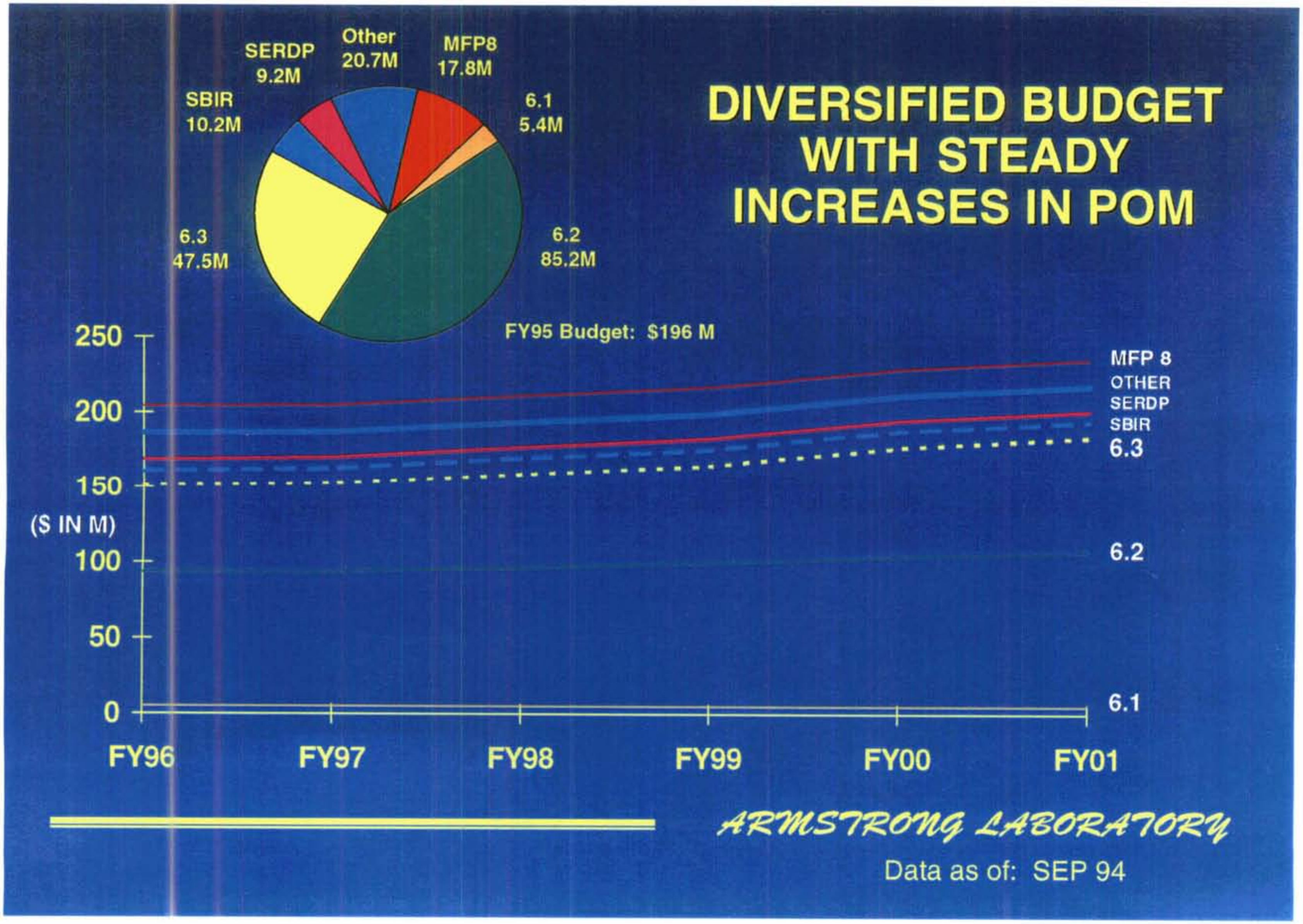
NUMEROUS MODERN FACILITIES

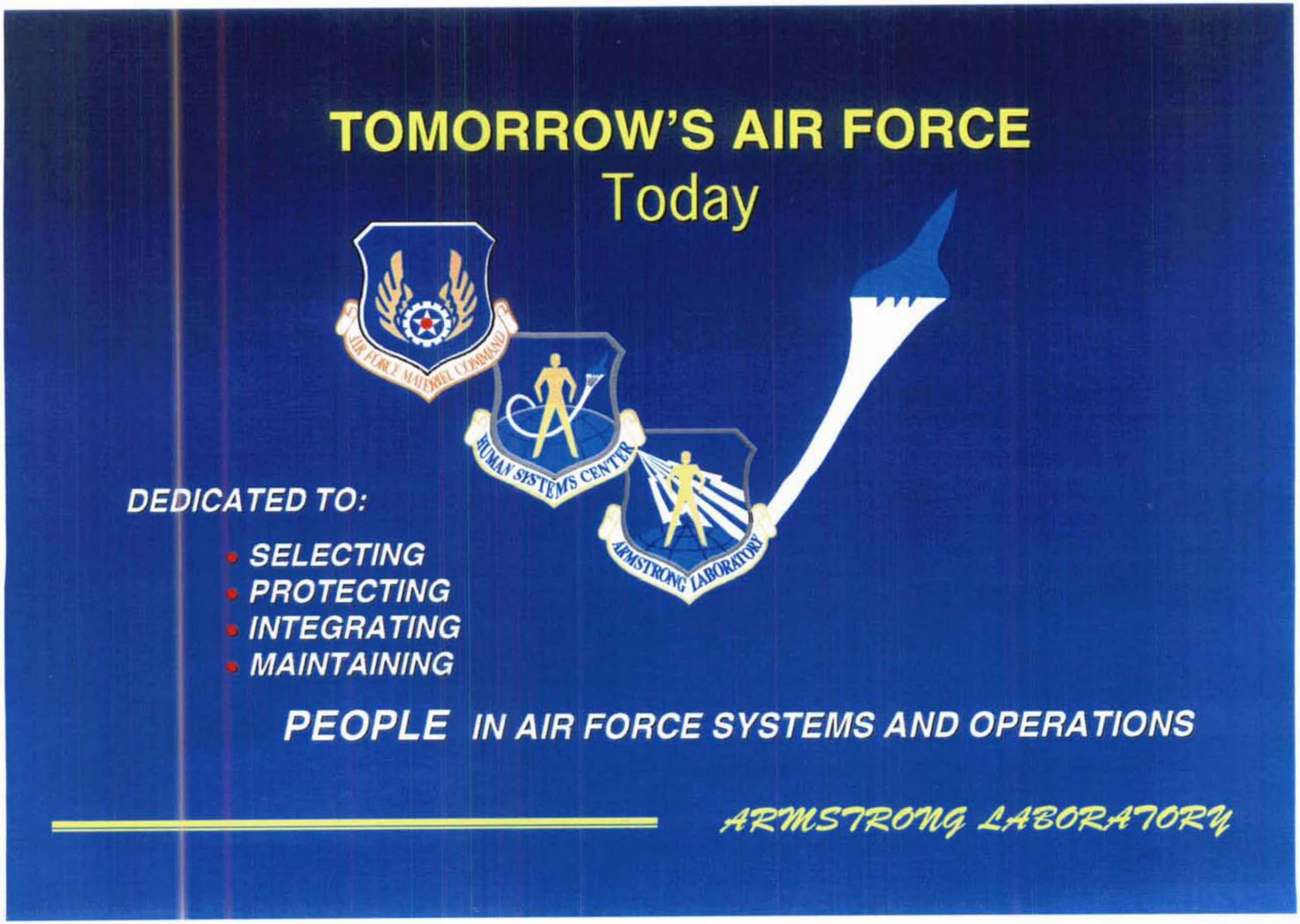
Virtual Environments Research Facility
Simulator Laboratory (Tempest)
Full Field of View Dome Display
Human-Centered Design Research Facility
Hyperbarics Facilities
Drug Testing Laboratory
High Speed Centrifuges
Advanced Spatial Disorientation Device
Biocommunications Laboratory
Acceleration/Impact Facilities
Environmental/Occupational Toxicology Facilities
Directed Energy Bioeffects Facilities
Propellants Disposal Pilot Plant
Bioremediation Laboratory
Accredited Vivariums

Centrifuge

Multi-Rad

ARMSTRONG LABORATORY


DIVERSIFIED BUDGET WITH STEADY INCREASES IN POM
SERDP 9.2M
Other 20.7M
MFP8 17.8M
SBIR 10.2M
6.1 5.4M
6.3 47.5M
6.2 85.2M
FY95 Budget: $196 M
250
200
150
($ IN M)
100
50
0
MFP 8
OTHER
SERDP
SBIR
6.3
6.2
6.1
FY96
FY97
FY98
FY99
FY00
FY01
ARMSTRONG LABORATORY
Data as of: SEP 94


TOMORROW'S AIR FORCE
Today
AIR FORCE MATERIEL COMMAND
HUMAN SYSTEMS CENTER
ARMSTRONG LABORATORY
DEDICATED TO:
SELECTING
PROTECTING
INTEGRATING
MAINTAINING
PEOPLE IN AIR FORCE SYSTEMS AND OPERATIONS
ARMSTRONG LABORATORY

ARMSTRONG LABORATORY

FACILITY AND EQUIPMENT OVERVIEW

6 APRIL 1995

AGENDA

- REQUIREMENT
- COST DATA FOR LABORATORY CONSTRUCTION AND MOVES
- ESTIMATE COMPARISON
- EQUIPMENT AND FACILITY ISSUES

REQUIREMENT

- CLOSE BROOKS AFB
- MOVE HSC, SAM, AND AL TO WP-AFB
- HYPERBARIC CHAMBERS RELOCATE TO LACKLAND AFB TX

ARMSTRONG LABORATORY
BROOKS AFB TX

- 1181 SCIENTISTS, ENGINEERS, AND SUPPORT
- $75M RESEARCH EQUIPMENT AND COMPUTERS: ORIGINAL COST
- 8.5M POUNDS OF EQUIPMENT, LIBRARY, AND FURNITURE
- UNIQUE FACILITY REQUIREMENTS
- 289 CONTRACT SCIENTISTS, ENGINEERS, AND SUPPORT

COMPARATIVE LABORATORY FACILITY DATA

WALTER REED ARMY INSTITUTE OF RESEARCH (WRAIR)

- REQUIREMENTS SIMILAR TO ARMSTRONG LABORATORY
- A&E DESIGN ESTIMATE FOR A MEDICAL RESEARCH FACILITY
  - 1036 RESEARCHERS AND SUPPORT
  - 460,000 SQUARE FEET
  - FACILITY COST: $147.3M
  - $320/SF = $142K/PERSON
- MOST ACCURATE COST DATA AVAILABLE FOR THE TYPE OF FACILITY THAT ARMSTRONG LAB REQUIRES

COMPARATIVE LABORATORY FACILITY DATA (con't)

KELLY MILCON ESTIMATE

- 1994 AFMC 21 ESTIMATE TO REBUILD AL AT KELLY
- NOT BASED ON A&E DESIGN ESTIMATE
  - $312M TO INCLUDE DORMS, HOUSING, VOQ
  - $255M FOR R&D FACILITY
  - 1,087,000 SF R&D FACILITY
  - $235/SF

THE AUSTIN COMPANY
COMPLETED FACILITY COST SUMMARY

	Total Building Area (SF)	Laboratory Area (SF)	Office & Admin. Area (SF)	Total Project Cost (x $1,000)	$ Per SF (1994 Dollars)
Mobil Oil Beaumont, Tx.	19,850	12,685	7,165	$ 4,320	$ 217.63
Diamond Shamrock Three Rivers, Tx.	10,550	7,492	3,058	$ 2,746	$ 260.25
Citgo Lake Charles, La.	27,636	10,936	16,700	$ 5,382	$ 194.75
Exxon (Remodel) Baton Rouge, La.	5,953	4,559	1,394	$ 1,224	$ 211.78
Mobil Chem. Houston, Tx.	5,832	4,082	1,750	$ 1,850	$ 317.00
Chevron Belle Chasse, La.	12,094	7,620	4,474	$ 2,600	$ 214.98
Rexene Odessa, Tx.	4,262	2,314	1,948	$ 1,154	$ 270.76
Hoechst Celanese Bayport, Tx.	11,100	9,950	1,150	$ 3,771	$ 339.73
Average	12,160			$ 2,881	$ 236.92

Phibro USA
Phibro Energy USA, Inc.

THE AUSTIN COMPANY
ARCHITECTS
ENGINEERS
BUILDERS

LABORATORY FACILITY COST ESTIMATE COMPARISON

	COST/SF	AL SPACE REQUIREMENT (SF)	COST
WRAIR LABORATORY	$320	580,000	$ 185,600,000
AUSTIN CO. AVG.	$237	580,000	$ 137,460,000
KELLY AFB MILCON	$235	580,000	$ 136,300,000
COBRA MODEL	$136	580,000	$ 78,880,000

LABORATORY EQUIPMENT AND FACILITY ISSUE HIGHLIGHTS

HUMAN/ANIMAL CENTRIFUGE
RESEARCH ENVIRONMENTAL CHAMBERS
AEROMEDICAL EQUIPMENT AIRWORTHINESS CERTIFICATION FACILITY
HIGH ALTITUDE RESEARCH SUPPORT FACILITY
DISPOSITION OF LEGACY ANIMALS
CAPACITY OF WPAFB ANIMAL FACILITIES
ANALYTICAL/RADIOANALYTICAL CAPABILITY
RELOCATION OF LASER AND BIOEFFECTS
SECURITY SPACE REQUIREMENTS
RELOCATION OF REFERENCE LABORATORY
RELOCATION OF HYPERBARIC SERVICES
RELOCATION OF ANECHOIC CHAMBERS

CATEGORY III ITEM #CFT-01
HUMAN/ANIMAL CENTRIFUGE

- **ISSUE:** RELOCATION OF THE BROOKS AFB HUMAN/ANIMAL CENTRIFUGE TO W-P AFB

- **FACTS:**
  - MOST ACTIVE AND PRODUCTIVE CENTRIFUGE IN WORLD
  - MAXIMUM **30 G** TEST CAPABILTIY
  - ONLY CENTRIFUGE THAT CAN MATCH FIGHTER CAPABILITY
    - **9 G; 6 G/SEC ONSET RATE**
  - LOW O&M COSTS COMPARED TO OTHER CENTRIFUGES
  - NAVY CLOSING DOWN WARMINSTER CENTRIFUGE

- **RECOMMENDATIONS:** MOVE THE BROOKS AFB CENTRIFUGE INTO A NEW BUILDING AT WPAFB.

- **IMPACT IF NOT RESOLVED:** LOSS OF A UNIQUE NATIONAL ASSET

CATEGORY III ITEMS #CFT-07, 08, 09

RESEARCH ENVIRONMENTAL CHAMBERS
AEROMEDICAL EQUIPMENT AIRWORTHINESS CERTIFICATION FACILITY
HIGH ALTITUDE RESEARCH SUPPORT FACILITY

- **ISSUE:** RESEARCH ALTITUDE CHAMBERS/SUPPORT EQUIPMENT, RELOCATE TO WPAFB

- **FACTS:**

  - 7 SPECIALIZED RESEARCH ALTITUDE AND ONE ENVIRONMENTAL CHAMBERS

  - REQUIRES REMOVAL OF BUILDING WALLS AND SPECIAL EXTRACTION EQUIPMENT

  - 19 HIGH CAPACITY VACUUM PUMPS, THERMAL CONDITIONING SYSTEM (SLED MOUNTED TANKS, PUMPS AND COMPRESSORS, AND HOT GLYCOL CIRCULATION SYSTEM)

- **RECOMMENDATION:**

  - DESIGN/BUILD NEW FACILITY TO ACCOMMODATE RESEARCH/ENVIRONMENTAL CHAMBERS AT W-P AFB

CATEGORY III ITEMS #CFT 07, 08, 09

RESEARCH ENVIRONMENTAL CHAMBERS
AEROMEDICAL EQUIPMENT AIRWORTHINESS CERTIFICATION FACILITY
HIGH ALTITUDE RESEARCH SUPPORT FACILITY

- **IMPACT IF NOT RESOLVED**

  - ONLY AEROSPACE ALTITUDE RESEARCH FACILITY IN DOD

  - LOSS WOULD ELIMINATE:
    - SUPPORT TO ACC, USSOCOM, AND NASA
    - ON BOARD OXYGEN GENERATING SYSTEMS DEVELOPMENT
    - LIFE SUPPORT EQUIPMENT DEVELOPMENT AND MAN-RATING
    - AIRWORTHINESS CERTIFICATION OF AEROMEDICAL EVACUATION EQUIPMENT
    - RESEARCH ON SPECIALIZED REQUIREMENTS FOR HIGH ALTITUDE PROTECTION

  - 1 - 1.5 YEARS DOWN TIME

CATEGORY III ITEM #OE-1
DISPOSITION OF LEGACY ANIMALS

- **ISSUE:** LEGACY ANIMALS REQUIRE LIFETIME CARE
- **FACTS:**
  - MOVE TO WPAFB NOT NEEDED
  - NO FURTHER RESEARCH, JUST SUPPORT
  - AAALAC CARE REQUIRED, SOMEWHERE
- **RECOMMENDATION:**
  - MILCON SPACE AT WPAFB
  - MOVE COLONY TO NEW LOCATION
  - LEASE BROOKS FACILITIES
- **IMPACT IF NOT RESOLVED:** CARE IS REQUIRED FOR 10-15 YEARS

CATEGORY III ITEM #OE-2
CAPACITY OF WPAFB ANIMAL FACILITIES

- **ISSUE:** SHORT FALL IN ANIMAL FACILITIES AT WPAFB EXISTS
- **FACTS:**
  - SPACE REQUIRED BEFORE MOVE OF ANIMALS
  - BAFB HAS 100K SF SPACE, WPAFB HAS 50K SF
  - SHORTFALL OF 60K SF IF CONSOLIDATE
  - SPACE IS EXPENSIVE
- **RECOMMENDATION:** LEASE OR BUILD SPACE AT WPAFB
- **IMPACT IF NOT RESOLVED:** LOSS OF ANIMAL SUPPORT SHUTS DOWN IN-HOUSE BIOEFFECTS WORK

CATEGORY III ITEM #OE-6
ANALYTICAL/RADIOANALYTICAL

- **ISSUE:** ENGINEERING SERVICE MISSION REQUIRES LABORATORY, COLLOCATION WITH CONSULTANTS
- **FACTS:** 60K SF LAB, 14K SF ADMIN, 3K SF HAZMAT
  MEDIUM LABS WITH HVAC (58 HOODS NOW)
  PROVIDE 30% OF AF ESOH ANALYSES, 90K PLUS
  COLLOCATED FOR READINESS MISSION
  EQUIPMENT REQUIRES R/R BY VENDOR
  RECERTIFICATION REQUIRED FOR WPAFB
- **RECOMMENDATION:** MOVE AS UNIT TO WPAFB
- **IMPACT IF NOT RESOLVED:** READINESS MISSION IMPACT. LOSS OF ESOH ANALYTICAL CAPABILITY

CATEGORY III ITEM #OE-7
RELOCATION OF LASER AND RFR BIOEFFECTS

- **ISSUE:** RELOCATION OF RF AND LASER BIOEFFECTS INVOLVES TRISERVICE RELIANCE COLLOCATES
- **FACTS:**
  - AGREEMENTS MAKE USAF RESPONSIBLE FOR MOVE
  - COLLOCATION DEMONSTRATED AS EFFECTIVE
  - 35 XMITERS, 9 CHAMBERS
  - 14 LASERS, 15 OPTICAL BENCHES
  - ALL COLLOCATES NEED ANIMAL MODEL SUPPORT
- **RECOMMENDATION:** STUDY ALL OPTIONS FOR MOVE
- **IMPACT IF NOT RESOLVED:** LOSE BIOEFFECTS R&D

CATEGORY III ITEM #OE-12
SECURITY SPACE REQUIREMENTS

- **ISSUE:** SECURE SPACE FOR MATH PRODUCTS DIVISION
- **FACTS:**
  - 3.4K SF SCIF, 3K NET ADMIN
  - COMPUTER WORKSTATIONS REQUIRE MOVE
  - READY SPACE NEEDED TO FACILITATE, IF MOVED
  - PROVIDES ONLY 1/3 SPACE FOR RELIANCE DETACHMENTS
- **RECOMMENDATION:** LEASE OR BUILD SPACE AT WPAFB
- **IMPACT IF NOT RESOLVED:** DELAYS IN IMPORTANT CLASSIFIED R&D

CATEGORY III ITEM #AO-01
RELOCATION OF REFERENCE LABORATORY

- **ISSUE:** DISRUPTION OF WORLD-WIDE REFERENCE LABORATORY SERVICES PROVIDED BY THE EPIDEMIOLOGIC RESEARCH DIVISION (AOE)

- **FACTS:**
  - RECERTIFICATION REQUIRED
  - 1 YEAR MINIMUM TIME BEFORE CERTIFICATION

- **RECOMMENDATION:** PROVIDE INTERIM CONTRACT SERVICES

- **IMPACT IF NOT RESOLVED:** LOSS OF PATHOGEN SCREENING REQUIRED FOR DEPARTMENT OF DEFENSE MEDICAL TREATMENT FACILITIES.

CATEGORY III ITEM #AO-04
RELOCATION OF HYPERBARIC SERVICES

- **ISSUE:** MAJOR ENGINEERING EFFORT REQUIRED TO RELOCATE HYPERBARIC SERVICES. EXISTING CHAMBERS ARE IN EXCESS OF 30 YEARS OLD.
- **FACTS:**
  - NEW SUPPORT FACILITIES MUST MEET NEW NATIONAL FIRE PREVENTION ASSN (NFPN)
  - PRESSURE VESSELS MUST MEET HUMAN OCCUPANCY (PUHO) STANDARDS.
- **RECOMMENDATION:**
  - RELOCATE EXISTING CHAMBERS IN NEW SUPPORT FACILITY
- **IMPACT IF NOT RESOLVED:** LACK OF TREATMENT CAPABILITY

CATEGORY III ITEM #AO-05
RELOCATION OF ANECHOIC CHAMBER

- **ISSUE:** RELOCATION OF ANECHOIC CHAMBER

- **FACTS:**
  - CHAMBERS ARE CUSTOM MADE
  - CONSTRUCTED INTO BUILDING

- **RECOMMENDATION:** BUILD ANECHOIC CHAMBER AT WPAFB

- **IMPACT IF NOT RESOLVED:** AIRCREWS CANNOT BE TESTED FOR RESEARCH IN HUMAN SYSTEMS PROGRAMS.

FISCAL ISSUE #AO-01
(FACILITIES AND EQUIPMENT)
DISRUPTION OF REFERENCE LABORATORY SERVICES
AL/AOE

1. ISSUE: The Epidemiologic Research Division (AOE) provides reference laboratory services to USAF medical treatment facilities (MTFs) world wide in support of direct patient care.

2. FACTS: Relocation of AOE out of state will require recertification by the College of American Pathologists (CAP). Disruption of services will occur due to moving and recalibration of equipment, establishing computer networks, and safety equipment. MTFs will have to seek services elsewhere to continue patient care. A minimum of 12 months will be required to fully resume services at a cost of $ 5.5 million.

3. SOLUTION: Award contract to provide services until the new facility is operational.

4. COST: $5,630,807

5. IMPACT IF NOT RESOLVED: Military training will lose rapid recruit screening for rubella, rubeola, sickle cell and pregnancy capability. Virology services will be lost to DoD.

EDITED BY MAJ PETERSON, 21 MAR 95

FI NO. AO-02

ADVERSE AFFECTS OF THE AIR FORCE HEALTH STUDY (RANCH HAND)

AL/AOEP

ISSUE: This program, as part of its investigative protocol, has and continues to gather a considerable amount of documentation and tissue specimens which need to be maintained for an extended time under increased security and extreme environmental controls. These perimeters must be maintained during relocation of the data and specimens.

Costs: Records must be shipped as a sealed shipment to maintain security of sensitive documents. Cost of overland truck movement of estimated 2,000 cubic feet of records at 35 pounds per cu ft equals 70,000 of records. One semi-truck can carry in excess of 2,000 cu ft of records. Cost of a secure truck shipment is $1.50 per mile times 1,265 to destination which equals $1,927.50.

16,500 specimens must be shipped Federal Express for next day delivery to maintain specimens in an ultra-low temperature frozen state. One hundred specimens can be shipped in dry ice containers weighing 50 pounds. Cost for shipment of one container equals $36.11. Total number of containers equals 165. Therefore 165 x $36.11 = $5,958.15 for shipment of specimens. An additional cost for containers and dry ice would bring the total cost to approximately $7,000.

$1,927.50
<u>7,000.00</u>

$8,927.50 rounded to $9,000

FISCAL ISSUE #AO-03
(FACILITIES AND EQUIPMENT)
Relocation of Drug Testing Laboratory
AL/AOT

1. ISSUE: Relocation of the Air Force Drug Testing Laboratory from Brooks AFB to WPAFB.

2. FACTS: The future of the Air Force's Drug Testing Laboratory lies with the DOD Tri-Service Consolidation and Regionalization Plan. Under this plan, the Navy will have Drug Testing Laboratories in San Diego, California and in Jacksonville, Florida. The Army will have it's Laboratory at Fort Meade, Maryland and the Air Force would have it's laboratory in San Antonio, Texas. As such, east, west, and central regions of the United States would be covered by specific services. All military installations, regardless of service, would provide specimens for testing to the Drug Laboratory in their respective region.

3. SOLUTION: Provide monies for the transportation of Drug Testing Laboratory equipment and materials. Provide monies for the construction of the new facility or renovation of an existing building. Special considerations must be given to walk-in freezer space, conditioned electrical outlets, drainage and water supply, computer hook-ups, fume hood ventilation, loading dock facilities and external and internal security systems. Additionally, on base storage space would be required for small amounts of radio-active waste.

4. COST: $4,240,934

5. IMPACT IF NOT RESOLVED: Without an Air Force Drug Testing Laboratory, the DOD would lose its key geographical position capability in the DOD Drug Testing Regionalization Program.

WILLIAM J. MEHM, Lt Col, USAF, BSC
Chief, Drug Testing Division
(210) 536-3723

FISCAL ISSUE #AO-04
(FACILITIES AND EQUIPMENT)
RELOCATING THE DAVIS HYPERBARIC LABORATORY

1. ISSUE: This paper asserts that the best course of action regarding the relocation of the Davis Hyperbaric Laboratory (AL/AOH) is to split and relocate present resources and mission elements to bases where we may best serve and satisfy the needs of our customers. Specifically the patient care and clinical investigations/trials mission elements, along with a smaller cadre of personnel (physicians, nurses, technicians), should relocate to Wilford Hall Medical Center (WHMC), Lackland AFB TX, while the research, equipment development and testing, consultation, and education mission elements, with a larger cadre of the same types (AFSCs) personnel, should relocate with the USAF School of Aerospace Medicine (USAFSAM) to WPAFB. We believe this action will best serve the interest of the clinical hyperbaric medicine program, the Air Force, and the DOD.

2. FACTS: Relocating and realigning the patient care and clinical investigations/trials elements under WHMC should not be accomplished until new chamber facilities are in place and operational, requiring this facility remain operational until final closure action occurs. Incorporating these elements into the WHMC mission may exceed the time allotted for base closure. Each of the clinical hyperbaric facilities at Wright-Patterson and Travis AFBs took approximately 10 years to complete. Using new technologies and lessons learned could possibly reduce this to a more acceptable timeframe. Thought must be given, however, to contingencies for providing HBO therapy to DOD and VA healthcare beneficiaries in Region 6 in the event of time overrun.

3. SOLUTIONS: We have determined (our opinion) that new facilities will be required. The attempt to move our currently "grandfathered" (for safety codes) treatment chambers may destroy them; they are likely to fail the hydrostatic pressure tests required following reinstallation. We will need a modern facility having three-interlocking treatment chambers and at least 15,000 contiguous square feet, including patient waiting and wound care treatment areas. This hyperbaric facility should be directly attached to or part of the medical treatment facility to facilitate patient transfer from ICU, ER, surgery, or other wards without the difficulties of transporting patients by ambulance. The preferred location would be close to the ER, ICU, or other intensive care support area since treatment of seriously unstable patients is anticipated. The new hyperbaric facility should have a main chamber capable of treating 15 patients (with two inside medical attendants), a second smaller chamber for treating patient overload and emergencies, and a third chamber to serve as an elevator and medical lock. These interlocking chambers will have to meet the stringent safety codes of the National Fire Protection Association, American Society of Mechanical Engineers-Pressure Vessel for Human Occupancy Committee, and the Americans with Disabilities Act. The cadre of personnel left in place at Brooks AFB could be transferred to Lackland AFB as required.

4. Placing the research, equipment development and testing, consultation, and education mission elements in collocation with the USAF School of Aerospace Medicine would effectively resolve critical mission concerns. To be most effective, this activity should be retained as a unique function within the Armstrong Laboratory (AL). AL scientific and engineering expertise would then be readily available to hyperbaric personnel for support and continual interaction. MFP 6 funds would be competitively available for 1) basic research designed to increase our understanding of the underlying mechanisms and principles of high pressure oxygenation, and 2) developing and testing equipment acceptable for use in high pressure/oxygen environments. The Air Force's fellowship and advanced education and training programs could effectively be maintained in conjunction with USAFSAM. This cadre of personnel would become the DOD's center of expertise and provide/satisfy Lead Agency requirements for world-wide consultation on all matters (physical, physiological, and clinical) related to clinical hyperbaric medicine, SAV support, and provide the chair for the Joint Advisory Committee on Clinical Hyperbaric Medicine (JACCHM). A man-rated chamber would be required at this AL facility to support equipment development and testing, animal and tissue culture research, and education for the USAFSAM. For the reasons stated above, we support and recommend the splitting of current AL/AOH resources, personnel, and mission for realignment with Lackland AFB TX and the base of residence for the USAFSAM.

6. COST: $879,053
Col Davis/AL/AOH/4-3281/gbk/17 Mar 95

FISCAL ISSUE #AO-05
(FACILITIES AND EQUIPMENT)
RELOCATION OF ANECHOIC CHAMBER
AL/AOCFO

1. ISSUE: Relocation of the anechoic chamber currently used for acoustical research is cost prohibitive.

2. FACTS: Anechoic chambers have structural requirements that prevent relocation. When such a chamber is built, it must be planned as an integral of a physical plant. Proper installation results in a room essentially "floating" within another room, in order to minimize sound conduction due to vibration. It cannot be moved to another location. Related to this, there ate size and weight constraints that have to be met, further limiting the area into which such a facility can be built.

3. SOLUTION: Include construction of an anechoic chamber into the facility to which the AOC will move. Construct new anechoic chamber at Wright Patterson AFB. This will enable research and clinical activities to continue. Current and planned research activities depend on having the sound insulation available only in an anechoic chamber.

4. COST ESTIMATE: $306,900 as part of MILCON.

5. IMPACT IF NOT RESOLVED: Auditory research in AOC will stop if anechoic chamber not available.

JOHN R. ALLEN/MAJ/240-2177
EDITED BY MAJ PETERSON

FISCAL ISSUE #AO-06
(FACILITIES AND EQUIPMENT)
VESTIBULAR RESEARCH LABORATORY
AL/AOCFO

1. ISSUE: Relocation of the Vestibular Laboratory to Wright Patterson AFB. Maintaining the research mission and clinical testing function of the Vestibular Laboratory in support of the Aeromedical Consultation Service (ACS), WHMC, and BAMC.

2. FACTS: The vestibular testing equipment currently in use was designed and built by the Senior Researcher. This researcher is not moving to W/P AFB. There are no other individuals in the Lab that have the knowledge to disassemble and move this equipment or to reassemble, maintain, and repair it once it is moved. Historically, chambers of this type, due to their construction, do not remain totally functional after a move.

3. SOLUTION: Re-establish the Vestibular Laboratory at W/P AFB using commercial, off-the-shelf vestibular testing equipment.

4. COST ESTIMATE: $104,349

5. IMPACT IF NOT RESOLVED: Vestibular research and testing will not be possible until the new support facilities and personnel are available.

EDWARD J. ENGELKEN, Ph.D./3201/2177
EDITED BY MAJ PETERSON

FISCAL ISSUE #AO-07
(FACILITIES AND EQUIPMENT)
OPTICAL RESEARCH UNIT
AOCOP

1. ISSUE: The Optical Research Unit (ORU) at the Armstrong Laboratory is supporting several , extremely important, ophthalmic frame and lens investigations initiated by the USAF Surgeon General and the Air Combat Command. The ORU has a number of special features designed into the infrastructure to accommodate the extraordinary and massive equipment. This equipment will require exceptional handling and packing and will be expensive to move. The special features in the infrastructure will also have to be built into any new receiving facility.

2. FACTS: The floor in the back area is heavily reinforced to support the two massive lens surfacing generators and a lap cutter that is bolted to the floor to reduce vibrations. A new polycorbonate generator requires a vacuum system, and a lens coating machine requires a total venting system to eliminate noxious gases. There is a unique sump line/trap installed into the floor to collect the heavy metal and glass residue from ophthalmic lens fabrication.

3. COST ESTIMATE: $13,496

EDITED BY MAJ PETERSON

FISCAL ISSUE #AO-08
(FACILITIES AND EQUIPMENT)
Movement of Nuclear Medicine Function to Wright-Patterson AFB
AL/AOCIR

1. ISSUE: The movement of the Internal Medicine Branch, Nuclear Medicine Function (NMF) to Wright-Patterson AFB (WPAFB) will present some unique problems.

2. FACTS: The movement of the NMF to WPAFB will present some unique problems and special contracting needs as well as prior planning and serious documentation work. The Gamma cameras of the NMF each weight 3200 pounds and will require special handling and disassembly by skilled contractors and movers to avert damage to the units. The head assemblies alone cost in excess $48,000 to replace and are very sensitive to quick temperature changes. Climate control is a must. The estimated cost of disassembly for the two cameras is approximately $9,312. The estimated shipping charges to the WPAFB area is estimated at $3,200 per unit if shipped together to minimize space utilization. Special contract insurance would have to be negotiated into the moving contract to insure the equipment against damage during transport and if installation area is not ready, storage must be obtained and insured. Additional charges of $200 per month could be incurred if put into storage. As much as $500 could be charged for each unit to be removed from carrier and again when reloaded for delivery after storage. The cameras have to be maintained at approximately 70 degrees with 20-60% non-condensing humidity. Heat output of the cameras alone is 4000 BTU/hour. Service contracts must be available immediately after the move installation. The estimated cost of installation at WPAFB would be approximately $15,520. These cost are based on estimated time frames as established by local regional service manager. Replacement costs for each camera if purchased new would be approximately $300,000 each. Support computer and imaging equipment as well as support Radioisotope Lab area equipment must also be moved. There are approximately 12 tons of additional equipment to be moved as support and use items to include: Radioisotope storage unit, isotope preparation enclosure, decay and storage modules, fume hood unit, receiving and holding storage unit, radioisotope decontamination barrels (6), lead lined Waste containers, dose calibrators (2), computer radiopharmacy system, ECG gating devices (2), Spectrum Analysis System with well counter device, radioactive monitoring equipment, patient tables, stress ergometer table unit with Collins Ergometer unit. Additionally the Diagnostic imaging computers interfaced to the cameras and the Siemens ICON AP Diagnostic workstation and associated equipment would have to be also moved. All clinical records would have to go with equipment as Federal Law mandates they be retained for Five years for review. The records of past visits and those reports would have to be transported to WPAFB also to be used for future reference. The personnel from Brooks would not be relocating to WPAFB and therefore all prior knowledge of research programs and clinical evaluations would be lost.

3. SOLUTIONS: The major costs are the $30,000 to disassemble and reassemble the systems, along with the $30,000 of movement charges associated with the cameras and all the additional support equipment charges for packing and shipping and unpacking. New Nuclear Regulatory License would have to be obtained and that could take as long as three to five years.

4. COST ESTIMATE: $ 31,950

JOSEPH E. TURNER, SR., GS-11, DAFC
SUPERVISOR, Nuclear Medicine Function
EDITED BY MAJ PETERSON

FISCAL ISSUE #AO-09
(FACILITIES AND EQUIPMENT)
VISUAL ELECTRODIAGNOSTIC LABORATORY RELOCATION (VEL)
AL/AOCOC

1. ISSUE: Significant costs will be associated with movement of the VEL. Research efforts will be lost. Unique research efforts will be lost. The residency programs in Ophthalmology at WHMC and BAMC will be jeopardized. Patient care costs will accelerate because of CHAMPUS exams which could no longer be performed.

2. FACTS: Collaborative efforts involving WHMC, BAMC, UTHSC, UTSA, and Hyperbarics would no longer be possible. Local non active duty clinical patient care now provided would need to be accomplished through CHAMPUS funding. Active duty VEL occupational evaluations would need to be accomplished under contract. The WHMC and BAMC residency programs will need revision.

3. COST ESTIMATE: $ 64,077

4. IMPACT IF NOT RESOLVED: The newly established protocol, directed by USAF Chief of Staff and SG, involving WHMC and the VEL to evaluate eximer laser photorefractive keratoplasty and visual performance will not be accomplished in requested timeframes. Other existing protocols in place will need to be canceled and accumulated data may be lost.

EDITED BY MAJ PETERSON, 21 Mar 95

FISCAL ISSUE #AO-10
(FACILITIES AND EQUIPMENT)
Relocation of the USAF Central
Electrocardiographic Library to Wright-Patterson AFB OH
AL/AOCAB

1. **ISSUE:** Relocating the USAF Central Electrocardiographic Library to Wright-Patterson AFB, OH.

2. **FACTS:** The USAF Central ECG Library currently has approximately 1,250,000 tests on 300,000 rated members. All of our tests is microfilmed and stored in two Lektrievers. These Lektrievers are 8' high, 9' wide and 5' deep. Each machine weights approximately 4000 lbs empty and 8000 lbs full. The cost of breakdown, crating, and installing of the Lektrievers alone would be approximately $11,000 plus shipping costs. Any building used for the USAF Central ECG library will need to have adequate re-inforcement in the floor to support these machines, particularly due to need for both to be in the same room and in close proximity. Any area would need to have a separate heating and cooling environment with humidity control possibilities per regulation for storage of microfilm. Additional security rolls of microfilm will need to be stored in a separate building from the USAF Central ECG Library and Aeromedical Consultation Service on base to allow immediate retrieval when needed. These cannot be stored in the same buildings in case of possible destruction of the microfilm by fire or other sources. Additional costs will occur in mailing of tests from HQ AETC/SGPS at Randolph AFB to the USAF Central Electrocardiographic Library for quick turnaround, review and reading of cardiovascular tests Adequate computers, printers, support materials and manning of a network system will be required. Funding, to include possible re-bidding of the microfilm contract, will need to be required. All files, microfilming equipment and office equipment will need to be moved. Training of personnel to perform the duties of the USAF Central ECG Library will need to be done prior to any move, due to probable lack of interest by current personnel in relocating to Wright-Patterson AFB. Proper arrangements will need to be made to insure that downtime is at a minimum if any move is considered. This is extremely important in that the USAF Central ECG Library mails hundreds of letters each week and receives an equal number of telephone calls requesting copies of tests or information on file.

3. **SOLUTIONS:** Insure that proper planning and moneys are appropriated to insure that downtime is at a minimum and vehicles are in place to alleviate any of the aforementioned problems associated with a move. This should include TDY money for any potential office personnel at Wright-Patterson so that training prior to any move is appropriate to insure a smooth transition. Included moneys for setting up the offices at Wright-Patterson with TDY money to support Brooks AFB personnel assisting in the move would be appropriate.

4. **COST ESTIMATE: $17,082**

PATRICIA T. WOODWARD, ART, GS-7
Supervisor, USAF Central Electrocardiographic Library
Medical Repositories

EDITED BY MAJ PETERSON

FISCAL ISSUE #AO-11
(FACILITIES AND EQUIPMENT)
Cardiac Catheterization Laboratory
AL/AOCI

1. ISSUE: The cardiac catheterization laboratory will need to be moved to Wright-Patterson AFB (WPAFB), or other arrangements for cardiac catheterization will need to be made.

2. FACTS: Occupational evaluation of aviators for heart disease is largely directed at detecting subclinical coronary artery disease. Since coronary angiography is the only accepted method of *in vivo* identification of coronary atherosclerosis, the capability to perform cardiac caths safely and efficiently is crucial to this evaluation process. Moving the cardiac catheterization laboratory to WPAFB would be expensive, and result in significant downtime.

3. SOLUTION: Using the clinical facilities at Wright-Patterson Medical Center. Given two functioning cath labs at WPAFB hospital and their present caseload, recommend that the Aeromedical Consult Service (ACS) use the clinical facilities at the hospital. This assumes that the ACS is located within a reasonable distance (up to 10 minutes) from the hospital, and that the capacity at WPAFB does not change significantly. The availability of the WPAFB Medical Center facilities has not yet been established.

4. COST OF ESTIMATE: $41,717

5. IMPACT IF NOT RESOLVED: The capacity to perform expeditious angiography must be maintained in some way at the ACS; otherwise, cardiac evaluations will in many cases be incomplete, prohibiting return to flying status recommendations.

EDITED BY MAJ PETERSON

FISCAL ISSUE #CFT-01
(FACILITIES AND EQUIPMENT)

HUMAN/ANIMAL CENTRIFUGE
AL/CFTF

1. **ISSUE:** Relocation of the Armstrong Laboratory Human/Animal Centrifuge to Wright-Patterson (WP) AFB.

2. **FACTS:** The Brooks AFB Centrifuge has historically been the most active and productive centrifuge in the world. The centrifuge has a maximum capability of 30 G with an onset rate of 6 G/sec. The centrifuge requires approximately 9000 square feet of floor space, including associated support space. The centrifuge requires 480 volt, 3 phase, electrical power and requires a current of 3200 amps (1.54 MW). The four 250 hp electric motors require special air conditioning for cooling. Relocation of the centrifuge would require a reinforced stable foundation of it's own, including ample space beneath the centrifuge for placement and maintenance of the electric motors. The centrifuge could not be mounted on any pre-existing concrete slab.

3. **SOLUTION:** Move the Brooks AFB centrifuge to WPAFB to continue the Air Force mission of research and development of advanced +Gz-protective equipment and techniques. Disassemble the centrifuge and move it to a new site at WPAFB. The major cost factor is constructing a new facility housing site at WPAFB.

4. **COST ESTIMATE:** The estimate of moving the centrifuge at Brooks AFB into a new building at WPAFB would be about **$1,239,628** not including MILCON.

5. **IMPACT IF NOT RESOLVED:** If the Brooks AFB centrifuge is disassembled and moved to WPAFB it will have a major impact on our in-house mission. It is estimated that to disassemble, reassemble and man-rate the centrifuge on a new foundation at WPAFB would require 1-1.5 years. However, if a new, more capable centrifuge were built at WPAFB our mission could be transitioned to the new centrifuge upon completion and without a lapse in productivity.

Dr. John W. Burns/GS-14/DSN 240-3521

FISCAL ISSUE #CFT-02
(FACILITIES AND EQUIPMENT)

SPATIAL DISORIENTATION COUNTERMEASURES I
AL/CFTF

1. ISSUE: Relocation of the Visual Orientation Laboratory (VOL) and the Attitude Awareness Laboratory (AAL) to Wright-Patterson AFB is essential to a continuing and aggressive research program to diminish spatial disorientation (SD) during USAF flying operations.

2. FACTS: SD continues to be a causal factor in a number of Class A mishaps exacting a high cost in lost lives and aircraft. The two research laboratories, the VOL and AAL, are dedicated to the SD Countermeasures task and are essential to the continuation of this research effort. However, unique space and power requirements must be provided. **(a)** The VOL addresses the fundamental visual mechanisms of spatial orientation. One unique feature for this lab is a fully enclosed subject chamber with a vertically adjustable projection screen. To accommodate this chamber, requirements must include adequate ceiling height (approx. 12 ft) and sufficient floor space (at least a 20 ft in length) for the subject chamber and the associated external projector system. **(b)** The AAL investigates the integration of orientation information for the pilot on all cockpit display media--i.e., head-down, head-up, and helmet-mounted displays. The essential element of this laboratory is the simulated cockpit suite with associated cockpit displays. Adequate floor space (at least 20 ft in length) is required to accommodate the simulated cockpit and the associated back projection system. **(c)** Dedicated computer equipment supporting both laboratories requires a special power source and a 24-hour a day, environmentally controlled (both temperature and humidity) room for proper functioning.

3. SOLUTION: Provide three adjacent rooms at the new location. One would be a dedicated computer room (approx. 250 sq ft) with the required power supply and 24 hour a day temperature & humidity control. The two laboratories (each approx. 300 sq ft) would include the required floor dimensions (at least 20 ft in one direction) and ceiling clearances.

4. COST ESTIMATE: Facility modifications to meet power requirements and environmental control and moving costs for the computers and projector systems is estimated at **$7,193**.

5. IMPACT IF NOT RESOLVED: Spatial disorientation continues to have a major impact on USAF operations, resulting in an average of one Class A Mishap per 300,000 flying hours. As technology continues to increase the sophistication and complexities in military cockpits, e.g., advent of helmet mounted displays, it is imperative to fully integrate orientation information to minimize workload and increase overall situational awareness for the pilots. Without adequate research facilities, it will not be possible to continue these unique research efforts into Spatial Disorientation Countermeasures.

Dr. Carita A DeVilbiss/GS-13/DSN 240-3521

FISCAL ISSUE #CFT-03
(FACILITIES AND EQUIPMENT)

SPATIAL DISORIENTATION COUNTERMEASURES II
AL/CFTF

1. **ISSUE**: What are the special costs and requirements for relocating to Wright-Patterson AFB the Advanced Spatial Disorientation Demonstrator (ASDD), necessary for determining cockpit design and inflight procedures that cause or counteract spatial disorientation (SD)?

2. **FACTS:** The ASDD is an advanced, motion-based simulator/centrifuge that is used for spatial disorientation training and research. It is a device that has several special requirements and costs. The ASDD and its console requires a room that is 40' x 35' x 25' in height. It requires a floor that is designed for dynamic stresses of 1500 PSI to support its 10-ton structure moving at 28 RPM. It must be surrounded at least partially by a high-strength glass enclosure to allow for visibility of the ASDD operation. Its advanced graphics computers require proper environmental control (limited temperature and humidity range) and the ASDD's computers and drive-motors require 3-phase 200V electrical power.

3. **SOLUTION:** The ASDD can be moved. The major costs involved would be 1) construction of new specialized building facilities to meet the above requirements, and 2) the cost of moving the facility. The purchase value of the ASDD (upwards of $5M) exceeds the sum of moving costs and new facility construction. It is best to move it rather than abandon it and build on entirely new ASDD at Wright-Patterson AFB.

4. **COST ESTIMATE:** The cost of moving the ASDD would be approximately **$56,136K**, based on the previous cost of installing the facility at Brooks AFB nearly 2 years ago.

5. **IMPACT IF NOT RESOLVED:** The ASDD is the only advanced spatial disorientation training and research device in the United States. Ground-based research regarding causation/counteraction of SD as influenced by design and inflight procedures, especially involving future helmet-mounted technology, would be severely compromised if this issue is not resolved.

Dr. Fred H. Previc/GS-13/DSN 240-3521

FISCAL ISSUE #CFT-04
(FACILITIES AND EQUIPMENT)

SMALL ANIMAL CENTRIFUGE AND G-LOC RESEARCH LABORATORIES
AL/CFTF

1. **ISSUE:** Relocation of the small animal centrifuge and research laboratories to WPAFB is required for continued basic research of the neuromechanisms of G-induced loss of consciousness (G-LOC).

2. **FACTS:** The laboratory for basic (6.1) research of the neuromechanisms of G-induced Loss of Consciousness (G-LOC) is unique: there is no other in the entire world. This laboratory has developed many specialized tools and techniques to study brain physiology and biochemistry in the high-G environment. The most notable piece of equipment is the high-G small animal centrifuge (5 ft diameter) and attached microwave brain biochemical fixation system. The attached physiological/ biochemical/molecular biology laboratories are also crucial to the basic research capabilities in this area of interest.

The G-LOC program requires approximately 1700 square feet and is divided into three distinct "wet laboratories", each with specific requirements and function. The physiology laboratory houses the small animal centrifuge, data acquisition station and a surgical preparation area. The room requires high ceilings (10'), dedicated high voltage (480 VAC/3 phase) and filtered water supplies, and floor substructure suitable for the weight (1500 lbs) and stress of the centrifuge during operation. The other two laboratories (biochemistry and molecular biology) require substantial counter-top space, cabinetry, fume hoods, de-ionized water systems, gas, compressed air, water and vacuum outlets. Both rooms must be radiation usage approved and have limited access by non-lab personnel.

An additional consideration is the proper packaging and shipping of delicate analytical equipment, which require set-up and calibration by the original manufacturers.

3. **SOLUTION:** Construct appropriate laboratory space at Wright-Patterson AFB with specifications similar to existing facility at Brooks AFB. Move the small animal centrifuge and accompanying laboratory equipment upon completion.

4. **COST ESTIMATES:** The cost of moving, set-up and re-calibration would be approximately **$90,524** which does not include MILCON

5. **IMPACT IF NOT RESOLVED:** In the last 12 years 23 class A mishaps have been specifically attributed to G-LOC. Many additional cases of G-LOC are unreported and the fear of G-LOC limits pilots from taking full advantage of their high performance aircraft capabilities. Research into novel solutions to either increase G-tolerance, prevent the incidence of G-LOC or enhance recovery from G-LOC would cease.

Dr. Paul M. Werchan/GS-13/DSN 240-3521

FISCAL ISSUE #CFT-05
(FACILITIES AND EQUIPMENT)

BRAIN Research Faclity
AL/CFT

1. ISSUE: The BRAIN Research Institute (BRI) maintains a AALAC-approved small animal vivarium that was specially designed to support circadian rhythm (biological clock) research. If the laboratory is moved to WPAFB, an AALAC-approved structural of comparable design and sufficient size to support the reseach mission of the BRI will be required.

2. FACTS: In order to successfully investigate the neurophysiological regulation of the circadian system, research animals must be maintained in temporal isolation, under conditions of constant light, humidity, temperature, and sound level. The minimum requirements of the BRI small animal vivarium are as follows:

a. AALAC accredited veterinary staff and facilities
b. 2000 sq ft of space divided into 4 rooms of roughly equal size
c. constant temperature (+2oC) and humidity (+5%)
d. sound attenuated rooms with washable floors and walls
e. all rooms "light-tight" and isolated by dark room doors.
f. capability for 200 channels of behavioral data acquisition

3. RECOMMENDATION: Construct new facility to accommodate requirements

4. COST ESTIMATE: Captured as Category II costs.

5. IMPACT: Mission failure

M. Rea/GS14/DSN240-2706

Estimated Cost of Facility#$250K

FISCAL ISSUE #CFT-06
(FACILITIES AND EQUIPMENT)

Aircrew Evaluation Sustained Operations Performance (AESOP)
AL/CFTO

1. ISSUE: Ability to provide research into multi-crew station design, crew interaction performance during simulated C^3 environments, sustained operations, weapons director display modifications, and communication strategies are directly dependent on this AESOP facility.

2. FACTS: The AESOP facility is currently meeting DOD requirements to evaluate AWACS weapon air controllers performance by creating realistic task demands through simulated wartime scenarios in Command, Control, and Communications (C^3) environments. Major factors that have to be considered are: (1) disconnecting and reconnecting to the Defense Simulation Internet Gateway via high bandwidth, wide-area T-1 data communication lines; (2) fire suppression and environmental control monitoring 24 hours/7 days week; (3) uninterruptible power requirements; and (4) fiber optical network lines and interfaces to high-speed data collection and analysis systems. In addition, access to a habitat enclosure for 8 subjects during extended duty time (days and weeks) are required for sustained operational experiments.

3. SOLUTION: Disassemble, transport, and reassemble all of the equipment to facilities at WPAFB.

4. COST ESTIMATE: The cost of moving and re-installation of the AESOP facility is **$255,559** not including the cost of a facility addition at WPAFB to contain the AESOP facility.

6. **IMPACT IF NOT RESOLVED:** Without resolution of this issue, a substantial loss of an integrated tri-service facility would occur. AESOP, among other things, provides the capability to evaluate the role of communications in aircrew situation awareness that allows the generation of solutions to prevent friendly-fire situations such as the Blackhawk shoot-down incident in Iraq.

Dr. Sam Schiflett/GM-15/240-3464.

FISCAL ISSUE #CFT-07
(FACILITIES AND EQUIPMENT)

RESEARCH AND ENVIRONMENTAL CHAMBERS
AL/CFTS

1. ISSUE: Aircraft oxygen system and life support equipment research, development and man-rating cannot be accomplished without the current Cockpit and Equipment Integration Laboratory, Research Altitude and Environmental Chamber facility, and Oxygen Systems Laboratories.

2. FACTS: The necessary chamber equipment includes: nine specialized research altitude and environmental chambers, thermal conditioning systems, vacuum pumps, a life support facility, vibration table, and emergency generator. The walls of the current chamber building will need to be removed to allow extraction of the chambers for transport. Transportation of all equipment may be by either rail or road but weight and size limits must be identified. Specialized facilities will be required at Wright-Patterson AFB to house the equipment and functions at issue. The new chamber facilities will require floor space [~ 17,500 sq feet] for pump rooms, chamber rooms, instrumentation and medical exams, and maintenance workshop. The chamber facility will require high pressure steam, chilled water, hot water, cooling towers with water treatment system, emergency generators, liquid oxygen storage and distribution system, hot glycol circulating system, and electrical power at 120, 220, and 440 (3 phase) volts. The foundation under the vibration table will require special reinforcement. Installation at the new facility will require extensive replacement of tubing, wiring, gaskets, electrical switch gears and plumbing on the chambers and pumps. The Cockpit and Equipment Integration Laboratory will require special transport of the 3 cockpit mock-ups, facilities with a dark room for field of view work, floor space for a life support facility, anthropometric booth, a high ceiling area for a suspended harness, and a fume extraction system [~ 3,100 sq feet]. The Oxygen Systems laboratories will require 5 separate specialized laboratories with one being a separate building for oxygen generation research to include an explosion proof room [~ 3,000 sq feet]. The laboratories will require 120, 240 (3 phase), and 480 volt (3 phase) phase electrical power; a compressed air, natural gas, and vacuum source; climatic control; a water system with softener, filter, cooling tower, circuit, and filter; and fume extraction system.

3. SOLUTION: Move and collocate the Research and Environmental Facilities with the USAFSAM mockups, the High Altitude Research Support Facility, and the Aeromedical Research Airworthiness Certification (ARAC) Facility at WPAFB. Disassemble, transport, and reassemble all of the equipment into new facilities at WPAFB. The proposal of new office and laboratory space collocated with the other aforementioned facilities would be the most effective solution and would minimize time spent moving equipment and personnel from one laboratory building to another.

5. COST ESTIMATE: The cost of moving and re-installation of 7 of the 9 chambers, pumps, vacuum lines, cooling system, purchase and installation of a new liquid oxygen system, new electrical wiring, installation of the required environmental chamber capability, purchase and installation of new emergency generators and cooling towers, plus other associated equip and supplies, plus man-rating all the systems would be approximately **$3,938,301.** A facility addition at WPAFB to contain the Research and Environmental Facilities, Cockpit and Equipment Integration Laboratory, and Oxygen Systems Laboratories would be add additional costs.

6. IMPACT IF NOT RESOLVED: The concerned assets are unique and current support of NASA, USSOCOM, DWHRP, ACC, and development and man-rating of On Board Oxygen Generating Systems (OBOGS) and related life support equipment for aircraft including the F-22, B-1, B-2, F-15, F-16, C-5, C-141, C-17, C-141, KC-135, and KC-10 could not be accomplished without them.

Charles D Caulkins/Major/DSN 240-3847

FISCAL ISSUE #CFT-08
(FACILITIES AND EQUIPMENT)

AEROMEDICAL RESEARCH AIRWORTHINESS CERTIFICATION (ARAC) FACILITY
AL/CFTS

1. ISSUE: Certification of the safety and compatibility of patient monitoring devices with aeromedical aircraft systems and the airborne environment cannot be accomplished without the current Aeromedical Research Facility. Relocation to WPAFB and remaining collocated with CFT design testing facilities and USAFSAM aircraft mockups is imperative.

2. FACTS: The facility requires the vibration table, research altitude and environmental chambers, and their support equipment as referenced in the AL Issue Paper for Task 7930-11, Research Altitude and Environmental Chamber Facility. A new facility for Aeromedical Research will require floor space [1500 square feet] for: 1) test design and instrumentation lab with sizable work benches, and 2) a technical library. This laboratory will require sinks and the following electrical power: 28 VDC, 120 V/60 Hz , 120 V/400 Hz (3 phase). The facility will require access to USAF School of Aerospace Medicine aircraft mockups to perform "form and fit " aircraft interface assessment (scheduled and coordinated through USAFSAM). Additionally, in-flight feasibility testing will require access to aeromedical evacuation flights. Although being located at Wright-Patterson AFB will increase access to C-141 flights, access to C-130 and C-9 flights will decrease substantially. Funding has not been identified to cover construction of the new facility, movement of the assets addressed in AL Issue Paper for Task 7930-11, or the probable increases in travel costs for access to C-130 and C-9 flights.

3. SOLUTION: Collocate at WPAFB the ARAC and USAFSAM mockups and Research and Environmental Chamber Facility. New design or facility modification collocated near the Research and Environmental Chamber Facility is essential. It is currently understood that USAFSAM intends to move the aircraft mockups to WPAFB. The timing of these moves must be coordinated so that access to the mockups is available upon arrival at WPAFB. Access to aeromedical evacuation flights for feasibility testing will increase TDY expenditures. Office and laboratory space collocated with the research altitude and environmental chambers would be the most effective solution and would minimize time spent moving large amounts of equipment from one laboratory building to another.

4. COST ESTIMATE: The cost of moving equipment is captured in #CF-07.

6. IMPACT IF NOT RESOLVED: The related equipment and facilities are unique and currently support both civilian manufacturers and military buyers of medical equipment used in aeromedical evacuation. Without this facility, design and certification of the safety and compatibility of patient monitoring devices with airborne environment and aeromedical aircraft systems including the C-9, C-12, C-21, C-27, C-130, C-141, KC-10, and KC-135 could not be accomplished.

Kindra A. Edman/ 2LT/DSN 240-2937

FISCAL ISSUE #CFT-09
(FACILITIES AND EQUIPMENT)

High Altitude Research Support Facility
AL/CFTS

1. ISSUE: Determination of specialized mission requirements for exposing humans to high altitude (low pressure) during special operations, high altitude reconnaissance, space missions and during F-22 tactical operations is an operational requirement that AL must support into the next decade. No studies can be conducted without the ability to simulate in hypobaric chambers the altitude environment related to a particular aircraft/spacecraft and/or mission scenario. Collocation of the High Altitude Research Support Facility near the Research and Environmental Chamber Facility is essential.

2. FACTS: The AL Issue Paper for Task 7930-11, in its description of the Research Altitude and Environmental Chamber facility, describes requirements related to movement of any chambers from their current location. The costs of those requirements must be considered when evaluating the following solutions.

3. SOLUTION: Move and collocate the High Altitude Research Support Facility near the Research and Environmental Chamber Facility at WPAFB. Office and laboratory space collocated with the research altitude and environmental chambers would be the most effective solution and would minimize time spent moving equipment and personnel from one laboratory building to another.

4. COST ESTIMATE: The cost of moving equipment is captured in #CF-07.

5. IMPACT IF NOT RESOLVED: On-going long term projects for ACC, USSOCOM, DWHRP, NASA and others will terminate if chamber capabilities comparable to those currently in use at Brooks AFB are not established at WPAFB.

Dr Andrew Pilmanis/ GS-14/ DSN 240-3545

FISCAL ISSUE #CFT-10
(FACILITIES AND EQUIPMENT)

CFT NETWORK FACILITY
AL/CFT

1. ISSUE: To meet the mission needs of the CFT division, there is a requirement to disassemble and transport network equipment and materials and install, at the new site, a high performance network cabling scheme.

2. FACTS: Network equipment includes various network-servers, UPS systems, and network switching hubs that must be shipped and handled with great care. Power requirements to satisfy the CFT network must include: (1) 230 VAC, 3-phase, 30 Amp, and (2) 120 VAC, 20 Amp. Both power requirements should have isolated grounds to service neutral. Dedicated HVAC and power systems are necessary for the network equipment on a 7-days per week, 24-hours per day basis. The network servers must be located in a limited access room (minimum of 400 sq. ft.) with proper security, HVAC, and emergency power. Remote switching hubs and patch panels (as necessary) shall be enclosed in wiring closets (minimum of 6'x6' area) with less than 230 feet total maximum cable runs between them. UPS systems will be installed in each hub location. Each hub location shall have 120 VAC, 20 Amp power requirements with proper HVAC, emergency power, and security.

3. SOLUTION: Recover approximately $400K of network equipment, software, and materials and install a new cabling scheme to reestablish the CFT network topology. Reestablishing the CFT network is necessary due to the requirement for high performance network capabilities 24-hours per day, 7-days per week.

4. COST ESTIMATE: Approximately $400K of network equipment, software, and materials are recoverable at a cost of **$273,903K**

5. IMPACT IF NOT RESOLVED: CFT will be unable to meet mission critical requirements that include high performance, distributed simulation research on a 24-hour/day, 7-day/week basis. This constitutes a mission failure.

STEPHEN STRANGES/GS-12/DSN: 240-3811

FISCAL ISSUE #CFT-11
(FACILITIES AND EQUIPMENT)

CFT Resource Center Facility
AL/CFT

1. ISSUE: To meet the mission needs of the CFT division, there is a requirement to disassemble and transport the Resource Center facility to new quarters at WPAFB. This facility provides CFT personnel a common work center with multi-computer platform inter-operability to perform many functions (see below).

2. FACTS: The Resource Center provides the following capabilities: graphic services, typesetting and pre-press publication services, visual aid construction, training stations, audio/video and multimedia services, poster presentation capabilities, scanning capabilities, data reduction and analysis, data acquisition, software development, software/peripheral evaluations and benchmarks, and World Wide INTERNET communication capabilities. The Resource Center facility also includes: multi-platform computer workstations, various quality printers and plotters, proprietary and in-house software, software library, scanners, secured cabinets, etc. Minimum facility space requirements will be no less than 800 square feet with a raised floor that includes indirect lighting, appropriate network connections, and emergency power. Power requirements must include 120 VAC, 20 Amp with isolated grounds to service neutral. Dedicated HVAC and power systems are necessary on a 24-hours/day, 7-days/week basis.

3. SOLUTION: It is cost effective to ship existing equipment, computers and software to augment a CFT Resource Center at the new site. The Resource Center needs to be in-house. Approximately $300K of computers, peripherals, and software are recoverable. Disassemble, move and reassemble the Resource Center at new facilities at WPAFB.

4. COST ESTIMATE: Moving cost of the facility's computers, furniture, equipment, software, and documentation (for approx. 4000 pounds) will be approximately **$145,445**.

5. IMPACT IF NOT RESOLVED: Without resolution of this issue, CFT will have no in-house mechanism to: (1) develop professional presentations and pre-press publications, (2) provide training, (3) to benchmark, test and evaluate new network, software, and peripheral technologies, (4) develop visual aids, poster presentations, and graphic illustrations, (5) provide scanning capabilities, and (6) provide a centralized work center to perform data reduction and analysis, data acquisition, and software development. This constitutes a mission failure.

CURTIS WHITE/GS-13/DSN 240-3811

FISCAL ISSUE #CFT-12
(FACILITIES AND EQUIPMENT)

CFT Electronics Shop Facility
AL/CFT

1. ISSUE: An electronics shop facility needs to be reestablished at the new site. CFT uses an electronics shop facility to support ongoing and pending research. This shop provides in-house hardware and software support, electronic circuit design construction, CAD/CAM, fabrication support, and maintenance support for all CFT computers, software, and equipment.

2. FACTS: The shop facility includes: tools, drill presses, test equipment, specialized electronic instrumentation equipment, oscilloscopes, meters, computer repair resources, wire and materials, storage cabinets, proprietary software and licenses, technical manuals, documentation library, etc. Minimum shop space will be no less than 1000 square feet to accommodate eight 3'x8' work benches with numerous shelves, drawers, cabinets, and racks. Power requirements to satisfy the electronics shop facility must include 120 VAC, 20 Amp with isolated grounds to service neutral. Other facility requirements include security, emergency power, and dedicated HVAC and power on a 24-hour/day, 7-days/week basis.

3. SOLUTION: It is cost effective to ship existing equipment and materials to augment a CFT electronics shop facility at the new site. Electronics shop facility needs to be in-house. Disassemble, move and reassemble electronic shop equipment at new facilities at WPAFB.

4. COST ESTIMATE: The cost of moving approx. 25,000 pounds is a Category II cost item.

5. IMPACT IF NOT RESOLVED: If the shop facility is not duplicated or reestablished, severe mission degradation and/or mission failure may be inevitable.

STEPHEN STRANGES/GS-12/DSN: 240-3811

FISCAL ISSUE #HR - 01
(FACILITIES AND EQUIPMENT)
AL/HR COMPUTER FACILITIES
AL/HRO

1. ISSUE: Adequate environmentally controlled computer facilities must be available to house the computer systems and local area network servers that support the AL/HR research program and office automation. Additional temperature and humidity controlled space for magnetic tape and optical data storage is required both on-site, adjacent to the computer facility, and off-site for backup storage.

2. FACTS: The present computer facility in Building 578, Brooks AFB, consists of *4600 square feet* of prime computer space with raised floor (2 ft. above subfloor), environmentally controlled to 72 degrees F. (plus or minus 2 degrees) and 50% humidity (plus or minus 5 percent) year round, with independent air conditioning, isolated 3-phase power transformer and extensive power distribution equipment. Additionally, there is a *2300 square foot* magnetic tape library adjacent to the computer room that is also temperature and humidity controlled year round. Both spaces are currently used to capacity. ***Assuming relocation will take place after 1 January 1997,*** the Unisys 1100/82 computer system will have been removed and the computer space requirements will be reduced to approximately **1200 square feet** (DEC 4000/610, IBM RISC 990, and SUN SPARCstation LAN servers, and others); magnetic tape and optical media storage will be reduced to approximately **800 square feet on-site** with **200 square feet off-site**.

3. SOLUTION: Locate or construct 2000 square feet of computer room (1200 sq. ft.) and adjacent data storage space (800 sq. ft.) with year round temperature and humidity control. The computer room requires raised computer flooring (modular, fireproof, 2 ft. square panels, 18 in. or 2 ft. above subfloor) and isolated power (3-phase "wye", 208 volt, 225 ampere service). Cost will depend upon the quality of existing facilities and type of modifications that will be needed. Also locate 200 square feet of off-site temperature and humidity controlled space for backup data storage. ***Schedule AL/HR relocation after 1 January 1997 to avoid moving Unisys 1100/82.*** AL/HR minicomputers and LAN servers must be collocated near the clients they serve if possible because the reliability of client/server applications is heavily dependent on having as simple and direct a network path as possible between the components. Upon determination of the actual space available for computers and data storage, develop a plan to remedy deficiencies from the requirements and complete any modifications or construction before the space is occupied.

4. COST ESTIMATE: $35,375.

5. IMPACT IF NOT RESOLVED: AL/HR will be deprived of computational and analytical tools essential to performing the research. Inadequate space to store research and historical personnel data will force scientists to eliminate potentially useful information from the data bank which may severely affect the ability to perform the mission. *(AL/HR is the sole repository for AF historical personnel data.)* Lack of adequate backup storage space will unacceptably increase the risks of permanent data loss and potential damage to the mission.
J. ELBERT MYER/GM13/DSN 240-3931

FISCAL ISSUE #HR - 02
(FACILITIES AND EQUIPMENT)
AL/HR NETWORKING FACILITIES
AL/HRO

1. ISSUE: All AL/HR computer rooms, offices, labs, and work locations must be provided with both 10 Megabit Ethernet and 155 Megabit ATM or FDDI/CDDI Local Area Network (LAN) connectivity with access to the AL/HR computer systems, servers, base network, and Internet.

2. FACTS: The current AL/HR facility, Building 578, Brooks AFB, is fully wired with wall outlets delivering networking services to all offices, labs, computer rooms, and work locations; every PC, workstation, minicomputer, server, and main frame computer system is presently connected via Ethernet to the base network and Internet. This connectivity is an integral and essential part of the AL/HR operation and is a critical factor for the mission, for productivity, and for efficient administration of the research efforts. The current wiring system is capable of supporting 10 Megabit Ethernet and up to 51 Megabit ATM protocols. Rapid growth in use and exchange of bit mapped and multimedia data mandates upgrade to optical fiber (preferred) or Category 5 Unshielded Twisted Pair (UTP) wiring that will support up to 155 Megabit speeds to the desktop. (Future applications could require video distribution as well.)

3. SOLUTION: Facilities need to be wired or upgraded with capability to support 10 Megabit Ethernet and 155 Megabit ATM or FDDI/CDDI protocols to all computer rooms, offices, labs, and work locations (estimated at 250 drops). Sufficient bridges, routers, hubs, etc. must be installed to support the network and provide connectivity with the existing base LAN and the Internet. Costs will depend on the amount and quality of existing capability installed and the difficulty of installing or upgrading, considering the age, configuration, type of construction, and number of structures involved. Upon determination of the specific space to be allocated for use by AL/HR, develop a plan to install or upgrade existing network wiring and components to the required specifications *before* personnel and equipment are moved in place. AL/HR network managers must coordinate with base network administrators concerning the logical network structure, host address assignment, protocol issues, recommended/mandated equipment, base standards, etc.

4. COST ESTIMATE: **$355,308** to set up networking capabilities for AL/HR at Wright-Patterson AFB.

5. IMPACT IF NOT RESOLVED: AL/HR scientists and administrative personnel will lose communications capabilities providing access to vital sources of information, both within the Directorate, with outside sources within the Air Force, in other agencies, and in the academic community. The ability to communicate via electronic mail, both internally and with off-base sites will also be lost, greatly hampering productivity and potentially causing significant extensions of project completion time frames. The Directorate mission will suffer in proportion to the lack of networking capability; in the worst case, a complete loss of networking capability will result in severe work slowdown or stoppage (up to 75%).
J. ELBERT MYER/GM13/DSN 240-3931

FISCAL ISSUE #HR - 03
(FACILITIES AND EQUIPMENT
AL/HR LIBRARY
AL/HR-DOKL

1. ISSUE: Fiscal issues associated with relocating the AL/HR library to the Wright Laboratory are addressed. Topics include packaging, transporting, and integrating library assets, requirements for new equipment, facility and staff, together with management issues involved in reduced access for on-site and distance services.

2. FISCAL: Moving, conversion, integration and related costs have not been planned in any prior documentation. Library moving is specialized, requiring expensive archival packing care, individual carton identification and integration into the destination in shelf number order. Special Export Control Act materials require higher cost specialized handling, packing, processing and recataloging, by Federal law and by Air Force regulations, not to be handled by any contractor. Reduced access to materials and divided staff locations during the moving process will increase operating costs in the sending and destination libraries. Total library recataloging, reclassification, automation conversion, and materials reprocessing budgeting is required by the radically different systems in place in the AL/HR library and the Wright Laboratory library. Remote users at Lackland AFB and the Mesa AZ sites will require additional staff and materials funding at the destination library for maintenance of adequate remote access and service. Addition of materials at the destination will require budgeting additional staff for conversion on the short term and additional long term staff to meet resulting increased needs. Costs for design, construction, shelving, and other furnishing and their installations, requirements of a new facility or new addition to extant destination library are required as the destination has no room for staging, other management or access to these materials.

MANAGEMENT: The destination library has zero room for new collection materials, no adjacent expansion space potential, and no additional room planned on the 10 year plan, placing an insurmountable block on library moving and access. During the moving process, the inevitable increased borrowing demands from other libraries until the HR collection is unpacked, recataloged, reprocessed, and available will result at the destination and sending locations, especially as staff from activities are moved. Current destination library staffing is below requirements for full access to materials and has resulted in reduced hours which are only 69% of current HR materials access hours, causing a 31% reduction in access to HR materials. Meeting requirements for receipt and rapid access to the collection will result in increased workload for destination library staff at all levels. Requirements for identification and segregation, of orderly shipments by a specialized library moving company with controlled temperature, humidity, and archival material packing and handling must be met. Export Control Act materials cannot, by Federal and Air Force law and regulation, be handled (packing, shipping, unpacking, processing, cataloging, integrating) by a contractor, requiring instead specialized levels of active duty or civil service employees at designated security clearances. Hazardous materials microform view and copier units (ozone depleting) must be accounted for and specially managed in the HR library, within special service and environmental guidelines.

3. SOLUTION: Allocate sufficient funds, accommodate security of classified materials, assure specialized moving, obtain staffing, construct a facility, convert all materials, upgrade access, and take measures for hazardous materials control.

FISCAL: Budget costs for a specialized library move must be allocated. Export Control Act materials handling special staff must be budgeted. Increased staffing is required at both sending and destination libraries during the unavailability of materials for the duration of both the HR staff and library collection move. Conversion of collection records to the different library automation system, recataloging, and reprocessing of each library item from the HR collection must be budgeted. Funds must be allocated for contracted conversion and processing of appropriate materials. Budgeting additional access tools and materials for increased demands of remote access to Lackland AFB and Mesa AZ is needed. Added materials increases budget requirements for added staff at the destination library. The action and time to design, develop, build, and furnish a new and/or expansion library facility must be budgeted.

MANAGEMENT: Specialized library movers are required to pack the collection in identified, humidity/temperature controlled components for orderly moving and unpacking in order to minimize shifting and integration at the destination site, and a library moving consultant is a requirement, especially as staff will corporate memory of the collection may become lost. Special Export Control Act materials handlers (not contractors) must be located for managing the technical reports collection, according to Federal laws and regulations (Title 22, USC, Sec 2751, et. seq., Title 50 USC, App. 2401 et seq, DoD Directive 5230.25 and others). Additional staffing to meet the mission during the move must be acquired for the increased interlibrary lending requirements resultant at both the source and destination libraries. Additional staff at specific expertise levels must be acquired for recataloging, reclassification, reprocessing, and integration of the collection into the destination library record and physical collection, whether it be co-located or remote from the intended destination. Additional staffing to meet mission information requirements in a timely fashion from Lackland AFB and Mesa AZ sites must be managed. Added materials at the destination will require additional staffing authority to manage the increased workload. The authority for and the expertise to acquire a new facility or destination expansion in an adequately accessible location must be planned, designed, and implemented, in concert with the materials move with adequate staging, security, and supervision of materials in transit, minimizing shifting and segregation, maximizing integration at the destination. Additional staffing authorizations at the destination are required to provide resulting increased demands to the collection. Additional destination library staffing to eliminate the current 31% reduced access time to the collection is required, as the destination library is open only 10 am to 4:30 pm (12 noon to 4 pm in the documents section), and has a proposal to further cut access to a 12 noon to 4:30 pm access.

4. COST ESTIMATE: $125,780 to relocate and set up outside the Wright Laboratory library system. If integrated, the cost would be **$721,780** that includes the cost of recataloguing reference material.

5. IMPACT IF NOT RESOLVED: The mission of the Human Resources Directorate will fail if the Human Resources library cannot be managed, funded, moved, made accessible, and supported. Besides DoD and Air Force regulatory requirements in starting a new Work Unit, library searches are required for avoiding duplicating work/research already done and results in hundreds of thousands of dollars in cost avoidance annually, as in any technical/research library. No similar sources of information are available or planned for the Wright-Patterson AFB commuting area.

Marilyn Goff/ GS-11 / 210/536-2651

FISCAL ISSUE # HR-04
(FACILITIES AND EQUIPMENT)
ON-SITE CONTRACTOR REQUIREMENTS
AL/HRTI

1. ISSUE: Unanticipated expenses to relocate in-house contractors to conduct and support research and development for intelligent tutoring capabilities.

2. FACTS: Relocation of the contractors has not been anticipated. Therefore, a funding disconnect exists. The contract support consists of the following:

- 10 contractors to support the **TRAIN** laboratory, 2232 SF office space, and computer infrastructure
- 10 contractors to support the **FST** project, 1136 SF office space, and computer infrastructure
- 4 contractors to jointly support the **ICATT** and **VIVIDS** projects, 530 SF office space, and computer infrastructure

These contractors are critical to the continuation of these programs. Major tasks include assistance in designing and developing laboratory experiments, development of intelligent tutors used in experiments, test subject acquisition and monitoring, data collection, and test results documentation. Other major tasks include development, implementation, evaluation of intelligent training systems, and support of technology transfer activities. Tasks involve development and evaluation of authoring systems for intelligent training, to include both two-dimensional and virtual environments, intelligent tutors built with these authoring systems, and tutor modules for fundamental skills such as math, reading/writing, and life science.

3. COST ESTIMATE: **$11,253.** Major costs are being estimated by HSC/PKR in item #PKR-01

4. IMPACT IF NOT RESOLVED: All products associated with the Intelligent Training Branch research stream will be delayed from 1-5 years as a consequence of relocation. We will have to delay delivery of training technology solutions to our customers in AETC, AFSPACECOM, ASC, and AFSOC by up to 6 years. This will negatively impact their Mission Area Plans and delay their ability to resolve some of their documented training deficiencies. And we will lose our demonstrated and acknowledged international technological superiority in the area of training and education technologies.

LEN MACKIE/CAPT/AL/HRTI/536-2034

FISCAL ISSUE #HR - 05
(FACILITIES AND EQUIPMENT)
RELOCATION OF INTELLIGENT TUTORING AND VIRTUAL ENVIRONMENT LABORATORY
AL/HRTI

1. ISSUE: Unanticipated expenses to relocate intelligent tutoring and virtual environment laboratory.

2. FACTS: Relocation of the laboratory equipment has not been anticipated. Therefore, a funding disconnect exists. The laboratory consists of the following:

- ù 1200 SF of office space for four in-house contract scientists and four government research scientists
- ù 1500 SF of laboratory space for equipment with raised floor
- ù one Silicon Graphics Reality Engine 2 workstation
- ù two Silicon Graphics VGX workstations
- ù one Sun SparcStation workstation
- ù two Pentium computers
- ù various input and tracking devices
- ù networking hardware

These resources are necessary to conduct ongoing research and development in the use of virtual environment-based intelligent tutoring systems. The goal of these efforts is to provide technologies to DoD customers that help them train faster and better with fewer resources. These technologies are referred to as intelligent tutoring systems. The ultimate products of these efforts are 1) prototype products and 2) specifications for operational systems that meet this goal by incorporating artificial intelligence and virtual environment technologies into automated training and education systems, with a corresponding reduction of up to 90% in development costs for such systems and a reduction of up to 80% in development time for such systems. In-house contractors are currently provided via a Science and Engineering Technical Assistance contract. This contract vehicle will change to a completion type contract during 3Q95, and is scheduled to be awarded to Command Technologies, Incorporated.

4. COST ESTIMATE: $658 not including facility costs.

5. IMPACT IF NOT RESOLVED: We will have to delay delivery of training technology solutions to our customers by up to 8 years. This will negatively impact their Mission Area Plans and delay their ability to resolve some of their training deficiencies. And, we will lose our demonstrated and acknowledged technological superiority in the area of training and education technologies.

LtColParlett/HRTI/DSN240-2146

FISCAL ISSUE #OE-01
(FACILITIES AND EQUIPMENT)
Disposition of Legacy Animals (AL-Brooks)
AL/OEV
OE-01

1. ISSUE: Armstrong Laboratory has a colony of approximately 500 nonhuman primates, primarily rhesus monkeys, which were previously used in research and will require lifetime care.

2. FACTS: Due to federal guidelines, DOD Directive and Tri-Services regulations, and public opinion, these animals cannot be euthanized for convenience or cost savings. These monkeys will require lifetime care; for a rhesus monkey, this is a 25-30 years. AL/OEV continues to market these previously used animals to other DOD and civilian research facilities at no-cost. However, most researchers prefer naive, 3-4 year old monkeys for their research projects, and the easiest-to-give-away monkeys have already been given away.

3. SOLUTION: Contract for transfer of ownership and lifetime care of these animals at the median per diem cost of $3.81 per day ($1.82 low to $7.36 high for 18 institutions). Estimated cost of 500 monkeys x $3.81 = $1,905/day x 365 days = $695,325 per year x 15 years = $10,429,875 total. Assumption: Rhesus monkeys live approximately 30 years and the estimated remaining life span per BAFB animal is 15 years.

- Potential bidders - Southwest Foundation for Biomedical Research, Southwest Research Institute, University of Texas Health Science Center at San Antonio. Costs may be less if Brooks AFB facilities are utilized.

4. RECOMMENDATION: Option a: Contract for transfer of ownership and lifetime care. Similar costs with both options, but the advantage of contracting is that the USAF liability would end.

5. COST ESTIMATE: $127,975 not including the on-going O&M costs and new MCP.

6. IMPACT IF NOT RESOLVED: The USAF will have to keep the monkeys at Brooks AFB for the next 15+years.

JOHN G. GOLDEN/Colonel/DSN 240-2825/9 Mar 95

FISCAL ISSUE # OE-02
(FACILITIES AND EQUIPMENT)
Care For Large Animals/Performance Testing Animals

ISSUE: Current animal care facility at WPAFB has limited housing for farm animals.

FACTS: AL/OEV provides animals and animal care for research requirements at AL/OER (RFR effects research), AL/OEO (Laser effects research), and AL/CFT (Centrifuge research). The animal care facilities must be collocated with these research facilities. WPAFB's vivarium has 11 small dog runs and 15 large dog runs. AL-Brooks requires space for an estimated 30 goats and 10 pigs for a total of 40 large animals. Assumption that WPAFB will need 50% of 26 runs, leaves 13 for AL-Brooks. Net result is a shortage of approximately 25-27 runs.

SOLUTION: Build additional inside multipurpose rooms at WPAFB that can be configured for 25 goats and/or swine; approximate cost $900K (3,000 sq ft x $300/sq ft), plus cage costs of $25K. Total = $925K

COST ESTIMATE: MILCON cost. Non-MCP Category III included in OE-1, 8, 19-25.

IMPACT IF NOT RESOLVED: Limit or curtail directed energy and G-LOC studies that utilize these species.

AUTHOR/RANK/TELEPHONE NUMBER: Col Golden/ 4-2825

FISCAL ISSUE #OE-03
(FACILITIES AND EQUIPMENT)
RADIOANALYTICAL BRANCH
AL/OEBA

1. ISSUE: Special requirements for moving the Radioanalytical Laboratory

2. FACTS: The Radioanalytical Branch has unique requirements for moving specialized equipment used in the measurement of radioactive contaminated samples.

a. Counting systems to be moved are:
6 Shielded Caves, total weight = 50,000 lb.
2 Liquid Scintillation Counters, total weight = 2,000 lb.
3 G-5000/AutoQuad Systems, total weight = 3,000 lb.
1 Whole Body Counter, total weight = 6,000 lb.

The estimated total cost of counting equipment is $2.5M. All counting equipment must be located in the same area and will require special floor loading considerations.

b. Hoods: The Radioactive Materials License requirements for hoods used to process radioactive samples is a minimum flow rates of 125 cfm. per hood..

-10 Hoods with flow rates of 125 cfm. Power requirements are two (2) 110 volt receptacle one (1) 220 volts outlets, plus connections for natural gas, air and vacuum are needed for each hood.

c. Muffle furnaces and commercial dishwasher require hardwiring and proper plumbing.

d. Electrical requirements to support Uninterruptable Power Supply (UPS) of 220 volts, 34.5 amps, 120 volts, 34.6 amps and 24 amps.

e. Laboratory space requirements:
Radiochemistry - 1,800 sq. ft. Measurements - 1,600 sq. ft
Sample storage - 1,000 sq. ft. Office space required -1,200 sq. ft.
AFRAT equipment/supplies - 1,100 sq.ft.
Total Area Required - 6,700 sq. ft.

f. Uncertified mover will cause loss of Service contracts. Special recertification survey will be required and are estimated at $5 K per each item.

3. SOLUTIONS:

a. Specialized counting equipment is maintained under specific service contracts. To maintain these service contracts the manufacturing company must QC instruments, pack, ship, set-up and QC instruments at new location. The estimated costs are to move equipment to WPAFB. Equipment to be moved under these requirements are the Whole Body Counter, 2 Liquid Scintillation Counters, 6 steel caves and associated detectors and electronics.

b. Due to the delicate nature of detectors and steel shielding necessary for their operation, the maintenance of equipment service contracts, and the bulk and weight of the steel shielding, it is recommended that Canberra Company and Gamma Products move their respective equipment.

4. COST ESTIMATE: All items considered Category II.

5. IMPACT IF NOT RESOLVED: Failure to handle delicate counting during moving and reestablishing the proper environment for operations will result in adverse conditions which will severely impact our mission to support all DOD installations. AL/OEBA is the only radioanalytical laboratory to support programs required by 10 CFR 20 and the U.S. Air Force Master Materials License Activities. Without this capability, the Air Forceshould anticipate adverse findings and notices of violation from the U.S. NRC and other regulatory agencies. Significant fines are usually associated with the violations.

A J Clay, GM-13, 4-5817

FISCAL ISSUE #OE-04
(FACILITIES AND EQUIPMENT)
Physical Plant
AL/OEA

1. ISSUE: Special modification to a facility is mandated by Occupational Safety and Health Agency (OSHA) and the Environmental Protection Agency (EPA) for relocation of an environmental chemistry laboratory.

2. FACTS: a. One - Pass laminar flow ventilation hoods capable of removing toxic substances to include strong acid mists are required. We currently have 48 of these hoods.

b. Fifteen linear feet of usable bench space without equipment on the bench per analyst is required. Additionally, 200 square feet of laboratory space per analyst is required we have 50 analysts on board, requiring 750 linear feet of bench space and a minimum of 10,000 sq. ft. of laboratory space without an hazardous/toxic substance extraction laboratory. Additional 10,000 sq. ft. required for implementation of this goal.

c. Special electrical requirements with dedicated electrical lines with uninterrupted power sources (UPS) are required for sensitive analytical equipment. $100K modifications are in progress to meet this need now.

3. SOLUTIONS: Bring in consultants to evaluate constructing a physical plant to accommodate an environmental laboratory. A minimum of 18,113 sq. ft. is required. This is our current laboratory space. Build a new building to ensure proper utilization of space.

4. COST ESTIMATE: All costs MILCON.

5. IMPACT IF NOT RESOLVED: Mission is compromised.

KENNNY D. LOCKE, LtCol/4-6167

FISCAL ISSUE #OE-05
(FACILITIES AND EQUIPMENT)
Equipping A Second Environmental Laboratory
AL/OEA

1. **ISSUE:** A second laboratory, fully equipped would be necessary during the moving transition to avoid compromising the missions and prevent the loss of our national certification status.

2. **FACTS:** We currently own $5M worth laboratory equipment, which approximately .50% is older than 7 years and would not move to the new facility.

3. **SOLUTIONS:** Buy sufficient equipment to operate the new laboratory as a satellite laboratory under the certification umbrella of OEA until independent certification status could be obtained.

4. **RECOMMENDATION:** As above

5. **COST ESTIMATE:** Priced under #OE-06.

6. **IMPACT IF NOT RESOLVED:** Loss of mission and organization.

KENNY D. LOCKE, LtCol/4-6167

FISCAL ISSUE #OE-06
(FACILITIES AND EQUIPMENT)
Relocation Of Analytical / Radioanalytical Services
AL/OE

1. ISSUE: Our Analytical (OEA) and Radioanalytical (OEBA) activities provide inhouse and contract management analyses to 90,000 samples yearly involving some 300,000 analytes for environmental and occupational health support AF-wide. These services require facility support catorigized as moderate.

2. FACTS: Radioanalytical occupies 12,800 sq ft net and analytical occupies 17,100sq ft net of moderate construction laboratory space. Additionally, they both require support of laboratory gases, hazardous waste disposal, hazardous material supply, access to stable power supplies without voltage fluxuations, some uninterupted power supplies, single pass fume hoods, a shipping and sample assession area (not included in the above space figures), some areas of high floor loading (approx 1000 sq ft) and normal chemical laboratory facilities. The two functions both support readiness tasking of the AFRAT, nuclear response team. These analytical functions support the professional consultants and contract managers currently collocated in the remainder of building 140. (There is a definate synergy for collocation of the consulting, analysis and research efforts of the ESOH mission.) They are supported by the quality assurance function also collocated. Each of these analytical activities are certified by federal and state regulatory activities for the analyses they perform. Their equipment is generally under contract maintanence agreements, valid only so long as it is maintained under these agreements and may require the manufacturer to relocate if moved.

Under HQ AFMC we have been working for nearly two years to form an Environmental Laboratory Cooperative (ELC) involving each of the ALCs to capalize on the existing capacity in analytical services. Although the ALC labs are limited in the tests they are certified to perform, the potential for a network of AF labs with the capacity for much of the DOD ESOH workload exists. Steps to initiate the ELC have been slow but are progressing. Its feared by the certifing agencies that when we move the AL/OE labs it will take two years to regain certification. In the interim we would either have to contract the efforts out, or duplicate the capacity elsewhere (WPAFB or another location) prior to shutdown. Since much of the operation is fee-for-service it is possible the customers would go elsewhere even at increased costs and may never come back if services are not maintained.

3. SOLUTION: First, a study group needs to establish the military utility of these laboratories (a make or buy analysis); then alternative locations for recommended inhouse functions would be needed. These include: collocation with an ALC, move to WPAFB, collocation with another service, or some other significant restructuring of the support mission. Colocation with the Safety Center and formation of a new ESOH FOA is feasible particularly if the clinical medical mission goes to Health Affairs.

4. COST ESTIMATE: $20,227,990M to provide contract services until proper certification is obtained from regulatory agencies.

5. IMPACT IF NOT RESOLVED: Loss of $6M /yr in ESOH savings plus loss of the AFRAT readiness mission if the function is contracted.

Erik K. Vermulen, Col, AL/OE, DSN 240-2003 (as of 9 Mar 95)

FISCAL ISSUE #OE-07
(FACILITIES AND EQUIPMENT)
Relocation Of Laser And Rfr Bioeffects Involves Relocation Of Reliance Tri-Service Collocates

ISSUE: The Directed Energy Program include US Army, US Navy and USAF components collocated here under Project Reliance. Relocating the Armstrong Laboratory does not automatically direct the USA and USN to move to the same location.

FACTS:

Project Reliance directives caused the USA and USN programs in Directed Energy to be moved to BAFB,TX. The moves started in 1992 (Army Laser program moved from the Presidio of San Francisco), and the last group (USN Laser & RFR Groups from Pensacola, FL) relocated in 1994. Facilities are not yet completed for the Navy Laser & RF groups. Collocation benefits to all services have been demonstrated. Personnel shared (Army Ophthalmologist) and facilities shared (Electron Microscope, Ultrashort pulse laser) as well as experiments designed to solve multi-service problems. In response to the BAFB closure, the USA/USN have considered these options for their DE efforts:

SOLUTIONS:

Relocate to WPAFB OH Based on the assumption that Project Reliance Goals are still in effect, and the Tri Service Directed Energy program should remain collocated. Plan for space accordingly. Notes: This solution adheres to policy guidance. Users of Directed Energy research products are world-wide. Major customers (PL/WS, LANTIRN SPO, WL/MLPJ, AFSOC, DNA, SG) are so widely dispersed that it is hard to justify location of program based on proximity to end user location.

COST ESTIMATE:

Costs captured under in other OE items.

IMPACT IF NOT RESOLVED:

Individual service components will make individual plans, and the integrated program objectives will be lost.

Farrer/GM-15/ 4-6043

FISCAL ISSUE #OE-08
(FACILITIES AND EQUIPMENT)
Disposition Of Proton Radiation (Life Time Effects) Animals

ISSUE: AL/OEV maintains a colony of primates (Rhesus) which were exposed to ionizing radiation (protons) during studies in the 1960s. The disposition of these animals is a serious concern.

FACTS: This is the only known life time study of proton radiation bioeffects on primates, and the results have attracted world-wide scientific attention. 358 animals (57 Control and 301 treated) were in this group at the start, and approximately 36 remain. It is anticipated that approximately 22 will be alive in 1997. NASA has provided funds (approximately 200K/yr.)for the continuation for this work for six years. International societies (e.g., COSPAR) will participate in the 30 year follow up symposium. Some of the most important radiogenic cancers are anticipated to occur at the end of the life span.The colony has been described as a national resource, and it is a highly visible project. Federal law prevents the destruction of research primates following the termination of the scientific study.

SOLUTION: Move colony to WPAFB, OH with remainder of OEV assets.

COST ESTIMATE: $7,474

IMPACT IF NOT RESOLVED: Potential legal problems associated with he disposition of primates. Animal rights activists involvement. Serious concerns from national academic community for loss of data if we do not handle this well.

Dr Ann Cox/GS-13/4-3554

FISCAL ISSUE #OE-09
(FACILITIES AND EQUIPMENT)
RADIOANALYTICAL BRANCH
AL/OEBA

1. ISSUE: Special requirements for moving the Radioanalytical Laboratory

2. FACTS: The Radioanalytical Branch has unique requirements for moving specialized equipment used in the measurement of radioactive contaminated samples.

a. Counting systems to be moved are:
6 Shielded Caves, total weight = 50,000 lb.
2 Liquid Scintillation Counters, total weight = 2,000 lb.
3 G-5000/AutoQuad Systems, total weight = 3,000 lb.
1 Whole Body Counter, total weight = 6,000 lb.

The estimated total cost of counting equipment is $2.5M. All counting equipment must be located in the same area and will require special floor loading considerations.

b. Hoods: The Radioactive Materials License requirements for hoods used to process radioactive samples is a minimum flow rates of 125 cfm. per hood..

-10 Hoods with flow rates of 125 cfm. Power requirements are two (2) 110 volt receptacle one (1) 220 volts outlets, plus connections for natural gas, air and vacuum are needed for each hood.

c. Muffle furnaces and commercial dishwasher require hardwiring and proper plumbing.

d. Electrical requirements to support Uninterruptable Power Supply (UPS) of 220 volts, 34.5 amps, 120 volts, 34.6 amps and 24 amps.

e. Laboratory space requirements:
Radiochemistry - 1,800 sq. ft. Measurements - 1,600 sq. ft
Sample storage - 1,000 sq. ft. Office space required -1,200 sq. ft.
AFRAT equipment/supplies - 1,100 sq.ft.
Total Area Required - 6,700 sq. ft.

f. Uncertified mover will cause loss of Service contracts. Special recertification survey will be required and are estimated at $5 K per each item.

3. SOLUTION: Specialized counting equipment is maintained under specific service contracts. To maintain these service contracts the manufacturing company must QC instruments, pack, ship, set-up and QC instruments at new location. The estimated costs are to move equipment to WPAFB. Equipment to be moved under these requirements are the Whole Body Counter, 2 Liquid Scintillation Counters, 6 steel caves and associated detectors and electronics. Due to the delicate nature of detectors and steel shielding necessary for their operation, the maintenance of equipment service contracts, and the bulk and weight of the steel shielding, it is recommended that Canberra Company and Gamma Products move their respective equipment.

4. COST ESTIMATE: Cost included in OE-03.

5. IMPACT IF NOT RESOLVED: Failure to handle delicate counting during moving and reestablishing the proper environment for operations will result in adverse conditions which will severely impact our mission to support all DOD installations. AL/OEBA is the only radioanalytical laboratory to support programs required by 10 CFR 20 and the U.S. Air Force Master Materials License Activities. Without this capability, the Air Force should anticipate adverse findings and notices of violation from the U.S. NRC and other regulatory agencies. Significant fines are usually associated with the violations.

A J Clay, GM-13, 4-5817

FISCAL ISSUE #OE-10
(FACILITIES AND EQUIPMENT)
Hazardous Waste Management Branch
AL/OEBQ

1. ISSUE: The Hazardous Waste Management Branch will be required to relocate its personnel, equipment and supplies to a suitable location. Shipment costs and facility requirements will be extensive.

2. FACTS: Equipment owned by the HWM Branch will require approximately 600 sq ft of secured storage space. Equipment is used for emergency response and field work. Storage location must also have vehicle access and a hoist since shipments are bulky and very heavy. Our five personnel will require a minimum of 100 sq ft of office space per person for a total of 500 sq ft. Each person will require computer capability equivalent to what is available presently. An additional 500 sq ft will be required for a library and a conference room. The library will house stored office supplies to include several hundred reference books, and a similar number of historical reports and contractual materials. A conference room is needed for meetings with contractors and customers. It is assumed bathroom facilities to meet requirements dictated by number of building occupants will also be provided.

3. SOLUTION: Major cost drivers include security for resources, and costs associated with electricity, heating, water, space, to name a few. All computer hardware and software should move with us. Existing facilities at our forwarding location may require upgrades and additional computer resources--the costs of which would depend on present status. A new facility or addition to existing facility would be a high cost item. An OE representative should work transition requirements for the directorate to ensure adequate resources will be available at our destination. Existing facilities at our new destination must be criticically reviewed. The transition representative should estimate through teaming with destination personnel required costs for facilities and other support requirements identified through inputs such as this one. If necessary, the cost for completely new facilities and associated plumbing, electrical lines, and water liens should be estimated.

4. COST ESTIMATE: Category II and facility cost issue.

5. IMPACT IF NOT RESOLVED: Without sufficient office space personnel cannot function effectively. Lack of space and security for equipment will lead to loss, ineffeciency, and lack of responsiveness.

Matta/Capt/3305

FISCAL ISSUE #OE-12
(FACILITIES AND EQUIPMENT)
SECURITY REQUIREMENTS MATHEMATICAL PRODUCTS DIVISION
AL/OES

1. ISSUE: Relocation of the Mathematical Products Division (AL/OES) to Wright-Patterson AFB (WP-AFB) may require the construction of a secure area.

2. FACTS: The Mathematical Products Division conducts health and safety research on Air Force classified systems. A work area comprising some 10,000 square feet and meeting SCIF specifications is required. The present facility occupied by AL/OES personnel cost approximately $530,000 excluding furniture and equipment. No funding exists or has been planned for this move.

3. SOLUTION: Identify or build secure facilities at WP-AFB prior to moving personnel, equipment and classified files. This will reduce the down-time of operations, minimize moving costs, and reduce stress on personnel relocated in the move. To do this we must first find existing facilities meeting both space and security requirements. Facilities meeting both space and security requirements may still need to be modified to meet our unique security requirements at a cost of approximately $50,000. If space is available, but does not meet our security requirements then we will require $500,000 to modify the facility to met those requirements. If suitable space does not exist then we will need to budget an additional $1,250,000 to build a secure structure. In addition approximately $300,000 is needed to move civilian personnel, equipment, and classified files directly into facilities at WP-AFB. A second solution is to lease SCIF space in the Dayton area (estimate approximately $200,000 per year) until a facility can be provided at WP-AFB. Again a small amount of support is required from Accounting & Finance, Contracting, etc., by WP-AFB. Again the total cost of moving to the leased facilities in Dayton and then move again to WP-AFB is approximately $335,000.

5. COST ESTIMATE: Facility cost issue.

6. IMPACT IF NOT RESOLVED: The Mathematical Products Division is the only group in the Air Force performing health and safety analysis on classified Air Force equipment. Without secure facilities this operation will stop. Delays in performing this work may impact the fielding of Air Force weapons systems.

David J. Goble, Major, 4-9033

FISCAL ISSUE #OE-13
(FACILITIES AND EQUIPMENT)
DEBL II CONSTRUCTION
AL/OE

1. **ISSUE:** Construction of Directed Energy Bioeffects Laboratory II (DEBL II) is approved for FY95; design is approaching 35% complete. AFMC intends to stop design until Brooks fate is determined under BRAC 95.

2. **FACTS:** Congress inserted a $6.5M MILCON into FY95 to develop a 52.000 sq ft DEBL in the 1100 area of Brooks. It is approaching 35% design, a point which requires HQ AFMC go-ahead to continue. AFMC/CEC indicates they will hold off on that decision. (Note: BRAC language reportedly addresses stopping construction) Should AL relocate its Directed Energy Research to WPAFB a synergism with Toxicology exists which could benefit both technology areas by eliminating redundant special support areas. Locating the DEBL II and the proposed new Toxicology Building adjacent to each other could eliminate 3000 sq ft in requirements form both buildings. Once the closure of Brooks is decided, transferring the construction of DEBL II to WPAFB could accelerate the move and provide for quality laboratory space for part of the transferred mission

3. **SOLUTIONS:** Modify the DEBL II design contract to develop a parallel 35% design at WPAFB. It is expected that construction costs at WPAFB will exceed those at Brooks by 20-30% and require a down sizing of the proposed footprint for the DEBL II. Obtain Congressional approval to relocate the DEBL II to WPAFB

4. **RECOMMENDATIONS:** Direct HQ AFMC/CEC to proceed with a parallel 35% design at WPAFB pending a final decision on Brooks.

5. **COST ESTIMATE:** MILCON issue.

6. **IMPACT IF NOT RESOLVED:** Construction at WPAFB will be delayed. The AF will be required to construct two DEBL II facilities as suitable space does not exist at WPAFB.

Erik K. Vermulen, Col, USAF, BSC, DSN 240-2003, (as of 8 Mar 95)

FISCAL ISSUE #OE-14
(FACILITIES AND EQUIPMENT)
ELECTRON MICROSCOPE FACILITIES
AL/OE

1. ISSUE: Between AL/OEA/OEV and AMRD we have 5 electron microscopes at Brooks AFB. These units require siting in facilities with utility support (power, cooling water, gas), extra structural support for their mass and vibration isolation.

2. FACTS: The subject units were acquired by separate organizations and some later moved to Brooks. They are used for environmental analyses, general ultrastructural pathology support and specialized pathology of eye tissue. Continued collocation of these units could result in elimination of redundant capacity in that new technology now on order permits each of the missions to be performed on only two instruments. Currently, the Army's AMRD has not confirmed continued collocation with AL should AL relocate to WPAFB. Any existing site proposed for relocation of the electron microscopes would require manufactures site certification to obtain maintenance contracts and service. The certification would verify a vibration free environment, noise free power supply and satisfactory utility/structural support. Site surveys are estimated at $20K per instrument. Planning for the new facility should recognize the need for at least 3000sq ft of relatively high cost space (estimated at $250/sq ft) to accommodate this mission. The DEBL II laboratory already has an EM laboratory in its design; its construction at WPAFB could eliminate this issue

3. SOLUTION: Plan for development of a 3000sq ft EM laboratory at WPAFB. Plan for site surveys if existing facilities are designated at WPAFB for the EM Lab. Complete a make or buy decision package on EM activities.

4. COST ESTIMATE: $16,368 not including MILCON.

5. IMPACT IF NOT RESOLVED: Without an inhouse capacity all samples and specimens would be contracted. Costs for environmental samples are $120 each, three times that for pathology samples. Research efforts benefit from interactive use of EM techniques.

Erik K. Vermulen, Col, USAF, BSC, AL/OE, DSN 240-2003 (as of 8 Mar 95)

HUMAN SYSTEMS CENTER
PRODUCTS AND PROGRESS
"THERE ARE NO UNMANNED SYSTEMS"

HUMAN SYSTEMS CENTER PRODUCTS AND PROGRESS

"There Are No Unmanned Systems"

Issued by
HQ Human Systems Center (AFMC)
2510 Kennedy Circle, Suite 1, Brooks AFB, Texas 78235-5120

Designed and Produced by Melissa M. Tarleton
HQ HSC Planning, Requirements, and Engineering
Marketing Office
October 1993

Contents

Vision, Missions, Goals, and Guiding Principle

AIR FORCE VISION: *Air Force people building the world's most respected Air and Space Force ... Global Power and Reach for America.*

AIR FORCE MISSION: *To defend the United States through the control and exploitation of air and space.*

AFMC MISSION: *Through integrated management of research, development, test, acquisition, deliverance, and support, we advance and use technology to acquire and sustain superior systems in partnership with our customers. We perform continuous product and process improvement throughout the life cycle. As an integral part of the USAF Warfighting Team, we contribute to affordable combat superiority, readiness, and sustainability.* ***AFMC goals are:***

GOAL 1: SATISFY OUR CUSTOMERS' NEEDS--IN WAR AND PEACE

GOAL 2: ENABLE OUR PEOPLE TO EXCEL

GOAL 3: SUSTAIN TECHNOLOGICAL SUPERIORITY

GOAL 4: ENHANCE THE EXCELLENCE OF OUR BUSINESS PRACTICES

GOAL 5: OPERATE QUALITY INSTALLATIONS

HUMAN SYSTEMS CENTER GUIDING PRINCIPLE: *To make the human the heart of aerospace systems and operations.*

Quality Air Force: A leadership commitment and operating style that inspires trust, teamwork, and continuous improvement everywhere in the Air Force.

Commander's Assessment

Our bottom line concern at the Human Systems Center (HSC) is: **How well do we meet your human systems needs?**

In a very real sense, HSC's customers are virtually every man and woman in the USAF, and increasingly those throughout the Department of Defense. Now more than ever, with President Clinton's Defense Conversion initiatives and our technology transfer programs, HSC customers also include nondefense commercial industry.

Military or commercial, HSC products have one common denominator: they enable people to do their jobs ... better. While people have not changed biologically over the years, human-centered technologies have dramatically increased their ability to perform. This concept is clearly illustrated in athletics where world records seldom stand for more than a few years. Likewise, HSC's equipment, training products, and operational techniques make today's warfighters and support personnel far more capable than those of just a few years ago.

I invite you to tell us how we are doing. Use any of HSC's various feedback programs, the survey on the following page, or any method you choose to tell us how we can better satisfy your human-centered research and product needs. Our people solicit your inputs and are empowered to respond with programs, procedures, or other changes to improve HSC's product quality.

This brochure presents a cross section of HSC's human-centered technologies. These technologies will help keep America militarily and economically strong as we restructure our armed forces to meet unparalleled rapid changes in world military and economic environments. I encourage you to inquire about any HSC technologies which might have the potential to enhance your unit's mission performance. From your first inquiry for information, through HSC product delivery and support, our number one goal is to **meet your needs.**

George K Anderson

Major General George K. Anderson, USAF, MC
Commander, Human Systems Center

4 **Human Systems Center Technology Feedback Survey**

USE THIS FORM TO - -

- learn more about HSC technologies and how they can serve you;

and/or

- tell us how this publication meets your needs and how we can improve it.

---

1. Send me additional information about the following HSC technology area.
   (attach additional sheet if required)

2. How can HSC better serve your needs?
   (attach additional sheet if required)

3. Other comments!
   (attach additional sheet if required)

Use the following scale to rate your satisfaction with this publication.

1	2	3	4	5	6
Very Dissatisfied	Dissatisfied	Slightly Dissatisfied	Slightly Satisfied	Satisfied	Very Satisfied

4. The information presented (content, level of detail, etc.)? ☐
   Comment:

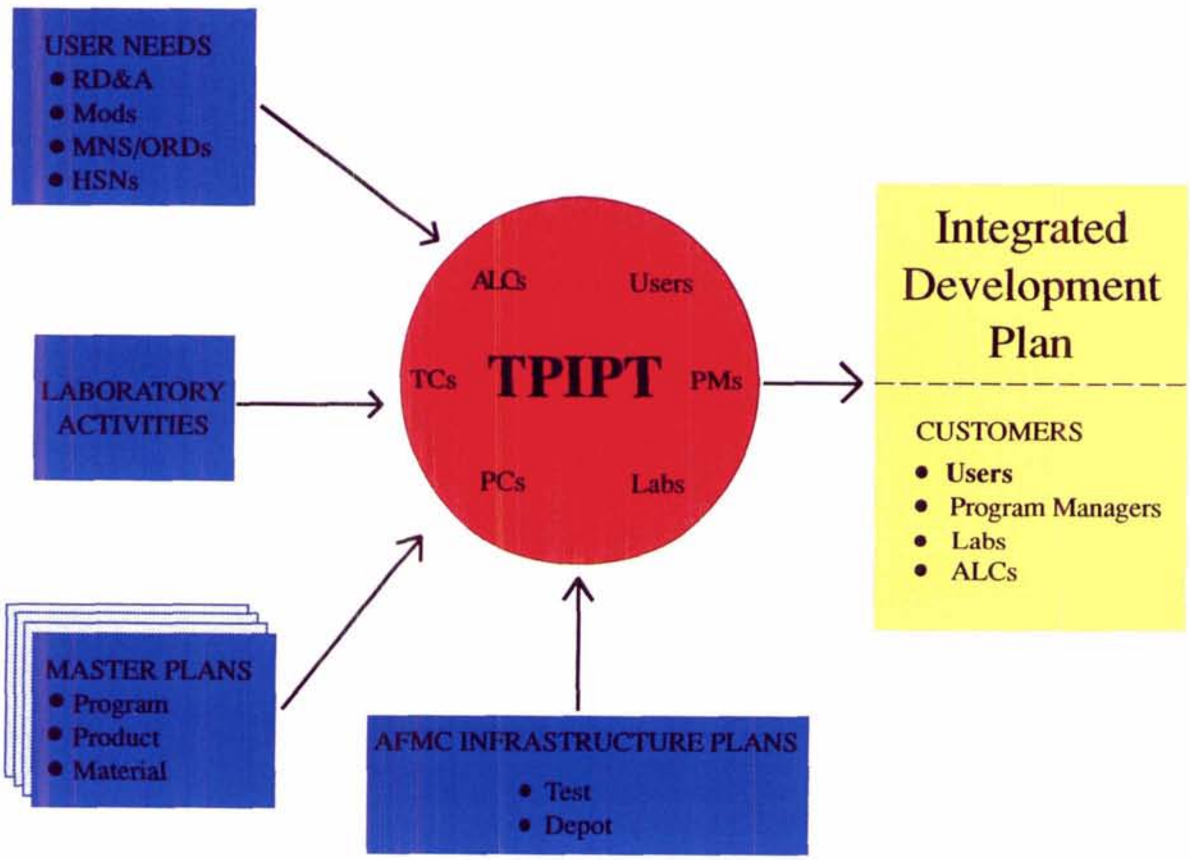
5. Layout design and readability? ☐
   Comment:

6. Meeting your initial information needs? ☐
   Comment:

Thank you! Please make a copy of this page and mail to: **HSC Commander, 2510 Kennedy Circle, Suite 1, Brooks AFB TX 78235-5120.** Alternatively, call **HSC Marketing, or a member of the Technical Planning Integrated Product Teams, at DSN 240-4460 or (210) 536-4460.**

Technical Planning Integrated Product Teams

A Technical Planning Integrated Product Team (TPIPT) is a network of key players from operational and support commands who use an integrated product team approach to plan and facilitate superior solutions to the users' operational needs. Human Systems Center has two TPIPTs--Human Systems Integration (HSI), and Environment, Safety, Occupational Health (ESOH)--whose job is to provide solution alternatives for our customers' human-system issues, needs, and requirements.



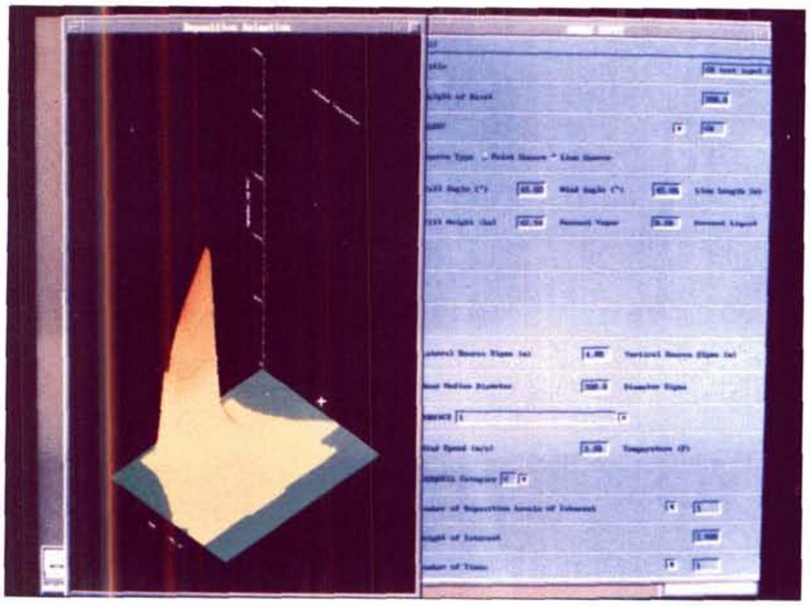
The TPIPTs, located in HSC/XRT, provide a convenient point of contact for all research, development, and acquisition activities at HSC ... call us today at: (210) 536-4460 [DSN 240].

Crew Systems

This Human Systems Center product area accomplishes research and develops, fields, and supports technology and systems to optimize human combat performance and survivability to ensure weapons systems configurations are compatible with human operator requirements.

Nuclear-Biological-Chemical Operability Assessment

Although the traditional chemical and biological warfare threat posed by the former Soviet Union has diminished with the Union's breakup, vulnerability to attack by Chemical Biological Warfare (CBW) has increased. The proliferation of CBW agents is well known and documented. Two major factors behind this explosive rate of spread are opportunity and cost. The opportunity to acquire or develop CBW agents has probably never been higher. The technology is well established and the skills needed are the same ones required for commercial pesticide production or operations requiring fermentation. Equipment for production is readily available and supplied on the open market. Compared to the cost for similar capability offered by nuclear or conventional forces, the price tag for these weapons is quite low.



Computer simulation predicts contamination levels over battlefield area.

Nuclear-Biological-Chemical (NBC) Operability Assessment begins with developing a scenario unique to the study objective. In coordination with the intelligence community, threat assets, including agents and delivery systems, are identified and modeled for selected regions of the globe. Potential US and allied target assets are described and the appropriate meteorological and terrain data gathered. A "red team" composed of threat analysts, operational experts, and simulation specialists is formed, along with a reasonable CBW attack scenario. Simulation models are selected and computer simulations conducted. Output from the simulations include agent challenge levels, contamination areas and persistence, casualty estimates, and predicted operational degradation. Analyses such as these are used to determine technology requirements and procedures for NBC defense, design standards, and realistic planning and training environmental projections.

Some recent products are: (1) "Post" Soviet Union CBW challenge-level assessments for NATO air bases; (2) analysis of the vulnerability of Naval surface assets to CBW attack; (3) definition of worst case, but reasonable challenge levels, for ground crew ensemble design specification; (4) assessment of US forces' vulnerability to CBW in Southwest Asia (after Desert Storm); and (5) publication of updated chemical warfare toxicity standards. Current efforts include: (1) analyzing CBW threat after agent filled warheads have been intercepted by ground based air defense; (2) modifying high altitude chemical and biological dissemination models; (3) developing revised biological toxicity standards; and (4) defining baseline biological warfare equipment capabilities and improvement areas, and developing initiatives to improve capability. Finally, active participation continues in the form of NATO sponsored working groups of experts, international task forces, and ad hoc committees, to identify the CBW challenge environment across a broad spectrum of scenarios.

OPR: AL/CFHA, (513) 255-8869 [DSN 785]

Chemical Defense Aircrew Ensemble

The current chemical defense ensemble encumbers the crewmember so much that normal tasks are difficult and fatiguing. Continuous protection must be provided during transit from a collective shelter to the aircraft, during flight operations, and then back to the collective shelter. To meet this need, a new Chemical Defense Aircrew Ensemble, referred to as the CWU-66/P, was developed.

F-16 pilot wearing both the CWU-66/P Aircrew Ensemble and a separate respiratory protection mask.

Of two candidate materials considered during development test and evaluation, one fabric using carbon sphere technology proved to be more effective in repelling (and insulating against) chemical agents. This option, however, suffered from problems with comfort and stiffness. The only acceptable option involved further development of an effective material with acceptable physical characteristics. This new fabric, 80 percent Nomex and 20 percent softer fiber, successfully completed initial operational test and evaluation in September 1989. Aircrews stationed at 12 USAF bases participated in this evaluation. Fielding of this item was expedited in response to Operation Desert Shield/Storm. Over 24,000 ensembles have been fielded to date. Follow-on procurement of approximately 40,000 additional units is ongoing

The new one-piece chemical defense ensemble replaces the current aircrew chemical defense ensemble (Nomex flight suit, charcoal undercoverall, and long cotton underwear). It is compatible with the crew station, environment control, and ejection systems of all fixed wing aircraft. It is washable, cooler, lighter weight, nonflammable, and vapor agent protective. With the new chemical defense ensemble, aircrew members can effectively operate their weapon systems confident that they are protected from chemical agents.

OPR: HSC/YAC, (210) 536-2675 [DSN 240]

Chemical Defense Ground Crew Ensemble

The new Chemical Defense Ground Crew Ensemble (GCE) program will produce and field a garment which maintains a high level of chemical protection while greatly improving the ability of wearers to perform their duties in a chemical environment. The GCE program will also develop a decontamination process which extends the combat utility of the new ensemble. The current garment, which protects ground crewmembers against the effects of chemical warfare agents, was originally developed by the Army. This protection, however, has come at the expense of comfort, resistance to heat stress, and durability of the material.

The Human Systems Program Office (HSC/YA) worked closely with the Sustained Operations Branch of the Crew Systems Directorate of Armstrong Laboratory (AL/CFTO), to investigate potential technologies which could be used in the acquisition of the GCE. Human subject testing by AL/CFTO indicates that certain approaches for the new garment can provide chemical protection without increasing heat stress more than 20 percent beyond that currently caused by the standard issue battle dress uniform. Additional testing funded by HSC/YAC indicates that the new suit will be launderable and may even be capable of being safely reused after chemical agent exposure.

OPR: HSC/YAC, (210) 536-2675 [DSN 240]

Even when life threatening chemicals are present, the ground crew will be able to perform their mission with minimal discomfort.

10

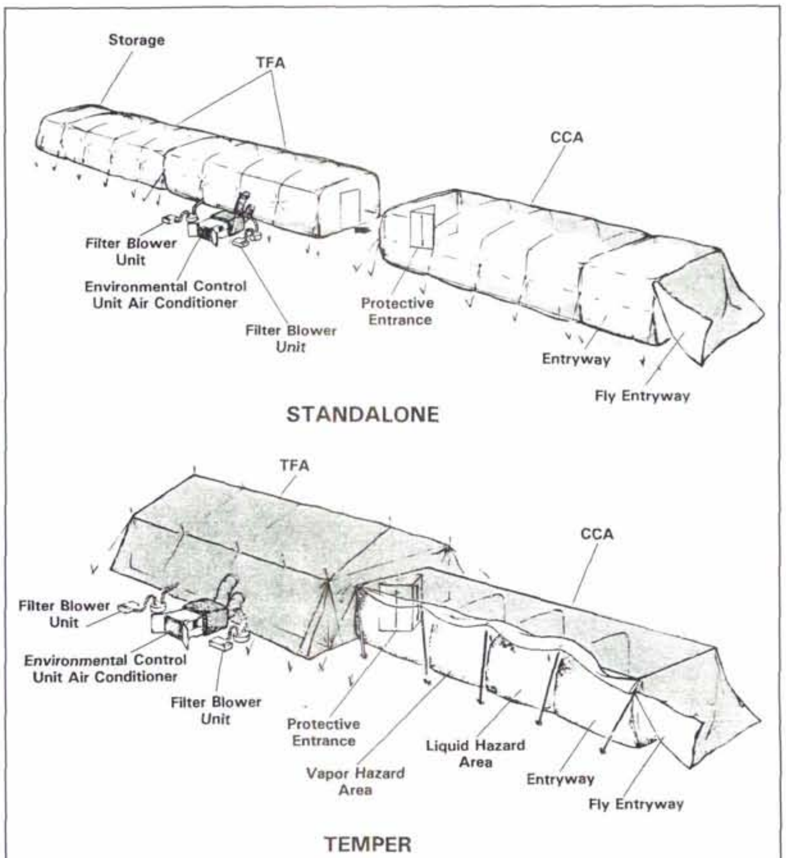
Transportable Collective Protection System

An operational need exists to provide the USAF with a chemical warfare (CW) collective protection capability. This capability is necessary to improve the USAF's ability to operate and sustain operations in a CW environment. In general, collective protection must provide a clean "shirt-sleeve" environment in which personnel can eat, drink, sleep, and perform duties which cannot be adequately performed while wearing individual protective equipment.

The Transportable Collective Protection System (TCPS) provides CW agent protection for mobility forces deploying to "bare bases." It can be transported by USAF cargo aircraft or by ship. The TCPS consists of a Contamination Control Area (CCA) and a host shelter modified for chemical protection using agent proof material and overpressure. Personnel process through the CCA, remove their chemical ensembles, and enter the bare base shelter to eat, sleep, or perform light work. The TCPS is available in three configurations: the tent, extendable, modular personnel (TEMPER) TCPS; the expandable shelter/container (ES/C) TCPS; or the stand-alone configuration in which two CCA units are combined to form the host shelter and a third CCA is used for processing.

United States Air Forces Europe is scheduled to become the first operational unit with the TCPS. Air Mobility Command, Air Force Special Operations Command, and Air Combat Command are also scheduled to receive TCPS units through FY97.

OPR: HSC/YAC, (210) 536-2675 [DSN 240]



A chemical liner is being installed in the "TEMPER" configuration of the TCPS tent during operational evaluation.

Wartime Medical Planning System

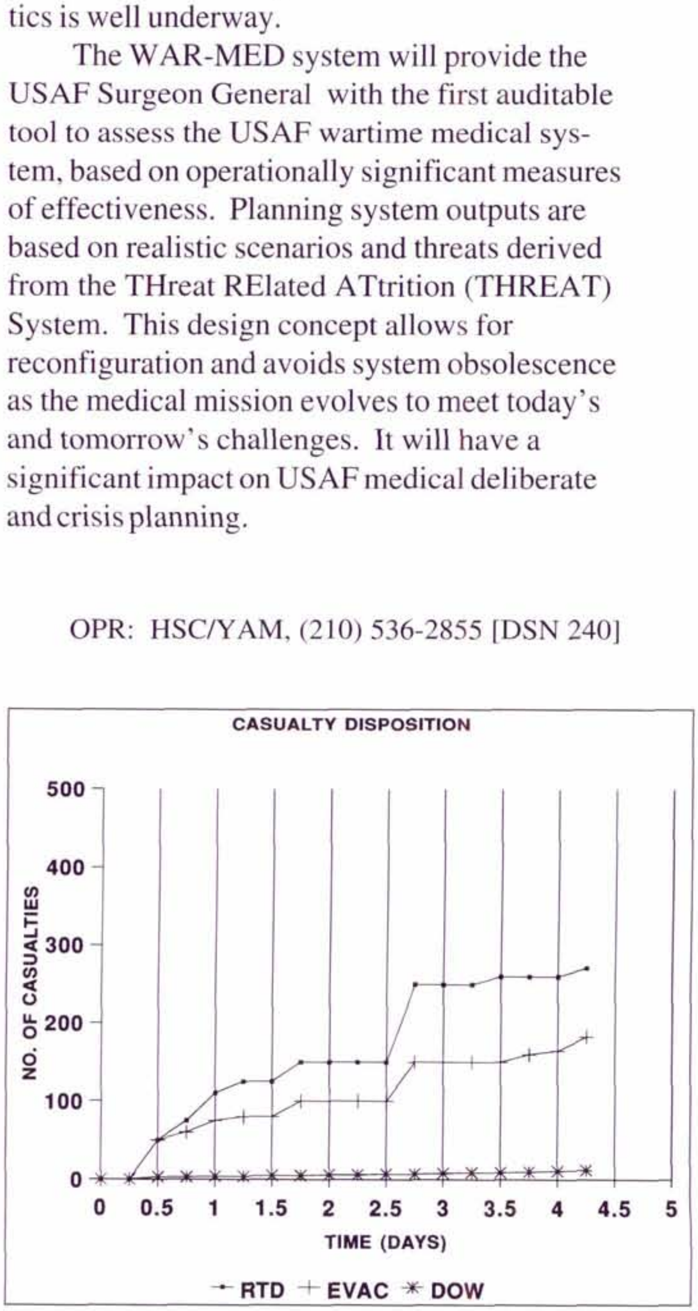
The mission of the USAF Medical Service is to rapidly expand, mobilize, and deploy medical support for USAF contingency operations. Varying threats and operational conditions worldwide make it extremely difficult to assess current capabilities and future requirements. USAF medical planners must have auditable databases and modeling tools for developing and assessing medical plans and support requirements if they are to optimize wartime medical assets for every site, within each theater of operations. The Wartime Medical (WAR-MED) Planning system has been identified as the Surgeon General's top priority development project.

The WAR-MED planning system is being developed to allow for the iterative analysis of integrated wartime medical systems. Straightforward data and graphical outputs will help the medical service to determine wartime manpower and resource allocations and to accomplish analyses of complex wartime medical plans and operations. Computer simulation and evaluation of service unique concepts of medical care, determining the impact of system or treatment changes, assessing the medical service's ability to return personnel to duty or to determine morbidity or mortality outcomes, based on assets employed, will be possible for the first time. This "tool" will assist in deliberate and crisis planning and in establishing realistic training requirements based on identifiable wartime tasks.

During the past year, the first and second echelon prototypes have been evaluated by the Human Systems Center, the USAF Surgeon General's Medical Readiness Division, and the USAF Medical Manpower Engineering Team. A third and fourth echelon model has reached the design phase of development and a concept phase for determining theater model characteristics is well underway.

The WAR-MED system will provide the USAF Surgeon General with the first auditable tool to assess the USAF wartime medical system, based on operationally significant measures of effectiveness. Planning system outputs are based on realistic scenarios and threats derived from the THreat RElated ATtrition (THREAT) System. This design concept allows for reconfiguration and avoids system obsolescence as the medical mission evolves to meet today's and tomorrow's challenges. It will have a significant impact on USAF medical deliberate and crisis planning.

OPR: HSC/YAM, (210) 536-2855 [DSN 240]



A typical computer product of the WAR-MED system will help the Surgeon General plan for wartime casualties.

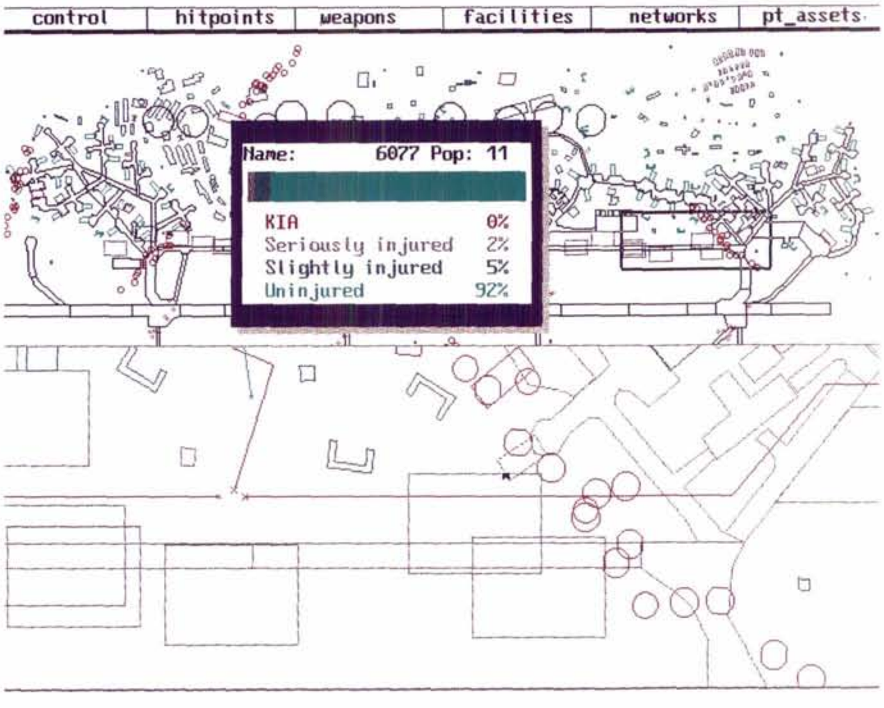
Threat Related Attrition System

The success or failure of a military operation depends on the ability to deploy and maintain sufficient combat force. Understanding the causes and circumstances which result in losing deployed military personnel will allow accurate planning of personnel and logistical requirements, and can lead to strategies for prevention and mitigation. The limitations to such predictions are insufficient information concerning attrition factors and a lack of credible modeling tools to utilize this information. Other DOD agencies have decision-support models; however, these are not satisfactory as they are constructed to support service-specific concepts of operations or are based on notional weapons' effects and human tolerance algorithms. The THreat RElated ATtrition (THREAT) system seeks to produce this information relative to USAF needs in providing methodologies for its analysis and software for its application.

Full-scale weapons' effects studies have been conducted with general purpose bombs, fuel air explosives, tactical air-to-surface missiles, and precision guided munitions. The results of these studies have been incorporated into three models: unprotected, temporary, and permanent facilities. A prototype theater-level model was completed and exercised to produce attrition rates for the Korean theater. The Disease and Non-Battle Injury module was also completed and is now undergoing test and evaluation. During Operation Desert Shield/Storm, the THREAT system was used to conduct a special study for HQ USAF/XO to assess potential noncombatant casualties resulting from the air campaign.

The THREAT system will directly support USAF manpower, personnel, medical, operational, and logistical planners with deliberate and crisis planning. THREAT estimations, based on actual scenarios and human tolerance to weapons' effects, will provide an unprecedented reality to these plans.

OPR: HSC/YAM,
(210) 536-2855
[DSN 240]



THREAT Installation-level graphical output.

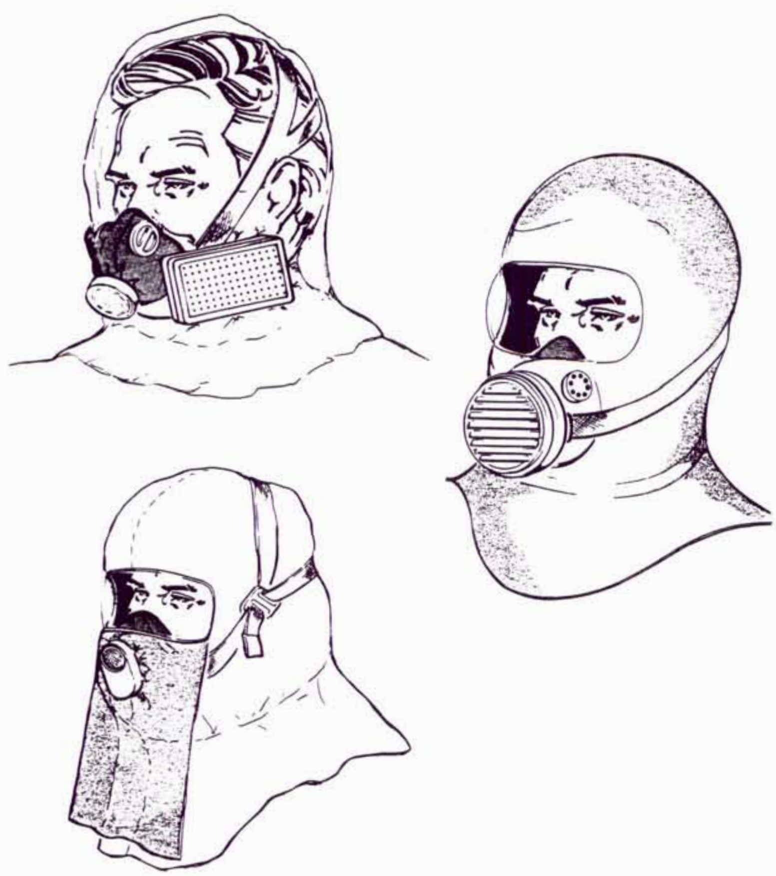
Disposable Eye/Respiratory Protection Program

The need for sustained operations in a chemical weapon environment led to a requirement for the Disposable Eye/Respiratory Protection (DERP) program. The DERP will consist of a hood with a filter to cleanse contaminated air, providing the wearer two hours protection against liquid, vapor, and aerosol agents. It will be sufficiently compact that it may fit into the pocket of the ground crew ensemble, the flight suit, and the anti-G suit. The DERP will be a low cost item; the goal is $15 per unit, allowing the mask to be disposed of after each use.

The DERP will be used in a contaminated environment and in a chemically protective shelter when the shelter filtration fails or when emergency evacuation of the shelter is required. In addition, other needs may exist for the emergency mask; these might include supporting aircrews deploying to high threat areas or supporting medical care providers and patients in certain instances.

Protection provided by the DERP mask will support the USAF's mission when personnel are unable to access their standard chemically protective mask/ respirator. The payoff will be inexpensive protection for personnel, reducing casualties, and enabling the USAF to maintain a high sortie generation rate under adverse conditions. The ongoing development program will support the award of a production contract in 1995.

OPR: HSC/YAC,
(210) 536-2675
[DSN 240]



Three prototypes are currently being considered.

Aircrew Eye/Respiratory Protection System

The Aircrew Eye/Respiratory Protection (AERP) provides for an improved chemical defense capability for aircrew members. The AERP, referred to as the MBU-19/P, was developed to meet Air Combat Command, Air Mobility Command, and Air Force Special Operations Command requirements. This under-the-helmet system enshrouds a standard MBU-12/P oxygen mask with impermeable material. In addition to the mask/hood portion, the AERP system has a communications system and a blower unit. Upgrades of this system include Valsalva and drinking capabilities plus both tear-away and automated antidrown features for parachute landings in water. Aircrew responses to the AERP system have been positive.

Initial production of the AERP system was initiated in August 1990, followed by full rate production supporting Operation Desert Shield/ Storm. Initial production deliveries started in January 1991 with over 10,000 currently in the USAF inventory. Flight testing in all USAF aircraft, with the exception of development test and evaluation, and operational test and evaluation in the B-1, has been completed. Aircraft modifications to support AERP system integration are in progress at the Ogden, Warner-Robins, and Oklahoma City Air Logistics Centers.

Follow-on production will continue through the year 2001. AERP will ensure crewmembers are protected from chemical agents while maintaining the comfort, mobility, and function necessary to fly all DOD aircraft.

OPR: HSC/YAC and HSC/YAD, (210) 536-2675 [DSN 240] and (210) 925-3756 [DSN 945]

An F-16 pilot prepares for a mission while wearing Aircrew Eye/Respiratory Protection.

Personal Transatmospheric Protection System

As the USAF focuses its mission on projecting global reach--global power, HSC has started to include programs to support manned spaceflight in transatmospheric vehicles. The current high altitude platform, the U-2, utilizes a backup, unpressurized suit which inflates in the event of cabin depressurization. The suit, which is donned prior to flight, is extremely bulky. The crewmember has limited mobility and dexterity while wearing the suit, even when it is unpressurized, and the suit's inadequate ventilation leads to heat stress. These crews conduct long duration flights which, when combined with the suit's shortcomings, result in extreme fatigue and degraded performance.

The Personal Transatmospheric Protective System (PTAPS) program, started in FY92, is a critical experiment for developing and demonstrating improved technology to be incorporated into a full pressure suit. This technology will be used in 21st Century high altitude and transatmospheric vehicles. The approach is to evaluate existing and near-term technology against mission requirements of the U-2 and National AeroSpace Plane (NASP)/NASP Derived Vehicles to determine all the deficiencies in the current suit.

Currently, work is being done on improved gloves and increased mobility joints. The goal is to create a more comfortable and usable suit, whether pressurized or not. The new gloves will offer improved tactility and will be designed to allow the crew to manipulate equipment more easily. The suit will also allow the crew to breathe oxygen en route, rather than prebreathe on the ground. This will reduce crew fatigue and the chance of decompression sickness. Future focus will include an improved helmet, better integration with altitude protection, and studies to decrease thermal stress.

OPR: AL/CFTS, (210) 536-2937 [DSN 240]

Advanced pressure suit technology developments will improve mobility and dexterity, while operating at higher pressures.

Aeromedical Evacuation Equipment Development

Medical equipment must be able to transit the entire casualty evacuation system. The environment onboard aircraft is considerably more hostile to equipment and patients than that of ground based hospitals. Equipment may be subjected to wide temperature changes, rapid changes in air pressure, and intense vibrations, along with unusual power supply problems and limitations. Additionally, demonstrations must prove that medical equipment proposed for air evacuation missions does not interfere with normal functioning of aircraft systems.

A variety of aeromedical items have been evaluated for customers across DOD. The equipment tested has been proposed for use by medical care providers for all phases of casualty care, with primary emphasis on air transport. Not only have off-the-shelf medical equipment items been evaluated, but also developmental prototypes and the test equipment itself. Ventilators, cardiac monitors, suction equipment, intravenous infusion pumps, and neonatal transport incubators are but a few of the many items which have been tested during the past year. Recent developments in the area of molecular sieve oxygen generation and ventilator control logic show potential for merging these technologies to provide unlimited medical quality oxygen on aeromedical evacuation airframes. This will significantly enhance the patient care capabilities of strategic aeromedical evacuation.

Air Mobility Command (AMC) has been tasked by DOD to transport sick and injured personnel during both peacetime and wartime. To provide the highest standard of care, AMC relies on state-of-the-art medical equipment which has been tested and found to be safe and reliable for use in aeromedical aircraft. HSC's Armstrong Laboratory is the only DOD laboratory which evaluates medical equipment to meet this standard. Benefits to the USAF are an increased inventory of medical equipment available to meet specific user needs, and the assurance that the equipment is safe for treating and monitoring acutely ill patients onboard USAF aircraft.

OPR: AL/CFTS, (210) 536-2937
[DSN 240]

A vibration study is conducted on a C-9A to validate test criteria for air evacuation medical equipment.

Molecular Sieve Oxygen Generating System

The B-1B Molecular Sieve Oxygen Generating System (MSOGS) separates oxygen from engine bleed air to produce a clean, oxygen enriched breathing gas for the aircrew. Oxygen is separated by adsorbing the nitrogen component of the bleed air onto a synthetic, aluminosilicate zeolite molecular sieve. The nitrogen is subsequently vented overboard. The B-1B MSOGS is presently being recertified since the type of molecular sieve will change in the near future, in that the original molecular sieve will no longer be manufactured. The Armstrong Laboratory (AL), working in cooperation with the Aircraft Program Office, the air logistics centers, and the aircraft contractor, is performing flight qualification testing and man-rating of the modified B-1B system. This testing will ensure the new system meets the aircraft specifications, and hence, produces acceptable oxygen concentration levels during all mission profiles.

This newly patented 99 percent MSOGS technology will be transitioned to the civilian sector. Near term technology transition plans include: licensing to a commercial company, initiating a Cooperative Research and Development Agreement to further develop this technology, and a Joint Research and Development Program with the US Navy to incorporate this technology in an AV-8B Harrier ground support unit. The current MSOGS is limited to generating oxygen concentrations of 93-95 percent, even under ideal conditions. The 99 percent MSOGS technology is capable of producing oxygen concentrations of up to 99.7 percent, satisfying the requirements of Military Oxygen Specification MIL-O-27210. This novel technology will represent the next generation of aircraft MSOGS systems.

AL scientists are pushing state-of-the-art MSOGS technology by advancing technologies which permit storage of large quantities of high-purity oxygen and improve MSOGS performance. Advances in miniature turbomachines for oxygen liquefaction will allow new systems to both generate and liquefy oxygen in a self-contained process. This liquefied oxygen will be used as a source of backup oxygen during the mission or for medical oxygen during aeromedical evacuation. MSOGS expert systems currently in development will revolutionize methods for improving MSOGS performance and will reduce engine bleed air consumption. These advances in MSOGS technology support AL's ultimate goal of delivering the best MSOGS technology to our users--the best aircrews in the world.

OPR: AL/CFTS, (210) 536-3361 [DSN 240]

Recertification of the B-1B MSOGS.

Thermal Flashblindness Protection Device System

The Thermal Flashblindness Protection Device (TFPD) system is designed to protect the aircrew member's eyes from flashblindness and retinal burns caused by the radiation from single or multiple nuclear flash events. Formal qualification testing on this off-the-shelf device is pending establishment of a clear use requirement. All test data collected will be analyzed, interpreted, and retained for potential future use. The TFPD utilizes state-of-the-art lanthanum-modified lead zirconate titanate (PLZT) similar to the lens in the current USAF flashblindness goggles, the EEU-2/P system. When the photo sensor senses the ambient light, reaching the level of a nuclear flash event, voltage is applied across the lenses causing them to become opaque. While opaque, the lenses shield the eyes from harmful light and radiation. Once the ambient light falls to a safe level, the lenses become clear again, restoring the crewmember's normal vision.

The system is small and lightweight, weighing approximately 5 ounces. Unlike the current inventory system, the TFPD has a self-contained power supply (a 12-volt battery) and fits under the visors of all standard issue flight helmets. It will be a welcome change from the bulky helmet-mounted EEU-2/P goggles.

OPR: HSC/YAS, (210) 536-2854 [DSN 240]

The TFPD system is small, lightweight, and fits underneath the standard issue helmet.

Laser Protection and Personnel Susceptibility

Optical technologies (e.g., lasers, optical munitions) could alter the air-land battlefield and enhance peacetime security operations. Third World nations could obtain low cost man-portable lasers for use as air defense weapons capable of defeating aircrew vision and aircraft sensors. Less than lethal effects could reduce wartime collateral damage or increase options to security forces for peacetime operations.

Exploratory and advanced development programs are underway to improve the modeling and simulation of personnel susceptibility and to transition new eye protection devices. The goals are to determine the vulnerability of personnel to optical technologies and develop protection devices suitable for many military operations. The protection program uses both mature technologies available from industry and advanced materials transitioned by the Wright Laboratory to develop devices that maximize protection and minimize human factors' limitations.

Prototype laser visors are being developed in the Advanced Aircrew Vision Protection (AAVP) program. The FV-6, developed rapidly for Operation Desert Shield/Storm, was the first multiline protection against invisible laser threats approved by HQ Air Combat Command for nighttime operations in the A-10 and F-16. The FV-6 is being modified for use in the F-15E. Aircrew concerns about compatibility with cockpit instruments, runway lights, and exterior aircraft lights, as well as threat identification, are being addressed through joint development, test, and evaluation at Edwards and Luke AFBs. Other AAVP program goals are to reduce the cost and maintenance requirements of laser visors, and to develop combination sun-laser visors. The modified FV-6 will be suitable for use by Special Operations Forces, and security, medical, and maintenance personnel.

Estimates of personnel susceptibility to optical devices and threats contribute to the requirements definition and vulnerability assessment processes. Personnel Effects Models (PEM) are being developed to enhance the reliability and accuracy of the estimates. Manned simulators have been used to assess the PEMs, such as was done during the Counter Target Acquisition Study (CTAS) II. CTAS employed networked fixed-wing simulators, in force-on-force, free play exercises, to determine the vulnerabilities of aircrews to laser air defense systems. By simulating the visual effects of laser exposure, CTAS enabled man-in-the-loop assessment of the military implications of laser weapons—without exposing personnel.

OPR: AL/OEO, (210) 536-3622 [DSN 240]

F-15E aircrew members with the 555 Fighter Squadron at Luke AFB, Arizona test new laser eye protection.

Combined Advanced Technology Enhanced Design G-Ensemble

The high-G maneuvers made possible by modern fighter aircraft can exceed the physiological protection afforded by traditional life support equipment and training. The combat crewmember must therefore restrict the aircraft's maneuvers to levels below the aircraft's full performance capabilities or risk suffering severe fatigue and possible unconsciousness. This fatigue can limit sortie surge capability, affecting flight safety and overall performance of the pilot.

In 1988, Tactical Air Command requested that a system be developed to provide F-15 and F-16 pilots enhanced protection from the negative effects of acceleration by incorporating a pressure breathing apparatus in conjunction with a currently fielded anti-G suit. This system is called Combined Advanced Technology Enhanced Design G-Ensemble (COMBAT EDGE). It uses a new oxygen mask, a counter pressure vest, a helmet modification kit, a new oxygen regulator, G-valve, integrated terminal block, and pressure sensor line for the aircraft.

Equipped with COMBAT EDGE, pilots can tolerate greater levels of "G" force.

COMBAT EDGE was certified Safe-to-Fly in 1990 following man-rating testing by Armstrong Laboratory. Development test and evaluation and operational test and evaluation flight tests in F-16 and F-15 aircraft were successfully completed in 1990 and 1991, respectively. Full rate production has commenced, and many F-16 units have already been equipped with this fatigue-fighting life support system.

OPR: HSC/YAS, (210) 536-2854 [DSN 240]

Advanced Technology Anti-G Suit

The anti-G suit used by USAF high-performance aircraft pilots represents technology dating back to the 1940's. The protective value of the current suit cannot match the high-Gz onset rate and sustained acceleration capabilities of modern aircraft. The Advanced Technology Anti-G Suit (ATAGS), developed by the Armstrong Laboratory, is intended to replace the currently fielded anti-G suit. No cockpit modifications are required for the system. The ATAGS can be used with or without Combined Advanced Technology Enhanced Design G-Ensemble (COMBAT EDGE). The ATAGS is a full coverage uniform pressure system designed to more effectively prevent pooling of blood in the lower body, one of the causes of the adverse effects of sustained acceleration. Full coverage means that counterpressure covers almost the entire lower body including the feet. Uniform pressure is achieved by surrounding the legs with pressure bladders rather than using smaller bladders and stretched fabric.

ATAGS reduces aircrew fatigue by decreasing the effort required for the anti-G straining maneuver. As compared to the existing suit, the ATAGS offers a 60 percent improvement in endurance during high acceleration—an indication of reduction in fatigue. When combined with COMBAT EDGE, a 450 percent improvement in endurance is seen. By reducing fatigue, fighter pilots can sustain performance during multiple air engagements and multiple sorties. During the past year the ATAGS has been significantly modified to improve comfort and operational acceptability. A series of man-rating evaluations (altitude, cockpit and equipment integration, and acceleration) were completed in preparation for an Early Operational Demonstration in cooperation with Air Combat Command. This demonstration consisted of a series of flight tests to collect using community comments before completing systems development. The ATAGS was successfully flown on more than 37 sorties in the F-15 at Langley AFB VA. The evaluation is continuing at Hill AFB UT in the F-16. Pilots using the ATAGS have been very enthusiastic about the tactical advantage offered by the suit. Transition to the Human Systems Program Office began in 1993.

The ATAGS addresses the most pressing problems associated with high-acceleration flight—performance compromise and G-induced loss of consciousness. By providing the crewmember with superior life support systems such as ATAGS, combat capabilities will improve while loss of lives and aircraft will decrease.

OPR: AL/CFTF, (210) 536-3811 [DSN 240]

ATAGS produces increased pilot tolerance to the high-G environment.

Aircrew Life Support

The Armstrong Laboratory (AL) Crew Technology Division is heavily involved in development programs for advanced aircrew life support and protective equipment. Recent advances in aircraft operational demands and capabilities have necessitated adding protective equipment, resulting in an increasing burden on the aircrews. In addition to the traditional flight gear and life support equipment for altitude, acceleration, hearing protection, and egress and survival, the aircrews are now being laden with systems for chemical/biological and enhanced acceleration protection, passive antidrown capability, helmet-mounted electro optical devices, and laser/flashblindness protection. The Cockpit and Equipment Integration Laboratory (CEIL) of the AL Crew Systems Division has been providing essential input concerning possible integration problems and proposed solutions.

Test subject conducting water immersion tests wearing an experimental anti-G suit and full complement of aircrew personal protective equipment.

Collocated with the USAF Life Support Systems 6.3 Advanced Development Program Office, and associated with the Human Systems Program Office at Brooks AFB TX the Cockpit and Equipment Integration Laboratory has conducted tests and evaluations on several new systems. As an integral part of the Advanced Technology Anti-G Suit Development program, the CEIL was instrumental in identifying critical design problems early, which limited emergency egress by larger crewmembers. Due to the involvement of cockpit integration early in the program, needed design changes can be accomplished with minimal impact on schedule and costs, and will result in increased user acceptance and reduced risk for the 6.4 Engineering Development program. The CEIL also tested an early design of an integrated positive pressure for G and chemical protective systems, a proposed active noise reduction system, a hose modification to the Aircrew Eye/Respiratory Protection hood/mask, and two versions of modified masks for the Combined Advanced Technology Enhanced Design G-Ensemble. Evaluation of equipment within the CEIL allows problems to be identified prior to costly flight trials.

As new systems are proposed and advances made in future aircraft capabilities, emphasis on equipment integration and design optimization will continue to be a basic element of the AL Crew Technology Division's mission. Future direction focuses on alleviating the burden on aircrew members by developing novel approaches to combined protective capabilities and reducing the volume of equipment to be worn.

OPR: AL/CFTS, (210) 536-3361 [DSN 240]

Life Support and Chemical Defense Sustainment

Life Support was the USAF's "first" cradle-to-grave single manager concept to be approved by the Secretary of the Air Force for Acquisition under the Integrated Weapon System Management concept. The single manager, HSC/YA, through the Kelly AFB System Support Manager, continues to provide first-class real time field support to operational USAF units worldwide. With responsibility for all USAF life support equipment, parachute and egress equipment, and fixed seat safety restraints in cargo aircraft, the division successfully maintained the war readiness posture of all flying units. Besides the active USAF commands which depend on the over 7,000 stock issue items that YA provides, the US Army, US Navy, NASA, Department of Transportation (forest fire fighters), and over 70 different foreign countries that purchase life support military hardware from the US Government are supported.

With annual expenditures of over $50 million, an average month of acquisition activity typically includes awarding approximately 40 contracts.

The HSC/YA division is composed of five integrated product teams (IPT): Egress, Survival Equipment, Fixed Seats, Mishap Investigation, and Chemical Defense and Electronics. Each team has assigned logisticians, equipment specialists, item managers, engineers, and contracting officers. The recent conversion to IPTs has proven invaluable, since manpower has been reduced by defense downsizing.

The "single manager" leadership style of development and sustainment has already identified better methods to support fielded equipment like COMBAT EDGE and AERP. This "up front and early" interaction significantly reduces the life cycle cost of both products. Additionally, close working relationships laid the groundwork for the future acquisition of solid and reliable systems for all of our customers.

OPR: HSC/YAD, (210) 925-3756 [DSN 945]

Supporting flight operations requires that over 7,000 items of life support gear be maintained, improved, and available to the airmen in the field.

High Altitude Protection Research Program

Crew operations in high altitude aircraft and space vehicles require protective measures to overcome the physiological hazards of the hypobaric environment. Goals of the Armstrong Laboratory's High Altitude Protection Research program are aimed at defining safe exposure limits and supporting development of crew protection equipment and procedures. The research program is currently focused in three areas: pressure breathing, decompression sickness (DCS), and effects of exposure to extreme altitude (ebullism).

Altitude research is used to quantify DCS risk for high altitude and spaceflight.

A recent survey of U-2 pilots indicates that 60 percent have experienced DCS in flight. Altitude chamber simulations show a 73 percent incidence of DCS for a typical U-2 flight profile. Although DCS risk can be reduced by prebreathing 100 percent oxygen prior to takeoff, requirements for rapid sortie generation and extended missions limit the amount of time available for prebreathing. To provide improved DCS protection in these situations, the concept of in-flight denitrogenation was experimentally demonstrated and recently transitioned to Air Combat Command in support of the high altitude reconnaissance mission. This concept can also provide significant improvements in crew protection during high altitude airdrop missions. A computer based decompression model is being developed to standardize DCS risk assessment. A first generation model has been demonstrated and continued development, including verification and testing, is underway. Very little data concerning DCS limits for exposures above 30,000 feet are available; experimental studies are planned to fill this critical void. At these altitudes, positive pressure breathing is required for hypoxia protection. The physiological effects of this procedure on pulmonary functions are being investigated.

The High Altitude Protection Research Program provides a critical part of the technology base necessary to successfully accomplish the USAF mission of defending the US through control and exploitation of air and space.

The results of these research efforts are transitioned to operational commands in the USAF and NATO, as well as to Air Force Materiel Command System Program Offices involved with life support equipment and the development of future high altitude aircraft and transatmospheric vehicles. Results of this research are also transitioned to NASA in support of manned space programs.

OPR: AL/CFTS, (210) 536-3545 [DSN 240]

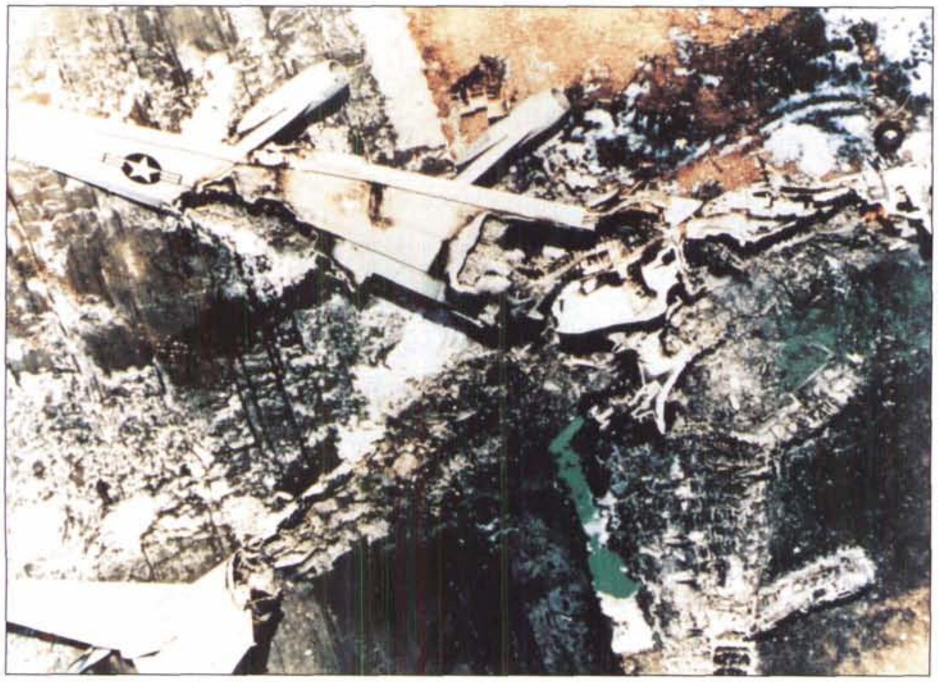
Aircraft Mishap Prevention System

Human factors contribute to more than two-thirds of the USAF's most serious class of mishaps. As a consequence, the annual costs are estimated to exceed $900 million with a loss of human life approaching 60 aircrew fatalities. The Air Force Safety Agency (AFSA) and mishap boards document human factors which lead to mishaps, but the exact significance and correlation of any specific factor in a mishap remain difficult to analyze. The Aircraft Mishap Prevention (AMP) system will be an automated tool designed to support the AFSA staff in collecting and analyzing human factors data related to aviation mishaps.

The AMP system is a distributed computer network which consists of two file servers, 25 workstations, a scanner, and associated peripherals. It will provide continuity and corporate memory by making human factors information readily available in a centralized repository. The AFSA analysts will use the AMP system to perform proactive analyses which solve difficult human factors problems and reduce aircraft mishaps by suggesting more effective preventive measures.

The AMP system will demonstrate an initial operational capability by FY94. When fielded, it will allow AFSA a more timely and comprehensive understanding of human factors in aircraft mishaps. It will have the flexibility and growth potential to accommodate future technology. By conservative estimates, the AMP system has the potential to reduce the aircraft mishap rate by 10 percent over a five-year period. The lives that will be saved are invaluable.

OPR: HSC/YAR, (210) 536-2477 [DSN 240]



Aircraft mishaps due to human factors can be significantly reduced, saving lives and resources.

Universal Water Activated Release System

Ejection from aircraft over water introduces additional hazards to the crewmember which are not primary concerns when ejecting over land. If the individual is unconscious or incapacitated, or if there are high surface winds or rough seas, the risk of drowning is significant. The current automatic parachute release system (AFSEAWARS) prevents the crewmember from being dragged through the high seas, but it is not compatible with the Capewell parachute release system used in the B-52 and KC-135. In addition, the AFSEAWARS failed to satisfy its reliability requirements, and its bulky design bruises crewmembers' arms. A follow-on system, the Universal Water Activated Release System (UWARS), alleviates these situations by providing a lighter, smaller, in-line device with increased reliability that is compatible with the Capewell, Frost, and Koch parachute release systems.

Compared to the AFSEAWARS, the new UWARS is significantly more streamlined and comfortable to wear.

UWARS incorporates the following technical improvements using 1980s and 1990's technologies: a semiconductor bridge initiator as the electro-explosive device; a printed circuit board; surface mount components; and a built-in test for battery voltage, polarity, and circuit continuity. UWARS requires low maintenance primarily limited to replacement of the batteries which will be stock listed items.

The UWARS development contract was awarded by the Human Systems Program Office in September 1991, the Critical Design Review was conducted in July 1992, and Development, Test and Evaluation (DT&E) started in February 1993. Operational Test & Evaluation and an option for production will follow DT&E.

OPR: HSC/YAS, (210) 536-2854 [DSN 240]

Advanced Recovery Sequencer

A recent adverse-flight conditions mishap of an A-10 aircraft outside the performance capability of the current ACES II ejection seat resulted in insufficient altitude for the parachute to fully open. Computer simulation of the mishap showed earlier deployment of the parachute may have saved the pilot. Consequently, the Accident Board recommended that a development program be initiated to investigate earlier parachute deployment at low altitude and moderate speed conditions.

The Advanced Recovery Sequencer (ARS) uses digital electronics coupled with electronic pressure transducers to more accurately determine the altitude and airspeed at the time of ejection. This information is fed to the sequencer and sets off a sequence of events to stabilize the seat once it has departed the aircraft. The ARS consists of two modules: the power module contains all the items necessary to provide power to the sequencer and the logic module contains all of the microprocessors and memory chips needed to process and store information. A major feature of the ARS is its ability to store the exact pressures and ejection times that existed at the time of ejection.

The ARS has improved maintainability. Intermediate- and depot-level test capability is built into the ARS. The power module and the electrical lines are replaceable at the intermediate level. The life of the ARS is 22.5 years, which represents a significant improvement in efforts to reduce life cycle costs of these types of components.

The ARS is fully qualified and is now scheduled for spare procurement for A-10, F-15, and F-16 aircraft; furthermore, it will be incorporated in the production seat for future F-16 aircraft. The ARS has even been identified as a baseline configuration requirement for the F-22 aircraft, and it represents the USAF's fervent pursuit of better and smarter ways to help save the lives of its aircrews.

OPR: HSC/YAD, (210) 925-3756 [DSN 945]

The ACES II seat lands at Holloman AFB, NM after a successful ejection test of the recently installed "Advanced Recovery Sequencer." Twenty-two seat ejections were accomplished for qualification of the seat with this critical new component.

Life Sciences Equipment Laboratory

The Life Support Mishap Investigation Lab is operated by the Human Systems Program Office's Life Support System Support Manager at Kelly AFB TX. USAF mishaps are investigated quickly, and technical reports and corrective actions are recommended. Board presidents, flight surgeons, and life support officers assigned to the mishap boards interface daily during active investigations. Annual training is provided for over 200 life support officers, life support superintendents and egress supervisors, thereby ensuring this core group can perform the first-level field investigations. The Mishap Investigation Lab ensures that one researcher is always available 24 hours a day to provide mishap boards with requested field expertise.

The lab maintains data and accident investigation histories (in accordance with AFR 110-14) to identify trends which could lead to future injuries or fatalities. All such deficiencies are immediately worked by the System Support Manager for correction via Technical Change Orders, equipment modifications, or recommended operational limitations.

The lab was established in 1983 and processes approximately 25 Class A mishaps annually. Extensive test procedures are developed to measure and interpret the various exhibits sent in for analysis. The full spectrum of metallurgical, dimensional, nondestructive inspection, fabric, chemical, and physical labs at Kelly AFB TX are fully available and easily energized to support these tests.

Recent assistance has been provided to the Joint Task Force for Full Accounting (JTFFA). This investigating team is charged with determining the status of missing in action in Vietnam. Several cases of national interest have been validated by the Mishap Lab's scientific methods applied to the remnants of life support equipment which have been discovered and returned for analysis. These analyses provided critical information supporting the JTFFA's cases and ensured that the necessary closure data could provide meaningful answers to concerned families.

OPR: HSC/YAD, (210) 925-3756 [DSN 945]

Discovering clues to the cause of any aircraft mishap often requires the expertise of the Life Sciences Equipment Lab.

Aircrew Spectacles

In 1990, a Human Systems Center study determined that 27.4 percent of USAF pilots and 51.5 percent of Navigators/ Weapon Systems Operators were spectacle wearers. HSC is responsible for developing optical devices for correction of aircrew vision and for integrating these devices with life support systems. The present aircrew spectacle frame, the HGU-4/P has been in the USAF inventory since 1958. Although the HGU-4/P has served well, there have been several significant advances in spectacle frame materials and design. The Armstrong Laboratory Ophthalmology Branch of the Clinical Sciences Division (AL/AOCO) was asked to find a sturdier frame that would be compatible with most life support systems and would have a wider field of view.

The attributes of the "ideal" aircrew spectacle frame were gleaned from a 1991 spectacle frame field study. An off-the-shelf prototype spectacle frame that possessed most of these attributes was chosen for further testing and evaluation. The new prototype aircrew spectacle frame meets ANSI Z-87.1 safety standards and has a flat black finish to reduce reflections and glint. It also has silicone nose pads for comfort and stability on the face when sweating or under G-acceleration. The larger eyesize of the new frame gives a wider field of view than the HGU-4/P. However, the total horizontal measurement of the new frame is less than that of the HGU-4/P which should make it more compatible with most life support systems. This was accomplished with a new wraparound hinge design.

AL/AOCO and the Air Warfare Center (AWC/TCO) at Eglin AFB FL will jointly field test the new aircrew spectacle frame. The frame will be evaluated for compatibility with life support systems, comfort (hot spots, weight, fit), stability on the face during G-load, acceptance by aircrew members, durability, reflections, field of view (checking six), and ease of adjustment by optometry technicians. Upon successful completion of testing and certification by the AWC, the aircrew spectacle frame will be recommended to the HQ USAF Surgeon General as the tri-service replacement for the HGU-4/P.

OPR: AL/AO, (210) 536-2745 [DSN 240]

New aircrew spectacles provide greater tensile strength and better field of view.

Infrared Voice Communications

Acoustic noise poses a serious problem for effective voice communications in operational environments such as chemical defense, aircraft maintenance, aircraft quick turnaround, cargo loadmaster, and emergency medical care. An Infrared (IR) voice communications system is being developed to provide personnel who perform tasks in these environments with the high level of intelligibility required for mission accomplishment.

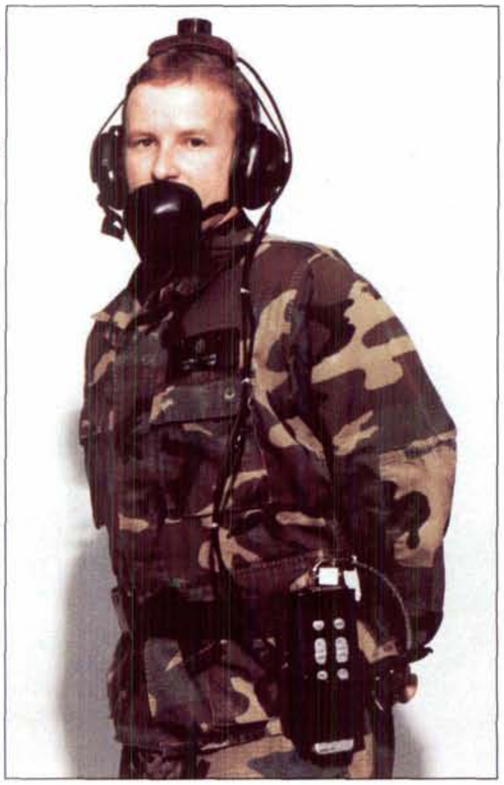
The IR system is a portable man-mounted voice communications system designed to operate with headsets and boom or mask microphones. The system provides a highly intelligible voice channel in conjunction with the noise attenuation provided by the headset. This allows the wearer to communicate with others wearing like systems in high noise environments. The lightweight transmitter/receiver mounts on the top of existing headsets and uses the standard microphones already fielded. The walkie-talkie sized electronics and rechargeable battery module mount on a belt. Since the system uses infrared light energy, it does not cause interference with radio frequency systems already in use for air base operations. Also, the transmission medium makes the system inherently jam resistant. The directional transmit range of the system is approximately 150 feet.

Demonstration models of the IR system technology have proven successful. The full design will include active noise reduction, omnidirectional transmit and repeater capability. The omnidirectional capability will allow personnel to operate at close range without the added task of aiming the IR beam. The directional transmit capability will be utilized for distant communications. The repeater system will be a portable module that will retransmit IR signals for extended range and allow communications around objects that would normally be obstructions in the IR transmission path.

The development of the IR communications system will result in better voice communications for personnel in high noise environments for the accomplishment of their missions. This technology can also be applied toward the development of voice communication systems in low noise environments such as military police and surveillance where portability and detection avoidance are requirements.

OPR: AL/CFB, (513) 255-3660 [DSN 785]

The IR voice communicator provides more intelligible communications in a high noise environment.

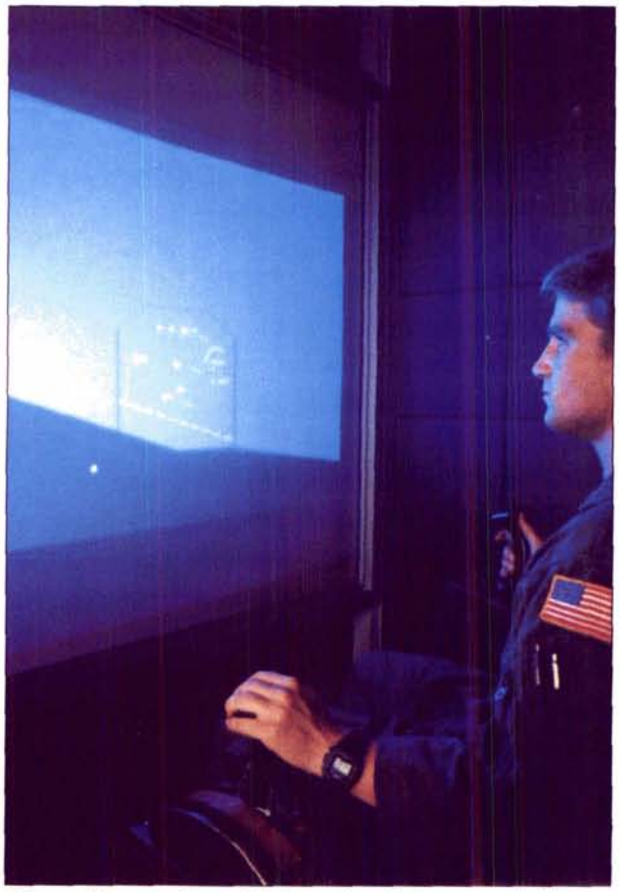


Heads-Up Display Symbology Evaluation

As a result of a series of aircraft accidents attributed to deficiencies in primary flight instrument symbology, HQ USAF/XO directed that cockpit displays, particularly Heads-Up Display (HUD) symbology, be optimized and standardized. Further emphasis on improving and standardizing primary flight displays was provided by the USAF Chief of Staff.

Armstrong Laboratory researchers compared, under rigidly controlled testing conditions, the HUD symbology elements to be evaluated. In the Visual Orientation Laboratory, USAF pilots participated in experiments requiring them to do precision instrument control tasks, unusual attitude recoveries, and instrument approaches while using various HUD symbologies. Ranking of efficacy of competing symbologies was based strictly on the pilots' performance while using them, but subjective ratings of the symbologies were also obtained.

The laboratory testing resulted in the following recommendations for standardized HUD symbology: (1) rotating pointers plus digits (counterpointers) for airspeed and altitude; (2) a variable-length arc around the altimeter for vertical velocity; (3) a climb/dive ladder with vertical and horizontal asymmetry (articulated bottom, tapered top, and left-side-only pitch numbers); (4) a "ghost" horizon to show the direction of the true horizon when the latter is outside the HUD field of view; and (5) "worm" and "caret" symbols for angle of attack and airspeed change rate, respectively. The recommended symbology elements were subsequently integrated into a draft standard symbology suite that was subjected to full-flight simulation and ultimately in-flight validation. As a result of successful completion of these phases, the recommended symbology will be incorporated into Military Standard-1787, Aircraft Display Symbology.



Pilot subject in Visual Orientation Laboratory helping to evaluate Heads-Up Display (HUD) symbology for standardization.

Flight display symbology development will continue in Armstrong Laboratory as improvements to the standard HUD symbology are proposed and as work progresses on optimizing and standardizing head-down and head-mounted flight instrument displays.

OPR: AL/CFTF, (210) 536-3521 [DSN 240]

Night Vision System

Modern warfare has led to an increase in airborne combat under the cover of darkness. Night missions include ground operations, takeoffs and landings in complete darkness, lights-off air refueling, and visual acquisition and identification of enemy targets hidden under the night sky. The current emphasis on flying aggressive missions with little visible light mandates that aircrews be able to see in ways that the human eye cannot. Devices called Night Vision Goggles (NVGs) currently exist and provide enhanced situational awareness for aircrews at night. Although NVGs permit operational effectiveness during these types of low-light operations, they are not safe to wear during an ejection from an aircraft. For that, and other reasons, an improved capability was required.

In 1988, Strategic Air Command requested the development of a Night Vision System (NVS) which would provide at least the same optical performance available from the currently used NVG known as ANVIS-6, but which would be lightweight, low profile, and ejection safe. Several other commands interested in improving their edge during low-level navigation, stealth operations, and target acquisition have cosponsored the program. The scope of this program now includes supporting bomber, attack, fighter, tanker, cargo, and helicopter, and various special operations for aircrews.

Two competitive contracts were awarded in 1993 for prototyping night visions systems. With the fielding of this advanced hardware, the safety of night training, the survivability of night missions, and the effectiveness of combat operations will be further enhanced.

OPR: HSC/YAS, (210) 536-2854 [DSN 240]

The Night Vision System provides an improved capability to see in low light/night conditions.

Aviation Night Vision Goggle Concept

The effectiveness of Night Vision Goggles (NVG) needs to be improved in several areas before the NVG can truly be adaptable for aircrew member use. In particular, improvements are needed in visual resolution (acuity), field of view, weight, and center of gravity. Enhanced night vision goggle designs are being explored through a Small Business Innovation Research (SBIR) effort. The program is being managed out of the Armstrong Laboratory Visual Display Systems Branch at Wright-Patterson AFB OH and has yielded some promising results.

Phase I explored alternative optical designs, with one chosen as optimum and selected for fabrication under Phase II. The Phase II design, currently called "Concept VI," has a minimum profile, adapts to the standard USAF issue helmet, and will fit underneath the helmet visor. A goal is for the NVG to be maintained on the helmet throughout the entire escape sequence for both ejection compatibility as well as use during descent. Anthropometry considerations, which are vitally important but often ignored, were implemented early in the design process. This has resulted in several independent adjustment features which provide an excellent optical fit. New and improved "hot" image intensifier tubes are part of the Concept VI design, allowing a wider field of view (45 degrees) and better visual acuity (20/26).

These critical performance parameters are far better than currently fielded systems, and offer a significant increase in night-fighting capability. The results of this SBIR effort are being supplied to the Helmet-Mounted Systems Technology Advanced Development Program Office and Human Systems Center Night Vision Systems Program Office for incorporation into their efforts.

OPR: AL/CFHV, (513) 255-7592 [DSN 785]

New NVG design fits underneath issue helmet and provides improved visual acuity.

Vista Saber II

Future air battles will increasingly rely on more advanced aircraft capable of directing their weapons with greater accuracy and at larger off-boresight angles. Analysis of current threats indicate that some potential adversaries already include some of this enhanced technology in their aircraft today.

Helmet-Mounted Displays and Sights (HMD/S), combined with an agile missile, provide a capable response to that threat. These systems let the pilot lock on to targets and fire missiles at much greater angles than normally allowed in the Heads-Up Display. The HMD also provides the capability to display other important and time critical information at any head orientation. No longer will the pilot have to look inside the cockpit to determine weapon status, airspeed, altitude, or general aircraft attitude, resulting in an increase in situational awareness and combat effectiveness.

The Vista Sabre II program effort is to install two helmet-mounted displays/sights on two F-15C aircraft to demonstrate the capabilities of this technology in air-to-air combat. The Visual Display Systems Branch of the Armstrong Laboratory Crew Systems Directorate has teamed with the 57th Test Group at Nellis AFB NV and the F-15 Engineering Group at Warner-Robins AFB GA to conduct this effort. The two aircraft are being modified by McDonnell Douglas Aircraft of St Louis MO to incorporate the Kaiser Electronics Agile Eye HMD and associated display electronics. The electronics will interface with other aircraft avionics and present a see-through 20-degree field of view projected on the helmet visor graphically overlaying the line of sight of the pilot's right eye.

The HMD/S will help the pilot locate a target faster, lock a missile onto that target, and simulate the missile launch. Previous simulator studies have shown significant improvements in aircraft kill ratio. This program will demonstrate the technology during actual flight tests. During this time, the system will be evaluated through all aspects of the close-in visual combat arena.

OPR: AL/CFHV,
(513) 255-7594 [DSN 785]

Vista Saber II is a field evaluation of a Helmet-Mounted Display/Sight system.

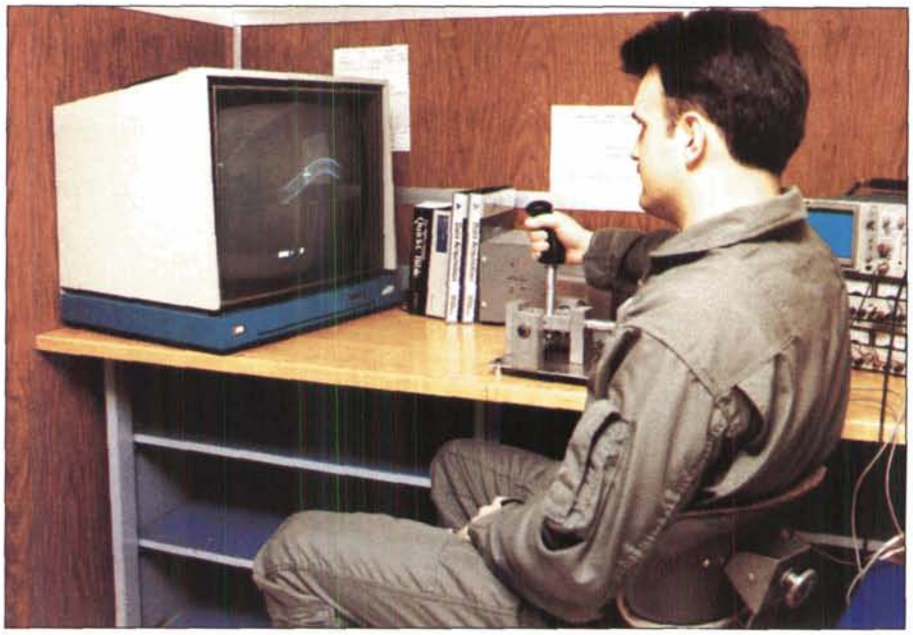
Force Reflection Stick Controllers

As pilots are subjected to accelerations greater than 1-G, arm/hand loadings are fed through to current analog and digital (fly-by-wire) stick controllers. These severe motions can adversely affect the pilot's tracking ability. Data from high-G centrifuge tests revealed that when acceleration forces opposed the stick displacement, tracking performance improved substantially.

A test bed facility showed conclusively that reflecting a force back opposite the hand motion, based on measurements of the external acceleration, provides smoother tracking responses. Presently, a second generation stick controller is used daily by handicapped people at the St Elizabeth Hospital in Dayton OH as part of a joint Armstrong Laboratory/Veterans Administration program. This program provides an extensive database for both pilots in static and acceleration situations and disabled people who need to control their spasticity.

Force reflection offers great promise in manual control with applications to controllers for aircraft during the high acceleration maneuvers typical of modern agile fighters, wheelchairs, and heavy equipment operations. Any exercise involving tracking where hand or arm motion may be disturbed by the environment or induced by neuromotor disorders can be improved by force reflection controllers.

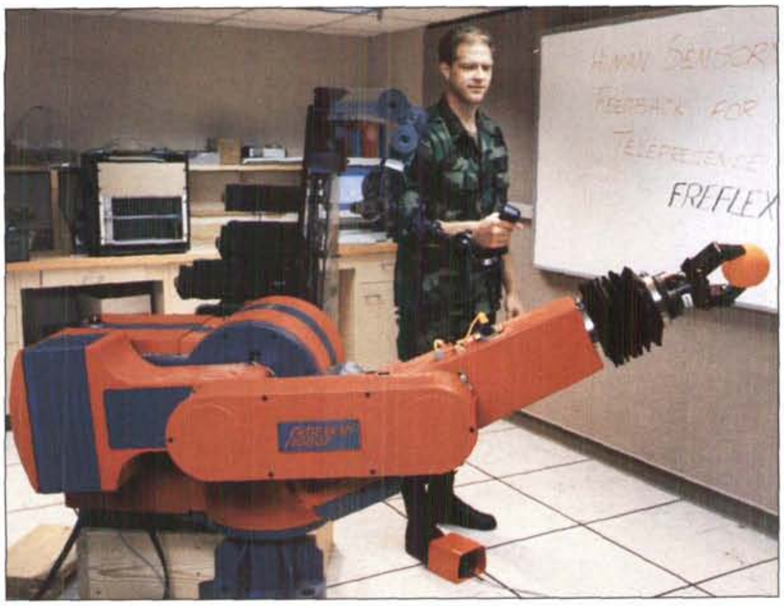
OPR: AL/CFBS, (513) 257-5742 [DSN 787]



Force reflection provides smoother tracking during random arm movements.

Force Reflection for Human Sensory Feedback

Telerobotic systems provide the capability to project human presence, cognition, and intuition into environments that would be lethal to human workers. High fidelity human-in-the-loop control of telerobotic systems requires natural intuitive feedback for the human operator. A key component to the successful operation of these remotely controlled systems is the use of force-reflection methods to give the operator the sensation of "presence" at the hazardous work sites. Natural intuitive force reflective feedback augments visual and auditory feedback in the unstructured work environment. The development of a Force REFLecting EXoskeleton (FREFLEX) has been a prime goal of the Human Sensory Feedback program.



Operator remotely controls strength with which robot picks up object.

Odetics, Inc., has developed a FREFLEX to support human sensory feedback research at the Crew Systems Directorate at Wright-Patterson AFB OH. The FREFLEX was delivered in June 1992. The system is designed to take full advantage of the human's seven degree-of-freedom shoulder, arm, and wrist movements. Data such as force reflection ratios, range of motion measurements and system encumbrances will be collected over the next three years. These data will support human factors design of the next generation of telepresence subsystems.

In addition to providing design information for master-slave telerobotic systems, this force-reflection device has applications in synthetic environments where direct interaction with simulations and virtual models are desired.

Land based applications include toxic chemical handling and environmental cleanup. Additional uses can be envisioned in nuclear, biological, or chemically contaminated environments such as post-attack cleanup in air base operations.

Space based operations include satellite refueling and servicing, as well as unstructured repair and maintenance functions.

OPR: AL/CFBA, (513) 255-3671 [DSN 785]

Active Noise Reduction

Operational testing of the HGU-55/P flier's helmet determined communications were minimally acceptable as the earcup permitted excessive background noise to be heard by the wearer. An electronic technique called noise phase reversal has been devised to significantly attenuate much of this unwanted sound, and the device has been packaged so that it does not exceed the restricted size of a helmet earcup. This technique creates an out-of-phase sonic signal that acoustically cancels noise within the earcup, thereby improving voice communication in noisy environments and reducing fatigue to the crewmember caused by the noise.

The Active Noise Reduction (ANR) system electronics are installed in the new earcup and are provided as a direct replacement for the current earcups used in existing helmets and headsets.

Prototypes were developed during an advanced development program and tested by all three services with excellent results. An engineering development test and evaluation program is ongoing.

The ANR system will reduce the number of aircrews grounded because of hearing loss, and that, in turn, should decrease the number of related compensation claims. More importantly, this program will provide the USAF and other service aircrews a system which provides greater attenuation of undesirable sound with a simultaneous increase in communications capability, reduced fatigue, and greatly improved mission effectiveness. An additional opportunity exists for use of this type of system in loud/high noise level environments on the ground, thereby further reducing legitimate medical claims for hearing loss.

OPR: HSC/YAS, (210) 536-4538 [DSN 240]

The Active Noise Reduction earcups, as installed in an aircrew helmet (HGU-55/P), will electronically reduce annoying or distracting background noise.

3-D Audio Display System

Situational awareness (SA) is critical to all aircrews. The 3-D Audio Display system has the capability to improve SA without adding any new signals to the cockpit or requiring any new skills. This is achieved by processing existing cockpit audio signals, such as radar warning receiver tones; wingman voice communications; other radio voice communications; and navigation tones, such that the crewmember hears signals which sound as if they are coming from specific locations in azimuth, elevation, and distance, i.e., a virtual 3-D auditory display. Presenting the signals in this manner takes advantage of the crewmember's natural ability to localize sound sources. This ability is demonstrated every day by people standing on a street corner determining the location of a vehicle approaching from the rear or from outside their current field of view.

Flight demonstration hardware has been developed which can generate up to four localized auditory signals simultaneously from any audio source. The 3-D Audio Display system uses a two-channel headset, and one independent earphone for each ear. The 3-D auditory cues are stabilized in space relative to the aircraft boresight and crewmember's head position. This is accomplished using the aircraft's flight or mission computer, navigation system, and a helmet-mounted head tracking system. The 3-D Audio Display system adds approximately 3 ounces to the helmet and approximately 12 pounds to the aircraft.

The flight demonstration hardware and software development have been completed. The system, with an interface control document, has been safety tested for flight test aircraft. Laboratory studies demonstrated the utility of the 3-D Audio Display system. Crewmembers using the system can locate targets with an average error of less than 10 degrees. Target acquisition times with normal visual radar warning display locations are significantly reduced using the system. Further, the system significantly enhances voice communications in all communications environments.

The 3-D Audio Display system is one technology which can increase SA without increasing aircrew workload. The increase in SA and communication capability results in improved mission effectiveness and survivability.

OPR: AL/CFB, (513) 255-3660 [DSN 785]

3-D Audio Display system increases SA without increasing workload.

Integrated Audio Technology Demonstrator

The Integrated Audio Technology Demonstrator (IATD) is a lightweight helmet in which several emerging audio technologies have been integrated for laboratory demonstration and data collection and use in high fidelity flight simulators. These technologies include active noise reduction, 3-D audio displays, advanced noise-canceling microphones, helmet-position monitoring, and a lightweight helmet shell. Two other concepts were investigated but not integrated into the final configuration. These were an ear microphone concept and a G-loss of consciousness onset monitor and warning system. These additional concepts may be integrated at a later date if their development for this application is successful. Six copies of the IATD have been fabricated to support both laboratory performance verification tests and technology demonstrations.

Voice communications significantly improved through use of the Integrated Audio Technology Demonstrator.

The IATD helmet development and laboratory performance verification have been completed. A complete battery of tests verified the helmet system's performance in high performance aircraft cockpit noise environments. The success of the laboratory studies led to flight demonstrations of the integrated IATD in the Navy/Marine T-1 AV-8B located at the Patuxent River Naval Air Station.

Performance verifications have demonstrated increased pilot performance in several critical areas. The 3-D audio display function dramatically reduced target acquisition times. Voice communications were significantly improved by both the active noise reduction headset, 3-D audio display, and advanced noise-canceling microphones. The active noise reduction headset not only provided increased comfort, but also decreased pilot fatigue.

OPR: AL/CFB, (513) 255-3660 [DSN 785]

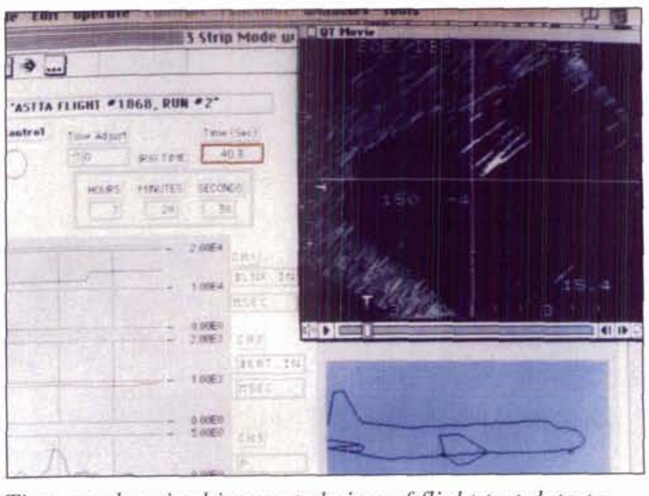
Performance Assessment and Workload Evaluation System

Critical to piloted aircraft flight testing is the assessment of the crew station and the cockpit design in terms of the aircrew's ability to meet mission objectives. Currently, no standard process for this aspect of flight tests exists. Thus, a variety of procedures have been employed during in-flight cockpit evaluation, resulting in a lack of commonality among test beds, programs, and systems. Often data from one flight test cannot be directly compared to another, leading to duplication of effort and reduced efficiency during test. The Performance Assessment and Workload Evaluation System (PAWES) offers a new way to support weapon system test and evaluation of crew station effectiveness and operational suitability.

This effort will develop and demonstrate a proof-of-concept capability for flight testing crew stations, while assuring common evaluation measures during ground, simulation, and in-flight tests. This includes steps for planning the crewstation evaluation, selecting procedures and measures, preparing briefing materials, processing data, and reporting results in a timely manner. In addition, PAWES will provide inspectable procedures for performing over 100 types of evaluations, recommend comparable measures for evaluating specific variables, and identify tools for implementation at the test facility. These computer based tools include form and report templates, a card catalog, a dictionary, an audit trail, and a notepad. PAWES will also include data analysis tools permitting a time synchronized display of digitized video, a 3-dimensional aircraft representation, and four real time data channels. This capability will allow the evaluation team to see an integrated view of the test results and aid in analyzing data.

PAWES offers a core capability to perform structured crew station evaluations using objective methods and measures. Further, PAWES will connect databases from flight tests and ground simulation. As a side benefit, PAWES will establish a link between laboratory personnel developing new human factors evaluation methods, and flight test practitioners who employ the methods, thereby facilitating the information flow between the research, development, test and evaluation communities. PAWES is a new capability for efficient crew station evaluation that will facilitate the technical communication of flight test results among engineers, researchers, and managers. A proof-of-concept PAWES will be built and tested by the end of FY94.

OPR: AL/CFHD, (513) 255-7581 [DSN 785]



Time-synchronized integrated view of flight test data to include aircraft attitude, performance, and video data.

Acceleration Protection

The advent of high performance fighter aircraft with the capability to sustain +Gz and the resultant potential for pilot G-induced loss of consciousness (G-LOC) has resulted in a concerted effort to improve G-protection. The +Gz training of high performance aircraft pilots has been beneficial and has led to significant reductions in G-LOC-related loss of aircraft and life. Training allows pilots to experience high +Gz and improve the efficiency of their anti-G-straining maneuver (AGSM) in a controlled centrifuge environment.

The AGSM is currently the most significant G-protective factor at high G (7-9 +Gz). The standard G-suit provides passive protection to about 5.5 +Gz. To maintain vision and consciousness above 5.5 +Gz, it is necessary to increase the AGSM level of effort as +Gz increase. Thus, at 9 +Gz, the AGSM effort is near maximal in many pilots. The AGSM is very fatiguing and is a limiting factor in pilot performance in the high +Gz environment.

The fatiguing aspect of the AGSM has driven us to develop new and improved G-protective equipment and techniques to reduce the need for maximal AGSM effort during high sustained +Gz. A recent improvement in G-protection is pressure breathing during G (PBG). PBG supplements the AGSM and can improve +Gz endurance during high +Gz by over 100 percent, compared to the combined protection of the standard G-suit and the AGSM. Combined Advanced Technology Enhanced Design G-Ensemble (COMBAT EDGE) incorporates PBG and is being retrofitted into high-performance aircraft at this time. An extended coverage anti-G suit called Advanced Technology Anti-G Suit (ATAGS) is also under development.

Investigation of the physiologic effect of G-protective equipment and techniques is a large portion of our research effort. It is important to understand the mechanism of +Gz protection and the margin of safety. Areas under investigation are (1) the effect of G-layoff (time away from the cockpit) on +Gz-tolerance; (2) a comparison of female/male G-tolerance/endurance during high +Gz and the influence of the menstrual cycle on female G-tolerance/endurance; (3) the physiologic interrelationship between blood pressure, intrathoracic pressure, the AGSM, PBG, and anti-G suit inflation during high levels of +Gz; and (4) man's upper limit of +Gz-tolerance as influenced by seat back angle, COMBAT EDGE, and ATAGS.

Our acceleration protection program is designed to provide the maximum +Gz protection, with a margin of safety, for pilot operational performance.

OPR: AL/CFTF, (210) 536-3521 [DSN 240]

Advanced +Gz-protection, illustrating the newly introduced pressure breathing system (COMBAT EDGE) and the advanced technology anti-G suit (ATAGS).

Workload Evaluation Tools

Objective measures of crewmember workload are needed for test and evaluation, design evaluation, and metric development programs. The increased complexity of modern USAF systems places higher mental workload demands upon USAF personnel. In some cases the limiting factor for new systems may be the human component. In order to design systems that can be used effectively, the mental workload placed upon the crewmembers must be measured, and systems that take human capabilities into consideration must be designed.

Traditionally, subjective measures have been used to measure operator workload, but these methods have shortcomings and need to be augmented. Measuring operator response can provide such data with heart rate, eye blinks, and brain activity acting as useful measures of cognitive activity. The Psychophysiological Assessment Test System (PATS) and the Workload Assessment Monitor (WAM) have been developed as tools to measure these signs of workload. PATS collects physiological data, stores it, reduces it, does statistical analysis, and provides many editing and analysis features. WAM provides on-line analysis of heart rate, eye blinks, and respiration. Thus, an operator's physiological state can be continuously monitored in real time and this information can be fed back to the system and evaluated by testing personnel.

Both PATS and WAM are designed to function in laboratory and simulator environments and can be used to analyze flight recorded data. Government, industry, and academic institutions have shown interest in both systems. Since they are general purpose in nature, they can fill the needs of a number of programs while meeting current USAF needs for workload measurement.

OPR: AL/CFHP, (513) 255-8748 [DSN 785]

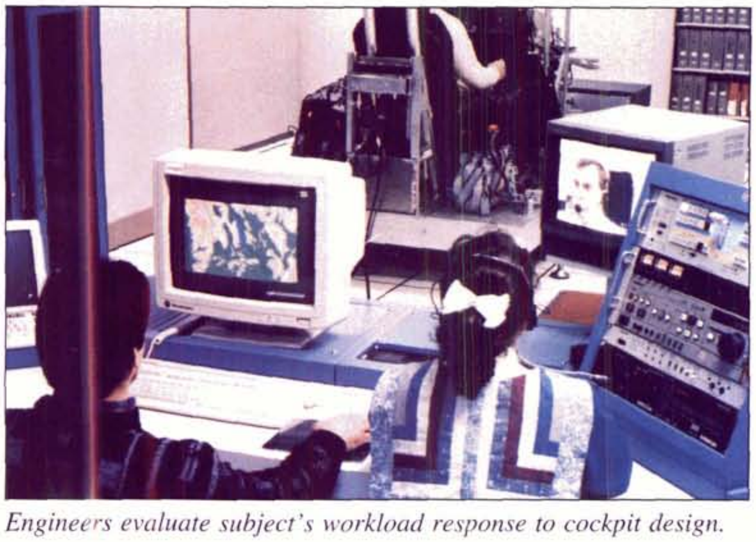
PATS collects data which can be used to reduce aircrew mental workload.

Crew-Centered Cockpit Design Project

Air operations depend on the aircrew's ability to employ all the capabilities of the weapon system. However, aircrew tasks are becoming increasingly complex and time constrained, and are often nearing the limits of the aircrew's ability to perform all required tasks. To meet this challenge, the Crew-Centered Cockpit Design (CCCD) project has formed an interdisciplinary team to develop a new cockpit design process that is centered around crew capabilities and mission effectiveness. This process is intended for use by the aerospace industry, but is adaptable for Government oversight of the system development, and for related technology development in the DOD Laboratories.

The main products of the CCCD development are its highly disciplined process for cockpit design and a complete set of support tools and technology that will help to make the process efficient. The process spans all phases of systems acquisition from concept exploration through production and deployment. It identifies and organizes each engineering design activity, while managing the flow of engineering data produced at each step. The supporting tools and technology are embodied within a Cockpit Design System (CDS), which is a self-contained design support system providing full-time support for crew-system engineering from start to finish. Included is an integrated set of cockpit analysis software, computer-aided design software for cockpit layout, database management tools for engineering data, and a real time cockpit simulator that is configurable in hardware and software for test and evaluation. The CDS computer software also affords the cockpit design team a complete and up-to-date picture of development status and work remaining, thereby serving a dual role for project management and engineering support. CCCD represents a new capability for human systems integration, correcting recognized shortcomings in the current design practice. An initial version of the CCCD design process and a full-scale functioning prototype of the CDS have been delivered and are undergoing checkout for validation and demonstration.

For the first time, the crew system can be developed using a proven process and integrated computer based tools producing a well documented, tested, and traceable design that is tied to mission requirements. Cockpit design and testing can start much earlier in the development cycle, thereby reducing cost and risk while improving operability. By designing the cockpit with crew capabilities as the central focus, CCCD can maximize the aircrew's capability to fly, fight, and win.


Engineers evaluate subject's workload response to cockpit design.

OPR: AL/CFHD, (513) 255-8860
[DSN 785]

Computer-Aided Systems Human Engineering: Performance Visualization System

Research and development efforts in the Design Technology Laboratory are significantly advancing the state of the art in design visualization technologies and preparing to transition those technologies into the USAF and civilian design communities. Armstrong Laboratory, leading a consortium of government organizations consisting of the Federal Aviation Administration; the Defense Technical Information Center; NATO Advisory Group for Aerospace Research and Development; the Army's Human Engineering Laboratory; the Naval Command, Control, and Surveillance Center; and the Air Force Office of Scientific Research is developing the Computer-Aided Systems Human Engineering: Performance Visualization System (CASHE:PVS).

CASHE:PVS version 1.0 is a CD-ROM-based hypermedia-ergonomic information base which will provide crew system designers ready and intuitive access to on-line graphical and textual human perception and performance data. Tightly coupled with this information base are sets of interactive software "test benches" which will provide designers with performance visualization capabilities to enhance their ability to analyze, explore, and apply human behavioral data to specific equipment designs. The CASHE:PVS version 1.0 will be available during the second quarter of FY94. A new contract start in the human performance and perceptual design visualization system will field test the version 1.0 software in actual design environments and will begin the development of a subsequent version for supporting collaborative design in Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE) environments.

The Computer-Aided Systems Human Engineering: Performance Visualization System (CASHE:PVS) will offer crew systems designers computerized hyperlinked access to over 1,150 entries on human perception and performance data.

As a precursor to developing collaborative design technology, an in-depth study of actual USAF design teams has been completed. Human factors branch team members from Aeronautical Systems Center at Wright-Patterson AFB OH, were interviewed using the in-house developed knowledge engineering tools, Concept Mapper and Concept Interpreter, to explore design as currently practiced in the crew system acquisition process. This collaborative design knowledge acquisition is the beginning of a framework for the development of advanced group centered design tools.

OPR: AL/CFH, (513) 255-8805 [DSN 785]

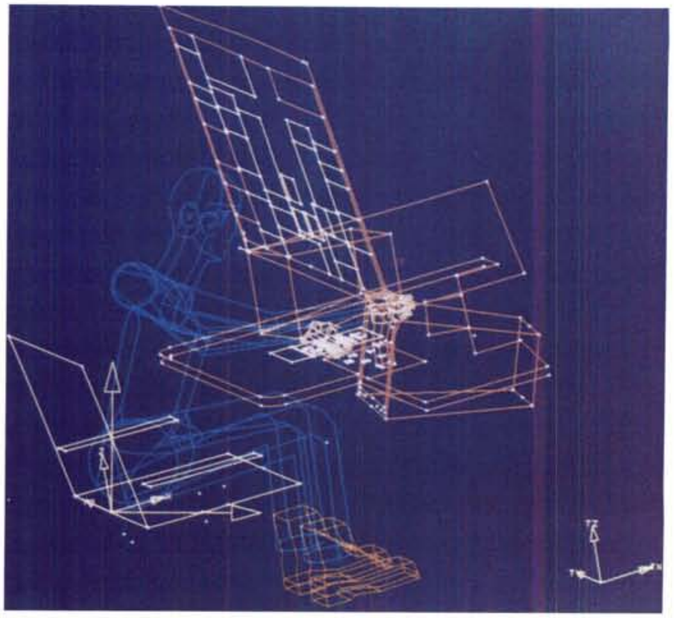
Computerized Biomechanical Man-Model

Early identification of potential design-induced operator accommodation problems is essential in order to correct a problem before mockup, fabrication, or production. To facilitate early identification of design problems, Human Systems Center's Human Engineering Division is developing Computerized Biomechanical Man-Model (COMBIMAN), a Computer-Aided Design (CAD) model of an aircraft pilot which allows the designer to perform the functions of an expert ergonomist. The designer may simulate an operator activity on the computer-generated image to determine if the activity is physically possible. Expert system software automatically creates the correct body size and proportions for male and female pilots, the encumbrance of clothing, personal protective equipment, and mobility. Expert system task analysis is available for reaching controls, visual access, and strength.

Version 9 of COMBIMAN was completed in 1992. It incorporates several databases, functional capability for 1st to 99th percentile male and female dimensions, and six flight clothing types. Automated task analyses include reach, vision, and strength analyses. The model computes strength for operating all types of vehicle controls (wheels, levers, pedals, etc.). Visibility shows the vehicle from the operator's viewpoint including controls, displays, windows, and even objects outside the vehicle. COMBIMAN's uniquely automated arm and leg reach and reach envelopes take into consideration the encumbrance of clothing and harness.

The COMBIMAN model will reduce the incidence of accommodation problems by allowing the designer to perform analyses and correct design related defects. Ultimately, not only will development engineering costs and acquisition time be reduced by doing it right the first time, but system performance will increase. COMBIMAN is interfaced directly with several popular commercial computer-aided design systems so the design itself can be used as an electronic mockup. Because the interface is direct, no file transfer or conversion is required prior to the evaluation. COMBIMAN software and analysis capabilities are now available to US businesses through the Crew System Ergonomics Information Analysis Center known as CSERIAC.

OPR: AL/CFHD, (513) 255-2558 [DSN 785]



COMBIMAN evaluates reach to a control grip in a navigator's crew station.

Advanced Dynamic Anthropomorphic Manikin (ADAM)

Armstrong Laboratory developed the Advanced Dynamic Anthropomorphic Manikin (ADAM) for use in testing escape systems and crew protection systems. Manikin development was initiated in 1985 to support the Crew Escape Technologies (CREST) advanced ejection seat program and has resulted in the fabrication of five small and five large manikins. The manikin design provides a human-like reactive load into the ejection seat and possesses realistic dynamics and kinematics during windblast, impact, vibration, and acceleration forces encountered during ejection.

ADAM was used in rocket sled tests to demonstrate "his" capability for ejection seat testing at speeds up to 700 miles per hour. ADAM was also used by Project PULL (Parachute Understanding Loads and Logistics) to develop a free fall parachute opening shock database for establishing potential injury criteria of parachute opening shock and ground impact loading.

Current emphasis is on developing a manikin-based injury assessment capability and corresponding ADAM refinements, including upgrading the ADAM data acquisition system. Composite materials have also been developed for use in manikin body segments resulting in a higher strength-to-weight ratio, more bone-like deformation properties, and more human-like inertial distribution properties than metal manikin segments. A prototype manikin leg has been fabricated with force sensors embedded directly in the composite material during production. This capability will provide researchers with information on forces transmitted through the leg segments during aircraft ejection. Further improvements include the development of an improved manikin neck structure adaptable to existing test manikins. It will provide a more human-like response than currently available manikin necks and will serve as a test and evaluation tool for head-mounted devices, protection equipment, and ejection systems.

ADAM will be a powerful test and evaluation tool for assessing ejection seat performance and crewmember protection. Its design provides for human-like reactive loading into the ejection seat and measurements on a variety of body, seat, and protection system responses. The ADAM data acquisition upgrade has been completed, and acceptance tests involving vertical and horizontal impacts were performed. Environmental tests of upgraded ADAM were completed in September 1992, and rocket sled ejection tests resumed in November 1992.

OPR: AL/CFB, (513) 255-3665 [DSN 785]

ADAM skydiving -- determination of parachute-opening shock criteria.

Near-Threshold Processing of Visual Stimuli

The Air Combat Command has been interested in the dynamics of pilot situational awareness (SA) since the 1980's. We now know that SA is an elusive, yet important concept, and its attainment is rooted in our human information processing capabilities. It is an ability which changes over time; pilots often claim their SA was "shut up in the map case," just out of reach, on a particular mission.

Researchers at the Armstrong Laboratory are targeting a component of SA known as "Near-Threshold Processing of Visual Stimuli," and testing two related theories. One theory is that pilots can be trained to recognize and identify objects in their environment presented for short durations (33-67 milliseconds). Pilot selectee ROTC students successfully demonstrated this training in two studies using identification of familiar playing card suit symbols. The second theory being tested is that there may be a basic ability to recognize and identify fleeting stimuli that separate top performing pilots from "average performers." Initial studies show that subjects differ widely in their performance of these tasks, but determining whether these subjects also differ in flight performance or ability to attain and maintain SA is our major goal. Neither of these theories have meaning to the USAF unless fleeting recognition skills correlate with superior SA in the cockpit. A special team, the Situational Awareness Integration Team (SAINT), was formed to coordinate Armstrong Laboratory efforts. A SAINT study using fighter pilots was completed in the fall of 1992 to try to establish the connection between near-threshold visual processing skills and operational SA.

Software has been developed to use operationally relevant symbols to test these selection and training premises. The current version uses a three-dimensional Silicon Graphics system with realistic computer-generated aircraft models and varying backgrounds. It tests pilots' abilities and gauges their performance improvement in the task. Future software will display targets in a dynamic mode, and the computer screen will emulate a moving cockpit's windscreen. If this system proves to be a valid measure for visual stimuli processing, it will be used as part of a computerized task battery for selecting pilot training candidates or in classifying students into fighter or tanker/transport/bomber tracks. Pilots might also use the system to hone this component of SA before a mission.

OPR: AL/CFTO, (210) 536-3464 [DSN 240]

A subject in an enclosure custom built for situational awareness research responds to a fleeting aircraft symbol.

Burn Prediction Model: Burn Simulator

Exposure to extreme thermal environments such as a fire, atomic flash, or aerothermal heating during emergency escape at high Mach will result in skin burns if protective measures are inadequate. BURNSIM is a computer model allowing the user to predict burn hazards. Originally written to run on minicomputers, it has been rewritten to run on more readily available personal computers (PC). Further, a module has been added to account for the insulation provided by protective clothing.

For the past two years, the Escape and Impact Protection Branch of the Crew Systems Directorate at Wright-Patterson AFB OH has been developing a PC version of BURNSIM and a clothing module for standard military clothing. In 1991, the PC version of BURNSIM was given to more than 30 users at the 2nd Annual Human Response Program Technology Transfer meeting.

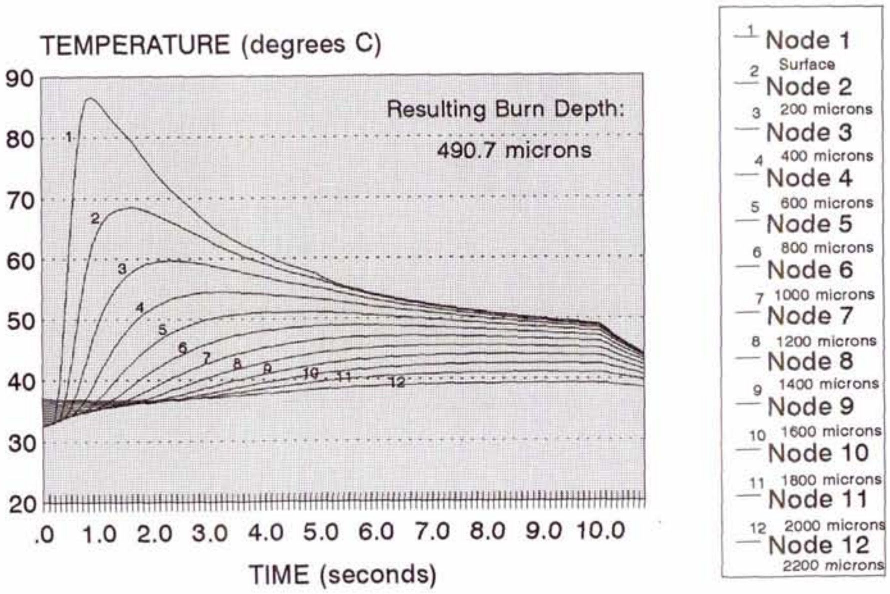
Two approaches to the clothing module have been developed. The first is an analytical solution requiring detailed knowledge of the properties and dimensions of the layers of the ensemble. The second, treats the ensemble as a lumped filter. The final clothing module will be selected, interfaced with BURNSIM, and validated over the next two years.

In addition to providing a tool for assessing the risk of burn injury for troops exposed to nuclear flash, BURNSIM has an application for conducting design studies to optimize the protective ensembles for hypervelocity vehicle crews.

Land based applications will include designing firefighters' protective clothing, foundry workers' clothing, and burn risk assessment associated with live fire studies of military systems.

Space based operations will also require a burn hazard assessment of injury causes.

OPR: AL/CFB, (513) 255-3931 [DSN 785]



Output of BURNSIM model predicts severity of skin burn.

Aircraft Windscreen Field Measurement Device: Haze-o-Meter II

The majority of military aircraft windscreens are made out of tough plastic to minimize the possibility of the windscreen shattering. However, the switch from glass to plastic has caused several phenomena which can impact the optical quality of the transparency. One of these phenomena is haze, which is caused by the scattering of light from materials (interlayers) within the windscreen and from tiny scratches on the surface of the relatively soft plastic.

Haze-o-Meter II being used to measure F-15 canopy during device field test at Eglin AFB FL.

At the request of the Windscreen System Program Office, a field usable measurement device has been developed to determine both the severity of haze (without removing the windscreen from the aircraft) and the correct time to repair the windscreen because of haze. Since haze scatters light backward (toward the light source) as well as forward, a single device can house both the test light source and the light detection system necessary to make the measurement. Furthermore, the device can be calibrated in such a way that the haze readings are nearly identical with the measurements obtained by removing the windscreen and testing it in the laboratory. Armstrong Laboratory researchers have patented the device called Haze-o-Meter II.

The Haze-o-Meter II was field tested in the summer of 1992 at Eglin AFB FL on an F-15 windscreen which had been in service for about 18 months. It performed well and is undergoing further improvement to make it easily usable by maintenance personnel.

OPR: AL/CFHV, (513) 255-8816 [DSN 785]

Spatial Disorientation Countermeasures

Spatial disorientation (SD) remains one of the leading causes of fatal aircraft accidents in the USAF. The improved capability of modern weapon systems to operate at night and in other conditions of degraded visibility creates situations especially conducive to SD; and increasing reliance on low-level maneuvering in combat tactics reduces the margin for error when SD does occur. Solutions to the SD problem are being sought in a three-pronged research and development attack: (1) improve our understanding of the mechanisms of spatial orientation and disorientation, (2) develop training methods that help pilots either resist or cope with SD, and (3) develop flight instrument displays that improve pilots' ability to maintain accurate spatial orientation.

The Visual Orientation Laboratory generated strong evidence supporting a new theory of the three-dimensional nature of visual attention--visual research and object recognition is most efficient in the upper right quadrant of the visual field. Additional work showing different effects of wide- and narrow-field-of-view background scenes on postural stability and manual control was completed. Both of these studies helped develop important concepts for efficient presentation of visual information on flight instrument displays. Research quantifying the "G-excess" form of SD was completed on the Dynamic Environment Simulator. Illusory vehicle tilts of 10 degrees were demonstrated when subjects' heads were tilted during exposure to G-levels up to +4 Gz. This finding helps explain why pilots tend to overbank their aircraft and inadvertently descend while looking out of the cockpit during sustained turns.

The Advanced Spatial Disorientation Demonstrator (ASDD) was delivered to the Armstrong Laboratory and the USAF School of Aerospace Medicine. This device will demonstrate to pilot trainees both visual and vestibular forms of SD in a special purpose flight simulator. Training methods for use with the ASDD will be developed and transitioned to Air Education and Training Command and Air Combat Command.

Flight instrument display research continued in two areas: head-up display (HUD) symbology and acoustic orientation. After evaluating competing HUD primary flight symbology elements, researchers provided the Joint Cockpit Office with optimally performing elements of a proposed USAF standard HUD symbology suite. Results of earlier flight-testing of a prototype Acoustic Orientation Instrument were analyzed, and laboratory refinement of candidate acoustic signals for airspeed, vertical velocity, and bank angle was accomplished.

SD Countermeasures research will improve the operational effectiveness of our weapon systems and reduce the drain on USAF resources resulting from SD-related aircraft mishaps.

OPR: AL/CFTF, (210) 536-3521 [DSN 240]

In-flight testing of the Acoustic Orientation Instrument, which provides an auditory display of bank angle, vertical velocity, and airspeed.

Personal Computer Software System for Crewmember Ejection and Crash Analysis

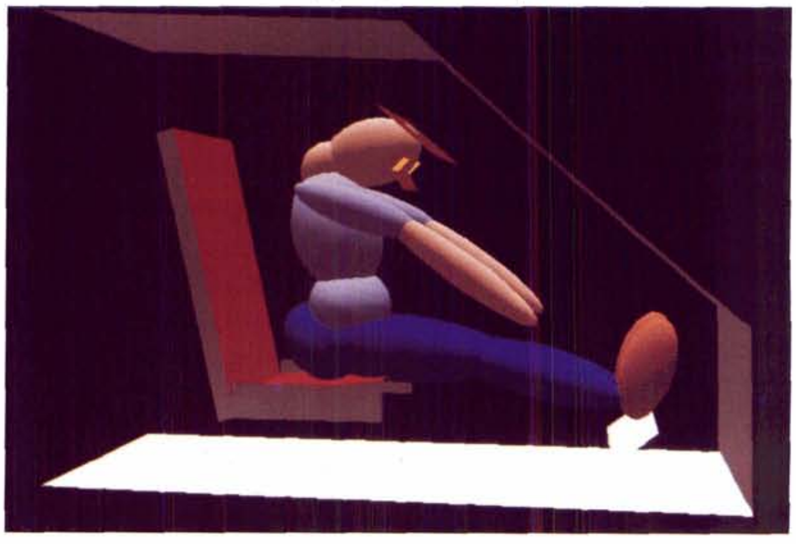
The Articulated Total Body (ATB) model is a computer simulation program developed by the Armstrong Laboratory (AL) for predicting human body dynamics during aircraft ejection, crashes, and other hazardous events. It is based on the Crash Victim Simulator developed by the National Highway Traffic Safety Administration (NHTSA) during the early 1970's. Its ability to predict internal and external responses of the human body, manikins, seats, and other structures, makes the ATB model broadly applicable in the automobile, aerospace, and other transportation communities. Recently, under a Small Business Innovation Research (SBIR) effort, the model has been installed on microcomputers, easing accessibility to a wider variety of users.

The ATB model has been used to determine the safety of proposed structures in the aircraft cockpit before prototypes were built or costly tests conducted. It has also been used to provide data that cannot be measured during a test, such as forces within the body, and to supplement test data through the ability to vary the parameters of the simulations.

The ATB model is used to test theories on the events during an accident and the cause of injury. It is also used to test the effects of design changes on safety before prototypes are built and costly tests are conducted. The model is also widely used in the civilian sector for improving consumer safety in the automobile industry. It is ideally suited for the commercial sector because it is applicable to many dynamic systems and can be used on different computer systems. Individuals investigating automobile accidents, developing restraint systems, studying human motion in any dynamic environment or interested in other dynamic systems can use the ATB model for their analysis.

The Phase II Small Business Innovative Research contract to install the ATB model on a microcomputer and develop a complete software package for improving its user-friendliness ended in October 1992. This package, named DYNAMAN, includes a user-friendly preprocessor for developing the simulation database, the ATB model, and a postprocessor for plotting the simulated body motion and graphing time history results. DYNAMAN operates on microcomputers running under DOS and on Silicon Graphics workstations.

OPR: AL/CFB, (513) 255-3665 [DSN 785]



ATB simulation of a crewmember during a cargo plane crash landing, studying head impact with head-up display.

Live Fire Testing and Human Vulnerability Assessment Methodology

In 1986 the United States Congress passed a law requiring all major weapon systems be tested for vulnerability and lethality. The tests were to place special emphasis on personnel casualties. This statute led to development of the Joint Live Fire Test program. Armstrong Laboratory's program assesses potential threats that may incapacitate aircraft personnel. It assesses the impact on aircrew of penetrating injuries from fragments, burn injuries from fires and explosions, toxicological effects from combustion gases, and hearing loss and organ damage from blast overpressures. Measurements are taken during realistic combat environment simulations which are produced in a highly sophisticated firing range with state-of-the-art instrumentation. A unique product of this research is a fragment capture manikin called Aerospace Incapacitation Response Manikin (AIRMAN), a spin-off technology from the NASA shuttle program.

Live-fire tests simulate controlled battlefield conditions, so the researcher can obtain accurate descriptions of the environment behind defeated armor on weapon systems. Information obtained from these tests helps predict the pilots' ability to successfully complete their missions. To collect data needed to determine the environment a pilot is exposed to, a variety of heat, pressure, and gas sensors are placed on the AIRMAN manikin and the manikin is placed in a full-scale aircraft crew station. A specially designed gun fires a predetermined size round into the crew station, and researchers analyze data from the sensors. Fragments that would hit the pilot are captured by the manikin. These data determine the injury a real human might receive, and conclusions are drawn on the pilot's ability to complete the mission.

Information obtained from live fire tests will establish standards for the design, development, and acquisition of future aircraft weapon systems and aircrew personal protective equipment. This information will provide understanding of combat injuries aircrew may receive from future threats. The live-fire test data can also be used to develop realistic computer simulations for training.

The F-15 Live Fire Test was completed in May 1991 and provided valuable information on human vulnerability which is the cornerstone of our research. The biological assessment of AIRMAN F-15 Live Fire Test data is being evaluated by the US Army Ballistic Research Lab using their "Computerman" wound simulator. To improve upon AIRMAN measurement techniques, a program to develop a computer-aided measurements system was initiated. This system will provide accurate, consistent, and user friendly analysis of AIRMAN data.

OPR: AL/CFB, (513) 255-5963 [DSN 785]

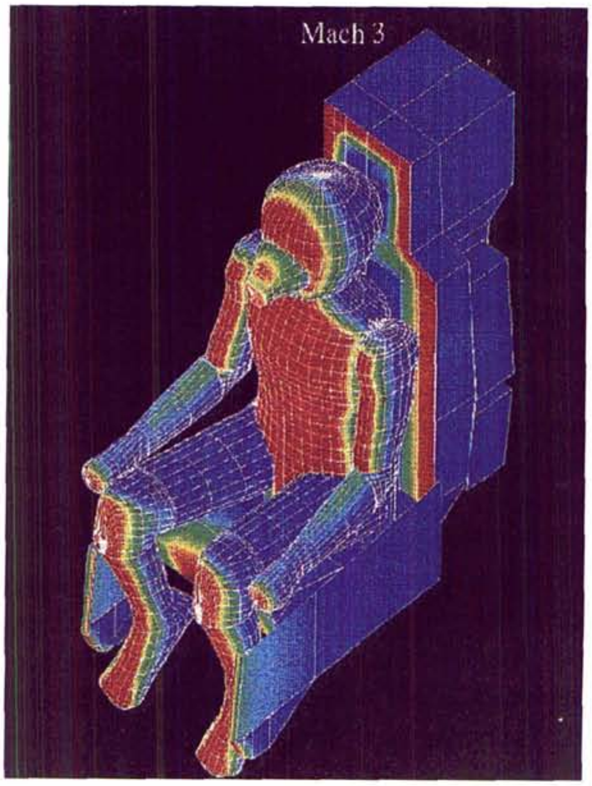
Full-scale live fire test for assessing crewmember vulnerability.

Hypersonic Flight Crew Escape

The Hypersonic Flight Crew Escape effort will provide the design criteria and evaluation techniques necessary to increase crew survivability during emergency egress from hypervelocity flight vehicles. Initial efforts will define ejection seat performance envelope limits due to aerodynamic and thermal loads acting on the crewmember, and build human systems technology required to develop advanced enclosed escape systems for crew protection at hypervelocity speeds. Existing test data will be analyzed to develop methodology for balancing the inertial and aerodynamic forces acting on the human body during emergency escape and to determine the burn injury potential from transient thermal exposure. These analyses will help to define the Mach limit of ejection seats and provide analytical methods and criteria required to maximize performance and develop or modify personnel protection systems. Advanced development programs will investigate the heat transfer characteristics of proposed pressure suit materials. Subsequent efforts will focus on human systems' issues associated with hypervelocity escape system concepts using separable forebodies. These issues involve developing human tolerance criteria for transient multi axial and long duration oscillatory accelerations.

A study contract was awarded to McDonnell Douglas Missile Systems in 1991. This study provided the design concepts, analytical tools, and evaluation methods that will be used in the development of crew escape systems for the X-30 and subsequent generations of manned transatmospheric vehicles. The escape simulations conducted have highlighted the need to advance specific key aeromedical technologies to enable the successful development of hypervelocity escape systems. The results of this concept study will be applied to the development of future hypersonic aerospace vehicles.

OPR: AL/CFB, (513) 255-3122 [DSN 785]



Predicted Pressure Coefficient on the Crew Escape Technology Seat, Mach 3.

Helmet Visual Display System

Unique Helmet-Mounted Displays (HMD) are being developed to meet specific user needs. Cooperative efforts with the US Army, Rome Laboratory, and Wright Laboratory have maintained direct user interface in our helmet display optics development activities. One such user-specific device under development is the bi-catadioptric helmet-mounted display (BI-CAT HMD) system.

The BI-CAT is based on bi-catadioptric lenses and provides a color-corrected, 50-degree, fully overlapped, binocular field of view with a very large 19-millimeter exit pupil for ease of use. The display mounts to a HGU-56 helmet and includes interpupillary adjustment. To allow for the future, it incorporates newly used tangent (theta) optics mapping to permit its direct use with advanced miniature LCD color image sources as they become available. Development of a new miniature cathode ray tube with a 23-millimeter active format area made it possible to achieve excellent performance.

Two BI-CAT HMD systems will be delivered to the Army for testing in a Blackhawk helicopter as part of a joint NASA/ US Army flight test. Rome Laboratory and Wright Laboratory will also take delivery of systems for use in their simulation work. Other advanced HMD optical systems are in preliminary design to meet specific user requirements and to feed into the Helmet-Mounted Systems Technology Advanced Development Program Office efforts.

OPR: AL/CFHV, (513) 255-8904 [DSN 785]

Helmet-Mounted Displays such as "BI-CAT" must be tailored for specific user needs.

Human Resources

This Human Systems Center product area accomplishes research and develops, fields, and supports unique Manpower, Personnel, and Training technology and systems.

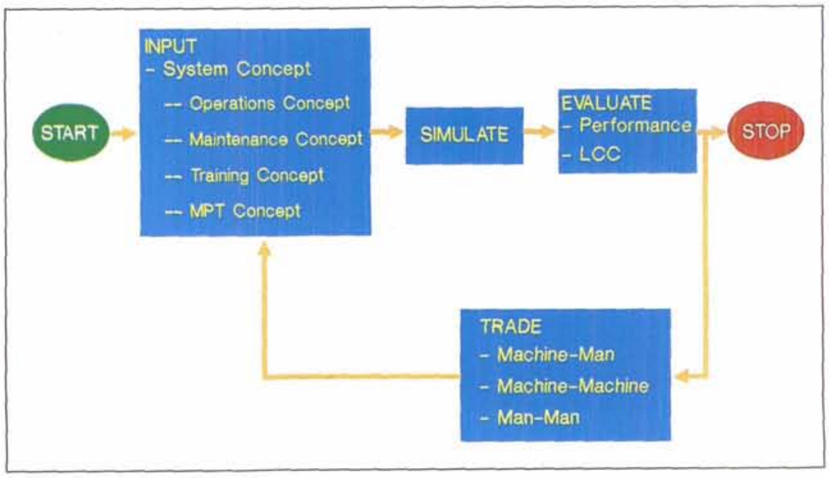
Weapon System Optimization Model

The USAF weapon system acquisition process requires weapon system life cycle cost and performance criteria to evaluate the emerging weapon system during design and development. Manpower, personnel, and training (MPT) factors must also be considered at the design phase. Major command (MAJCOM) planning shops and MPT Planning Team members need a model to consider tradeoffs among weapon system characteristics, maintenance, and logistic concepts; MPT factors; and performance/ cost parameters. The Weapon System Optimization Model (SYSMOD) will integrate MPT issues into the early weapon system design process.

Front-end analysis for SYSMOD development was completed in 1991, resulting in a conceptual research and development plan and a demonstration model for user feedback. Input/output variables were identified and system specifications developed. The prototype SYSMOD will be a personal computer based user-friendly information management system needing minimal user knowledge to operate. SYSMOD will take into account not only MPT requirements, but also organizational structure, maintenance, and operational concepts, and sortie requirements. Follow-on efforts will include necessary model refinements to interface SYSMOD with the MPT Decision Support System, which will provide MPT analysts a tool for use in post-Milestone I weapon system acquisition analysis.

SYSMOD will provide MPT Planning Team members and MAJCOM planning personnel with the integrated tool they need to develop early MPT criteria for weapon system design. It will provide concrete data for cost vs performance tradeoffs to optimize weapon system operation and maintenance support.

OPR: AL/HRM, (210) 536-3648 [DSN 240]



SYSMOD integrates MPT issues early in the design process

Learning Abilities Measurement Program

USAF personnel work in highly technical environments. The challenge is to identify individuals most likely to succeed in these environments. Recent developments in personnel assessment technology promise to enhance the selection and training of our personnel. The Learning Abilities Measurement Program (LAMP) is a basic research effort to identify learning abilities using computer based aptitude assessment technology. Information processing tests delivered on microcomputers measure abilities not captured by traditional written tests and bring increased flexibility, comprehensiveness, and utility to personnel selection and training.

LAMP scientists developed and refined the Cognitive Abilities Measurement (CAM) battery. The CAM measures such abilities as processing speed and capacity, and when used in conjunction with the Armed Services Vocational Aptitude Battery will improve the ability to predict training success. We validated the improved prediction capability of CAM in the areas of computer programming, basic electricity, and flight engineering.

Presently LAMP scientists are investigating new abilities such as speed-distance estimation, multi-model (auditory versus visual), and perceptual motor processing. We will relate these abilities to the acquisition of basic flying skills using the Basic Flight Instruction Tutoring System which yields a detailed quantitative record of learning performance.

LAMP scientists also collaborated with aircrew selection and classification experts to develop a Situational Awareness Aptitude Battery. The goal is to identify pilots who develop the highest degree of situational awareness in flying combat missions. In the near future, scientists will develop performance assessment batteries to evaluate the effects of unusual environments (e.g., space), disruptive, stressful environments (e.g., cockpit, control tower), and medical conditions (e.g., drugged state) on thinking, learning, and problem solving ability.

LAMP results indicate that assessment technology can improve the current selection and classification system. These improvements will reduce training costs and enhance training procedures and performance measures.

The Basic Flight Instruction Tutoring System (BFITS) teaches flying skills and records performance data.

OPR: AL/HRM, (210) 536-3876 [DSN 240]

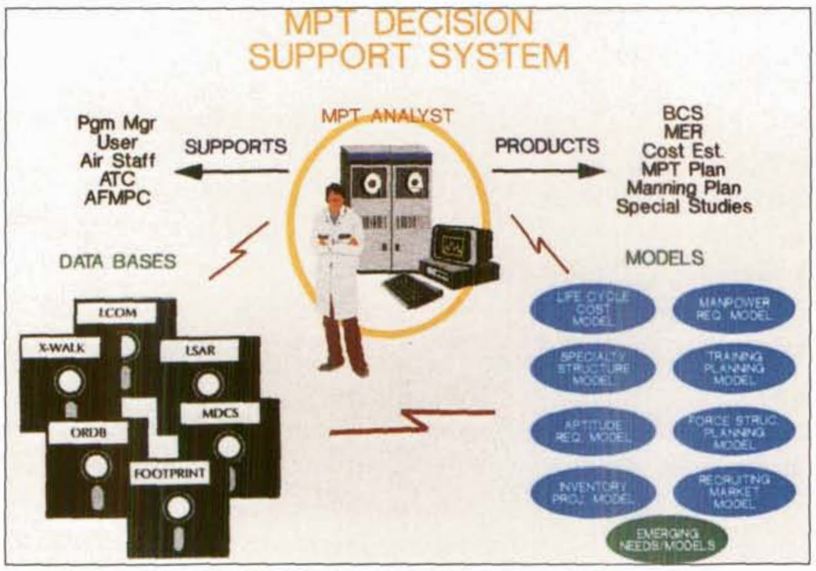
Manpower, Personnel and Training Decision Support System

Manpower, personnel, and training (MPT) issues are integral to weapon system operation and performance, and account for about half of the life cycle cost. At this time there is no effective process to account for MPT issues during weapon system design and acquisition. The MPT Decision Support System (DSS) will provide an integrated software system to permit up-front estimation of MPT requirements during weapon system development. It will also enable tradeoff analyses and allow validation that emerging designs meet MPT constraints. In addition, it will provide planners with information needed to set up personnel acquisition and training pipelines.

The MPT DSS builds on technology developed for the USAF Integrated Manpower, Personnel, and Comprehensive Training and Safety, known as IMPACTS, program. Databases have been developed and integrated, and procedures developed for database linkage, tradeoff analyses, and automated instructional system development. The MPT DSS will be complete in 1996.

Integrating MPT tradeoffs early in the weapon systems acquisition will reduce cost, improve weapon system supportability, and maximize combat readiness. MPT DSS will ensure the USAF meets operational requirements despite reduced MPT resources and shorten the time between system delivery and full operational capability.

OPR: AL/HRM, (210) 536-3648 [DSN 240]



MPT DSS Model analyses up-front MPT tradeoffs during weapon system development.

Productivity Capacity Project

USAF enlistment standards are continuously evaluated and raised or lowered, as necessary, to ensure recruits have the aptitude to successfully complete technical training. With the force size shrinking and competition for high-quality personnel increasing, Congress and DOD are scrutinizing standards closely to assure adequate linkage not only to training outcomes, but also to later actual job performance.

Exploration of alternate measures of job performance to serve as criteria has become a priority research topic. Accurate and fair measures are essential. Further, performance measures must be "user friendly" to enable operational managers to specify their minimum job requirements precisely and easily.

Productive capacity is one of the innovative scales being studied. It reflects the amount of work per unit of time an individual could produce, relative to the most productive member of that USAF specialty. Hands-on tests of job tasks are set up in the workplace, then actual times are recorded for enlisted personnel to satisfactorily complete the tasks. Supervisors are also participating to determine if they can give accurate estimates of the productive capacity of their employees. A major research interest is whether the less costly supervisor estimate can be substituted for the labor-intensive hands-on test.

During the initial field tryout, researchers collected data on 600 airmen in four Air Force Specialties: Aircrew Life Support (122XO), Aerospace Ground Equipment (454X1), Avionics Communication and Navigation (455X2), and Personnel (732X0). Preliminary results were encouraging, and productive capacity measurement in additional jobs is underway.

The most immediate and important application of productive capacity research focuses on setting enlistment standards for optimal selection and classification of USAF personnel. The measures also have potential value in evaluating the impact of personnel policies, such as the force structure and training practices on job performance.

OPR: AL/HRM, (210) 536-3942 [DSN 240]

An avionics specialist is timed and evaluated as he performs a task in the hands-on performance test.

Pilot Candidate Selection Method

The identification of candidates most likely to succeed as USAF pilots is a key USAF goal. The maneuverability and complexity of USAF aircraft demand exceptional physical condition, psychomotor coordination, and cognitive abilities. The Pilot Candidate Selection Method (PCSM) is a system which will combine computer based Basic Attributes Test (BAT) scores with more conventional paper/pencil tests to obtain a prediction of candidate performance in Undergraduate Pilot Training (UPT). UPT attrition rates have been well above 20 percent over the last several years. PCSM will fill the existing requirement to improve the current selection procedures.

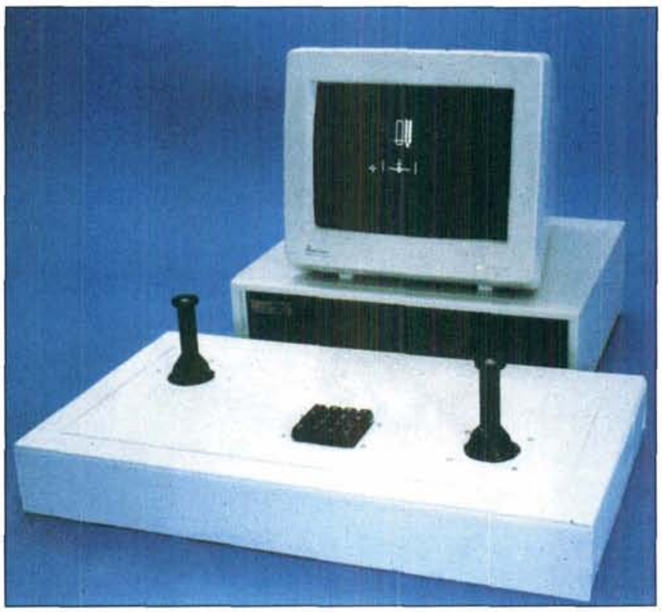
The BAT battery consists of six computerized tests that assess individual differences in psychomotor coordination, information processing ability, and personality. The BAT also includes a short biographical section which records the subject's age, previous flying experience, and other data.

Related efforts include a project to tie situational awareness in fighter pilots to computer administered tests, and a test battery developed in collaboration with the Euro-NATO Aircrew Selection Working Group. European selectees for the Euro-NATO Joint Jet Pilot Training (ENJJPT) program at Sheppard AFB will be assessed using the BAT and tracked through the program.

BAT stations were developed by the Human Systems Program Office and deployed at over 100 training sites throughout the USAF. A test processing station was also installed at Air Force Military Personnel Center to automatically receive and process BAT scores from the USAF training sites.

Payoffs from using PCSM include high-quality pilot candidates, reduced attrition, decreased training costs, optimal assignment, increased job satisfaction, and improved retention.

OPR: HSC/YAR, (210) 536-2477
AL/HRM, (210) 536-3942
[DSN 240]



PCSM system evaluates aptitude of undergraduate pilot candidates.

Job Design System

The military has entered a period of rapidly shrinking resources. The USAF needs to broaden many current job boundaries, create "generalists" rather than "specialists," and consolidate job categories into a smaller number of specialties. Complex rearrangements of duties are needed in certain job areas because of advancing technologies and new deployment concepts. Most research in the past has been directed toward matching people to existing jobs or specialties. The current research is aimed at defining the requirements of new or hypothetical specialties that might result from an extensive classification restructure.

A Job Design System is being developed to address these problems. Job requirement technologies being researched include procedures for identifying, describing, and measuring the characteristics of people and jobs. Examples include the physical demands and learning difficulty of tasks and jobs; the knowledge, skills, and attributes needed for successful job performance; and the aptitudes and technical training required for entering specialties.

Technologies that address the transferability of skills are being developed and include research of methods for estimating retraining times, job learning difficulty, and ease of movement for personnel changing from one job to another. Restructuring methods include engineering approaches to job design based on time studies; workflow analysis, and various efficiency measures; participative approaches involving employee working groups and quality circles; and modeling approaches that simulate the effects of a given job structure.

The Job Design System will be applicable to other services and agencies within the DOD and to other agencies that manage a large number of people across multiple job classifications. Under the Project TAPSTEM initiative, the Army Research Institute is sending research scientists to work in Armstrong Laboratory Human Resources Directorate, Job Structure Branch to address related issues.

OPR: AL/HRM, (210) 536-3256 [DSN 240]

Scientists are working to increase the speed with which occupational analysis data can be collected and analyzed.

The Automated Personnel Testing Program

In order to guarantee that the best qualified individuals are selected by the USAF, it is essential that the most current approaches to identifying learning abilities and sophisticated measurement be used for selection and classification. In the recent past, significant advances have occurred in the psychological theory of the underlying abilities related to training and job performance and in the technology available to measure these abilities.

The Automated Personnel Testing project (APT) is a recent initiative designed to evaluate the utility of computerized selection and classification instruments. This will be accomplished by examining the validity of the tests in predicting performance in technical training. The first tests to be examined are cognitive ones developed in the Learning Abilities Measurement Project (LAMP). Unlike the traditional selection and classification test currently used by the USAF, this new battery of tests is based on an information processing approach to learning. Here, more basic factors related to learning such as speed of processing and working and long-term memory capacity are measured rather than the more traditional measures of aptitude such as verbal and quantitative abilities.

The second purpose of APT is to expand the criterion space beyond that currently used for validation. At present, the measure used to validate USAF selection and classification tests is technical school final grade. Although this is a good measure, it captures only a part of a person's knowledge about the job. New criteria will be developed using training outcome measures currently gathered in technical school. Broader criteria will allow a more accurate estimation of the validity of the tests.

Concurrent with the primary work, APT scientists will be involved in research on computer testing issues. Among the issues to be addressed are the contribution of previous computer experience to computer test performance. Investigation of such issues will enhance the validity and the fairness of the tests.

The APT program will benefit the USAF by identifying tests which provide greater selection validity and more classification efficacy than do the tests currently used.

OPR: AL/HRM, (210) 536-3713 [DSN 240]

Recruit being evaluated with computerized test battery.

Simulation Utility Management System

The future outlook for the DOD is a decline in total budgeted dollars resulting in overall enlisted force reductions. To remain operationally prepared, the USAF must be concerned with optimal force structures and experience mixes within and across career fields that maintain mission readiness while minimizing overall costs of training and maintenance of the enlisted force. Conceptually, tradeoffs should be possible between experience, productivity, and force size; i.e., a more experienced force may need smaller numbers of personnel to maintain a desired level of productivity.

The Simulation Utility Management System (SUMS) model provides manpower managers and policymakers with a tool to analyze the effect of manpower decisions and personnel policy on specific enlisted career fields or overall force structures. Given an initial force structure and accession pool, SUMS simulates a policy decision (e.g., 10 percent force reduction in the third year) and evaluates the overall force productivity changes based on that decision. In addition, SUMS provides the end strength, accessions, and overages/shortages for each year of the simulated time period. SUMS can also analyze current force structures and assist in the determination of optimal force structures given a desired future end strength in terms of aptitude and experience within and across USAF specialties.

OPR: AL/HRM, (210) 536-2257 [DSN 240]

SUMS allows personnel managers to simulate the effects of force structure policy changes.

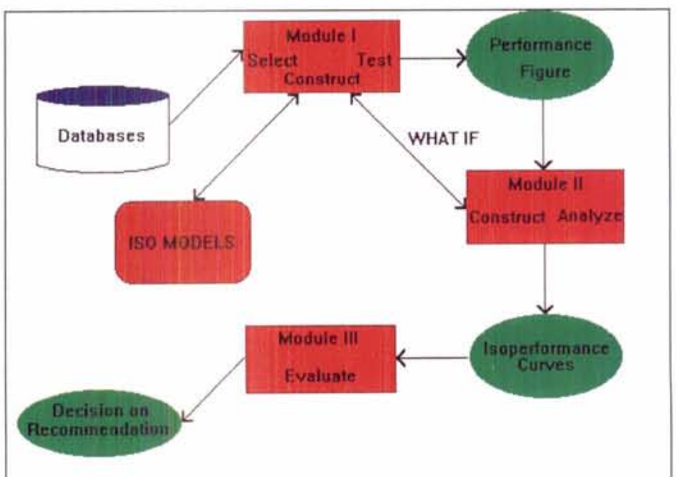
Isoperformance Methodology as a Framework for Human Systems Integration: SBIR Study

In recent years weapons systems and products have become more advanced as technology advances, and logistics requirements have increased in kind. Weapons development contractors are faced with a dilemma because the costs related to system/product acquisition and support are increasing at alarming rates, while the climate of decreasing military budgets results in less money. In view of these trends, one of the greatest challenges facing the Defense Systems Acquisition process today is to meet the need for more effective and efficient use of our resources. The national push to increase productivity in an environment of tight resources has placed emphasis on all phases of the weapon systems' life cycle. As a result, one primary requirement for weapon systems developers is to analyze the logistics, human factors, and manpower, personnel, training, and safety implications of alternative approaches as part of the weapon systems' design process in order to maximize human systems' effectiveness.

The Human Systems Center is conducting a Phase I Small Business Innovation Research (SBIR) study to assess the applicability of Isoperformance Methodology as a Framework for Human Systems Integration (HSI) issues in the design and acquisition of weapons systems. The study has several advantages: (1) it is a cost-effectiveness analysis and as such directly addresses the need not only to have HSI solutions, but also to have affordable solutions; (2) it provides authentic tradeoff functions; and (3) isoperformance is not an isolated approach but could be integrated with other HSI approaches. Phase I will result in the draft of a script that will guide the user through the design process using a question-and-answer approach with supplemental illustrative and informative materials. This will provide the basis for a computer program designed to run on USAF standard microcomputers.

The benefits anticipated from this study include integration of human factors issues and how to develop technically sound, meaningful tradeoff functions into the design process. A successful effort would do much to forward the current state of these integration methodologies. In particular, study results are expected to contribute innovative techniques to Armstrong Laboratory efforts such as the Manpower, Personnel, and Training Decision Support System.

OPR: HSC/XRS, (210) 536-2424 [DSN 240]



FLOW DIAGRAM

Cycle Ergometry Fitness Test

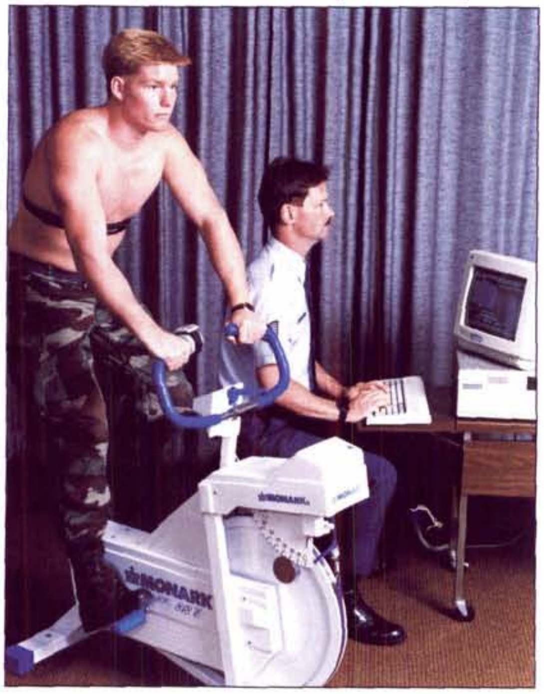
USAF interest in the cycle ergometry method for determining individual physical fitness began in the early 1980's when field studies showed that an alarming number of USAF ground crew were physically incapable of performing strenuous operational tasks under simulated chemical/biological warfare conditions. The fact that all of these "failures" had successfully completed the annual USAF fitness test (i.e., 1.5-mile run or 3-mile walk) was evidence that these methods of measuring fitness were not identifying problems of physical unpreparedness. However, the Armstrong Laboratory demonstrated that a safe and relatively simple estimate of cardiovascular fitness from heart rate response to submaximal exercise on a cycle ergometer could accurately predict performance in a variety of tasks requiring strength and stamina.

The cycle ergometer test is based on the physiological principle that heart rate increases directly with increases in work intensity. Exhaustion occurs when an individual's heart rate has reached its maximum, which is estimated as being 220 minus age. Thus, for a given level of work, the higher the heart rate, the greater the stress and the closer an individual is to his or her limit of performance.

The precision instrument used in the cycle ergometry test allows one to accurately measure exercise heart rate response to a precise workload. People with high heart rates at low workloads are significantly less fit than those with low heart rates at high workloads. Fitness scores represent cardiovascular fitness, and standards are based on (1) population averages that are age related, and (2) levels required for specific physical tasks.

The cycle ergometer program was adopted as mandatory for all USAF firefighters in March 1989. At about the same time, the program was selected for evaluation in a model health promotion program at Carswell AFB TX; it was adopted as the fitness testing method for all students entering the Air War College (Maxwell AFB AL); and it was being requested for implementation in a number of Air Force Health Promotion programs in all commands. In May 1991, this program was implemented on a trial basis at HQ Air Force Systems Command; it was subsequently adopted as the new fitness-testing program and implemented command-wide in February 1992. During this same period, General McPeak, Air Force Chief of Staff, directed the USAF Surgeon General to take responsibility for implementing this cycle ergometry fitness testing program for all USAF personnel, thus replacing the 1.5-mile run/3-mile walk test.

OPR: AL/CFTO, (210) 536-3464 [DSN 240]



New USAF Physical Fitness Test: Computer-guided cycle ergometry for assessing cardiovascular fitness.

Air Force Uniforms

The USAF is undergoing dramatic changes in composition and structure in the nineties and the uniform is changing right along with it. This is the first major design change to the entire service dress uniform since its inception in the days of General "Hap" Arnold. USAF men and women have completed testing the new uniform design. The wear test was conducted primarily in three areas of the country with approximately 800 participants. The wear test lasted from May to November 1992, and questionnaire collection and analysis were completed in January 1993.

Various changes have been introduced to the new uniform, including a more streamlined design. On the service dress coat, simulated welt and flap pockets have replaced the patch pockets. The "US" on the collar and the name tags have been eliminated. New rank designations and buttons were also tested. Two new styles of the skirt were tested for women. Both styles were designed to fit a wide range of body types while allowing more room for walking. In a move toward using more natural fabrics and commercially available components, the three fabrics tested were polyester/wool blends. The fabric selected for both officers and enlisted was the 55 percent polyester/45 percent wool serge weave.

Various designs for wear of officer's rank (such as sleeve braid) were evaluated in wear test evaluations.

The styles for both men and women are similar with a three-button front, greater ease and a more comfortable fit.

The Human Systems Center's Air Force Clothing Division also develops all other new uniform items for the USAF such as the women's maternity jumper, tuck-in blouse, slacks, and (for both men and women) a new polyester/wool shirt fabric. Furthermore, we modify existing uniform items to improve comfort, wear, and serviceability to the members of the USAF.

The end result is a simple yet distinctive appearance. The design changes, new fabric, and wear testing contribute in producing a USAF uniform that members can wear proudly to reflect their profession.

OPR: HSC/YAG, (513) 255-4733 [DSN 785]

Pilot Situational Awareness

According to the Air Force Times, many of the friendly fire casualties during Operation Desert Shield/Storm occurred because pilots mistakenly believed they were in free-fire zones. Studies of air combat since World War I have shown that relatively few pilots (4 to 5 percent) account for about 40 percent of the combat kills. These statistics represent both breakdowns and successes of situational awareness. USAF/XO defines situational awareness as "a pilot's continuous perception of self and aircraft in relation to the dynamic environment of flight, threats, and mission, and the capability to forecast, then execute tasks based on the perception."

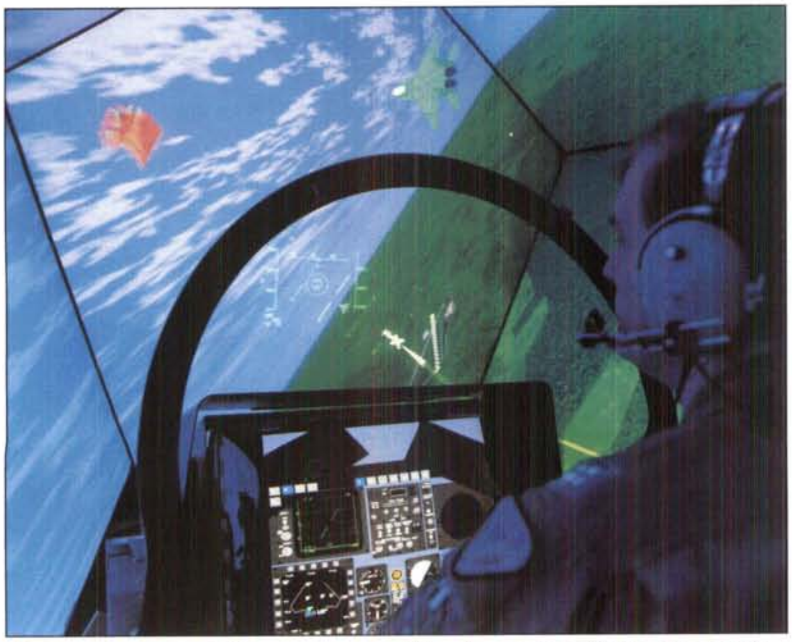
Situational awareness is a unifying concept behind much of Armstrong Laboratory's human factors research. New display technologies are developed to improve the pilot's situational perception and prediction of tactical trends. New control technologies seek to improve the pilot's capability to execute necessary actions. Selection and training prepare a pilot to accomplish the mission. Armstrong Laboratory has been at the forefront for developing system assessment metrics including tools for pilot workload evaluation. Current research emphasizes developing and validating subjective, performance based, and physiological situational awareness metrics. Armstrong Laboratory researchers have evidence that near-sensory-threshold information processing is an essential and trainable situational awareness skill and are testing a low cost training device. Other Armstrong Laboratory research has identified the critical behavioral components of situational awareness in multiship air combat. This information is being used to develop training guidelines and devices.

The Situational Awareness Challenge: The measurement of pilot characteristics and behavior to enhance selection, training, and design which are the pillars of combat effectiveness.

In a response to a request from the USAF Chief of Staff, Armstrong Laboratory researchers formed the Situational Awareness Integration Team known as SAINT to perform a quick response research program. The program has three main objectives: (1) develop measures of pilot situational awareness, (2) identify tools for selecting pilots most likely to develop good situational awareness, and (3) identify tools for training situational awareness. Armstrong Laboratory scientists have developed two rating scales to elicit expert judgment on pilot situational awareness performance. A computer based selection test battery has been developed to measure fundamental cognitive dimensions of situational awareness. In addition, the test battery includes some tactical game-like software that may train important situational awareness components. The program includes a validation of the scales and selection tests to be conducted in the high fidelity Multiship Training Research and Development facility at Williams AFB AZ. Air Combat Command is fully supporting this program with critical pilot resources.

OPR: AL/CFHP, (513) 255-8750
[DSN 785]

Training for Situational Awareness



Future aircrew training programs will enhance the pilot's situational awareness during combat.

While success in air combat requires a certain level of competence in both procedural and perceptual motor skills, it is the general consensus that the most important skills are cognitive in nature. Throughout air combat, pilots are continuously gathering information from the environment, making judgments about the intent of their adversary, deciding upon the best course of action from a larger set of alternatives, evaluating the success of their actions, and deciding when their chosen course of action is no longer appropriate. Such behaviors have been included under the umbrella concept of "situational awareness" or SA.

A cross directorate research program has been initiated to address issues of measurement, selection, cockpit design, and training. Of specific interest to the Armstrong Laboratory Aircrew Training Research Division is the issue of how to train for enhanced SA during tactical flight operations. Specifically, the objectives are to: (1) develop and validate measures of SA and its components for air combat operations; (2) develop and validate quantitative models of aircrew behavior during air combat; (3) conduct controlled experiments investigating components of SA in an attempt to determine the underlying situational assessment, judgment, and decision-making processes employed by tactical pilots during combat operations; and (4) develop and evaluate training methods and techniques for measurably improving SA during combat operations.

The long-term goal of this research program is to gain an understanding of the components of SA, to determine which elements are most crucial to success in air combat, and to develop training programs designed to enhance a pilot's SA during combat. Such an understanding should lead to a better characterization of differences between novices and experts and, more importantly, how these differences develop. Without a basic understanding of this skill development process, training will likely continue in its current haphazard process in which expertise simply "emerges" as a function of practice. Given the likely decrease in training resources, the preferred alternative would be to "shape" expertise. However, without an understanding of the basic decisional components of air combat, such a prospect appears unlikely.

OPR: AL/HRA, (602) 988-6561 [DSN 474]

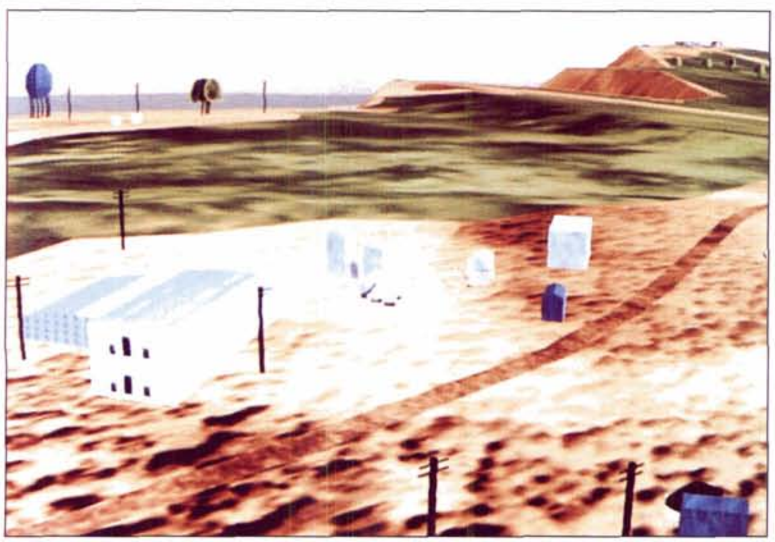
Aircrew Training Systems

USAF aircrew training programs are designed as integrated systems of academic coursework, simulator instruction, and flight training. Recent advances in training technology provide new techniques for USAF aircrew training. There is also a shift toward contracting the design, delivery, and support of aircrew training. A number of technical and management issues must be considered to maximize effectiveness and control costs. The aircrew training system research program provides principles, procedures, and user-oriented guidelines to support USAF acquisition and operational training agencies.

The initial phase of this research effort produced the Model Aircrew Training System (MATS), a major design effort that used modern learning theory to restructure how aircrew training is conducted. The C-130 Aircrew Training System (ATS) specification was based on MATS principles and implemented at Little Rock AFB AR and six other operating bases. An analysis of cost and training effectiveness data from the old and new training systems revealed a reduction in cost with the new approach, largely from reductions in flying hours and numbers of instructor personnel needed. Lessons learned during acquisition, development, and implementation of the C-130 ATS were documented. Evaluation and training information issues, requirements, and key design features are being described based on lessons learned and extensive analyses of operational USAF training programs and organizations.

Armstrong Laboratory's Aircrew Training Research Division recently initiated a research partnership with the Special Operations Forces (SOF) community to address training system effectiveness and mission rehearsal issues, taking advantage of newly acquired rehearsal capabilities collocated with the SOF formal school at Kirtland AFB NM. The goal of the rehearsal research is to develop guidelines for effective integration of emerging rehearsal technologies into the mission preparation process and to document the impacts of these technologies.

OPR: AL/HRA, (602) 988-6561 [DSN 474]



Simulator photo of special operations mission.

Multitask Trainer

The Multitask Trainer (MTT) is a research and development effort aimed at providing a squadron-based trainer. This goal led to the following requirements: a high-fidelity training environment (including cockpit fidelity, real time simulation, and networking for team training); a "pilot-friendly" low cost flexible and extensible design; modular hardware and software; a small package for a classroom or deployment, and concurrence. The physical device is a fully functional three-dimensional cockpit with all cockpit controls and incorporates F-16C aircraft simulation. The air conditioning and the computers necessary to drive the real time simulations, cockpit instruments, instructor/operator station, and a one-channel visual are self contained. The MTT can be split apart to fit through a 36-inch doorway and requires only three 110-volt, 20-amp circuits, ensuring access to any squadron classroom. It uses actual aircraft code to ensure high fidelity avionics and concurrence. Existing high fidelity Air Force owned operational flight-trainer (OFT) software provides the aircraft simulation. Government owned software was converted to keep development costs and risks low, while maintaining the highest fidelity simulation in existence. The MTT is a 5- by 6-foot box that can be produced at a fraction of the cost of an OFT. It is capable of training many mission critical tasks at the squadron level and can be deployed with the unit to continue combat mission training in the field.

A simulator using actual aircraft avionics software modules not only provides concurrence but also offers many opportunities in programs other than training. The MTT design could provide in-depth test of proposed line replaceable unit updates prior to aircraft tests. These updates could be prototyped and even put into specified squadron trainers for user feedback prior to design freeze. The same concept could be carried into new aircraft development. In this case the prototype/trainer software becomes the designed, written, and tested aircraft code.

The technical success of the program and its impact on the future of aircrew training device design led the Air Force Materiel Command to select the MTT program as the USAF "Technology Demonstrator" for the 1992 international air shows. Armstrong Laboratory's Aircrew Training Research Division (AL/HRA) is conducting the program with an in-house contractor. The first device was delivered to the 926th Fighter Group in New Orleans, LA in August 1992.

OPR: AL/HRAD, (602) 988-6561 [DSN 474]

The F-16C Multitask Trainer provides high fidelity training within a portable platform costing only a fraction of existing trainers.

Night Vision Device Training Research

The capability afforded by Night Vision Devices (NVD) for the conduct of nighttime military operations has literally revolutionized modern warfare. Certainly, the recent war in the Persian Gulf was a convincing demonstration of an overwhelming military advantage due in large part to night vision technology. NVDs, primarily night vision goggles (NVG) and forward-looking infrared (FLIR) sensors, have become an integral part of night operations for many aircraft, both rotary and fixed-wing. While NVDs impart a significantly increased capability over unaided night vision, their restricted field of view and reduced resolution (visual acuity) are somewhat deficient when compared to unaided day vision. In addition, the imagery produced by NVDs has unique characteristics that require specific interpretive techniques which must be learned by the operator. These aspects of night vision technology have a significant impact on operational procedures and training requirements.

Night Vision Device Training in the "Test Lane"

It is a certainty that nighttime military operations will receive even more emphasis in the future, but training at night will be constrained by shrinking resources, airspace restrictions, and reduced manning. Cost-effective ground based training systems and facilities will be essential.

(Continued on page 72)

(Continued from page 71)

To effectively employ NVDs, aircrew members must understand the physiological and operational limitations of the devices. The requirement for USAF-wide NVG aircrew training program was identified in an AFISC Functional Management Inspection of Night Vision Goggles (PN 89-622) and by the USAF NVD Working Group which includes representation from all major commands using NVDs. The Armstrong Laboratory Aircrew Training Research Division, Night Vision Program Office, was established to meet the operational training requirements of both existing and future systems.

After thorough review of existing DOD NVD aircrew training programs, research objectives were developed with user inputs and contributions by subject-matter experts. The first completed product was the NVG Test Lane, which combines a specially designed NVG resolution chart (developed at AL/CFHV) and standardized light source with a comprehensive set of adjustment and assessment procedures. The NVG Test Lane provides, for the first time, a practical means by which NVGs can be adequately adjusted and functionally assessed in an operational setting. This capability is vital not only for initial NVG training, but also for routine preflight procedures in operational units.

A prototype course for NVD ground training has also been developed and is now in use or undergoing implementation by all USAF major commands. Individual modules include (a) Visual Physiology and Spatial Orientation, (b) Fatigue and Circadian Rhythm, (c) The Night Environment and NVD Theory, (d) NVG Adjustment and Preflight Assessment Procedures, (e) Cockpit Procedures and Lighting, (f) Lessons Learned, and (g) Hazards and Emergency Procedures.

Efforts in video media development include the production of individual video tapes that address NVG adjustment procedures and a broad spectrum of NVG effects, limitations, and illusions, and an interactive videodisc to be assessed as a self-paced stand-alone audiovisual instructional aid. Work is also underway on the integration of NVG video into existing interactive computer based training software. Future work will include similar products for FLIR and other electro-optical devices as they become operational.

Basic visual research is underway to enhance our understanding of aided night vision. This includes the investigation of size and distance perception with NVGs and the role of unaided peripheral vision on aircrew performance during NVG-aided flight. NVD visual display effectiveness, training transfer effectiveness, and simulator sickness studies are planned.

Activities in advanced simulation technology involve the development of specialized databases and image generators for NVD simulation and helmet-mounted visual displays designed to provide a low cost, deployable, ground based aircrew training capability.

The objective of the NVD Training Research Program is to produce cost-effective, comprehensive ground based training that prepares aircrew members for the unique aspects of NVD employment and enhances USAF operational capabilities and safety in night operations.

OPR: AL/HRA, (602) 988-6561 [DSN 474]

Multiship Training Research and Development

Realistic training for tactical air-to-ground and air-to-air battle is difficult, dangerous, and costly. Combat mission training for the air combat forces has limitations such as use of tactical ranges, frequency of practice, and capability to rehearse specific missions. Advances in simulation technology are needed for combat training such as affordable training devices, networking for interactive force-on-force training, and rapid turnaround databases for mission rehearsal. The Multiship Training Research and Development (MULTIRAD) project will develop, integrate, and evaluate several simulation and training technologies for this purpose. The focus is on acquisition and maintenance of multiship air-to-air and air-to-ground aircrew combat readiness. The goal is to identify specific training needs for a joint air/land battle exercise and match those training needs to cost-effective training devices.

During 1990, in cooperation with Defense Advanced Research Projects Agency (DARPA), simulator network (SIMNET) version 6.6 was installed, including expansions to include USAF weapon systems. Both local area and long-haul networking of aircrew training devices were demonstrated. Training effectiveness research and development was initiated with ACC to identify combat tasks that could be effectively trained using ground based simulators. During 1991, a variety of training devices were integrated to the SIMNET network. Extensive testing of this expanded protocol was initiated in cooperation with DARPA, Naval Training Systems Center, Institute for Simulation and Training, and industry. Training utility evaluations are underway to identify the training potential of low cost aircrew training devices. During 1992, MULTIRAD directly supported DARPA's efforts in WAR BREAKER. This simulation recreates the last months of SCUD hunting during Operation Desert Shield/Storm.

The MULTIRAD program will provide the simulation and training effectiveness tools needed to enhance critical multiship aircrew skills. This capability will be used to develop and evaluate multiship air-to-air and air-to-ground training systems. Ultimately, results of this R&D will provide the air combat forces with the capability to more realistically train for a joint service air/land battle exercise.

OPR: AL/HRA, (602) 988-6561 [DSN 474]

Realistic Multiship Training.

Intelligent Training Technology

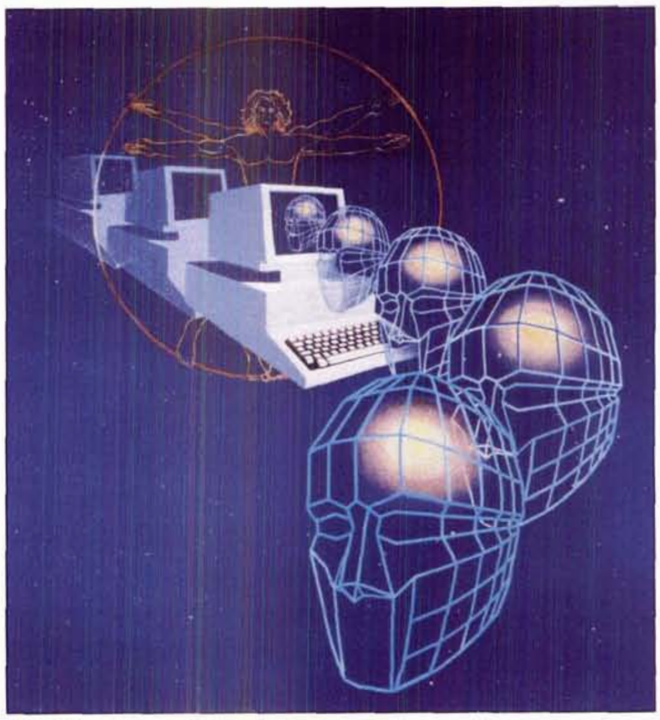
While USAF weapon systems demand increasing levels of technical expertise, the availability of quality trainees is diminishing. Advancements in artificial intelligence enable computerized instruction that adjusts to the knowledge and ability of each trainee. These advancements will enable faster, more effective training of personnel from diverse educational backgrounds and minimize errors in complex maintenance and operations tasks. The Intelligent Tutoring System (ITS) integrates subject-matter expertise, instructional methods, and student modeling to produce human-like tutoring environments. Products of this research include intelligent tutoring systems, intelligent authoring systems, and instructional effectiveness assessment technology. Users of this research include Air Education and Training Command, Air Mobility Command, Space Command, the USAF Academy and NASA.

Completed ITS products include tools for rapid development of expert knowledge bases and tutoring systems. Ongoing efforts oversee the development of tutors for various purposes. For example, the Intelligent Computer-Assisted Training Testbed (ICATT) will support development of intelligent simulation based training systems for equipment maintenance tasks.

An ICATT prototype was completed in 1992. Another example, the Fundamental Skills Research Program addresses the critical thinking skills required for basic literacy in the United States. Test sites for this project were established at eight public schools nationwide during 1992. In addition, subject-matter-specific tutors have been developed for weather forecasting, satellite console operations, auxiliary power unit maintenance, and cryptographic equipment maintenance. Other ongoing research topics address natural language processing, intelligent hypermedia knowledge bases, machine learning, and authoring system capability for microcomputers.

The payoff is faster, more cost-effective training of USAF personnel. ITS will provide greater consistency between technical training schools and on-the-job training, reduced cost and development time for computer based training, and critical technology for the private sector.

OPR: AL/HRT, (210) 536-2034 [DSN 240]

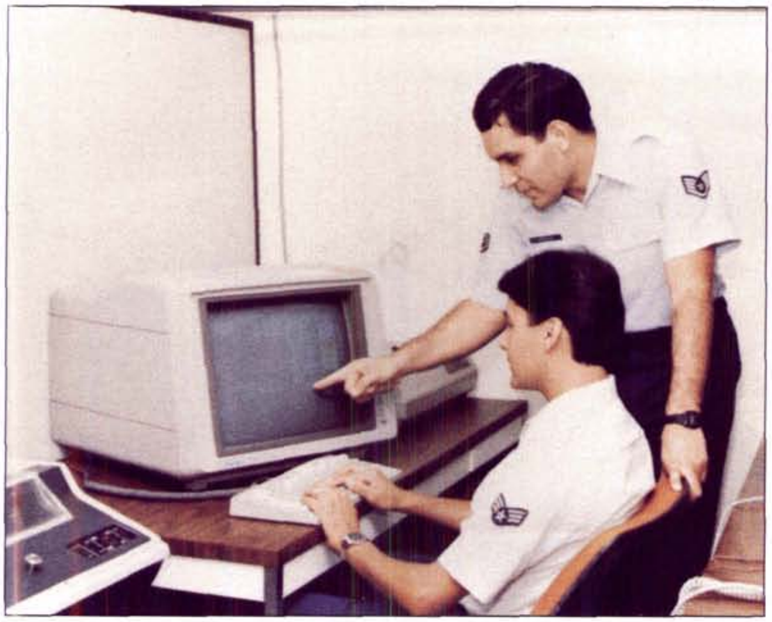


Intelligent training technology will result in faster, more cost-effective training for USAF personnel.

Advanced Instructional Design Advisor

The USAF must provide personnel with technical training for a number of weapon systems and missions. At the same time, we are experiencing a significant cutback in resources to support training requirements and a decrease in the number of instructors. In turn, there will be increased demand for computer based instruction (CBI). The Advanced Instructional Design Advisor (AIDA) project will provide automated and intelligent tools to assist novice instructional designers in the development of effective CBI. AIDA incorporates two technologies from artificial intelligence: case-based reasoning and expert systems. One AIDA component provides detailed guidance for designing CBI for several cases which are fully elaborated and available on line. A second component uses expert system technology to collect and configure reusable lesson frameworks appropriate for a variety of specific instructional purposes.

An evaluation of these technologies in USAF technical training settings has been conducted. Initial results indicate such techniques and tools can be used by subject-matter experts with little background in CBI and development time can be reduced by a factor of ten. An experimental AIDA has been prototyped and is now undergoing formative evaluation. The initial effort will target electronics and aircraft maintenance training. It will provide four on-line cases and four intelligent lesson frameworks. These frameworks will be integrated with a front-end advisor which will query users for information about students, course objectives, and content. It will then provide an initial configuration appropriate to that specific instructional development effort.



The Advanced Instructional Design Advisor project will provide automated and intelligent tools to assist novice instructional designers.

AIDA will enable subject-matter experts to develop effective CBI without extensive training. Use of this technology will significantly improve the productivity of CBI developers and enable the USAF to produce effective CBI without recourse to expensive contract efforts. Additional payoffs include: (1) reduced training time, (2) decreased TDY costs, (3) development and delivery of CBI closer to the workplace, and (4) instruction that can be delivered using distance learning technologies.

OPR: AL/HRT, (210) 536-2981
[DSN 240]

Maintenance Skills Tutor

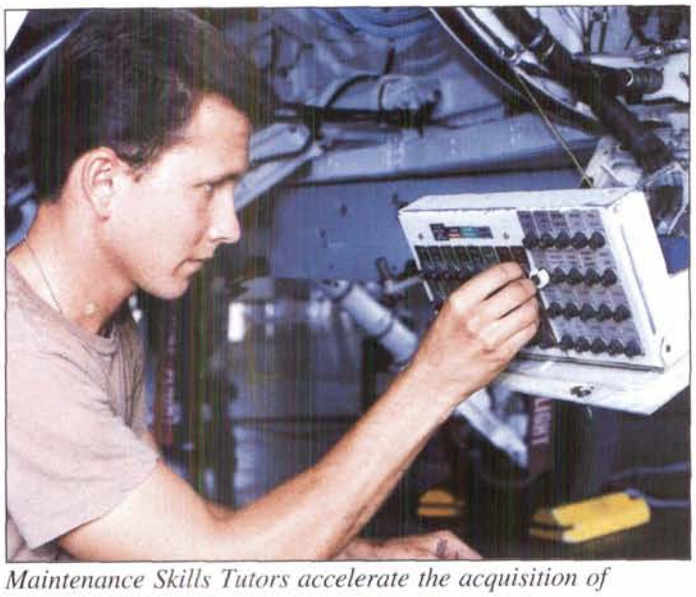
Well trained, productive maintenance technicians are essential to USAF readiness. Today, the thinking skills required for maintaining complex weapon systems and support equipment cannot be adequately taught in existing formal schools and on-the-job (OJT) training programs. In the past, weapon systems and support equipment failed frequently, providing many opportunities for learning through field experience. This is no longer the case because today's weapon systems breakdown less often. In addition, we are reducing the number of technicians per aircraft through the RIVET WORKFORCE program. As a result, each technician must have broader based knowledge and skills. Air Combat Command (ACC) identified a need to improve flight line maintenance technician troubleshooting skills normally taught through time consuming and manpower intensive OJT.

In response to the Air Combat Command need, Human Systems Center's Basic Job Skills (BJS) research program is developing two complementary technologies. First, cognitive analysis techniques were developed to examine novice versus expert troubleshooting strategies and to develop effective training techniques. These techniques are documented in the Cognitive Task Analysis Procedural Guide. Second, artificial intelligence based tutors are being developed to present trainees with a computerized interactive troubleshooting environment for problem solving. They also provide coaching hints and feedback. Prototype tutors were demonstrated at ACC fighter wings at Langley AFB VA and Eglin AFB FL. Novice technicians showed significant gains in proficiency after only 20 hours of training.

The Human Systems Program Office is developing operational Maintenance Skills Tutors (MST) for ACC based on the Basic Job Skills technology. ACC identified this technology as a top priority for fielding. MSTs for tactical aircraft maintenance specialists, flight line avionics, and other USAF specialties are being developed.

The MST effort has several payoffs: (1) faster more complex skill learning, (2) increased adaptiveness and efficiency of technical personnel, (3) reduced need for retraining, (4) increased productivity and ability to carry out the mission. This technology can be transitioned to private sector settings for effective training of complex problem-solving tasks.

MST OPR: HSC/YAR, (210) 536-2477
BJS OPR: AL/HRT, (210) 536-3570
[DSN 240]



Maintenance Skills Tutors accelerate the acquisition of complex skills.

Advanced Training Systems

Even with today's high technological capabilities, training systems remain both labor and paperwork intensive. The effectiveness of training systems can be maximized by carefully blending operational requirements with instructional strategies, student flow, media selection, instructor skill level, lead time, and available resources. The Advanced Training System (ATS) is an interactive computer support system being developed to automate the training processes at Air Education Training Command's (AETC) Technical Training Centers (TTC). When fielded, it will perform and unify training management, development, delivery, testing, and evaluation. The USAF plans to utilize this new capability to control the training services of the TTCs.

The ATS system will perform all functions involved in training including registration, scheduling of courses and students, monitoring student flow through the system, and recording of student evaluations. In addition, ATS will assist the instructor in course development and presentation; ultimately, it will control training from beginning to end. This distributed system of personal computers interfaces with larger computers strategically located to facilitate data storage and network transfer. ATS will interface with the Air Force Training Management System at Randolph AFB TX and other TTCs using existing military telephone and data networks.

The system is designed for maximum portability and hardware independence. Transition to ATS began in 1993 at Keesler AFB MS TTC. This program provides AETC with an integrated, computerized network system which capitalizes on modern interactive media and provides efficient transfer of instructional information throughout the training environment. With the full implementation of this program, training costs will decrease as training effectiveness improves. The ATS can be transitioned to automate any military or civilian schoolhouse environment.

OPR: HSC/YAR, (210) 536-2477 [DSN 240]

Advanced Training Systems will unify training development, delivery, testing, and evaluation.

Base Training System

Several years of hard work and perseverance by the Human Systems Center (HSC) has paid off in the development of a prototype USAF enlisted on-the-job training system known as the Advanced On-the-Job Training System (AOTS). In 1988-89, the Human Resources Laboratory demonstrated the feasibility of this advanced training technology in the operational environments of Tactical Air Command (TAC), Air Force Reserve (AFRES), and Air National Guard (ANG). The system integrated the three main components of training (management, evaluation, and training development/delivery) into one complete training system. The work involved was primarily software development because hardware was to be purchased off the shelf; thus, no hardware was developed. In July 1990 the implementation of the management portion of the AOTS was given the go-ahead with further enhancements to follow in the coming years.

Shortly thereafter, the AOTS program was transitioned to the Human Systems Program Office as the Base Training System (BTS). BTS is an HSC "high-gear" program approach to meet the immediate needs of the user. HQ USAF/DPP (AF On-The Job-Training Policy) serves as the requirements manager. BTS standardizes all aspects of the OJT management processes and allows supervisors and training managers across the active duty, civilian, ANG, and AFRES communities to perform their OJT jobs more quickly and efficiently. The management system (their first priority) software from AOTS was modified to work on the USAF standard AT&T 3B2 minicomputer. The 12th Flying Training Wing at Randolph AFB is conducting an operational assessment of the prototype system. The program is awaiting approval of the Air Force Training and Education Automated Management System requirements board and will upgrade the software prior to USAF implementation.

BTS uses existing base level communications and computer infrastructure to allow for maximum access. It automates training records for officers, enlisted, and civilians to allow real time training requirements and training status to be determined. The BTS has automated interfaces with the Personnel Data Systems to obtain military and civilian personnel data to allow each USAF supervisor to have a current and complete training template for every USAF member. This approach optimizes the reuse of existing data while injecting state-of-the-art OJT management where it is most needed. This fosters greater productivity and enhances the quality of "total person" USAF training.

BTS continues to pursue this state-of-the-art training system in support of today's and tomorrow's user needs. This system can be applied to any military or civilian training management need.

OPR: HSC/YAR, (210) 536-2477 [DSN 240]

Training Impact Decision Systems

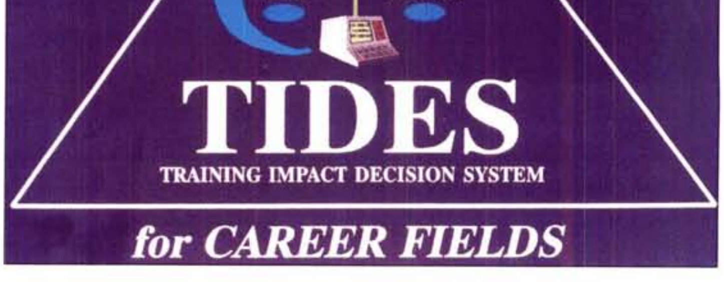
USAF planners and training managers face a complex array of variables when making broad decisions on career field training. Changes in the Manpower, Personnel and Training (MPT) system can have unanticipated long-term impacts. Budget fluctuations, job restructuring, and policy revisions involving training and the force structure add further complexity. The Training Impact Decision System, or TIDES, helps key decision makers recognize the impact of these factors on the training system. TIDES integrates information about jobs, personnel utilization factors, training costs, resource requirements, capacities, and managers' preferences in identifying the optimal allocation of training resources.

TIDES identifies which tasks within a specialty to train, the career points at which training should be provided, and the optimal combination of training settings--formal classroom instruction, self-paced study, hands-on training, or on-the-job training (OJT). Analysts use TIDES to dynamically model the current utilization and training pattern of a specialty and then assess alternative scenarios based on proposed changes to the specialty. For example, TIDES assesses the impact on personnel, resources, cost, and mission resulting from a decision to add or eliminate a training course, front load OJT into technical training courses, or recruit industry trained personnel. Decision makers can use TIDES information to manage career fields, optimize resources, and develop Career Field Training Plans (CFTP). Users of this research include HQ USAF, HQ Air Education and Training Command, and operational major commands.

In 1988, proof-of-concept work was completed on this technology. Exploratory development of the forerunner to TIDES, the Training Decisions System (TDS), included development of training cost and capacity models, the analysis methodology, and supporting data files for eight Air Force Specialties (AFS). Advanced TIDES research is aimed at designing a template for CFTPs and developing a user interface that facilitates data manipulation and analysis.

The payoff to the USAF is a systematic method to enable functional and training managers to maximize efficiency and training effectiveness while minimizing training costs, yet still provide the means to produce the highest quality fully trained forces.

OPR: AL/HRT, (210) 536-2932 [DSN 240]



Training Effectiveness and Efficiency Model

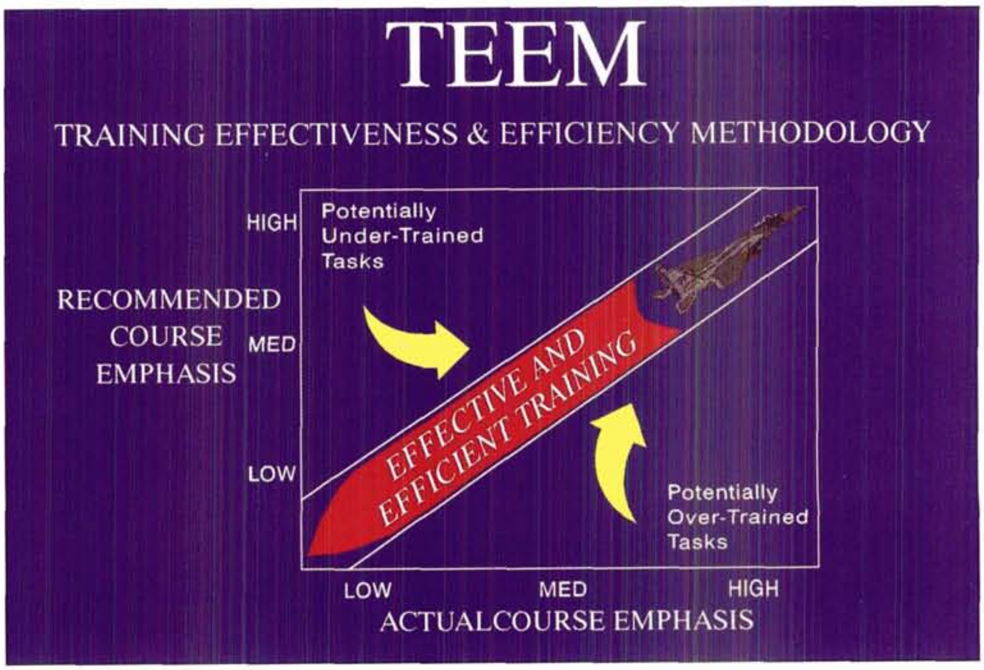
With today's fewer resources and increased complexity of jobs, the USAF will find the Training Effectiveness and Efficiency Model (TEEM) an invaluable asset. The TEEM method will enable the USAF to make knowledgeable decisions in the realm of training. TEEM not only identifies deficient or excessive training, but also helps determine the content validity of that training.

TEEM examines training efficiency with a comparison between field recommendations of task training emphasis and the actual emphasis given in the classroom. Under- and overtrained tasks are quickly identified and revised making the training program revision process both more time and cost efficient.

TEEM methodology addresses the effectiveness of training by examining the job performance and knowledge level of the identified over-and under-trained tasks. These results could then be used to facilitate training course changes. For example, training time might be reduced for overtrained tasks that were performed well, while training time might be increased for undertrained tasks where performance was low.

TEEM, written in IBM compatible software, is applicable to all enlisted and officer specialties for all USAF and military contexts including Active, Reserve, and Guard components. In addition to its military application, TEEM is suitable for civilian training assessment. To date, TEEM has been utilized for the aerospace ground equipment mechanic and aerospace physiology instructor training program analyses. TEEM will provide the USAF with a reliable and accurate feedback device for refining technical training to better meet the field requirements.

OPR: AL/HRT, (210) 536-3047 [DSN 240]



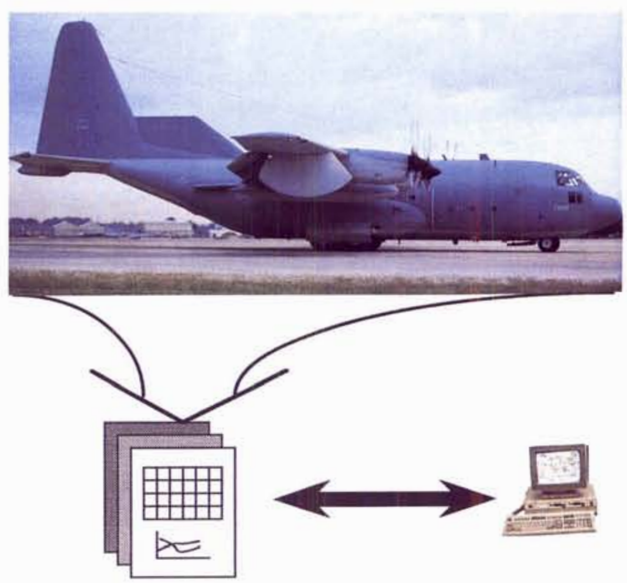
Maintenance Skills Training Studies

USAF maintenance organizations are adapting to new challenges resulting from several significant personnel, technological, and organizational trends as well as budget realities. A growing need to enhance troubleshooting skills, capture lost expertise, and transfer years of maintenance technical experience has generated strong interest in Human Systems Center Intelligent System Technology. Accordingly, major commands need to assess the applicability of tutors to improve maintenance skills and substantiate requirements documents for program funding.

An analysis of an Air Combat Command (ACC) F-16 and F-15 maintenance skills needs and technology assessment was completed to support transition of Armstrong Laboratory technology to the Systems Program Office for the planning of a full-scale development effort. Since the effort dealt with development of an unprecedented system with respect to acquisition, evaluation of software development approach, and programming language issues an initial risk had to be assessed. The study substantiated that use of Intelligent Tutoring Technology was necessary to address ACC needs. In addition, technology assessment and associated supportability issues laid the groundwork for determining applicability of this training technology to USAF-wide maintenance technician training requirements such as for the Air Force Special Operations Command (AFSOC).

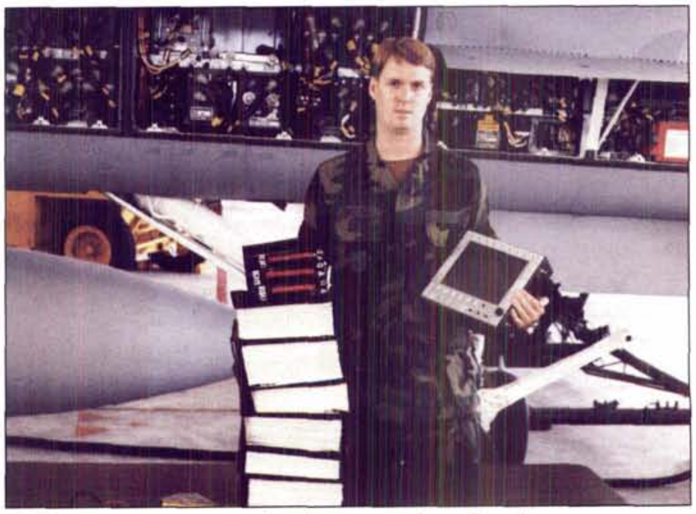
As a natural outgrowth of the original maintenance skills study for ACC, a needs analysis and capability assessment was initiated in FY92 for the AFSOC. The study will provide a basis for AFSOC training program planning. The mission of AFSOC and the different types of aircraft imposed a diversity of maintenance skills required which entailed a study broader in scope than the corresponding study for ACC. The applicability of Human Systems Center training technologies--intelligent tutors, in particular--is being assessed to address AFSOC maintenance-training problems. This will also result in determining the applicability of tutors to other MAJCOM needs and thus foster the improvement of proficiency and efficiency of USAF maintainers.

OPR: HSC/XRS, (210) 536-2424 [DSN 240]



Analysis captures technology application for maintenance training on the flight line.

Integrated Maintenance Information System



IMIS uses computer technology to replace hard copy technical orders and aids in diagnosing maintenance

USAF maintenance personnel are called upon to repair increasingly complex modern weapon systems. Maintenance must be accomplished under a wide variety of deployment scenarios and with fewer maintenance specialties. Technicians must have ready access to huge amounts of technical information to maintain aircraft. The Integrated Maintenance Information System (IMIS) is an automated system which is being developed to provide the technician all of the information that is needed to do the job from a single source.

The IMIS consists of a small Portable Maintenance Aid (PMA) computer, maintenance information workstations, and an aircraft interface panel. The PMA provides technicians with rapid access to all the information required to find and fix maintenance problems. This includes step-by-step instructions, troubleshooting guidance, part numbers, illustrations, and aircraft maintenance history. The PMA directly connects to the aircraft to run built-in tests and extract aircraft system data for use in troubleshooting.

User requirements studies have been conducted to ensure that the system meets the technicians' needs. It is being developed in a phased approach, with field tests being conducted to evaluate each new capability as it is incorporated in the system. In the most recent test, the diagnostic capabilities were tested using the F/A-18 as the test bed. Technicians used maintenance instructions, diagnostic guidance, and the PMA/aircraft interface to identify faults in the aircraft. The test demonstrated that technicians can troubleshoot more effectively when using the IMIS. A full-scale IMIS is presently in development which will demonstrate and test all IMIS capabilities.

IMIS technology will save millions of dollars by reducing maintenance time and by reducing the inventory of spare parts. It will improve deployment capability. Electronic media will replace the vast bulk of paper technical orders. Also, the IMIS will enhance the country's technology base and maximize the return from our investment in weapon systems.

OPR: AL/HRGO, (513) 255-2606 [DSN 785]

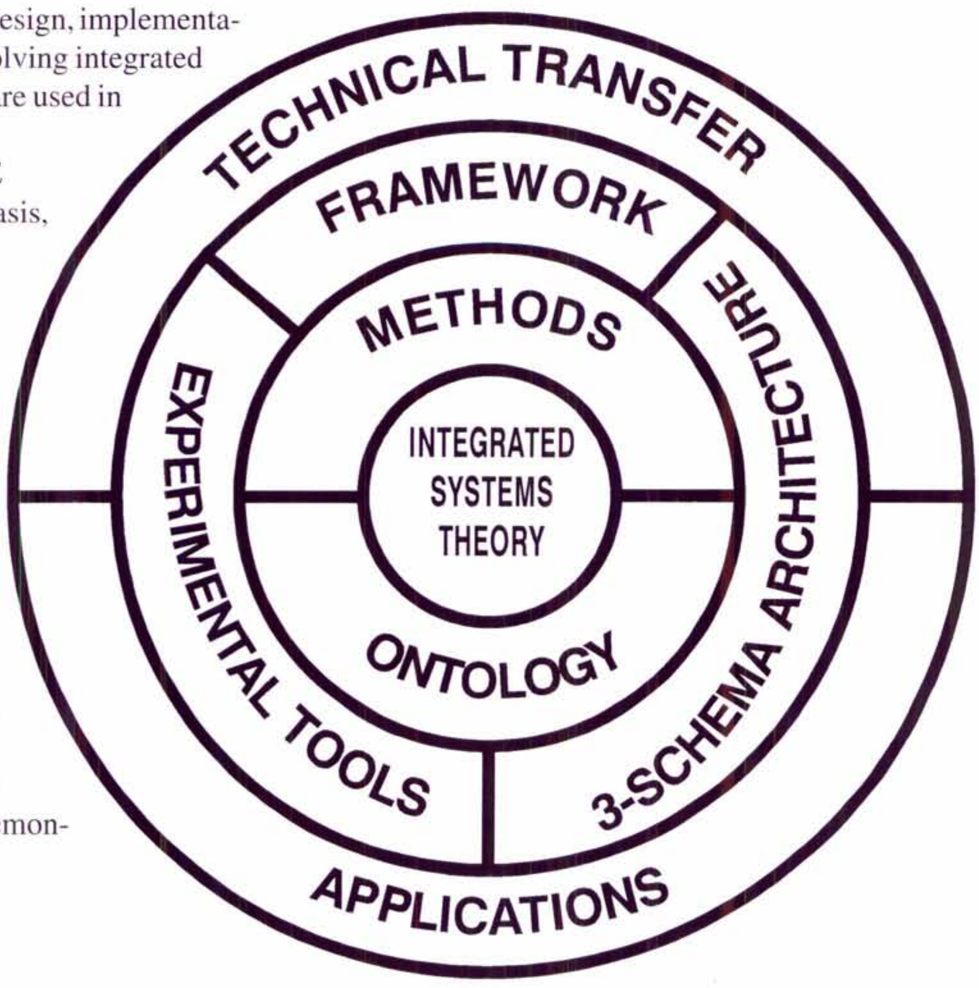
Information Integration for Concurrent Engineering

Modern technology is cursed with inefficiencies in information management; for example, software packages that are unable to input data from other software packages, special-purpose methods and procedures, nonstandard data repositories, etc. The overall effect of this diversity keeps organizations from integrating their information. The Information Integration for Concurrent Engineering (IICE) project is developing the critical technologies for information integration in support of concurrent engineering processes. These technologies will provide a structured engineering approach to life cycle activities associated with the definition, engineering, design, implementation, and maintenance of evolving integrated information systems which are used in concurrent engineering.

In order to set the IICE project on a firm scientific basis, the program is designed to have theoretical as well as experimental and application components. This has led to a wide range of user interest: invited participation in prestigious conferences, requests for information from numerous DOD agencies, even funds contributed by the Army Natick Research and Development Center to initiate a concurrent engineering pilot project at their facility. A demonstration is currently being planned at a USAF air logistics center.

The IICE technologies have the potential to save the government millions of dollars by creating the capability for integrated concurrent engineering enterprises. Products include, methods for integrated design, frameworks which guide the choice of design tools, flexible information storage, and a design environment which supports the concept of evolving enterprises.

OPR: AL/HRGA, (513) 255-7775 [DSN 785]



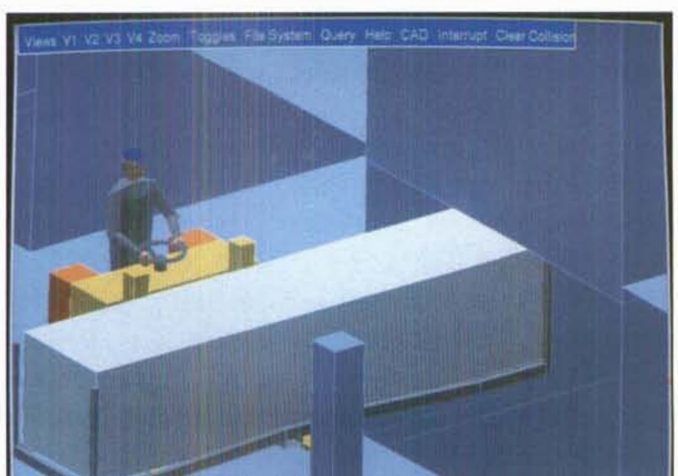
Design Evaluation for Personnel, Training, and Human Factors

Human resources constitute a large share of the cost of USAF system maintenance. If we can account for these costs when systems are being designed, we will acquire more efficient systems. This is the goal of the Design Evaluation for Personnel, Training, and Human Factors (DEPTH) program. DEPTH uses dynamic human figure modeling to present realistic images of people interacting with equipment and the workplace on a computer aided design (CAD) screen. Modern CAD graphics can accurately simulate critical elements of proposed maintenance and repair procedures. We will no longer rely on costly and time-consuming physical prototypes to perform human task analysis. Instead, DEPTH creates a "virtual prototype" for task analysis that allows human/machine interactions to be visualized and manipulated.

The DEPTH task analysis workstation draws on two human modeling technologies. The Armstrong Laboratory's "Crew Chief" provides accurate body sizing, strength and related data on USAF maintainers. The University of Pennsylvania's "Jack" model provides an interactive system for human figure animation and control. We are combining these two technologies into a flexible, powerful, inexpensive CAD graphics workstation for task analysis. New technologies implemented through DEPTH will include virtual reality devices which allow realistic simulation of the work environment and multimedia/hypertext software for "activation" of human performance data. These technologies will simulate a wider range of human abilities and task conditions than current human models. Human performance through DEPTH task simulation will join other engineering disciplines as a full partner in Integrated Product Development. By including human modeling results with Logistics Support Analysis data systems, we will unify the many elements of Human Systems Integration (HSI) involved in system support. Human factors; workplace safety; maintenance manuals; and manpower, personnel, and training domains all rely on DEPTH task documentation. In this way, the Computer aided Acquisition and Logistics Support, or CALS ideas of digital creation, management, and reuse of design data will be served.

DEPTH technologies are being demonstrated at General Electric Engines in Cincinnati OH and Oklahoma City Air Logistics Center. As new capabilities are added, the range of DEPTH applications will include manufacturing job design and space logistics problems.

OPR: AL/HRGA, (513) 255-6797 [DSN 785]



Computer aided design graphics simulate maintenance and repair procedures.

Aerospace Medicine

This Human Systems Center product area provides research and specialized operational support in aeromedical consultation, epidemiology, drug testing, and hyperbaric medicine, as well as development, fielding, and support of aeromedical systems and equipment.

Civil Reserve Air Fleet Aeromedical Evacuation Shipsets

Installation of these shipsets in existing commercial B-767s will enhance our wartime capability to evacuate the injured.

Immediate transport of critically wounded patients from battle zones to medical facilities is crucial for effective treatment. Military airlift capability is augmented by the Civil Reserve Air Fleet (CRAF), composed of civilian aircraft contracted for military service. These aircraft must be converted to enable evacuation of severely injured patients. The CRAF Aeromedical Evacuation Shipsets (AESS) were developed for Air Mobility Command to permit rapid reconfiguration of civilian B-767s during wartime.

CRAF AESS consists of litter stanchions, nurses' workstations, therapeutic oxygen storage/distribution equipment, and electrical power/distribution equipment designed for installation without prior or permanent modification to the aircraft. This enables the B-767 to transport up to 111 litter patients, 40 ambulatory patients, and 10 medical personnel. Shipsets can be installed and removed 20 times (each), stored for 30 years, and can fly for 5,000 flight hours. Full operational capability for the scheduled buy of 34 B-767 shipsets occurred in 1994.

Prior to the end of the Persian Gulf Conflict, 10 B-767 shipsets were produced in an accelerated program to support Operation Desert Shield/Storm. In a departure from the baseline program's concept, which anticipated that reconfigured aircraft would fly to and from civilian airports, the Desert Storm aircraft were flown from East Coast USAF bases to military installations in Germany and England. The shipsets would have allowed 10 aeromedical B-767s to free up, by best estimates, 17 C-141s to exclusively carry war materials, greatly contributing to both care of the wounded and resupply of the war effort.

OPR: HSC/YAM, (210) 536-2664 [DSN 240]

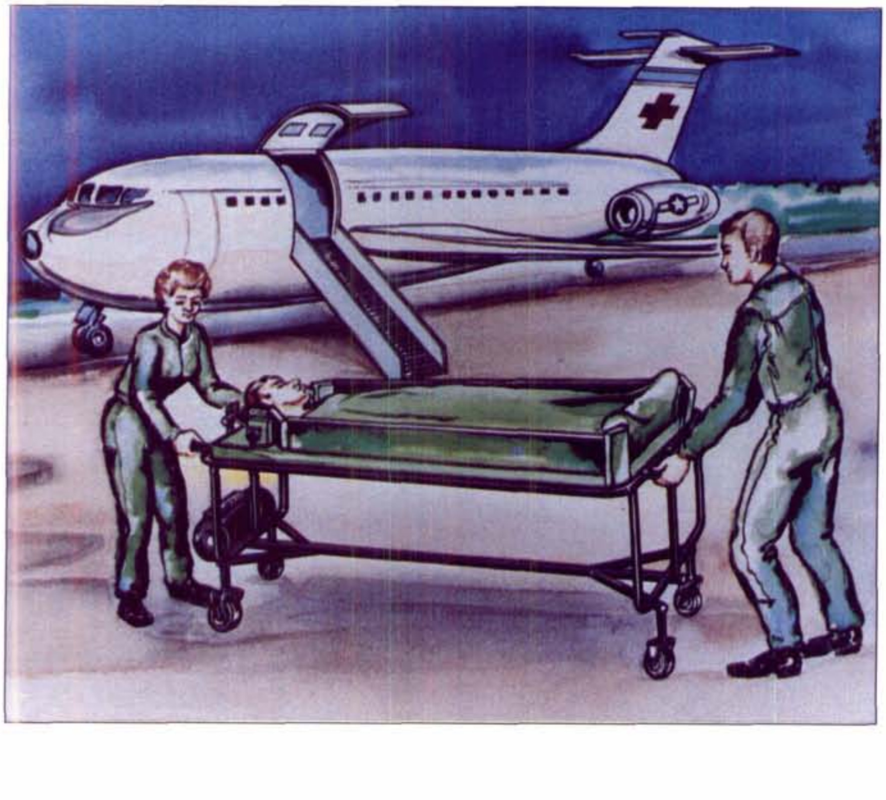
Spinal Cord Injury Transportation System

Safe transportation of spinal cord injury patients between medical treatment facilities is necessary to prevent further trauma to the patient. The objective of this program is to ensure that patients with spinal cord injuries who must be airlifted significant distances receive the same quality of care in transit that would be available from medical treatment facilities. The Spinal Cord Injury Transportation System (SCITS) will incorporate the latest in kinetic therapy including continuous side-to-side motion for treating and preventing complications of immobility, skeletal traction, and stability for the spine.

There are several operational performance parameters that are unique to the SCITS design and its aeromedical evacuation mission. SCITS must be sufficiently light and portable so that four individuals can pick up both it, and the patient, for transport into the medical evacuation aircraft, ambulance, or ambus. Furthermore, this device must fit properly into the standard litter stanchion used onboard those evacuation vehicles. Since medical evacuation aircraft impose additional requirements above and beyond those of an ambulance or ambus, the SCITS must be made of lightweight materials (with a total weight of less than 200 pounds) and must be extremely durable to withstand the rigors of flight. Medical evacuation aircraft on which SCITS will be used include the C-9, C-17, C-27, C-130, C-141, and the Civil Reserve Air Fleet (Boeing 767).

Planned award of the research and development contract is in FY94. Once an acceptable prototype is developed, a production effort will build approximately 180 units. These devices will be fielded in FY97 and will replace the Stryker Frame that is currently used by Air Mobility Command, the USAF Reserve, and the Air National Guard.

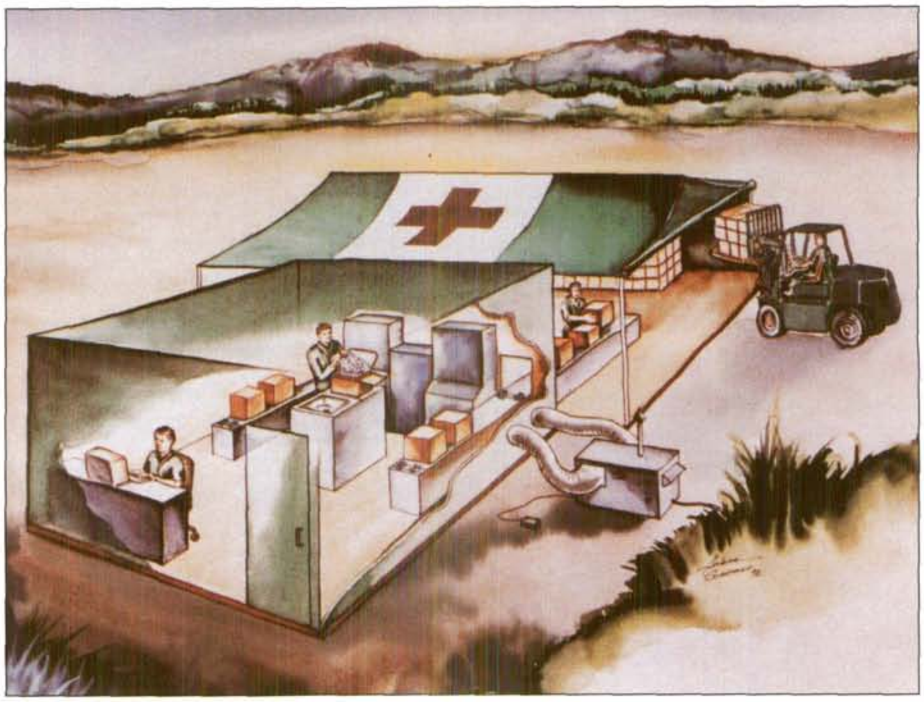
OPR: HSC/YAM,
(210) 536-2664
[DSN 240]



Patients with injuries to their spinal cords can be safely airlifted over long distances.

Transportable Blood Transshipment Center System

An urgent need exists for a liquid/frozen blood system to meet future military blood needs. The DOD Military Blood Program Office is responsible for ensuring an adequate blood supply, and the USAF is the lead service for the airlift of blood products. Current blood transshipment facilities are vulnerable, not mobile, and cannot handle large quantities of frozen blood products.



TBTC enables shipment of large quantities of liquid and blood.

The Transportable Blood Transshipment Center (TBTC) system will enable shipment of large quantities of liquid and frozen blood products. Each TBTC includes refrigerators, freezers, ice makers, and shelters to store over 7,500 units of blood. The TBTC provides the capability to communicate and coordinate blood requirements, and it ensures environmental protection of blood products, equipment, and system operators. The TBTC can be transported anywhere in the world and can be operational in 48 hours. An integral part of the TBTC design is the Frozen Blood Shipping Container (FBSC) which will provide thermal protection for up to 48 hours. The FBSC contains a reusable coolant, thus avoiding the problems of shipping blood with dry ice. A prototype TBTC will be developed with a likely follow-on production of seven additional units. The TBTC Request for Proposal was released to industry in late 1990 with contract award in March 1991. Initial operational capability is scheduled for 1995.

The TBTC will allow frozen blood to be pre-positioned in theater. This will decrease the time required to get blood products to the wounded in time of war and decrease the initial demand on our strategic airlift forces.

OPR: HSC/YAM, (210) 536-2664 [DSN 240]

Chemically/Biologically Hardened Air Transportable Hospital

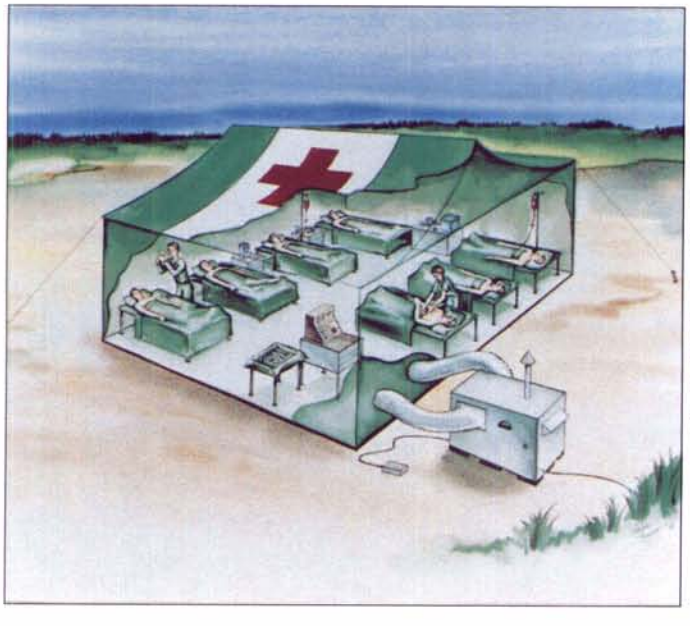
Immediate treatment of injured and wounded personnel is critical to survival and recovery in both combat zones and on humanitarian relief missions. The recent experience of Operation Desert Shield/Storm identified several shortcomings in the current standard of care while employing present Air Transportable Hospitals (ATH). The USAF started the Chemically/Biologically Hardened Air Transportable Hospital (CHATH) to improve the current field medical capabilities of the US Air Force and US Army.

The CHATH program will make four major improvements to field medical care. First, a chemical and biological protection from enemy weapons will be provided for the first time to the medical complex. Second, a constant temperature control will be provided for field patients in all weather environments encountered around the globe. Third, a clean fixed-site hospital environment will be available in the field for the first time. This will prevent the spread of infection and speed stabilization and recovery of patients. Fourth, the field hospitals will be able to admit and treat casualties during active enemy attack instead of waiting until the attack is over. This will greatly speed critical medical care access to the injured. These improvements can be made within the current medical care system.

The CHATH program will modify the current (ATHs) and retain the same medical equipment and personnel. The CHATH program will utilize existing and modified Army equipment to line the current ATH tents and provide an airtight shelter. The Human Systems Program Office is developing a new Chemically/Biologically Hardened Air Management Plant (CHAMP). The CHAMP units will provide chemically/biologically filtered fresh outside air, recirculate and filter interior air to a clean hospital standard, provide heating and cooling, and provide its own backup power for use in blackouts or when electricity is not available.

The CHAMP prototype development efforts began Spring 1993 with full unit testing in Spring 1994. Complete qualification testing will take place in 1995. Two complete hospitals will be assembled and field tested by Air Combat Command in the Summer of 1995. Production of all 27 new CHATHs is scheduled to begin in 1996.

OPR: HSC/YAM, (210) 536-5114 [DSN 240]



An important modification to existing "hospitals" will protect occupants from both chemical and biological attacks.

Hyperbaric Medicine

The role of the Armstrong Laboratory Davis Hyperbaric Laboratory (DHL) has expanded tremendously since 1974 when its primary purpose was to treat aviators suffering from decompression sickness. The DHL, is today internationally recognized as a leading center in patient treatment, facility requirements, safety standards, and research using Hyperbaric Oxygen (HBO). HBO is used to treat indicated medical disorders such as chronic nonhealing wounds, carbon monoxide poisoning, osteoradio-necrosis, gas gangrene, and air gas embolism. The DHL presently serves as the lead agency for all DOD Clinical Hyperbaric Facilities and establishes policy for all USAF Clinical Operational (Field) Hyperbaric Facilities. DHL personnel continually work to broaden the understanding, application, and acceptance of HBO therapy through both clinical and basic scientific research. Team members spearhead medical research efforts in the areas of nonhealing wounds, oxygen toxicity, recompression therapy, burns, and crush injury.

To date, our personnel have treated over 3,500 patients. Staff physicians provide worldwide consultation activities around the clock. As the DOD lead agency, the DHL coordinates facility expansion and personnel training including clinical hyperbaric fellowship for US Air Force, US Army, and international physicians, physiologists, and nurses along with enlisted medical and physiology technicians. They have established contacts with private and governmental research organizations in facilities research and assisted NASA in developing specifications for hyperbaric treatment capabilities aboard Space Station Freedom. The DHL leads the way in hyperbaric chamber design and fabrication. Efforts are underway for improved design and construction of facilities including the first concrete hyperbaric chamber. Evaluation of alternate construction strategies may result in greatly reduced construction cost and increased transportability.

The primary payoff is improved overall healing time for many debilitating conditions. This directly translates into reduced hospitalization time and associated medical costs for the DOD. For example, HBO reduces the healthcare cost for treating burn patients by as much as 30 percent. More importantly, the quality of life is immeasurably improved for patients who otherwise face amputation of limbs or continuation of longstanding conditions resolved by hyperbaric oxygen therapy.

OPR: AL/AO, (210) 536-2941 [DSN 240]

Patients in an oxygen rich environment.

Dental Investigations

USAF medical readiness requires that equipment be appropriate and effective. The USAF Dental Investigation Service (DIS), located at Brooks AFB TX provides a central point for rapid identification and resolution of equipment, material, and facility issues relative to dentistry. The scope includes technical evaluation of commercial equipment and materials for DOD dental use worldwide. DIS conducts a variety of standardized equipment and material evaluations in-house. In addition, clinicians of USAF clinics worldwide perform users' evaluations under DIS direction. DIS provides consultation service for dental construction projects and dental infection control standards for the USAF.

During 1991, DIS performed 54 project investigations, $1.6 million in Equipment Action Requests, and responded to over 4,200 telephone requests for technical information and support from headquarters and operational levels. DIS completed compilation of all patient treatment delivered outside the continental US in conjunction with Operation Desert Shield/Storm (16,000-plus patient visits), and provided an after-action report on material problems encountered by USAF dental personnel deployed during the Persian Gulf crisis. Over 90 facility design actions were accomplished on construction projects valued at over $400 million. DIS publications are sent to over 750 separate federal dental facilities.

DIS maintains close relationships with universities, hospitals, and other interservice agencies and cooperates with national agencies such as the American Dental Association, Federal Drug Administration, and Centers for Disease Control to establish standards for dentistry. DIS has formal agreements with the dental school at the University of Texas Health Science Center in San Antonio and the Naval Dental Research Institute at Great Lakes Naval Air Station.

OPR: AL/AOCD, (210) 536-3503
[DSN 240]

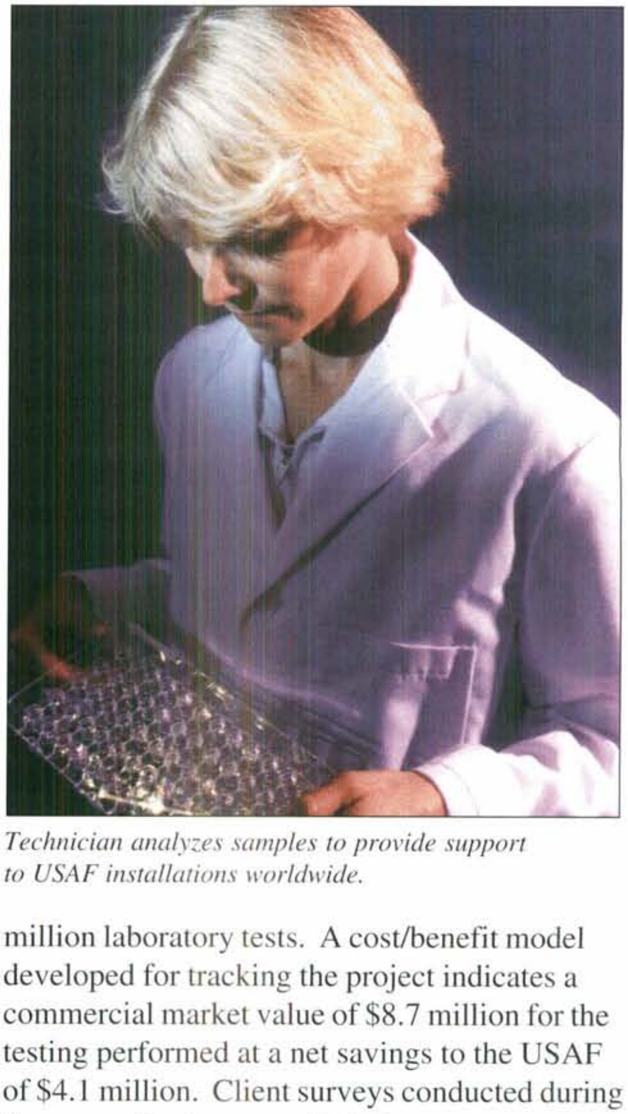
Dental laboratory personnel evaluate equipment for possible USAF use.

Central Military Reference Laboratory

The downsizing of the services has not diminished the requirement to provide cost-effective health care to service members. Advances in technology continue to increase clinician reliance upon diagnostic support services which must now be met within the constraints of tight budgets and limited manpower resources. Under a Congressional Management Efficiencies initiative, the concept of a central military reference laboratory was tested and implemented in order to meet the requirements of USAF medical treatment facilities (MTF) for supplementary diagnostic testing services. This was accomplished through expansion of Armstrong Laboratory capabilities at Brooks AFB TX.

In 1990, after a pilot project with 30 MTF test sites validated the concept while saving $2.3 million during the first year of operation, the reference services were upgraded for an additional 60 clients in 1991-92. Reference laboratory services now provided to 90 USAF and DOD MTFs incorporate a commercial overnight air courier service for specimen transport with a comprehensive laboratory information system. Printers at each local facility produce chartable patient reports within hours of test completion. Among the new clients added were a number of overseas facilities which represented unique requirements for sample transport and data transmission. Unlike many civilian laboratories offering reference services within a region, the new capabilities of the Armstrong Laboratory make it unique among reference laboratories in providing diagnostic services to international clients on a routine basis.

The success of the project is evidenced by the growth in demand for services which increased 30 percent last year. The Armstrong Laboratory reference facility processed over 450,000 computer accessions equating to 1.4 million laboratory tests. A cost/benefit model developed for tracking the project indicates a commercial market value of $8.7 million for the testing performed at a net savings to the USAF of $4.1 million. Client surveys conducted during the year reflect an overwhelming customer satisfaction and are further used to identify new or changing field requirements for diagnostic reference services. New initiatives are underway to further improve services by the addition of remote terminals at client sites and the application of barcode technology for sample accessing and tracking.



Technician analyzes samples to provide support to USAF installations worldwide.

OPR: AL/AO, (210) 536-8378 [DSN 240]

Ophthalmologic Publications

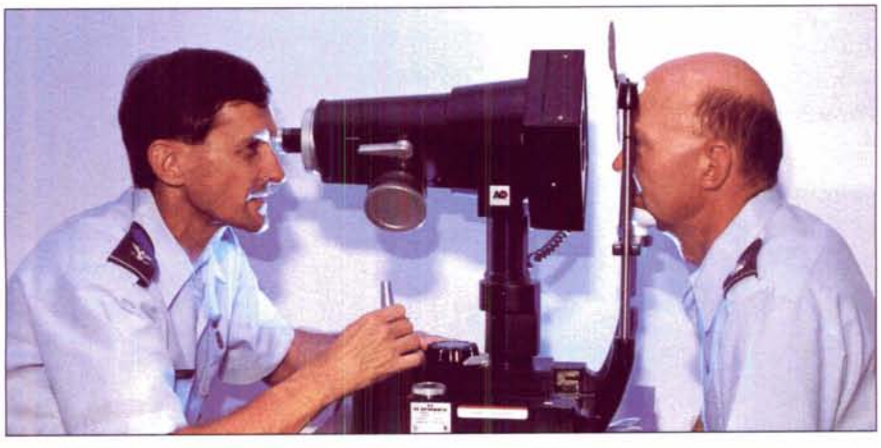
The Ophthalmology Branch of Armstrong Laboratory's Aerospace Medicine Directorate completed long-term research on three Aerospace Medicine Division (HQ AFMOA/SGPA) and Clinical Ophthalmology Branch (AL/AOCO) study groups in 1992. Each study-group research project helped aid HQ USAF personnel in understanding the visual performance limitations of fliers with ocular diseases and conditions and will enable HQ AFMOA/SGPA to set future visual standards for fliers with these diseases and conditions.

The first study group consisted of those fliers with keratoconus, a noninflammatory, usually bilateral corneal dystrophy in which the cornea progressively thins and protrudes causing high, irregular, myopic astigmatism. This leads to visual problems such as blurred vision, diplopia, glare, ocular irritation, photophobia, etc. From 1965 to 1988, AL/AOCO has evaluated 37 flying candidates and fliers with keratoconus. Of these, seven were grounded due to their disease. The other 30 managed to remain on flying status and to fly for hundreds of hours.

From 1979 to 1992, AL/AOCO evaluated 35 flyers who had cataracts removed and a plastic lens placed in one or both eyes. Prior to the use of intraocular lenses, fliers were either grounded or had to wear contact lenses. Intraocular lenses are a significant visual improvement over contact lenses. All of our fliers achieved 20/20 vision in each eye; 81 percent even achieved 20/15. Serious complications were low. All were deemed visually qualified to return to flying status at some point, and some successfully flew hundreds of hours. This surgical technique appears to be an extremely useful method of visual rehabilitation of fliers.

From 1977 to 1988, AL/AOCO evaluated 50 fliers who had ocular Pigmentary Dispersion Syndrome (PDS). We found, through our research, that those fliers with PDS but without elevated intraocular pressure (IOP) rarely progress. However, of those with PDS and elevated IOP, 50 percent developed glaucoma. Thus, additional screening of flying candidates merely for the pigment dispersion is unnecessary. Those with pigment dispersion and elevated IOP should be identified by tonometry. Of the fully trained fliers (with or without elevated IOP), many flew hundreds of hours with proper follow-up and treatment.

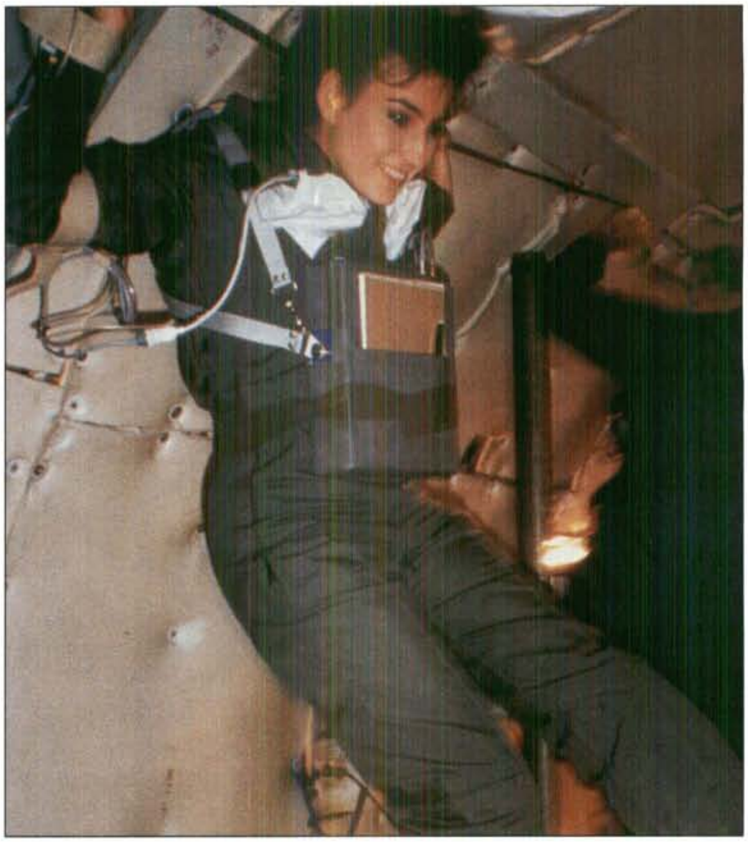
OPR: AL/AOCO, (210) 536-3250 [DSN 240]



Armstrong Laboratory physician evaluates intraocular lenses in an Air Force flier.

Laboratory for Aerospace Cardiovascular Research

Sixty percent of all grounding is cardiovascular related. This represents a significant loss to DOD in terms of experienced aircrew and training expenditures. The Laboratory for Aerospace Cardiovascular Research (LACR) is a joint US Army/US Air Force effort sponsored by the Armstrong Laboratory to gain further understanding into the basic physiologic and pathophysiologic cardiovascular effects induced by the aerospace and aeronautical environments. The aeromedical community will use LACR research results to help further define physical standards for selection and retention of aircrew and address cardiovascular issues as they relate to occupational medicine concerns.



Subject undergoes parabolic flight testing to study effects of weightlessness on the heart.

Recently, the LACR professional staff have published papers and given numerous presentations at national and international scientific meetings on the results of KC-135 testing. Testing centered on central circulatory hemodynamics and our ability to predict responses during altered gravitational states. New findings were presented concerning calculations for total peripheral resistance and ventricular vascular coupling. Transesophageal echocardiography and Evans blue dye were utilized during the parabolic KC-135 flights to investigate fluid shifts during initial entry to microgravity. This was done to simulate conditions and results discovered during space shuttle flights. Many of the successes seen in this program are the result of our recent biosensor technology developments, including advancements in chronic animal instrumentation and Doppler flow techniques.

OPR: AL/AOC, (210) 536-3202 [DSN 240]

Aircrew Aeromedical Standards

Medical standards for aircrew are dynamic, changing in response to operational environments, advanced diagnostic tools, and research. As the USAF center for operational aeromedical science and technology, Human Systems Center validates existing standards and recommends new standards to select and retain crewmembers. Each year approximately 700 grounded crewmembers are evaluated for medical qualification, with over 75 percent returning to duty. The immediate payoffs are retention of experienced personnel and avoidance of the new training costs. The long-term payoff is the refinement of aeromedical standards.

In 1992, the Supraventricular Tachycardia (SVT) study group was reviewed. Four hundred and thirty crewmembers with a mean followup of 11.4 years were studied. SVT is a cardiac rhythm disturbance of the upper chambers of the heart. The effects of the arrhythmia may range from no effects to incapacitation, but the great majority of crewmembers tolerate SVT quite well. Long-term follow-up studies have identified the approximately 10 percent of our population with SVT which would be unacceptable for return to flying. These observations will be used by the USAF Surgeon General for liberalization of waiver criteria for SVT.

The Aeromedical Consultation Center, at Brooks AFB TX is committed to support USAF readiness aggressively and economically with due concern for flying safety and the aircrew health. The aircrew standards programs returns fully qualified aircrew members to duty and provides recommended medical standards for flight qualification.

OPR: AL/AO, (210) 536-3836 [DSN 240]

Evaluation board meets to set new medical standards for USAF fliers.

Multi-Probing System for Rapid Identification of Mycoplasma

Mycoplasmas are the smallest free-living organisms. These microorganisms cause life-threatening lung disease in premature infants. Diagnosis and treatment are often delayed because these organisms grow slowly and cannot be identified with the usual medical laboratory techniques.

A system has been developed to specifically probe and identify the Deoxyribonucleic Acid (DNA) of these organisms in clinical specimens. Clinical evaluation has shown 100 percent agreement between this DNA probe and traditional methods performed on specimens from newborns to two years. One patent is pending, and a technical paper has been published. Additional DNA probes are in development. These should be of great clinical value.

Research in the application of these techniques to rapidly identify organisms that cause toxic intestinal infections is ongoing. These infections have frequently caused problems during military deployments and combat operations.

OPR: AL/AO, (210) 536-8382 [DSN 240]

New clinical evaluation of infant tissue detects lung problems far sooner than previous tests.

Project Gargle: Influenza Disease Surveillance

Project Gargle is an integral part of the World Health Organization (WHO) collaborating centers for influenza, via the Centers for Disease Control (CDC), in the United States. In the WHO program, the Armstrong Laboratory Epidemiology Services Branch provides the CDC with a weekly summary of upper respiratory infection/influenza morbidity rates and the number of viral isolates. Data are provided by 14 sentinel USAF bases (six in the continental US and eight overseas) and are unique within DOD. Depending on the time of year and base location, the "target number" of weekly specimens submitted ranges from four to eight. Specimens are screened for seven types of respiratory viruses: influenza A and B, Respiratory Syncytial (RSV), adenoviruses, and parainfluenza (1, 2, and 3).

In every war, respiratory illness has denigrated readiness to a greater extent than combat related injury and death. The annual results of Project Gargle are used by the National Civilian Advisory Committee on Immunization Practices in reaching decisions concerning influenza vaccine formulation. The USAF's influenza immunization program serves as the key preventive medicine program for reducing the impact of influenza in the active-duty population. The success of the USAF Project Gargle program requires close cooperation between the medical staff, laboratory technicians, and military public health team to ensure that appropriate and adequate specimens are submitted. This is a very successful preventive medicine program with worldwide impact.

OPR: AL/AOES, (210) 536-3471 [DSN 240]

Testing for the newest strains of influenza keeps USAF members healthy.

HIV Screening Process

In 1985, DOD directed the screening of all military personnel for human immunodeficiency virus (HIV) and evaluation of the medical status of those infected. In response, the Armstrong Laboratory's Epidemiologic Research Division began a two-year screening of USAF personnel in August 1986 to estimate the prevalence of HIV infection. A second two-year screening of USAF personnel began in October 1988 to estimate the incidence of new HIV infections.

Technician performs HIV screening.

The first screening of USAF personnel ended in September 1988 with a prevalence of 0.95 infections per thousand individuals. The second screening of USAF personnel ended in September 1990 with an estimated incidence rate of 0.21 per thousand; lowest in DOD. The low incidence supported a five-year test interval, coinciding with the periodic physical, to monitor for changes in the incidence of HIV infection. Increasing the testing interval to five years resulted in an annual test volume reduction. This volume reduction enabled the Epidemiologic Research Division to handle all tests "in-house," which reduced costs 60 percent.

HIV screening assists in monitoring the readiness of USAF personnel in both mission performance and deployment. The ability to search a repository of HIV test results supports battlefield blood transfusion and blood bank lookback programs. Testing by the Epidemiologic Research Division has resulted in fewer administrative requirements for submitting units, decreased turnaround times for results, and closer integration of submission procedures into those of normal clinical testing.

OPR: AL/AO, (210) 536-8934 [DSN 240]

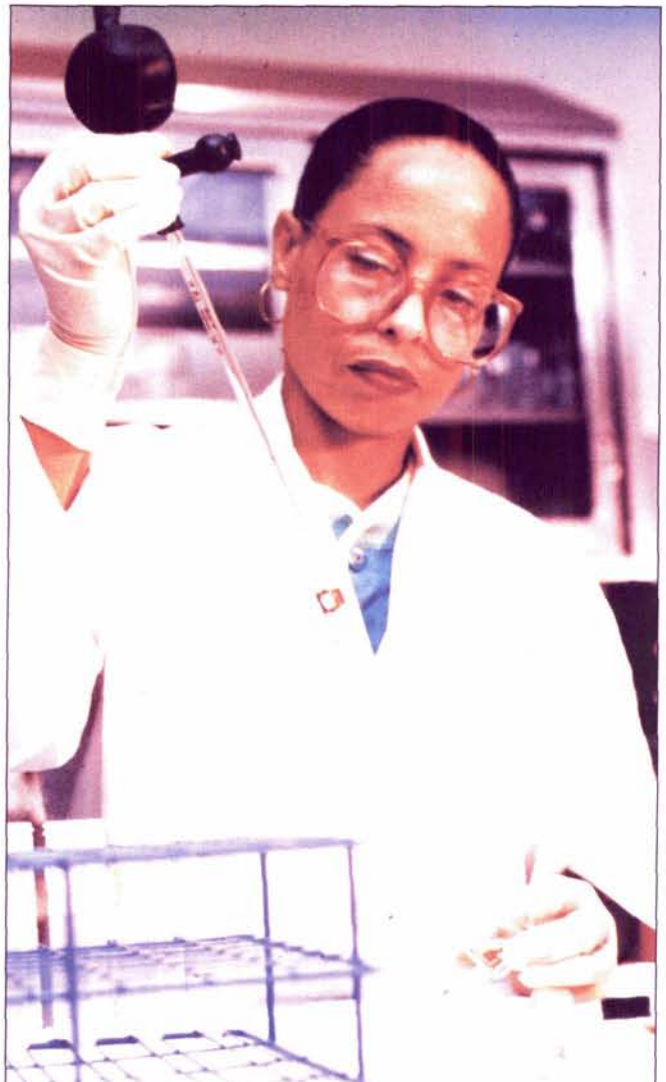
Drug Testing

As one of the eight DOD drug abuse detection laboratories, the Armstrong Laboratory's Drug Testing Division is the sole USAF laboratory implementing the DOD drug testing program. Their mission is to deter the use and abuse of controlled and illegal substances by military personnel through a comprehensive drug testing program. Supporting the DOD objective to provide a drug-free, mission ready force and workplace, the Drug Testing Division is a key player in the field commander's ability to maintain a healthy operational ready force. Over 800,000 member and quality control tests were performed in the past year.

The Drug Testing Division began testing United States Air Forces Europe in June 1992 and is currently transitioning drug testing support for Pacific Air Force personnel.

To support all USAF components worldwide, personnel in the Drug Testing Division incorporate strict chain-of-custody and quality control procedures with advanced laboratory technology. The Division analyzes more than a quarter million member specimens each year for evidence of drug abuse to include marijuana, LSD, cocaine, amphetamines, barbiturates, opiates, PCP, and others.

Serving as a reference laboratory for the National Institute on Drug Abuse Certification Program, the Drug Testing Division helps set the standard for other laboratories to follow.



Armstrong Laboratory's drug testing results are among the most accurate in the world.

OPR: AL/AOT, (210) 536-3723
[DSN 240]

Preventive Medicine Consultation

The Armstrong Laboratory's Epidemiologic Research Division consultants manage infectious chronic and environmental disease surveillance programs. They analyze USAF, DOD, state, national, and international morbidity and mortality data and provide consultation to medical treatment facilities, major commands and the Headquarters Air Force Medical Operating Agency at Bolling AFB DC.

An epidemiologist, a public health officer, and two physicians serve as consultants. They provide hundreds of consultations quarterly. This support ranges from developing immunization recommendations and disease control strategies to providing guidance for Aerospace Medicine resident projects to assist development and fielding of fitness and other line-mandated programs. The continuous flow of consult requests is processed by a weekly rotation of the consultants whose primary responsibility is to coordinate this support.

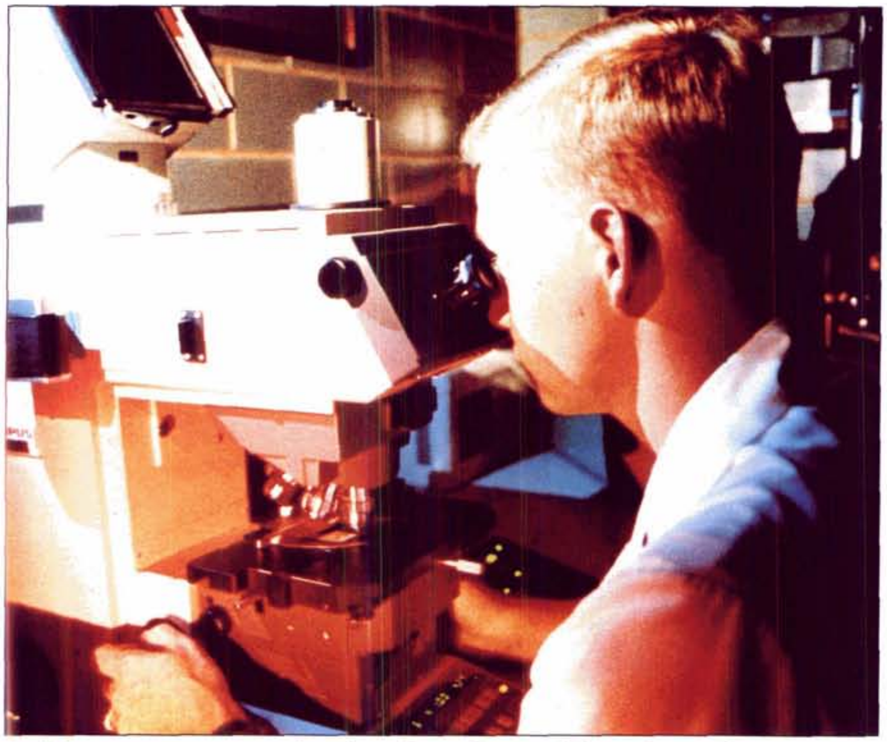
Consultants also serve as investigators in numerous research programs and represent the USAF at national and international symposia. For example, at the 1991 Advisory Group for Aerospace Research and Development Conference held in Rome, Italy, USAF research findings on hepatitis, vaccine preventable diseases, and the human immunodeficiency virus were presented. Ongoing research efforts include analysis of USAF alcohol related morbidity and mortality and a descriptive study of the USAF hepatitis experience from 1980-1989.

OPR: AL/AOES, (210) 536-3471 [DSN 240]

Physicians provide specialized consultation on a regular basis.

Outbreak Investigations

The investigation of disease outbreak is an important part of the mission of the Armstrong Laboratoy's (AL) Epidemiology Services Branch. Outbreaks can involve communicable diseases, injuries, occupationally related illnesses, foodborne illness, and even cancer. Surveillance systems initially note the occurrence of an apparently increased trend in a disease or syndrome, perhaps a cluster of illnesses related temporarily by location or exposure history. The AL Epidemiology Services Branch responds to USAF or DOD requests for assistance in investigating the apparent disease outbreak.



Quick response to rare outbreaks reduces the possibility of an epidemic.

An actual outbreak investigation involves collecting and analyzing data on the cases of illness or injury. Similarities (age, race, sex, or squadron) between cases can provide evidence of epidemiologic links and elucidate the circumstances of occurrence or spread. Once these associations are defined, control measures can be implemented to stop an outbreak and prevent a recurrence.

Recent examples of outbreaks include 900 cases of foodborne illness at the USAF Academy, a cluster of turberculosis (TB) skin test conversions from an active case of TB at a European base, a foodborne illness during Operation Desert Shield/ Storm, a cluster of possible occupationally related respiratory diseases in a joint allied/ USAF work site, and streptococcal disease among USAF basic recruits. The ability of the AL Epidemiology Services Branch to provide rapid professional assistance in investigating and controlling outbreaks makes it an effective preventive medicine tool and contributes to the maintenance of a mission capable force.

OPR: AL/AOES, (210) 536-3471 [DSN 240]

Ranch Hand II


Ranch Hand II investigation continues to probe the effects of dioxin used in Vietnam.

At the direction of the White House, the USAF is conducting a 20-year epidemiologic investigation of possible adverse health effects of USAF personnel involved with aerial spraying of herbicides in Vietnam from 1962 to 1971 (Operation Ranch Hand). This investigation is to determine whether long-term health effects exist due to occupational exposure to herbicides and associated dioxins. In 1982, 1985, 1987, and 1992, physical examinations were given and health questionnaires administered to approximately 2,300 study participants, including 1,000 exposed persons and 1,300 in the control group. Medical histories of spouses and offspring are also tracked. Analyses of these data were published in a series of morbidity and mortality reports. A morbidity report released in 1991 using individual serum dioxin levels as a measure of exposure revealed associations between dioxin level and HDL cholesterol, diabetes, fasting glucose, and percent body fat, suggesting effects on lipid metabolism. However, any conclusion regarding cause and effect must wait for additional data analysis from physical examinations and other corroborating studies.

A major milestone in the study, the reproductive outcome report, was completed and released in the Fall of 1992. This report examined 5,489 pregnancies and 4,514 children and found no evidence to support a hypothesis of adverse effects of paternal dioxin on reproductive outcome. Another significant milestone was reached with a further refinement of dioxin half-life. This analysis indicated that the half-life varies with changes in body weight and disease. The current estimate of half-life is approximately 13 years. We are currently in our fourth cycle of examinations. We expect to examine and report on 2,300 participants.

This program has provided information necessary for executive and congressional policy decisions regarding compensation and regulation of occupational exposures. Further, procedures to investigate issues of occupational exposures and health were established. The Air Force Health Study design is becoming the worldwide statistical and epidemiologic standard for occupational disease research.

OPR: AL/AO, (210) 536-2600
HSC/YAW, (210) 536-2274
[DSN 240]

Aerospace Medicine Training Systems Analysis

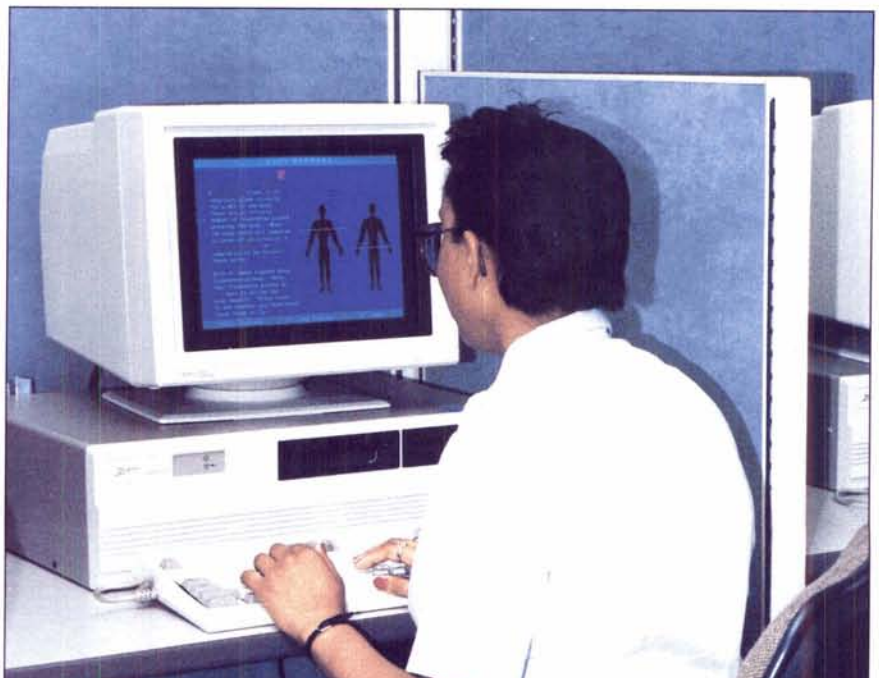
The USAF School of Aerospace Medicine (USAFSAM) is currently responsible for training over 5,000 aerospace medicine professionals and technicians each year. Improvements to the present training systems are being planned in the areas of program management, engineering, and logistics support planning courseware. The USAFSAM Learning Center is upgrading hardware and authoring software capabilities on a limited scope level at this time.

The Aerospace Medicine Training Systems Analysis is being conducted to determine basic systems requirements and perform pre-acquisition planning to upgrade the present USAFSAM training systems. An assessment of the offered courses and evaluation of the training media will be conducted to ensure maximum cost effectiveness of the training methods and technologies employed.

The study will be performed as a two-phase one-year project to produce five primary products: (1) the definition of USAFSAM computer based training systems requirements; (2) a training media analysis; (3) a tradeoff analysis of existing and developing training technologies; (4) a systems specification; and (5) a long-range roadmap for future systems enhancements and direction.

OPR: HSC/XRS, (210) 536-2424
[DSN 240]

Student trains in USAFSAM Learning Center.



Operational Applications of Aerospace Medicine

The USAF School of Aerospace Medicine (USAFSAM) conducts education programs in aerospace medicine and closely related fields for officer and enlisted personnel who are in direct support of the USAF flying and missile missions. In addition to USAF members, selected students from other branches of the armed services, civilian agencies, and numerous allied countries attend courses offered at the school. Education programs are specifically designed for physicians, nurses, military public health officers, bioenvironmental engineers, aerospace physiologists, and other medical service personnel. This aeromedical education program provides quality training to over 5,000 persons each year. Courses offered range from the residency in aerospace medicine education programs for physicians to specialty training courses for airmen entering active duty. The residency is fully accredited by the Accreditation Council for Graduate Medical Education. Most of the enlisted specialty courses are accredited through affiliation with the Community College of the Air Force.

A standard course validation process fielded to the major commands (MAJCOMS) ensures the identification, documentation, and validation of the educational needs of aeromedical operations. An Education and Training Review Board validates MAJCOM training proposals which are incorporated into the training program. Courses are added, changed, or deleted based on operational need.

Computer based training is used extensively in the enlisted Air Force specialty awarding courses and is expanding in use in the professional level courses. Future plans call for the installation of a Local Area Network (LAN) which will greatly increase the students' access to large amounts of on-line information worldwide. Computer based training and the integration of high-tech educational methodologies are very much a part of the future at the USAF School of Aerospace Medicine.

A new course for flight surgeons, Aerospace Physiologists and Clinical Psychologists, was implemented in spring 1993. The Aircraft Mishap Investigation and Prevention Course is intended to prepare attendees to perform actual mishap investigations. Topics covered include aviation physiology, aviation psychology, aviation pathology, forensic pathology

Bioenvironmental engineers sampling a drum before a hazardous waste sample is obtained.

and dentistry, crash survivability, life support equipment, crash dynamics, and engineering factors in aircraft mishaps. The major emphasis of the course is on mishap investigation techniques. A new mishap lab is under construction where students will get experience in searching for evidence in a wreckage and interviewing witnesses. They will then reconstruct the accident, decide upon causes, and make recommendations to prevent further mishaps. Plans are to present the course three times per year.

The Residency in Aerospace Medicine (RAM) Program was expanded from two to three years beginning with the June 1992 class. The third year emphasizes clinical medicine topics considered key to a base level aerospace medicine program and includes rotations in occupational medicine, preventive medicine, and clinical medicine.

With the increased awareness on the importance of restoring and preserving the environment, the USAFSAM will soon expand its role in providing this vital education. Plans are underway to establish an Air Force Environmental Safety and Occupational Health (ESOH) Education and Training Integration Office within the USAFSAM. The prime role of this office will be to ensure that all USAF personnel, military or civilian, are adequately trained to carry out their ESOH responsibilities. This includes identifying disciplines and occupations requiring this education and training, the degree and level of knowledge needed, sources for the training, and monitoring the program for the entire USAF.

Through the years, USAFSAM's output of graduates and course offerings have continually expanded. Added to this is the increased complexity of the curricula. Consequently, the USAFSAM has outgrown its school facility. A new 83,500 square foot $8.9 million academic complex has been approved for construction, with completion planned for Winter 1996.

The unique blend of education, research and development, and operational aeromedical support in the aeromedical education curriculum produces qualified operationally effective aeromedical specialists for the using commands.

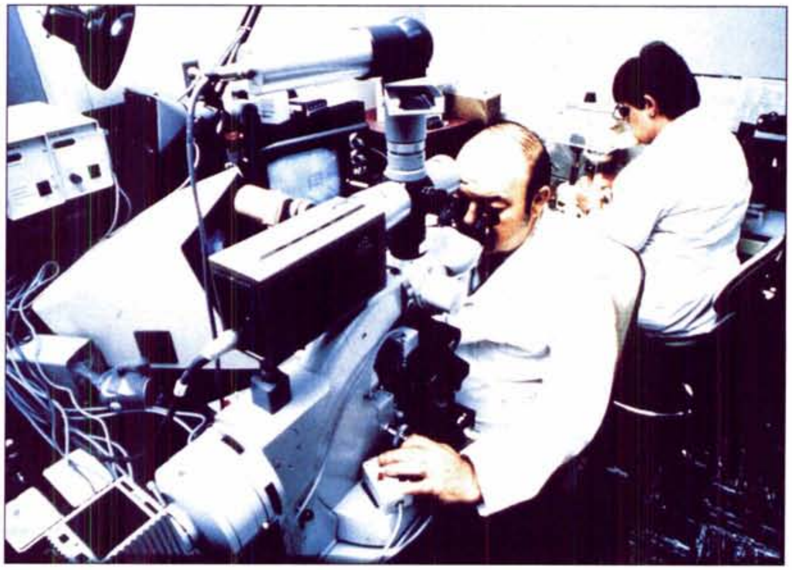
OPR: USAF School of Aerospace Medicine
(210) 536-3500 [DSN 240]

This simulation mishap acts as a training aid for a "hands-on" approach in investigative techniques.

Occupational and Environmental Health

This Human Systems Center product area assesses risks to personnel from hazardous materials, noise, electromagnetic radiation, and occupational processes in USAF operations. The work combines human-centered research and development in these emphasis areas with broad field consultation responsibilities to measure and reduce occupational illness and environmental hazards.

Asbestos Health Hazard Assessment



Asbestos fiber counting by Phase Contrast Microscopy.

It is USAF policy to remove all asbestos from the work and living areas of USAF personnel. This policy has a single purpose: prevent inhalation of unhealthy levels of airborne asbestos fibers. Base officials must follow Environmental Protection Agency (EPA) regulations for identifying and removing harmful asbestos from existing buildings. The Bioenvironmental Engineers must follow Occupational Safety and Health Administration (OSHA) requirements for monitoring occupant exposures to airborne asbestos fibers. Scientists from Armstrong Laboratory's (AL) Occupational and Environmental Health Directorate provide operational support to ensure base officials meet their requirements.

AL can analyze 6,000-8,000 asbestos samples per year. Bulk asbestos samples are analyzed by polarized light microscopy, and airborne asbestos samples are analyzed by phase contrast microscopy. Both procedures are mandated by federal law. AL also has the capability of special procedures on the scanning electron microscope. These procedures may be discussed with the laboratory. AL maintains asbestos certification with the American Industrial Hygiene Association and participates in the Proficiency Asbestos Analytical Testing Program of the National Institute of Occupational Safety and Health.

The AL provides USAF installations with information that is timely and accurate. Turnaround times are 5 to 7 days for routine samples and only hours for priority samples once received in the laboratory.

OPR: AL/OEA, (210) 536-3626 [DSN 240]

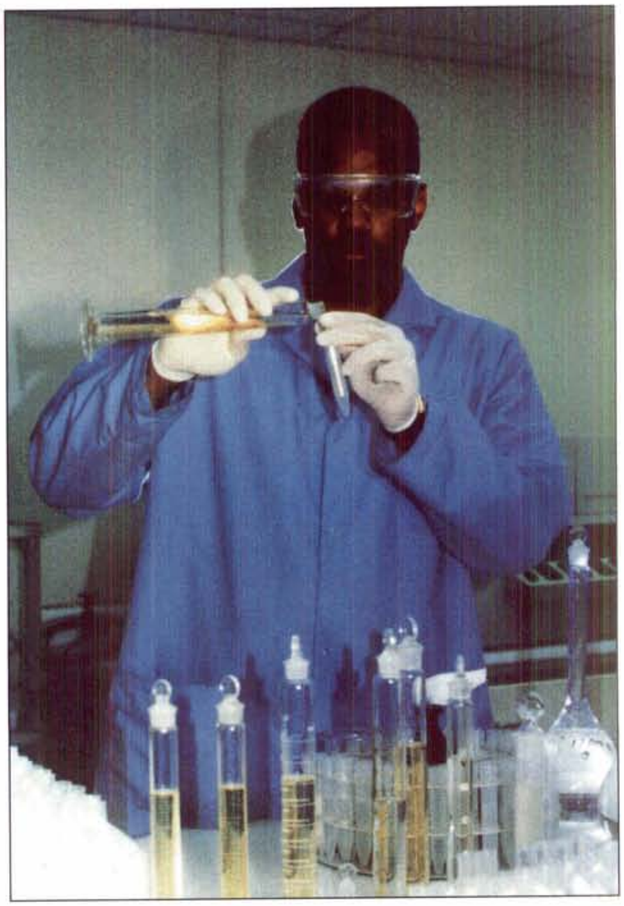
Safe Drinking Water Act Implementation

The Environmental Protection Agency's (EPA) Safe Drinking Water Act (SDWA) requires DOD to monitor, report, and notify the public of chemical contaminants in installation drinking water. It is USAF policy to provide high quality drinking water at all USAF installations. Scientists from Armstrong Laboratory (AL) provide operational support to achieve these high standards.

In 1991, AL completed a three-year effort of analysis of Phase I volatile organics as directed by the 1986 amendments to the SDWA. Scientists analyzed drinking water for 59 volatile organic contaminants from 3,600 samples from 900 USAF installations worldwide. Several bases had volatile organic chemicals in wells exceeding maximum allowable levels for which corrective action was required.

In 1992, a monitoring program of lead and copper was started for USAF installations, in compliance with the SDWA amendments. Phase II and Phase V monitoring started in January 1993. Armstrong Laboratory is preparing for rigorous quality assurance. Analysis will include volatile organics, not included in Phase I, metals, nitrate/nitrite, asbestos, pesticides/herbicides/polychlorinated bi-phenyls, and water treatment chemicals. This massive new program will cover USAF installations worldwide.

The USAF is meeting today's water monitoring requirements and is prepared for future requirements. The AL sampling analysis team will meet these challenges to ensure USAF personnel and families are provided with high quality drinking water.



Preparing drinking water samples for metal analysis to comply with Safe Drinking Water Act requirements.

OPR: AL/OEA,
(210) 536-3626
[DSN 240]

Indoor Air Quality

The Armstrong Laboratory (AL) has operated a program to investigate the causes and effects of poor Indoor Air Quality (IAQ) for the past seven years. IAQ is a term applied primarily to office space where occupants complain of health problems which disappear when they are not at work. The primary effects of poor IAQ are reduced productivity and low morale. Typical symptoms are drowsiness; inability to concentrate; dry itchy skin; irritated eyes, nose, and throat; excessive colds and allergies; and dissatisfaction with temperature or humidity.

The IAQ Program objective is to reduce illness and absenteeism among office workers and increase their productivity. AL prepares educational materials and briefings, interacts with federal agencies and national organizations, and conducts IAQ surveys at USAF bases across the continental US in an effort to prevent and remediate IAQ health problems. A key educational reference completed this year is a comprehensive "Guide for Indoor Air Quality Surveys" sent to all Bioenvironmental Engineering and Military Public Health offices. Together, with the AL Environics Directorate, we are developing guidance for base level civil engineering on the relationship of ventilation systems to IAQ. Survey customers include active duty personnel from USAF bases, the Air National Guard, the Air Force Reserve, the Defense Logistics Agency, the Army Corps of Engineers, and health professionals from the Army, Navy, Environmental Protection Agency, and Occupational, Safety and Health Administration.

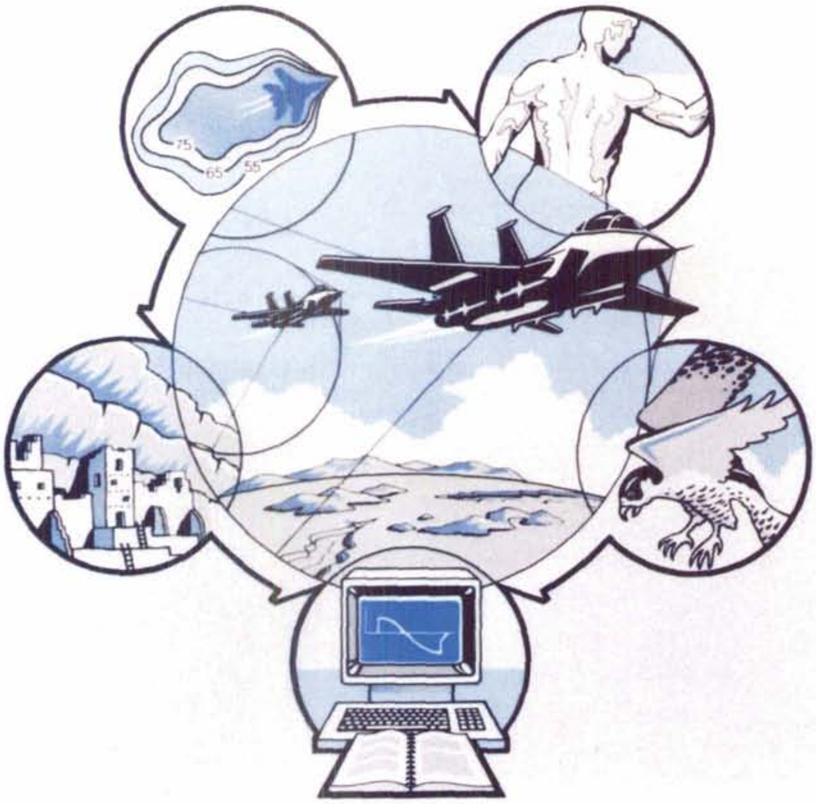
Inspecting the HVAC system for causes of indoor air quality problems.

In 70 percent of the over 50 buildings investigated, a major cause of poor IAQ has been inadequate design or maintenance of the heating, ventilation, and air-conditioning (HVAC) system. Other major contributors of IAQ problems are insufficient amounts of fresh air and relative humidities below 40 percent. The IAQ program emphasizes increased awareness among both civil engineering and medical specialties concerning what causes IAQ problems, our continuing support of customer requested surveys, and giving health oriented input into the HVAC design and maintenance process within DOD.

OPR: AL/OEM, (210) 536-3214 [DSN 240]

Environmental Noise Technology Program

Noise related problems associated with air operations are increasing as the USAF requires more low-altitude/high-power flights to maintain pilot proficiency and increase aircrew survivability. Encroachment continues as communities develop near airbase installations. Base closures and force realignment exercises intensify these problems by increasing the number of aircraft (and their noise) at the remaining bases. Each change to the operations at any USAF base, range, route or Military Operating Area (MOA) requires the USAF to evaluate the environmental impacts as defined in the National Environmental Policy Act (NEPA). The USAF must accomplish comprehensive environmental noise-impact analyses to continue operations within regulatory requirements and defend itself against litigation. The Environmental Noise Technology (NOISETECH) program develops the measurement methods, metrics, databases, models, and criteria essential in defining noise exposure and assessing its effects on humans, animals, and structures.



Technological advances in aerospace systems require noise exposure assessments.

Beta testing was accomplished for the NOISETECH computer based Assessment System for Aircraft Noise (ASAN), a planning and decision support system for predicting and analyzing the effects of subsonic noise and sonic booms on humans, animals, and structures. It will be used by the USAF operational and environmental planning communities to plan operational changes and assess the predicted environmental noise impacts of these new and modified operations. When fully implemented at the major commands, ASAN will develop legally defensible documents that describe and assess the impact of subsonic and supersonic aircraft operations on wild and domestic animals. It also assesses potential damage to conventional and unconventional structures, determines likelihood of snow avalanches or landslides, and predicts individual and community annoyance responses, sleep disturbance, and potential long-term human health effects.

New modeling capability was added to the NOISEMAP computer program to evaluate terrain effects on noise propagation near the start of aircraft takeoff roll. NOISEMAP forms the cornerstone of the DOD Air Installation Compatible Use Zone program and must be continually updated to reflect the current technology to provide legally defensible airbase noise assessments. These assessments are used to defend the airbase mission from encroachment of developing local communities. New computer controllable units have been commercially developed and integrated into our NOISECHECK II program for use in spot check monitoring that is often required in cases of controversy or litigation. An initial prototype of a noise monitoring network similar to those used in major civil airports was developed using this NOISECHECK capability. It may become necessary for military installations and controversial special use airspace to use these noise monitoring networks to obtain the degree of public acceptance necessary to avoid further operational restraints.

NOISETECH research programs involve laboratory and field studies on the effects of subsonic aircraft noise and sonic booms on both domestic animals and wildlife, including fowl, horses, caribou, bighorn sheep, the desert tortoise, and other species. Specific projects currently underway include development of a domestic animal effects model, a predator-prey interaction model, and a grazing animal model. Draft USAF position papers and assessment models for these efforts will be incorporated into ASAN.

OPR: AL/OEB, (513) 255-3605 [DSN 785]

Health Risk Assessment Program

The Superfund legislation in 1980 created the Agency for Toxic Substances and Disease Registry (ATSDR) as part of the Public Health Service in the US Department of Health and Human Services. ATSDR conducts a Public Health Assessment for every site on the National Priorities List (NPL), also known as the Superfund list. The USAF in 1992 had 33 installations on the NPL for a Public Health Assessment to be performed. ATSDR reviews available information about hazardous substances at a site and evaluates whether exposure to them might cause any harm to people in the past, present, or future.

The Occupational and Environmental Health Directorate of Armstrong Laboratory (AL/OE) initiated the Health Risk Assessment Program to provide the USAF, major commands, and installations a technical center of expertise to assist with ATSDR in the health assessment process. The team of professionals consists of physicians, epidemiologists, toxicologists, bioenvironmental engineers, public health officers, industrial hygienists, and biologists. Members of the team travel to USAF bases on the NPL before the assessment process to preview the hazardous sites and identify where additional environmental data should be collected. During this process, recommendations are made to prevent or reduce personal exposure to hazardous substances. An AL/OE representative then accompanies the ATSDR health assessor during the site visit and assessment. This working association with ATSDR allows for the best flow of information providing a more complete and accurate Public Health Assessment document. This document is then reviewed by the technical experts at AL/OE for validity and accuracy in such areas as toxicology, epidemiology, biological pathways, and health impact to the person.

The AL/OE focal point acts as a liaison with the ATSDR Division of Health Assessment and Consultation. This provides for consistency of the reviews, uniformity to the health assessment process, and technical support to the installations and MAJCOMs. Since the Health Risk Assessment Program is active in the Army and Navy, AL/OE works closely with the sister services to enhance the combined capabilities of toxicology and epidemiology. The USAF has taken the lead for cleaning up the environment in and around our sites, and through this program AL/OE is working to ensure the environment is safe for the public now and into the future.

OPR: AL/OEM, (210) 536-2063 [DSN 240]

Bioenvironmental engineers discuss possible locations of toxic substances.

Air Force Ergonomics

Ergonomics related illness has been called the "occupational disease of the 1990's." Impairments of the muscles, tendons, nerves, and joints which occur over time in the workplace are very common; the average employee loses nearly two days of work each year due to disorders of this nature, and "cumulative trauma disorders" now comprise nearly 60 percent of all occupational illnesses reported to the Bureau of Labor Statistics. Ergonomics or the study of the "laws" of work, focuses on selectively adapting the job environment to individual needs. By achieving a close fit between workers and their environment through task, tool, or workstation redesign, the ergonomist hopes to reduce or eliminate many of the common job stressors associated with occupational disease.

In 1990, Armstrong Laboratory initiated the Air Force Center for Ergonomics Consultative Services and Information Exchange. In response to this tasking, a multidisciplinary team, composed of an occupational medicine physician, industrial hygienist, and military public health officer, was established to provide telephone and on-site ergonomics consultations to customers. Since its inception, the team has published ergonomics related technical reports and consultative letters, and conducted ergonomic surveys in a variety of work areas. High levels of cumulative-trauma illness have been identified in USAF sheet metal shops, supply, commissary, and tire shops. Most recently, the team analyzed jobs in a base parachute shop, and made recommendations for administrative and engineering design changes to minimize the ergonomic hazards found in the drag parachute packing areas.

This year, the focus has been on developing the "total program requirements" for implementing a USAF-wide ergonomics program. The Air Force Occupational Safety and Health or AFOSH standard resulting from this endeavor should ultimately have a significant, positive impact on the USAF working environment.

OPR: AL/OEM, (210) 536-2063
[DSN 240]

Measuring the computer station to ensure worker "fit."

Hazardous Waste Analysis Program

The Resource Conservation and Recovery Act (RCRA) mandates that all USAF installations conform to certain requirements to have their waste characterized and disposed of properly. In response to this need, Armstrong Laboratory maintains waste management teams to provide waste management guidance and sampling assistance.

The Human Systems Center also acts as a focal point to provide bases worldwide with an avenue to have potential hazardous waste samples analyzed. Utilizing major command Civil Engineering funds, samples are analyzed by civilian contract laboratories that are the best in the industry. Data provided by these laboratories are forwarded to Armstrong Laboratory for assessment and evaluation by highly trained scientists prior to release to the installation, thus assuring a quality product delivered to our customers.

Complete characterization of a waste is extremely expensive and time consuming. Costs can range from $700 to $2,000 per sample, and analysis can take up to three weeks to perform. Over 45 separate analyses are performed on each sample to determine if they fall into the category of hazardous waste as defined in RCRA.

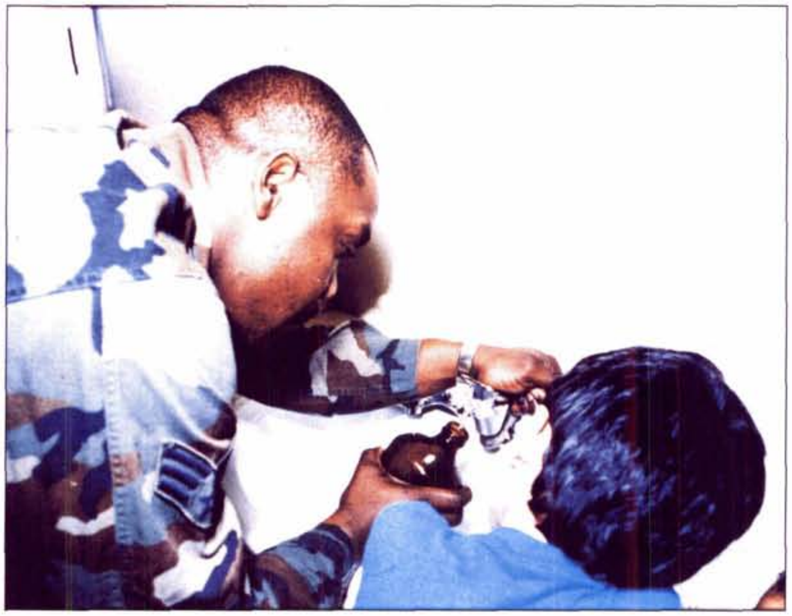
All USAF installations must abide by RCRA. The hazardous waste analysis program is a key in providing bases with the information necessary to dispose of waste safely and economically while avoiding potential costly fines imposed by the Environmental Protection Agency.

Samples are analyzed to identify potential hazardous waste.

OPR: AL/OEA, (210) 536-3626 [DSN 240]

Environmental Sampling

Recent changes to the Water Quality Act, the Clean Air Act, the Safe Drinking Water Act, and the Resource Conservation and Recovery Act require detailed sampling or computer modeling of air, drinking water, and wastewater. The Water Quality Act, also known as the Clean Water Act, requires permits and discharge limitations for industrial waste, sanitary waste, and storm water. The Clean Air Act Amendments require detailed emission inventories of all sources of air pollution and also contain provisions for air emissions permits. The Resource Conservation and Recovery Act rules govern the identification and disposal of hazardous waste material. The Safe Drinking Water Act requires monitoring and treatment when necessary for over 100 contaminants in drinking water.



Sampling for lead testing in a child development center.

Armstrong Laboratory (AL) environmental scientists provide technical expertise survey teams that will travel to bases and perform environmental samplings and unique in-house analysis. Bases experiencing environmental problems can contact a variety of specialized consultants for interpretation of regulations or problem-solving suggestions. On-site environmental surveys are scheduled in a priority fashion based on the urgency of the request, but can take place in a matter of days if necessary.

Most samples collected during on-site surveys are analyzed without cost to the base. The primary source of analytical support is the AL Analytical Services Division. An increasing number of permits require special analysis of samples using fish or minnows. AL can help bases avoid sampling for some air emissions by maintaining the necessary software to perform Environmental Protection Agency approved modeling of air pollution sources.

Environmental sampling teams provide a significant resource to bases in their efforts to comply with today's complex array of environmental regulations. DOD customers include civil engineers and medical personnel in all major commands.

OPR: AL/OEB, (210) 536-3305 [DSN 240]

Lead Based Paint

Armstrong Laboratory (AL) consultants are evaluating military family housing units, child care centers, and youth centers for the presence of lead based paint (LBP). According to the Center for Disease Control, lead poisoning is one of the most common pediatric health problems in the United States today. Potential sources of lead in the environment are lead based paint, industrial emissions, lead in pipes, and lead in food containers. The pathways by which lead from these sources finds its way into the human body include inhalation of air, ingestion of food and drinking water, and ingestion of nonfood solids such as paint, house dust, and soil dust. LBP is the most widespread source of lead exposure to children.

In a typical survey, bioenvironmental engineers and technicians prioritize housing units based on whether children under seven years of age or pregnant woman are presently living in the house, the condition of the paint, and the age of the unit. Units built before 1970 (especially those built before 1950) are more likely to contain LBP. The survey team uses an X-ray fluorescence spectrum analyzer to measure the amount of lead in paint. In addition, the team collects dust samples in each unit and soil samples outdoors. LBP is often found on house components such as door frames, window frames, wooden trims, and exterior walls. Levels of lead dust and lead in soil are generally within the acceptable levels established by the Environmental Protection Agency and the Department of Housing and Urban Development.

AL is now developing USAF technical guidance on LBP investigations and is a member of the DOD Interagency Committee on Lead Based Paint in military housing and other buildings.

OPR: AL/OEM, (210) 536-3214
[DSN 240]

X-ray fluorescence monitoring for lead based paint.

Toxicology Research and Development

Armstrong Laboratory's toxicology research and development defines the toxic hazards associated with fuels, chemicals, and structural materials used in advanced aerospace weapon systems. A multidisciplinary scientific research team examines the mechanisms of toxicity and recommends human exposure criteria. In addition, the team develops new methodology and creates methods to relate data from animals to humans.

Toxicology research is vital to the development and acquisition of materials designed to enhance USAF operational capability. Researchers proposed USAF materials to toxicological evaluation, enabling decisionmakers to build acquisition strategies that balance the USAF mission, health risks, environmental factors, and life cycle costs. Recently, nonflammable aircraft hydraulic fluids, new fuels, and lubricants were evaluated for USAF use. This research effort is also substantially involved in a high priority effort to find safe replacement chemicals for halons currently in the USAF inventory.

Technician performing toxicity assessment on fuel sample.

This research integrates investigations of toxicity ranging from the cellular level of target organs, to whole animals or human systems. The quantitative description of the uptake, distribution, metabolism, elimination, and toxicity of USAF operational chemicals and materials involves the use of kinetic studies, analytical biochemistry, biomathematical modeling, cancer mechanism studies, and cell culture techniques.

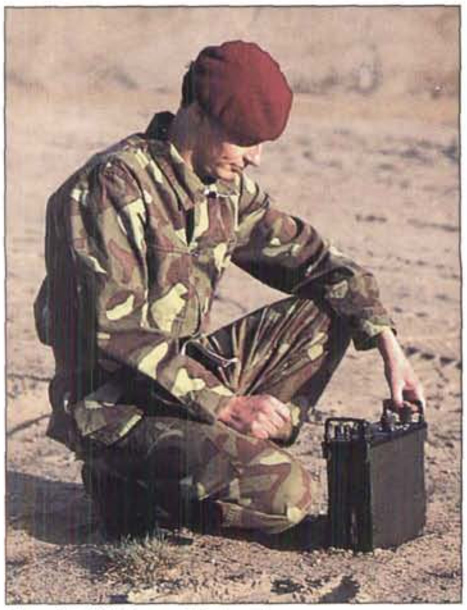
USAF toxicology research responds to a spectrum of mission driven needs ranging from rapid relative toxicity screens to long-term chronic inhalation studies. The presence of hazardous materials adds several hundred million dollars to each weapon system's life cycle and increases health risk to personnel. Ongoing research enables reducing both cost and risk to personnel health.

OPR: AL/OET, (513) 255-5740 [DSN 785]

Automatic Mustard Agent Detector

Detection and warning is a key element of preparedness for chemical warfare defensive operations. To operate effectively in a contaminated environment, commanders need to know the type and concentration of the chemical agent, location of the agent, movement and spread of the contamination, and must be alerted when the contamination has been reduced to a safe level. The automatic remotely alarmed detectors currently in use detect only nerve agents and are prone to produce false positive readings from common battlefield contaminants.

Use of mustard agents against a wartime enemy dates back to World War I. Because an increasing number of countries are developing chemical weapons, the Human Systems Program Office is pursuing a fast-track acquisition of a small number of automatic mustard agent detectors for contingency operations. The Finnish M-90 has been selected for this purchase and will be used by specialized teams to determine if the area being monitored at air bases is contaminated. It will also be used to provide a remote chemical detection capability to warn personnel of chemical attack and to monitor the atmosphere in collective protection shelters for the intrusion of contamination. Upon completion of this initial limited buy, a much larger acquisition will continue to meet the requirements for vesicant agent detection worldwide. All devices will provide timely and critical information the commander needs to improve his chemical warfare defense posture while in the battle area.



The M-90 from Finland.

OPR: HSC/YAC, (210) 536-2675 [DSN 240]

Radiation Detectors

Commanders must have a nuclear radiation detection capability to monitor nuclear materials and contamination levels during peacetime and wartime scenarios. Currently fielded USAF radiation detectors are unsupportable. This exposes military bases by providing little or no long-term detection capability. With the addition of the new radiation detector, bases will have the ability to monitor all forms of radiation for extended periods of time.

In an effort to provide a nuclear radiation detection capability, the Human Systems Program Office is conducting a commercial off-the-shelf procurement contract. The fielding of these devices will permit timely detection of nuclear radiation vital to the protection of personnel on the battlefield and in the manufacture, transportation, handling, decontamination, storage, and eventual destruction of nuclear materials. These detectors will improve operational capability in wartime and peacetime missions.

OPR: HSC/YAC, (210) 536-2675 [DSN 240]

USAF Personnel Radiation Dosimetry

USAF personnel work with various types of radioactive materials and radiation-producing machines to include nuclear medicine, radiotherapy, instrument calibration, irradiators, gauges, nuclear weapons, and research and development. The potential for exposure to ionizing radiation is present which necessitated the establishment of national standards to minimize the risk associated with exposure to ionizing radiation. The danger of ionizing radiation to USAF personnel is minimized through the proper use of personnel dosimetry.

The USAF's large-scale personnel radiation exposure monitoring program utilizes state-of-the-art software, hardware, and dosimetry to ensure the protection of the worker. Physicians, dentists, weapons inspectors and handlers, non-destructive inspection operators, and reactor operators are some of the occupations that are monitored. The system is considered to be reliable, accurate, and technically advanced.

Success of the program is essential for positive proof of compliance with Air Force Regulation 161-28 and Title 10, Code of Federal Regulations, part 20. The USAF participates in the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the US Department of Commerce, National Institute of Standards and Technology, formerly the National Bureau of Standards. We have fulfilled the requirements for this certification and continue to maintain this level of proficiency in all eight categories. The Instrument and Calibration facility supports the personnel dosimetry program by providing periodic calibration of the thermoluminescent dosimeters in order to maintain a high level of quality assurance as required by NVLAP.

OPR: AL/OEB, (210) 536-3486 [DSN 240]

Reading dosimeters to determine ionizing radiation exposure of USAF personnel.

In Vivo Bioassay

Personnel who routinely use radioactive materials can inadvertently inhale or ingest these materials. To determine the amount of radioactive material internally deposited, Armstrong Laboratory utilizes a combination of instruments and procedures.

In vivo activity of gamma-emitting radionuclides is determined by using a Canberra Accuscan II Whole Body Counter (WBC). The WBC provides quantitative and qualitative determination of the radionuclide body content of potentially exposed personnel. After the ingested or inhaled activity has been determined, specialized software is used to determine the cumulative dose that is expected over the next 50 years (the committed effective dose equivalent, [CEDE]). This CEDE is then entered into the USAF Master Radiation Exposure Registry (MRER), which is maintained as a historical dose record database at Armstrong Laboratory.

Armstrong Laboratory routinely provides radioanalytical support to all the armed services in addition to the Department of Energy. This in vivo bioassay capability establishes Armstrong Laboratory as the premier radioanalytical laboratory within the DOD.

OPR: AL/OEB, (210) 536-2061 [DSN 240]

Measuring internal radiation exposure to determine short- and long-term health effects.

Environmental Bioassay

The Ecology and Bioassay Function in the Occupational and Environmental Health Directorate of Armstrong Laboratory provides aquatic and soil bioassay support for bases USAF-wide. Bioassay tests statistically compare a test organism's response to a potential contaminant versus the organism's response to an uncontaminated control. While chemical analysis can provide useful data on the makeup of contaminated water, soil, or products, only a bioassay can assess the actual hazard it may present to living things in the environment.

The Ecology and Bioassay Function uses fathead minnows (Pimephales promelas), water fleas (Ceriodaphnia dubia), algae (Selenastrum capricornutum and Photobacter phosphoreum) as test organisms for aquatic bioassays, sorghum (Sorghum bicolor), and pinto beans (Phaseolus vulgaris) for soil bioassays. Although most bioassays take several days to accomplish, the function capabilities include a computerized bioassay system called Microtox TM, which completes a bioassay in about 30 minutes.

Many bases have legal requirements for bioassays under their National Pollutant Discharge Elimination System permits. Other bioassays are requested for investigations of fish kills, lawsuits involving farming lands contaminated by fuel or oil spills, and investigations of the environmental impact of products used by the USAF, such as aircraft deicers. The Ecology and Bioassay Function complies with the Environmental Protection Agency and the most stringent state guidelines. In FY92, the function completed over 200 bioassays in support of 17 USAF installations. The Ecology and Bioassay Function provides USAF installations with a cost-effective alternative to contracting these services, some of which cost thousands of dollars per individual test and could add up to hundreds of thousands of dollars per year at a single installation.

OPR: AL/OEM, (210) 536-3214 [DSN 240]

Culturing organisms for bioassay.

Air Force Radiation Assessment Team

The Air Force Radiation Assessment Team (AFRAT), based at the Armstrong Laboratory, provides assistance worldwide for on-site detection, identification, and quantification of any ionizing radiation hazard. AFRAT stands ready in the event of a nuclear weapon accident or any incident involving the potential release of radionuclides. The AFRAT team consists of 34 extra duty personnel which includes health physicists, bioenvironmental engineers having expertise in industrial hygiene and environmental quality, bioenvironmental engineering technicians, radioanalytical laboratory technicians, a radiochemist, and an occupational health physician. AFRAT is capable of deploying to any location worldwide within 48 hours, and provides a full range of equipment and consultation to the on-scene commander in health physics, industrial hygiene, and environmental quality.

AFRAT member monitoring for radionuclides during building entry operations at Loring AFB, Maine.

Recently, AFRAT deployed to Loring AFB ME and Keesler AFB MS. At Loring AFB, workers cutting into an abandoned and sealed weapons storage facility were potentially contaminated with radioactive material. Subsequent measurements made by AFRAT determined that the source of the contamination was naturally occurring radon gas which had accumulated in the facility due to poor ventilation. AFRAT determined that personnel involved in the initial entry of this facility were not adversely affected by the radon gas thereby avoiding widespread public concern. Follow-on AFRAT actions at Loring AFB included the development and implementation of a comprehensive health and safety plan which ensured a radiologically safe entry into the facility. At Keesler AFB, a garbage truck was turned away from the local landfill after landfill officials detected unknown radioactive material in the waste. The AFRAT succeeded in locating, identifying, and segregating the suspect material. Keesler and state environmental officials were impressed with the AFRAT's quick response and thoroughness.

AFRAT provides a specialized team for radiological monitoring and assessment at any place and time. AFRAT's readiness posture is exemplified by its deployments. The interagency response community can depend upon AFRAT to set the standard for response and to retain its position as one of DOD's premier radiological accident/incident response forces.

OPR: AL/OEB, (210) 536-3486 [DSN 240]

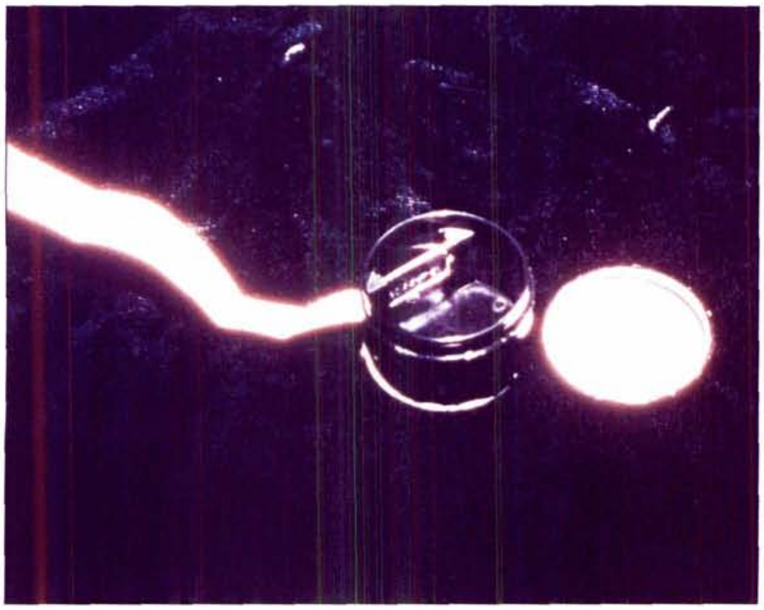
Radon Assessment and Mitigation Program

Radon, a naturally occurring radioactive gas produced by the decay of uranium, is second only to cigarette smoking as a cause of lung cancer. The Environmental Protection Agency (EPA) estimates radon causes 5,000 to 20,000 lung cancer deaths per year in the US. Elevated concentrations of radon in homes are widespread. An EPA survey of 25 states found one in four homes tested had elevated levels. In response to this concern, Congress enacted Title III of the Toxic Substance Control Act (also called the Indoor Radon Abatement Act) in 1988, which requires testing of all federal facilities for radon. Prior to enactment of this legislation, the Armstrong Laboratory's Radon Assessment and Mitigation Program (RAMP) had already been implemented and accomplished 5,000 screening measurements at 135 USAF installations worldwide.

As a result of the screening measurements, 51 installations were targeted for year-long measurements of all residential, school, child care, and lodging structures. Of the approximately 46,000 measurements made thus far, 14 percent are above the EPA screening level. Structures identified as having radon levels exceeding the EPA level will require mitigation. In early 1993, measurements of administrative structures began at previously identified installations which are not on the base closure list. Mitigation in response to RAMP measurements is ongoing at several installations.

RAMP efforts have been proactive from the start, and RAMP continues to serve as a model for other agencies. RAMP efforts will reduce the long-term risk of lung cancer from exposure to radon for personnel living and working on USAF facilities.

OPR: AL/OEB, (210) 536-3486 [DSN 240]



The Tech-Ops/Landauer Alpha Track "RadTrak" radon detector is a passive monitor for radon levels.

High-Flier Radiation Dosimetry Program

High altitude aircrews risk exposure to relatively high levels of naturally occurring ionizing radiation. The sources are cosmic and solar particles and their associated secondary radiations produced by interaction with the Earth's atmosphere. Under normal conditions, at high latitudes and altitudes above 40,000 feet, dose rates can reach levels on the order of rem per hour experienced during a major solar flare.

In an effort to more accurately assess the operational radiation environment and exposure to high altitude aircrews, the Air Combat Command and the Armstrong Laboratory have entered into a collaborative program to conduct radiation measurements on U-2 aircraft. Several total dose meter instruments (TDM) are under construction which will be flown routinely on U-2 missions. Detectors used will be tissue equivalent proportional counters. The TDMs will have a multichannel analyzer to register the particle spectrum. A large-scale memory will sequentially store the data and dose as a function of flight time for analysis of flight dose profiles. An LED warning feature will also alarm at a preset radiation level.

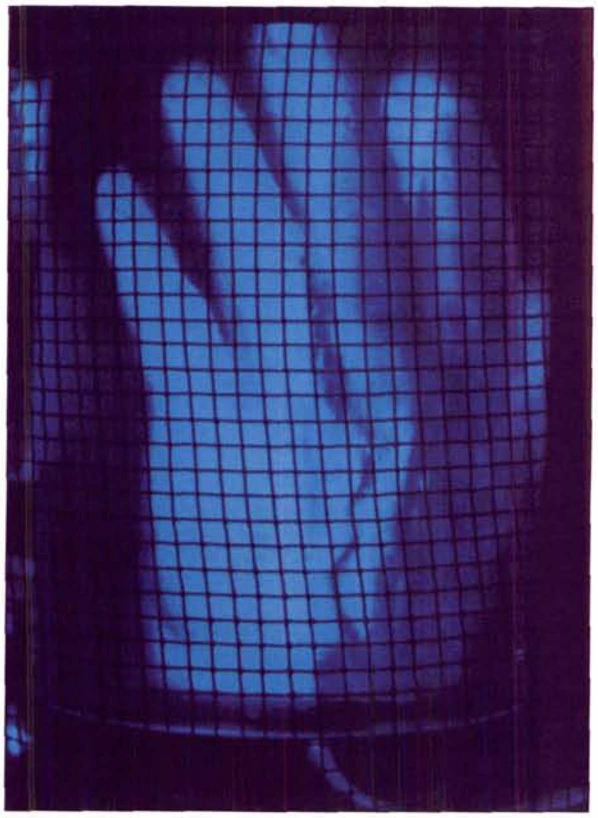
The radiation data collected will provide a database from which rapid and accurate radiation risk estimates required for military and contingency planning can be made. The dosimetry technology developed and used in this program will help decrease human health risk in these operational environments.

Radiation meter will measure U-2 pilot doses.

OPR: AL/OEB, (210) 536-3486 [DSN 240]

Radiofrequency Radiation Assessment

Many USAF systems produce nonionizing electromagnetic radiation. Human Systems Center researchers are improving current methods to measure radiofrequency radiation (RFR). One revolutionary approach, Thermochemiluminescent Radiofrequency Radiation Microdosimetry (TRM) uses a combination of hardware, software, and chemistry to determine the absorption patterns of RFR in models of the human body. With TRM, a plastic anthropomorphic phantom is filled with a light emitting polymer and exposed to RFR. The measured luminescence of the polymer indicates the level of absorption of the RFR signal. Because the emitted light is imaged, a map of the microdistribution of the absorbed energy is obtained in near-real time.



Human-hand phantom containing tissue simulant that luminesces.

This light emitting polymer was invented by Armstrong Laboratory (AL) researchers (US Patent 5,003,050). AL researchers have invented a biosynthetic method (patent application filed) for producing the polymer in bacteria using fermentation technology. This has made RFR dosimetry possible even in single cells. The luminescence is detected, quantified, and displayed using the USAF Quantitative Luminescence Imaging System (QLIS) on the human phantom and microscopic scale (US Patent 4,948,975). Researchers are now developing anthropomorphic phantoms capable of being placed in various postures since these geometric factors affect the amount and distribution of RFR energy absorbed.

This new technology replaces a time-consuming procedure requiring many consecutive point-by-point measurements. Critical information on RFR exposures in the workplace will be more accurate and cost-effective. In addition, this technology will result in significant new applications in civilian medical and industrial applications of RFR such as hyperthermia treatments of diseases, luminescent labeling in diagnostics, and the heat-curing of materials using radiofrequency energy.

OPR: AL/OER, (210) 536-3176 [DSN 240]

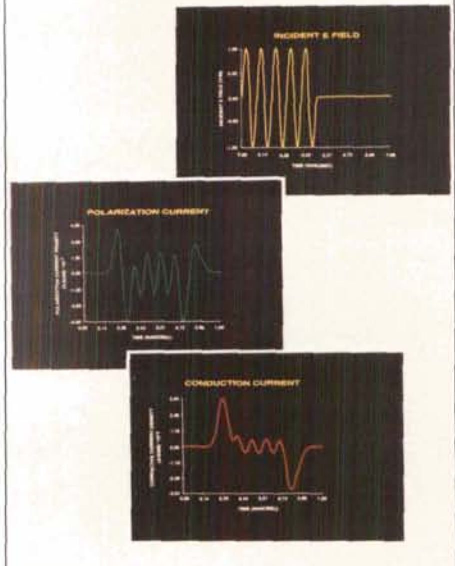
Computational Bioelectromagnetics

Ultrashort directed energy microwave and laser systems are evolving rapidly in accordance with the USAF Directed Energy Master Plan. These systems produce intense short-lived pulses of electromagnetic energy which previously have not been seen in nature. These unique and intriguing physical events represent a concern from the human health and safety point of view, and they represent an exciting and very deep opportunity to explore new classical physics' and biomedical physics' principles and applications.

In response to the health, safety, and applied science challenge and opportunity posed by the development of ultrashort pulsing devices, Armstrong Laboratory (AL) has instituted an electromagnetic computing and mathematical physics research program. This program studies the propagation of very high peak power microwave and laser pulses through living tissue. When these pulses enter tissue, they strongly couple to the charged chemical structures which are part of living cell membranes and to other key molecular structures such as enzymes, DNA (the genetic material), and RNA. The charged components of these biomolecular entities are mechanically driven by the propagating pulses, and the resulting movement of the charged components sets up a reactive electromagnetic field.

Research in the newly formed AL effort is proceeding toward an understanding of short pulse propagation in living tissue. In-house mathematical and physics researchers have defined the existence of large electric field transients produced in living tissue by impinging short pulses. In the past year, electric currents induced in tissue by electric field transients have been computed for the first time ever in the history of electromagnetic research. These currents are of two types: a conduction current that corresponds to the translational movement of free ions in the tissue material and a polarization current that corresponds to the perturbation of charges that are bound to membrane, enzyme, or other biomolecular structures. The figure shows the polarization and conduction currents induced by a one-volt-per-meter square wave modulated pulse striking a tissue surface (the incident signal). Note that the induced polarization current is substantial, being amperes per square meter in order of magnitude. A small portion of the total current is conductive in nature. It remains for future research to delimit the possibly differing biological effects of the two current flows.

OPR: AL/OES, (210) 536-3884 [DSN 240]



Tissue model current response to a 1 v/m incident pulsed field at a depth of 1 cm.

Delayed Radiation Effects in Aerospace Operations

Future aerospace missions such as high-flying USAF surveillance activities, National Aerospace Plane, Space Shuttle, Space Station or Lunar Base, will involve increased radiation exposures due to high altitude or high-latitude orbits as well as longer missions outside the protection of the geomagnetic fields. Increased hazards to personnel will require radiation-protection measures based on in-depth knowledge of the risks. Exposure to ionizing radiations is associated with higher probabilities of developing cancers and visual cataracts as well as lowered life expectancy. The Delayed Radiation Effects research program was designed to assess the long-term radiation risks for personnel in aerospace operations and will develop practical guidelines for crew protection.

Resolution of health risk problems associated with late effects of space radiations is best achieved by studying long-lived physiological models. Our research on radiation-induced cancer, cataracts, endometriosis, and genetic (chromosome) damage in a model system close to man will help define parameters in such areas as spacecraft and aircraft shielding design. In addition, spinoffs from the ionizing radiation research project, especially in the area of genetics, will have an impact on investigations of late effects of chemicals and other environmental toxins to which personnel may be exposed on the surface of the earth; for example, in base cleanup operations.

The 30-year space radiation biology database provides for rapid and accurate radiation risk assessments required for military decisions and contingency planning. The development and applications of dosimetry technology and evaluations of late radiobiological endpoints will help decrease short- and long-term human health risks and ensure the highest probability of mission success.

OPR: AL/OER, (210) 536-3416 [DSN 240]

Molecular probes for human chromosomes which detect aberrations in monkey cells following irradiation with protons.

Initial Development of Roadmap for Radiological Detection: Concept Study

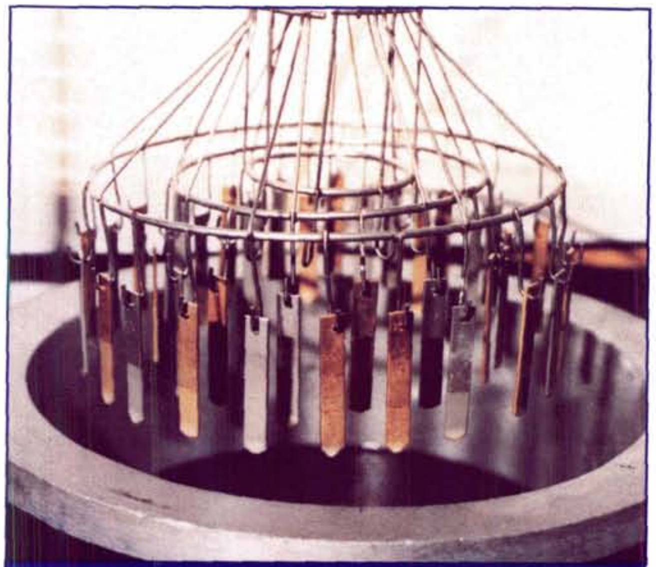
Despite changes in the geopolitical environment, the USAF must remain technologically current to adequately support personnel during both peacetime and wartime situations. One area in dire need of technology refreshment is radiological detection. Current radiological detection equipment is obsolete, is limited in capability, and requires excessive maintenance. This situation must be remedied to meet projected USAF requirements.

The Radiological Detection study will meet USAF requirements by determining our current capabilities and what we must do to meet our future requirements. There are four major objectives of this study. First, identify and summarize the current operational radiological detection equipment throughout DOD. Second, identify and summarize radiological detection related research and development throughout DOD. Third, develop initiative programs to eliminate technology gaps and meet USAF requirements. And fourth, develop an implementation plan (i.e., roadmap) for the initiative programs. The results of this effort will ensure the USAF can meet future demands.

OPR: HSC/XRS, (210) 536-2424 [DSN 240]

Candidate radiation detection devices are currently under review.

Environics



This Human Systems Center product area provides environmental quality technology that supports the Air Force mission by reducing the cost of cleaning up past waste sites while assuring, through compliance, the completion of critical wartime and peacetime missions. Environmental Quality efforts at Tyndall AFB, Florida, center on low cost highly effective ways to prevent environmental problems and to restore existing facilities.

Microorganisms Used in Biodegradation

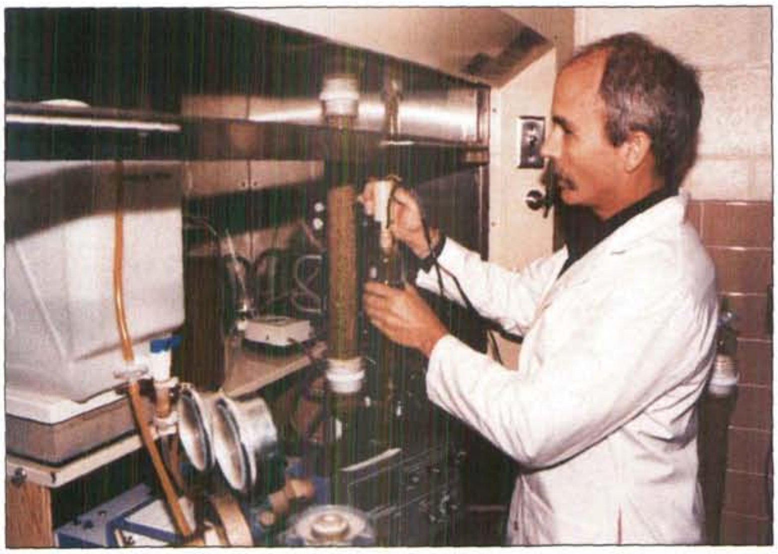
To address the need for an effective and inexpensive groundwater treatment technology, researchers at this laboratory have isolated a strain of Pseudomonas bacteria which readily destroys complex pollutant mixtures. In laboratory tests, the microorganism converts these contaminants to harmless materials such as water, carbon dioxide, and chlorides. In bench scale experiments, complex mixtures of solvents were reduced to nondetectable levels in 30 minutes.

After extensive fundamental research on the metabolic capabilities of the microorganism, scientists tested the concept in the field to determine its applicability to USAF pollution problems. A pilot plant bioreactor was tested at Kelly AFB TX, where the soil and groundwater in an abandoned waste storage area had been contaminated by various solvents and chemicals.

Preliminary tests were conducted on groundwater under a variety of operating conditions. The system reduced concentrations of benzene, toluene, chlorobenzene, and dichlorobenzene from parts-per-million level down to the parts-per-billion level when the reactor was operated at a 40-minute retention time. Results are being evaluated for use in an Installation Restoration Program feasibility study for cleanup of this site. A second field test is planned to collect additional operating data for use in the design of a full-scale system.

This technology can be used for more effective pump-and-treat remediation at any installation where groundwater has been contaminated by aromatic solvents and chemicals, and where economic cleanup and site restoration are imperative. Biodegradation offers an effective inexpensive treatment alternative to traditional physical and chemical treatment technologies. Although the technology can be widely used by the USAF and DOD, its technology transfer potential to the private sector is even greater. Knowledge gained from these studies will result in more effective pump-and-treat remediation and may lead to later use of Pseudomonas strains for biodegradation of aromatic solvent compounds on an in situ basis.

OPR: AL/EQ, (904) 283-6272 [DSN 523]



Biodegradation studies.

Bioventing for Enhanced Biodegradation

Soil bioventing is a modification of soil venting technology which is used to treat contaminated soil. Soil venting pulls air through a perforated well in the contaminated zone, using a vacuum pump system. Air can enter passively through an open well or be injected through a well. The air flow volatilizes and removes the contaminants bound to the soil and provides oxygen to the soil bacteria. Air Force Civil Engineering Support Agency (AFCESA) first conducted a small-scale test of bioventing technology at a jet fuel contamination site in a sandy permeable aquifer at Tyndall AFB FL. Goals included optimizing the amount of hydrocarbon removal by in situ biodegradation while minimizing the volatilized hydrocarbons given off in the vented airstream. The effect of adding nutrients and moisture to the subsurface to stimulate bacterial growth was also studied. Operating the bioventing system under optimum conditions resulted in 85 percent hydrocarbon removal by in situ biodegradation. A full-scale demonstration of bioventing was done at Hill AFB UT and a feasibility study is underway at Eielson AFB AL to determine the applicability of bioventing in a subarctic environment. To expand the range of sites where bioventing can be used, a large-scale test will be conducted in the northern US under less permeable conditions. Results indicate this may be a low cost, highly effective remediation technique that is transferable to the public. The Air Force Center for Environmental Excellence is transferring this technology by implementing bioventing as a cleanup technology at 50 USAF sites.

OPR: AL/EQ, (904) 283-6272 [DSN 523]

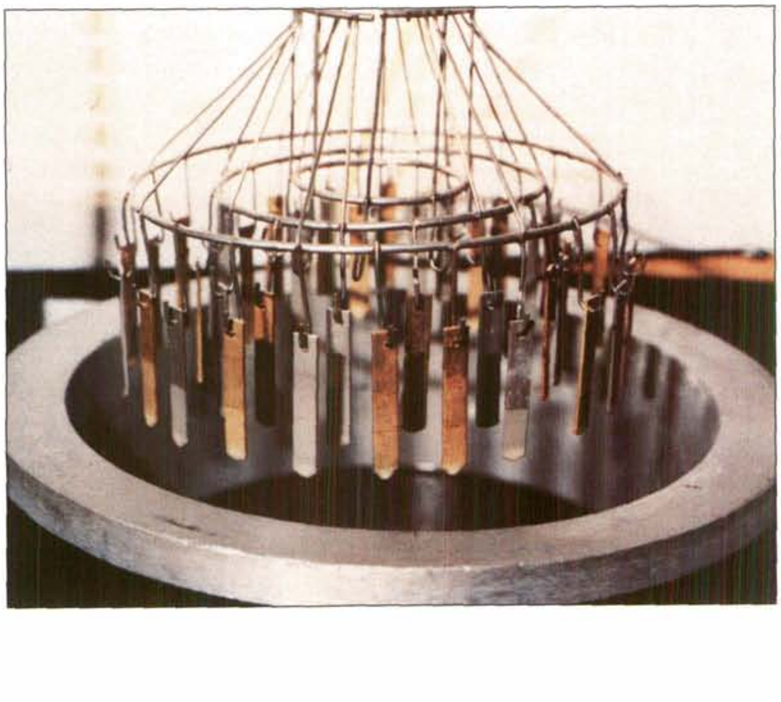
Bioventing under Arctic conditions.

Biodegradable Solvents and Cleaners

Solvents and cleaners are used at the USAF air logistics centers and base level aircraft maintenance facilities for degreasing and removing wax and paint before repairing or electroplating the parts. Most solvents are toxic and combustible. Many, such as the 1,1,1-trichloroethane used in vapor degreasing, cannot be treated with biological processing methods used in most Industrial Waste Treatment Plants (IWTP). Waste from the process must be placed in drums and shipped elsewhere for disposal. Other solvents such as chlorofluorocarbon-113 (CFC-113 or Freon-113) and perchloroethylene will soon be placed under stricter EPA control because of their potential ozone-depleting effects. The Air Force Civil Engineering Laboratory's (AFCEL) program identifies both solvents replaceable with biodegradable products and the biodegradable solvents that can be used and develops implementation procedures. Solvents were screened for biodegradability, cleaning efficiency, and corrosiveness. Of 40 solvents passing cleaning and biodegradability tests, ten passed the basic test criteria; five survived further testing. Other evaluations include economics, solvent life, process control, and whether replacement solvents create an increased organic load that adversely affects biological treatment. Testing is underway to demonstrate the solvents and processes on aircraft parts being overhauled at Oklahoma City Air Logistics Center. Results indicate that effective biodegradable solvents are available that can be treated in the IWTP system.

In addition to the Biodegradable Solvents research program, AFCEL co-sponsored the annual International Workshop on Solvent Substitution. This joint conference with the Department of Energy brings together experts from government and industry to ensure the successful transfer of solvent substitution technologies. The first two workshops took place in Phoenix, Arizona, and have been hailed as the foremost conferences on hazardous waste minimization through solvent substitution.

OPR: AL/EQ, (904) 283-6272
[DSN 523]



Metal tabs used to test solvent-cleaning capabilities.

Solid Rocket Propellant Disposal Program

Armstrong Laboratory is developing safe environmentally acceptable alternatives to the open burning and open detonation (OB/OD) of solid rocket propellants. The only methods currently available for disposal of ammonium perchlorate (AP)-based, solid rocket propellants are OB/OD or static firing. During these procedures, the burning propellant produces toxic corrosive hydrogen chloride (HCl) gas. This production of toxic gas and the dispersion of unburned propellant from OB/OD are environmentally unacceptable.

The program plan will develop a disposal process for the elimination of Class 1.1 and Class 1.3 propellants generated from the manufacture, maintenance, refurbishment, and disposition of Air Force missiles. The plan addresses three critical aspects of propellant disposal: removal of the propellant from the motor casing, pretreatment of the propellant for processing, and recovery and disposal.

For Class 1.3 propellants, extraction and reclamation of propellant ingredients proved the most desirable disposal method because it reclaims strategic ingredients for resale and reuse (aluminum and ammonium perchlorate).

Hot water dissolves the ammonium perchlorate from propellant components. Filtering the solution removes any entrained solids, after which the pure ammonium perchlorate crystallizes as the liquid cools. The crystals are recovered as a wet cake. Oxidizing the remaining binder material leads to the recovery of the aluminum as aluminum oxide. Waste, which contains dilute concentrations of AP, can be biodegraded and sent to the sanitary sewer or discharged. Indeed, if ammonium perchlorate recovered in this manner meets or exceeds military specification standards for virgin material, it may be reclaimed and sold.

No nonpolluting method exists to safely remove and dispose of Class 1.1 propellants [which contain mass detonating ingredients such as nitroglycerine (NG), cyclotetramethylenetetra-nitramine (HMX), and nitrocellulose]. Our proposed process removes the propellant from the motor casing and converts it into a powder. The powder is washed, separating the soluble AP and NG from the insoluble HMX, nitrocellulose, aluminum, and binder. The AP/NG solution is reduced to chloride and nitrogen gas prior to reducing the carbon content and discharging to the sanitary sewer. The insoluable mixture is oxidized to carbon dioxide, water, nitrogen, and solid salts.

A bioreactor is now demonstrating biodegradation of rocket fuels. A joint effort is planned with this laboratory and other DOD agencies cooperating to solve this problem. The program, useful both in DOD hazardous waste disposal programs and in solving applicable NASA problems, is need driven and highly transferable.

OPR: AL/EQ, (904) 283-6272 [DSN 523]

Experimental cell for reducing solid propellant.

134 Technology Transfer

To derive maximum return on our country's technology investments and enhance US competitiveness, Congress has passed legislation to encourage the transfer of federally funded or originated technology to the private sector. Most recently, the Federal Technology Transfer Act of 1986 provided significant new authority for the USAF laboratories to enter into Cooperative Research and Development Agreements (CRDA) with private companies and public nonprofit organizations, and to negotiate license agreements of intellectual property on behalf of the government.

CRDAs provide an easy way for industry and nonprofit organizations such as academia to collaborate with USAF research and development activities to facilitate technology transfer for the technological and financial benefits of both parties. The USAF benefits by:

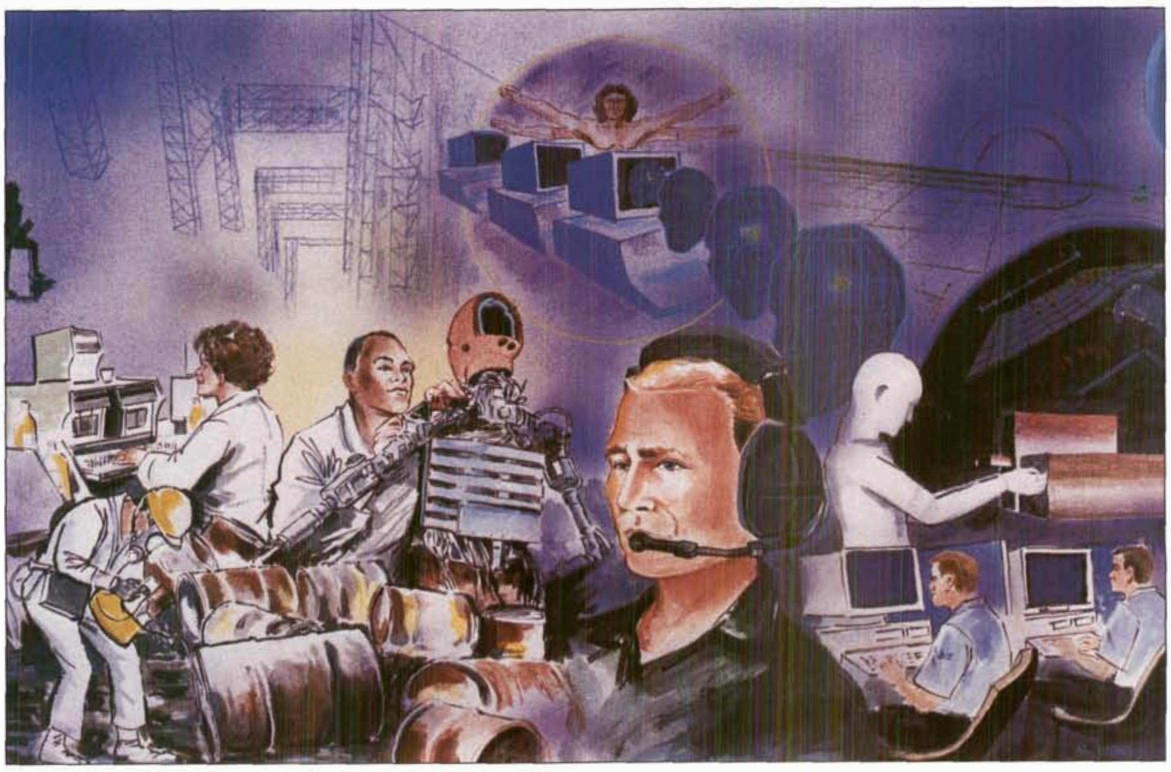
- Improved opportunities to develop and transfer technology
- Accelerated interaction with industry to transfer basic research findings to the commercial development process
- Increased familiarity with market needs
- Sharing of royalty income with the inventors and the laboratory

The collaborating organization benefits by:

- Improved access to USAF scientists and facilities
- Better access to expertise related to research results and inventions
- Options to exclusive licenses on inventions made under the CRDA
- Profitable new products and processes

Many Armstrong Laboratory technologies have near-term potential for CRDAs or license agreements, which include many technologies contained in this book, plus additional technologies available through the Armstrong Laboratory Office of Research and Technology Applications (AL/XPTT).

OPR: AL/XPTT, (210) 536-3817 [DSN 240]



Systems Acquisition School

The Air Force Materiel Command (AFMC) has a legacy of being a DOD leader in acquisition techniques and processes. To instill and maintain this excellence, formal education and training is viewed as a key component. Two thrusts are currently pursued, professional accreditation training for the Acquisition Professional Development Program and command unique acquisition training for specific AFMC needs. To meet these thrusts, AFMC sponsors a command unique acquisition "school house."

The Systems Acquisition School (SAS) provides critical acquisition education and training. Most courses are one-to-two weeks long and are provided in a resident interactive format. However, to meet command needs, any SAS course may be requested for a "road show" offering. The school is "self-contained" providing curriculum development, instruction, and full registrar services. Field experts are recruited from across the command for a tour of instructor duty -- the instructors are known for being top in their respective arenas. The school relies on these experts to teach. The benefit for AFMC is a quick response, expert training resource which can provide solid acquisiton fundamentals and also adapt to the fast changing DOD and AFMC acquisition environments. The Systems Acquisition School stands ready to support command acquisition training needs.

Courses offered (subject to change) are:

Computer Resource Acquisition Course
Subcontract Program Management
Intermediate Systems Acquisition Management
Work Measurement in Pricing Applications
Laboratory Acquisition Management Course
Integrated Product Support Course
Basic Systems Acquisition Management (Medical)

OPR: 615 SCHS/CC, (210) 536-2623 [DSN 240]

Training excellence: A resident interactive session.

Studies and Analysis

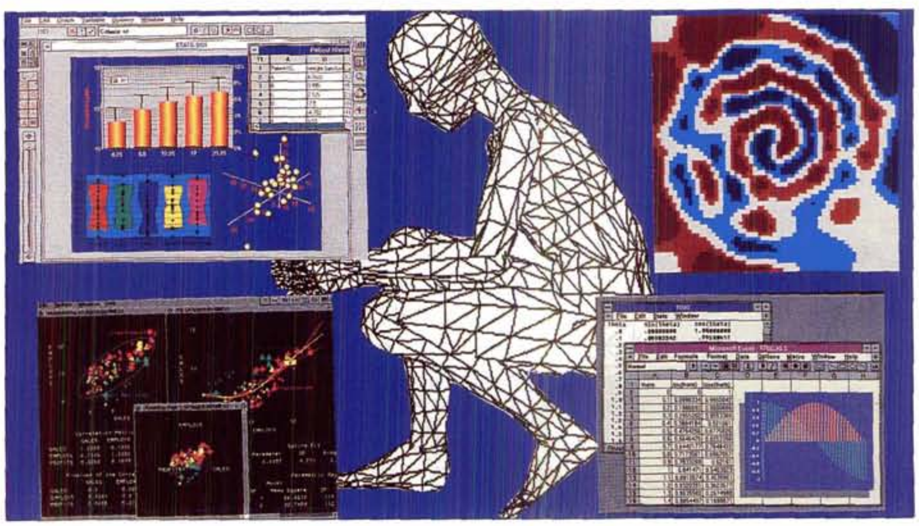
Operational requirements have historically focused more on hardware parameters than on human performance. This man-machine imbalance always produces increased costs and reduced mission effectiveness. The Human Systems Center's Studies and Analysis Division (HSC/XRS) helps users acquire human enhancing technologies that optimize mission performance. Examples of HSC/XRS services include:

- Pre-acquisition requirements analysis to identify human and environmental impacts of new/ changing defense systems, missions, threats, or deployment and support concepts
- Assess the potential of emerging human systems technologies to meet user operational requirements
- Develop/evaluate analytically derived operational systems concept options based on emerging technologies
- Provide data and decision aiding tools that help users select optimal man-machine systems requirements

HSC/XRS's modeling and simulation capability is being expanded to improve quality, scope, and responsiveness of its services. This increased capability will also support:

- Process improvement studies to enhancing a unit's ongoing internal operations
- Strategic planning studies to help focus HSC's technology base towards its customer's long range needs

OPR: HSC/XRS, (210) 536-4452 [DSN 240]



HSC's Studies and Analysis Division is often the first step towards enhanced mission performance.

Organization Functional Statements

HQ Human Systems Center

Works with customers to enhance our warfighters' competitive edge by providing superior human-centered technology, systems, education, and support. We are the systems' independent advocate for the human in design, deployment, and operation of aerospace systems.

Human Systems Program Office

Enhances USAF ground crew and aircrew survival and performance through advanced development, engineering and manufacturing development, production, and operational support of human-centered systems and equipment. This includes life support equipment, aircraft escape systems, crew station equipment, computer based training and intelligent tutor systems, nuclear/biological/chemical defense systems, aeromedical systems and equipment, AF uniforms/clothing, mishap and analyses, and environmental technologies.

Armstrong Laboratory

Plans, manages, and conducts research, advanced technology development, and specialized operational support for the readiness, maintenance, protection, and extension of human capabilities in USAF weapons systems and operations. Functional responsibilities include environmental quality, occupational and environmental health, crew-systems integration, aerospace medicine, and human resources.

USAF School of Aerospace Medicine

As the center for aerospace medicine education, the USAF School of Aerospace Medicine is the major provider of educational programs involving aviation, space, and environmental medicine for USAF, DOD, and Allied Nations personnel. The programs span entry level through graduate medical education in all disciplines encompassed in the aerospace medicine specialty.

615th Systems Acquisition School

Responsible for advancing the education of acquisition professionals in development and acquisition policies and processes, to support and sustain all USAF weapon systems.

648th Air Base Group

Operates and maintains Brooks AFB and provides base element support to Human Systems Center, three USAF Field Operating Agencies, tri-service laboratories and the USAF School of Aerospace Medicine. Support includes, but is not limited to, plans, civil engineering, communication and computer systems, transportation, supply activities, child development, recreation, base security, mission support, command post and family support programs.

Points of Contact

(as of October 1993)

HQ HUMAN SYSTEMS CENTER - HSC

Commander - HSC/CC Maj Gen George K. Anderson	(210) 536-3652 [DSN 240]
Vice Commander - HSC/CV Col James G. Roudebush	(210) 536-3654 [DSN 240]
Staff Director - HSC/CS Col George W. Irving III	(210) 536-2358 [DSN 240]
Director, Planning, Requirements, and Engineering - HSC/XR Mr. James A. Vinarskai, SES	(210) 536-3514 [DSN 240]
Director, Financial Management - HSC/FM Col Bryan J. Cory	(210) 536-2802 [DSN 240]
Director, Personnel - HSC/DP Col Allen T. Snyder	(210) 536-3372 [DSN 240]
Director, Contracting - HSC/PK Col Richard M. See	(210) 536-6312 [DSN 240]
Staff Judge Advocate - HSC/JA Lt Col Samuel S. Bagley	(210) 536-3301 [DSN 240]
Public Affairs - HSC/PA Maj Peter D. Kirk	(210) 536-3966 [DSN 240]

HUMAN SYSTEMS PROGRAM OFFICE - HSC/YA

Program Director - HSC/YA Col Mahlon H. Long III	(210) 536-3475 [DSN 240]
Chief, Chem/Bio Systems Division - HSC/YAC Lt Col William R. Kelly	(210) 536-2675 [DSN 240]
Chief, Engineering Division - HSC/YAE Lt Col Michael A. White	(210) 536-3712 [DSN 240]
Chief, Systems Support Division - HSC/YAD Lt Col John R. Stampley	(210) 925-3756 [DSN 945]
Chief, Test and Evaluation Division - HSC/YAT Lt Col James H. DeGarmo	(210) 536-2957 [DSN 240]
Chief, Air Force Clothing Division - HSC/YAG Maj Mary C. Gorman	(513) 255-4733 [DSN 785]

Chief, Aeromedical Systems Division - HSC/YAM Lt Col Russell M. Solt	(210) 536-2700 [DSN 240]
Chief, Environmental Systems Division - HSC/YAQ Maj Randall J. Stager	(210) 536-4904 [DSN 240]
Chief, Human Resources Systems Division - HSC/YAR Lt Col Jack L. Blackhurst	(210) 536-2477 [DSN 240]
Chief, Life Support Systems Division - HSC/YAS Lt Col Martin J. Clement	(210) 536-2854 [DSN 240]
Chief, Acquisition Support Division - HSC/YAW Mr. Richard W. Ogershok	(210) 536-2274 [DSN 240]
Chief, Program Control Division - HSC/YAP Lt Col John F. Horn	(210) 536-2345 [DSN 240]
Chief, Logistics Division - HSC/YAL Mr. John Rendon, Jr.	(210) 536-2158 [DSN 240]
Chief, Contracting Division - HSC/YAK Lt Col David A. Newbry	(210) 536-6310 [DSN 240]
Chief, Management Operations Division - HSC/YAA Ms. Joyce G. Peavy	(210) 536-2159 [DSN 240]
Chief, Medical Systems Training Division - HSC/YAH Lt Col Dennis L. Ray	(210) 536-4200 [DSN 240]

ARMSTRONG LABORATORY - AL

Director - AL/CC Dr. Billy E. Welch, SES	(210) 536-3116 [DSN 240]
Commander - AL/CD Col Richard F. Jones	(210) 536-3136 [DSN 240]
Chief Scientist - AL/CA Dr. George C. Mohr	(210) 536-3656 [DSN 240]
Director, Plans and Programs - AL/XP Dr. William C. Alexander, SES	(210) 536-2091 [DSN 240]
Director, Aerospace Medicine Directorate - AL/AO Col William H. Wolfe	(210) 536-3208 [DSN 240]
Director, Crew Systems Directorate - AL/CF Mr. James W. Brinkley, SES	(513) 255-5227 [DSN 785]

Director, Human Resources Directorate - AL/HR Col William J. Strickland	(210) 536-2665 [DSN 240]
Director, Environics Directorate - AL/EQ Col Neil J. Lamb	(904) 283-6272 [DSN 523]
Director, Occupational and Environmental Health Directorate - AL/OE Mr. John C. Mitchell, SES	(210) 536-2001 [DSN 240]

USAF SCHOOL OF AEROSPACE MEDICINE - USAFSAM

Commander, USAFSAM/CC Col Robert J. Stepp	(210) 536-3500 [DSN 240]
Vice Commander, USAFSAM/CV Col Joseph E. Burton	(210) 536-2801 [DSN 240]
Chairman, Dept of Aerospace Medicine - USAFSAM/AF Col Melvin Q. Antonio	(210) 536-2844 [DSN 240]
Chairman, Dept of Aerospace Physiology - USAFSAM/FP Col Britton L. Marlowe	(210) 536-3365 [DSN 240]
Chairman, Dept of Military Public Health and Occupational Medicine - USAFSAM/EH Col Vicky L. Fogelman	(210) 536-2058 [DSN 240]
Chairman, Dept of Bioenvironmental Engineering - USAFSAM/BE Col David A. Hadden	(210) 536-3831 [DSN 240]
Chairman, Dept of Aerospace Nursing - USAFSAM/AN Col Karen D. Kimmel	(210) 536-3894 [DSN 240]
Chairman, International Training Services - USAFSAM/IT Mr. Zvonimir Lisac	(210) 536-2646 [DSN 240]

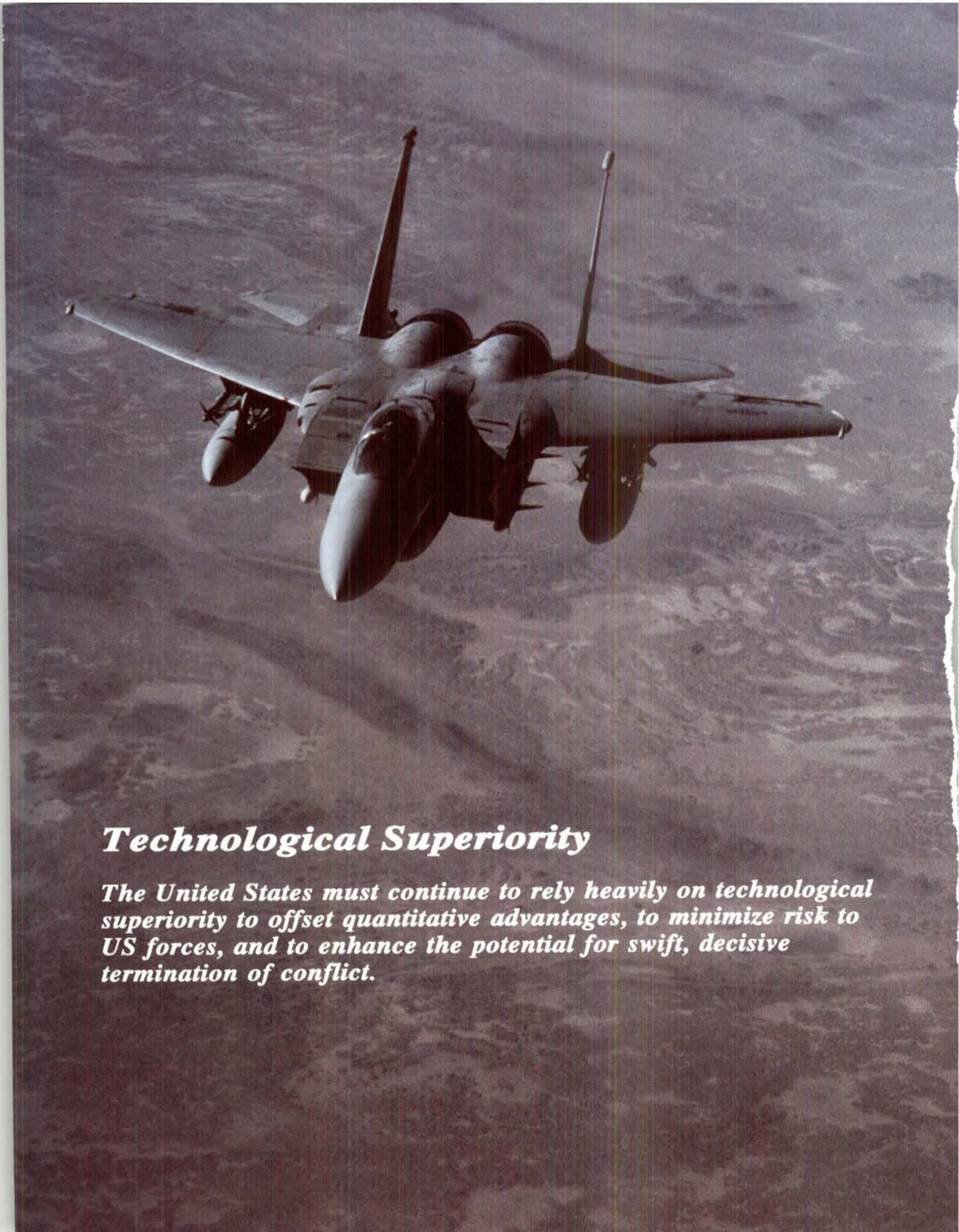
SYSTEMS ACQUISTION SCHOOL - 615 SCHOOL SQUADRON

Commander, 615 SCHS/CC Lt Col Gerald M. Stoermer	(210) 536-2770 [DSN 240]
Director, Operations - 615 SCHS/DO Maj Robert D. Hunt	(210) 536-2412 [DSN 240]
Director, Educational Services - 615 SCHS/ED Dr. Barbara L. Riley	(210) 536-2687 [DSN 240]

Article Listing

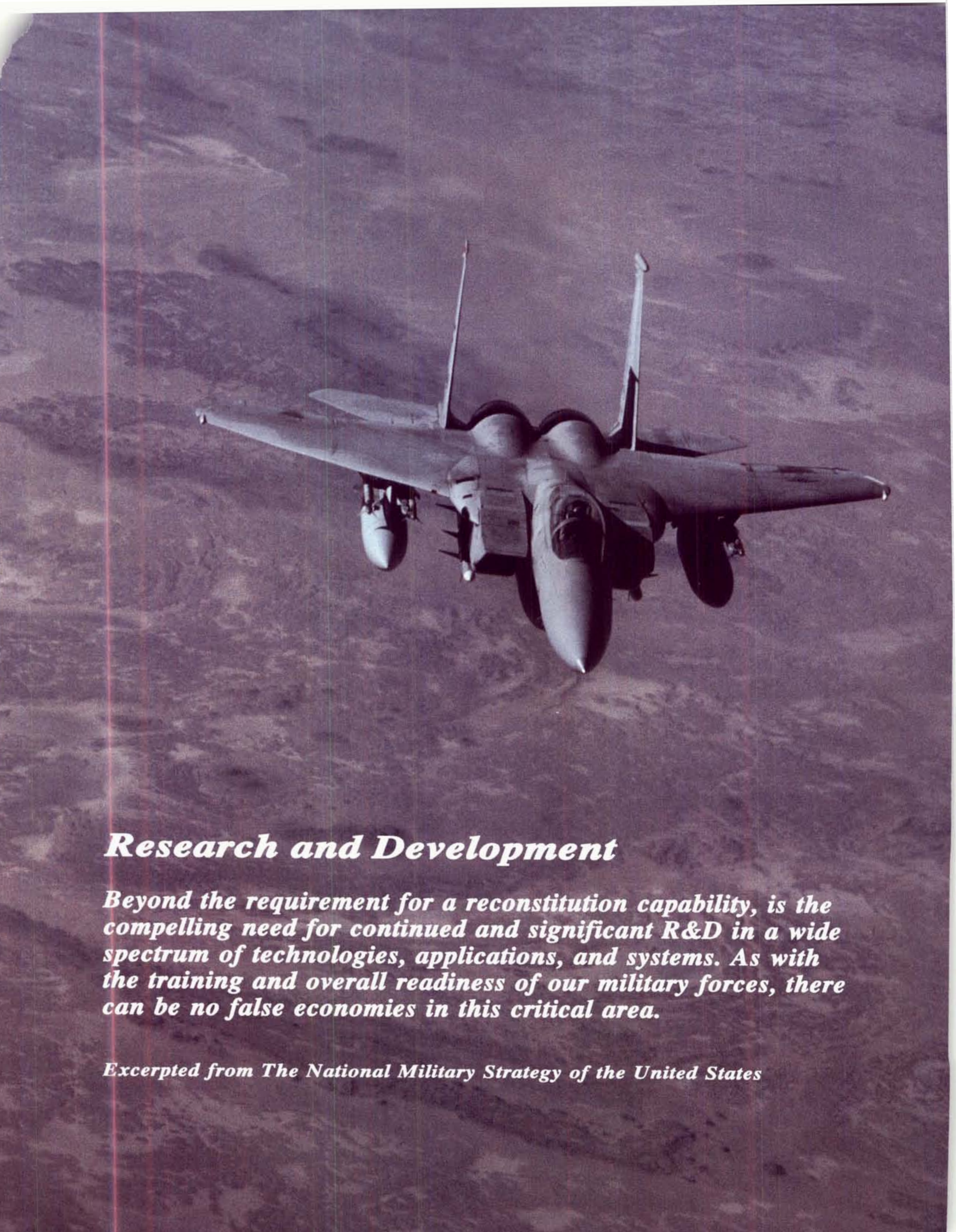
ARMSTRONG LABORATORY

MEETING THE HUMAN CHALLENGE
GLOBAL POWER - GLOBAL REACH



Technological Superiority

The United States must continue to rely heavily on technological superiority to offset quantitative advantages, to minimize risk to US forces, and to enhance the potential for swift, decisive termination of conflict.



Research and Development

Beyond the requirement for a reconstitution capability, is the compelling need for continued and significant R&D in a wide spectrum of technologies, applications, and systems. As with the training and overall readiness of our military forces, there can be no false economies in this critical area.

Excerpted from The National Military Strategy of the United States

ARMSTRONG LABORATORY

The Armstrong Laboratory, headquartered at Brooks AFB, San Antonio, Texas, is the Air Force's center of excellence for human-centered science and technology (S & T). Activated in December 1990, the Armstrong Laboratory was created by integrating into a single organization the human systems research, development and aeromedical support activities of the Harry G. Armstrong Aerospace Medical Research Laboratory, the Air Force Human Resources Laboratory, the Air Force Drug Testing Laboratory, the Air Force Occupational & Environmental Health Laboratory, and specific functions of the United States Air Force School of Aerospace Medicine. In 1992, the environmental quality S &T of the Air Force Civil Engineering Support Agency was added to the mission of the Armstrong Laboratory. The formation of this "super" laboratory (one of four in the Air Force) saw the blending of several disciplines: life sciences, behavioral sciences, and engineering science, as well as the integration of elements of two Department of Defense major force programs involving research & development and operational support.

LCD Helmet-Mounted Display

The laboratory plays an integral part in accomplishing the Air Force's mission of defending the United States through control and exploitation of air and space. As part of the Human Systems Center of the Air Force Materiel Command, Armstrong Laboratory is dedicated to solving human challenges in Air Force systems and operations. It provides the technical leadership for transitioning new human-centered technology to war-fighting systems and pursues innovative, long-term, high pay-off research, as well as providing human systems related operational support internationally.

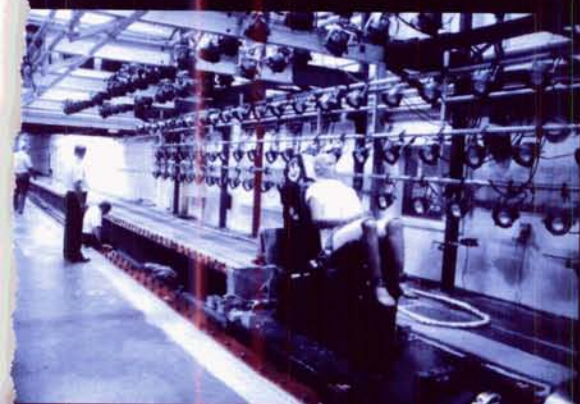
The Armstrong Laboratory does both in-house and contracted basic, exploratory, and advanced development research. The laboratory works closely with industry, academia, the Army and Navy, DoD, NASA, and other government agencies to provide effective leveraging of technology dollars. The laboratory employs a work force of approximately 1,500 people, of which over 650 are Scientists and Engineers (S & Es). A majority of the S & Es have advanced technical degrees. More than 1/3 of them have doctoral degrees. Work is accomplished in 88 different facilities located in Texas, Arizona, Ohio, Florida, and Okinawa.

The research, development and support activities of the laboratory are performed within five interdisciplinary technical directorates. They address current and future needs in aerospace medicine, crew systems, human resources, occupational and environmental health, and environics.

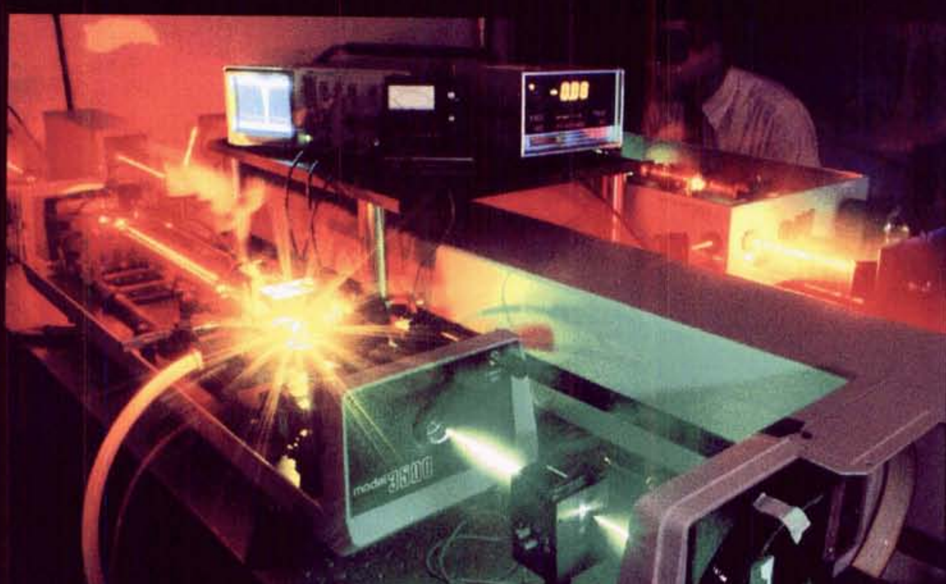
Centrifuge

Aerial View - Armstrong Laboratory

Maj Gen Harry G. Armstrong
First Director - Aeromedical
Research Laboratory



Horizontal Sled



Ultra-Short Pulse Laser

AEROSPACE MEDICINE

This directorate addresses the selection, protection and enhancement of humans in Air Force systems and operations. Mission-related research and specialized operational support are conducted in aeromedical consultation, epidemiology, drug testing and hyperbaric medicine. The directorate is composed of four divisions:

Clinical Sciences evaluates over 700 grounded air crew each year, returning, on average, 72% to flying duties. Research is conducted to develop standards for aviator selection and retention using data from the world's largest aviator database. Consultation requests are received from all elements of the Air Force Medical Service.

Epidemiologic Research provides worldwide reference laboratory service; provides support to DoD and USAF/SG for epidemiology and preventive medicine/disease surveillance; and collects, analyzes and interprets health data on Air Force populations. In FY91, 2.6 million procedures were performed, expanding services to 85 medical treatment facilities. Conducts the Air Force Health Study to understand health risks of Operation Ranch Hand.

Aeromedica

Hyperbaric Medicine is the office of primary responsibility for the development and execution of Air Force hyperbaric medicine advanced training, education, application, and research.

Drug Testing Services

The **Drug Testing** Division supports the DoD objective of maintaining a drug-free, mission-ready force. Advanced laboratory technology is used for over 800,000 tests annually on a quarter of a million specimens.

Epidemiolo

ase Discussions

Vestibular Function And Eye Tracking Research

esearch: Laboratory Services

Hyperbaric Medicine

CREW SYSTEMS

This directorate, located at Wright-Patterson AFB, Ohio and Brooks AFB, Texas, seeks to optimize human combat performance and survivability and to ensure weapons systems configurations are compatible with human operator requirements.

The goals of the **Biodynamics and Biocommunications Division** are to understand the limitations of the human subject to mechanical stresses (noises, vibration, impact, acceleration), provide design criteria for weapon system development or enhancement, propose protection devices, and improve the human/weapon system interface.

The **Human Engineering Division** studies human adaptation to increasingly severe operational challenges and develops methodologies, tools, and standards to help system designers take maximum advantage of man's capabilities. The programs of the Human Engineering Division are aimed at learning more about human physical and mental performance capabilities and limitations in modern complex systems. The objective is to provide information for design engineers that permits them to integrate human operators into systems in a manner that will maximize total system effectiveness.

Test Subject in Centrifuge

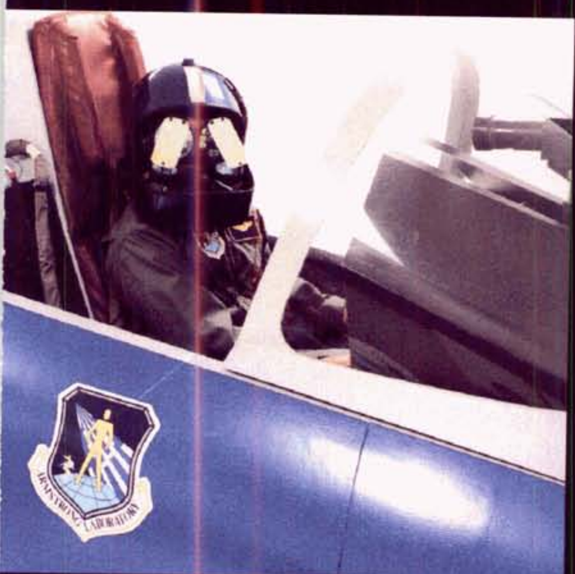
The efforts of the **Crew Technology Division** center on improving crew performance and safety through gaining a better understanding of the operational stress environment. Researchers seek to understand the effects of altitude, acceleration, and sustained operations on crew members. Aircrew protective equipment is developed, based on an understanding of these effects. The division also evaluates aeromedical evacuation equipment.

Fusion Interfa

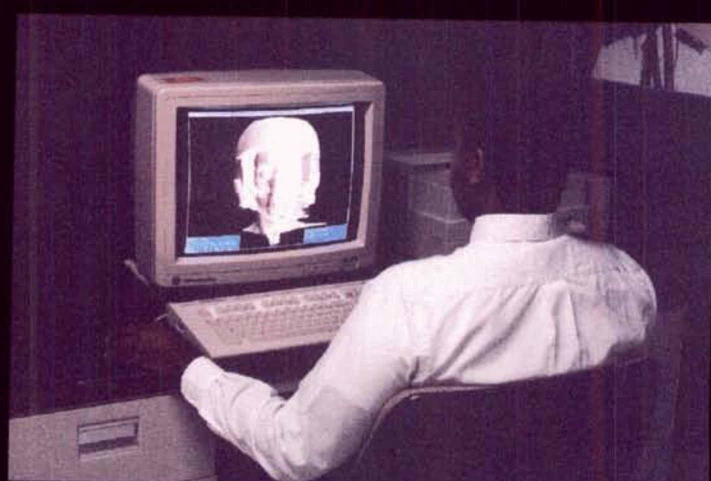
Visually C

for Tactical Environments

Vertical Drop Tower



led Aircraft Systems Simulator



Anthropometric Research and Design

HUMAN RESOURCES

This directorate develops unique human-centered approaches to Manpower, Personnel, and Training (MPT) and logistics issues with special emphasis on:

- personnel selection and ability measurement,
- integration of MPT considerations throughout system development and acquisition,
- more effective training for aircrews and other Air Force Personnel,
- better application of artificial intelligence and other computer-based technologies to address MPT concerns, and
- better capture, management, and application of maintenance and other system-related data.

Manpower and Personnel Research focuses on force management methods and tools. This division has been using advances in understanding of human thinking, learning, and cognition along with those in computer technology to better evaluate personnel and match them with the Air Force's needs. Emphasis is being placed on the integration of the human factor into weapon system development and acquisition, from initial design to later maintenance of fielded systems.

F-16 Air Intercept Trainer

Technical Training Research has made maximal use of the latest in intelligent systems theory and the increased power and availability of the microcomputer to provide tutors for increasingly complex skills. Guidelines for the application of these technologies are provided for trainers and educators to make better decisions on "what, when, and where" to train. Issues addressed include student availability, cost considerations, and similar resource information.

Logistics Research, located at Wright-Patterson Air Force Base, Ohio, addresses reliability and maintainability issues in the development, acquisition, utilization, and ultimate disposal of Air Force systems. Using the latest in computer technologies, the research has involved better approaches to design and manufacturing, more effective maintenance data capture and utilization, and better tools to apply that knowledge.

Aircrew Training Research examines the best technologies and strategies for improving aircrew training. Special emphasis is placed on reducing risk and cost through various simulation techniques. High-fidelity simulators, part-task trainers, and low-cost moderate fidelity training devices have been developed, along with effective techniques for their employment.

Bas

Integrated Maintenance Information System (IMIS)

Fundamental Skills Training

Attributes Test (BAT)

Virtual Reality Research

OCCUPATIONAL & ENVIRONMENTAL

This directorate assesses risks to personnel from hazardous materials, noise, electromagnetic radiation, and occupational processes in Air Force operations. The work combines human-centered research and development in these emphasis areas with broad field consultation responsibilities to measure and reduce occupational illness and environmental hazards. Work is accomplished through five divisions:

Environm

Analytical Services provides analytical chemistry services in support of the Air Force Environmental Pollution Control Programs. They respond to over 250 base-level customers who send over 100,000 samples annually. These samples include occupational and environmental hazard samples contained in air, water, soil, vegetation, and industrial materials.

Bioenvironmental Engineering provides specialized engineering support worldwide in air, water and solid waste environmental monitoring, hazard abatement, and pollutant control. These environmental concerns are solved through professional consultation, specialized laboratory services, applied research, and on-site technical support. The Radiation Dosimetry Branch processes personnel radiation dosimeters and maintains exposure histories for all Air Force personnel worldwide. The Noise Effects Branch, located at Wright Patterson AFB Ohio, conducts exploratory research and advanced development to define noise and sonic boom parameters resulting from operations around air bases and along military training routes.

Radiation Health Risks

Occupational Medicine provides laboratory studies and consultation in support of occupational and environmental hazards. The Hazardous Materials Information System and Hearing Conservation Data Registry are two well-known databases maintained to supply current, comprehensive and scientifically valid guidance to customers worldwide. The division also supports Air Force base-level personnel responding to the Agency for Toxic Substance and Disease Registry as that agency provides public health assessments at all national priority list hazardous waste sites.

Directed Energy Research conducts research and development on the effects of electromagnetic and particulate radiation in the aerospace environment with special emphasis on operational issues of safety and environment, vulnerability assessment, and protection associated with modern weapon systems as well as long-term biological effects of exposure to radiofrequency, microwave radiation, lasers, and ionizing radiation.

Ultra-Short

Toxicology Research, located at Wright-Patterson AFB, Ohio (part of the Tri-Service Toxicology Center), investigates the hazards of Air Force chemicals and materials on humans and the environment. A major product of this research is health risk assessment associated with various new or substitute chemicals and procedures throughout the Air Force.

HEALTH

ental Sample Analysis

Hazardous Waste Health Risks

ulse Laser Research

Occupational Health Assessment

ENVIRONICS

Environmental Quality technology supports the Air Force mission by reducing the cost of cleaning up past waste sites while assuring, through compliance, the completion of critical wartime and peacetime missions. Environmental Quality efforts at Tyndall AFB, Florida, center on low-cost, highly effective ways to prevent environmental problems and to restore existing facilities.

Spray Castir

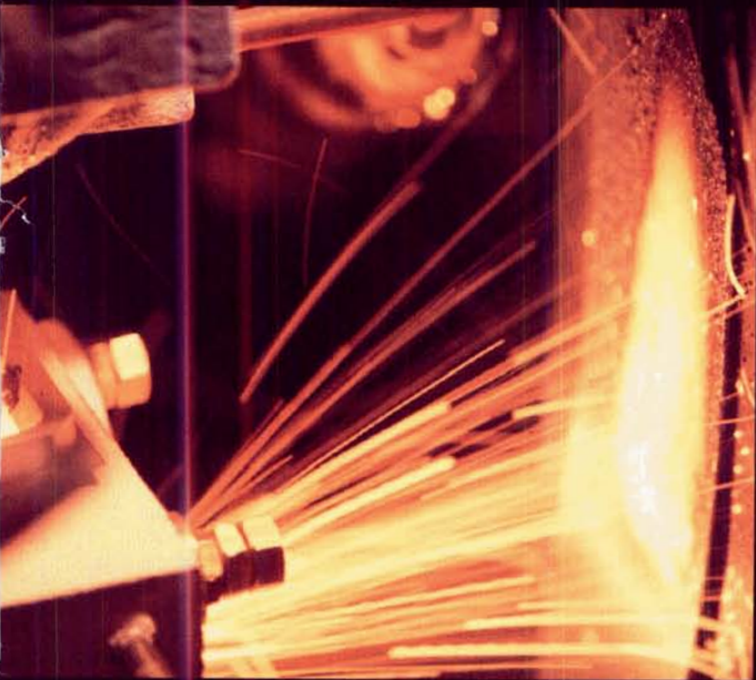
The directorate has a state-of-the-art analytical laboratory, staffed by engineers, chemists, microbiologists, other scientists, and technicians. The extended research base that supports this laboratory includes investigators from colleges and universities throughout the U.S., as well as cooperating research partners in private institutions, industry, and other federal laboratories.

Environmental compliance efforts are concerned primarily with developing technologies to measure and minimize environmental impacts of volatile organic compounds and solvents, rocket propellants, aircraft fuels and emissions, and weapon system materials used in Air Force operations. Research is directed at minimizing hazardous wastes resulting from AF industrial operations and pursuing new methods of curtailing generation of toxic wastes in existing electroplating processes. Key efforts include minimizing hazardous wastes, developing substitutes for environmentally damaging processes and materials, and categorizing the behavior and fate of Air Force atmospheric pollutants, with particular emphasis on modification of transport mechanisms and processes.

Air-Stripping Apparatus

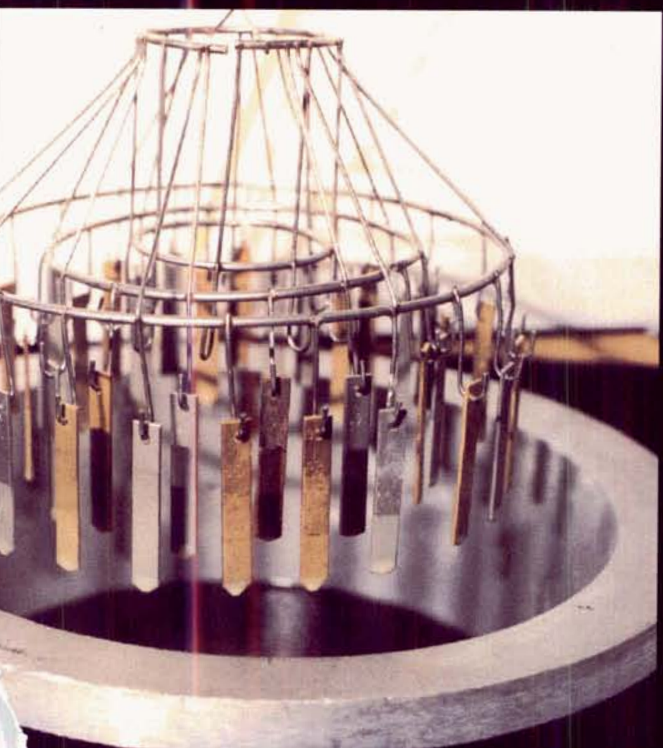
Site restoration efforts entail developing the technologies for cleaning up contaminated Air Force locations worldwide. These technologies include biological, chemical, or physical treatment operations. The new technologies are for on-site destruction of contaminants. To limit future liability by the Air Force, research has focused on enhancing three critical capabilities: (1) more efficient remedial action technologies, (2) rapid site characterization tools, and (3) more accurate models for predicting transport, migration, and fate of fuels and chemicals in soil and groundwater.

Alternativ



g Process

Computer Modeling R&D Of Launch Vehicle Explosions



vent Testing

Biodegradation Studies

TECHNOLOGY TRANSFER

To derive maximum return on our country's technology investments and enhance U.S. competitiveness, Congress has passed legislation to encourage the transfer of federally funded or originated technology to the private sector. Most recently, the Federal Technology Transfer Act of 1986 provided significant new authorities for Air Force laboratories to enter into Cooperative Research and Development Agreements (CRDAs) with private companies and public nonprofit organizations and to negotiate license agreements of intellectual property on behalf of the government.

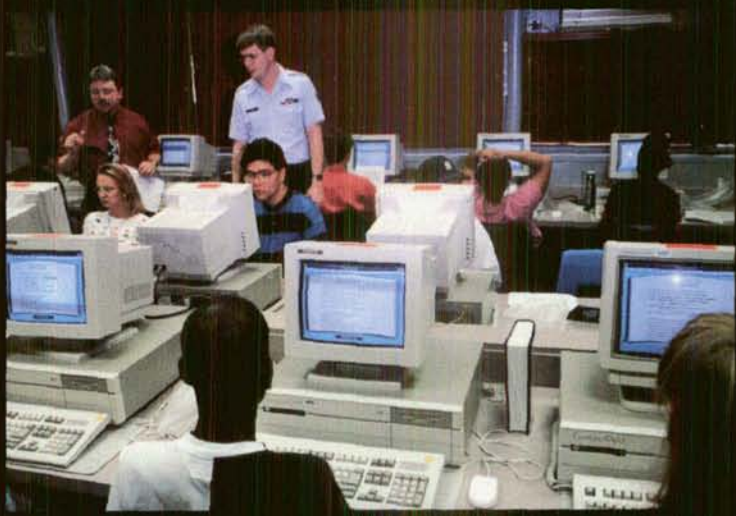
CRDAs provide an easy way for industry and nonprofit organizations such as academia to collaborate with AF R&D activities to facilitate technology transfer for the technological and financial benefits of both parties. The Air Force benefits by:

- Improved opportunities to develop and transfer technology
- Accelerated interaction with industry to transfer basic research findings to the commercial development process
- Increased familiarity with market needs
- Sharing of royalty income with the inventors and the laboratory

The collaborating organization benefits by:

- Improved access to Air Force scientists and facilities
- Better access to expertise related to research results and inventions
- Options to exclusive licenses on inventions made under the CRDA
- Profitable new products and processes

Some of the Armstrong Laboratory work that has resulted in, or has the potential for CRDAs or license asgreements, includes quantitative luminescence imaging system, blood and tissue rewarming device, 3-D audio display technology, molecular sieve oxygen generating system, risk predictors for coronary artery disease, networking simulators, fundamental skills tutor, and advanced technology anti-gravity suit.



Fundamental Skills Training

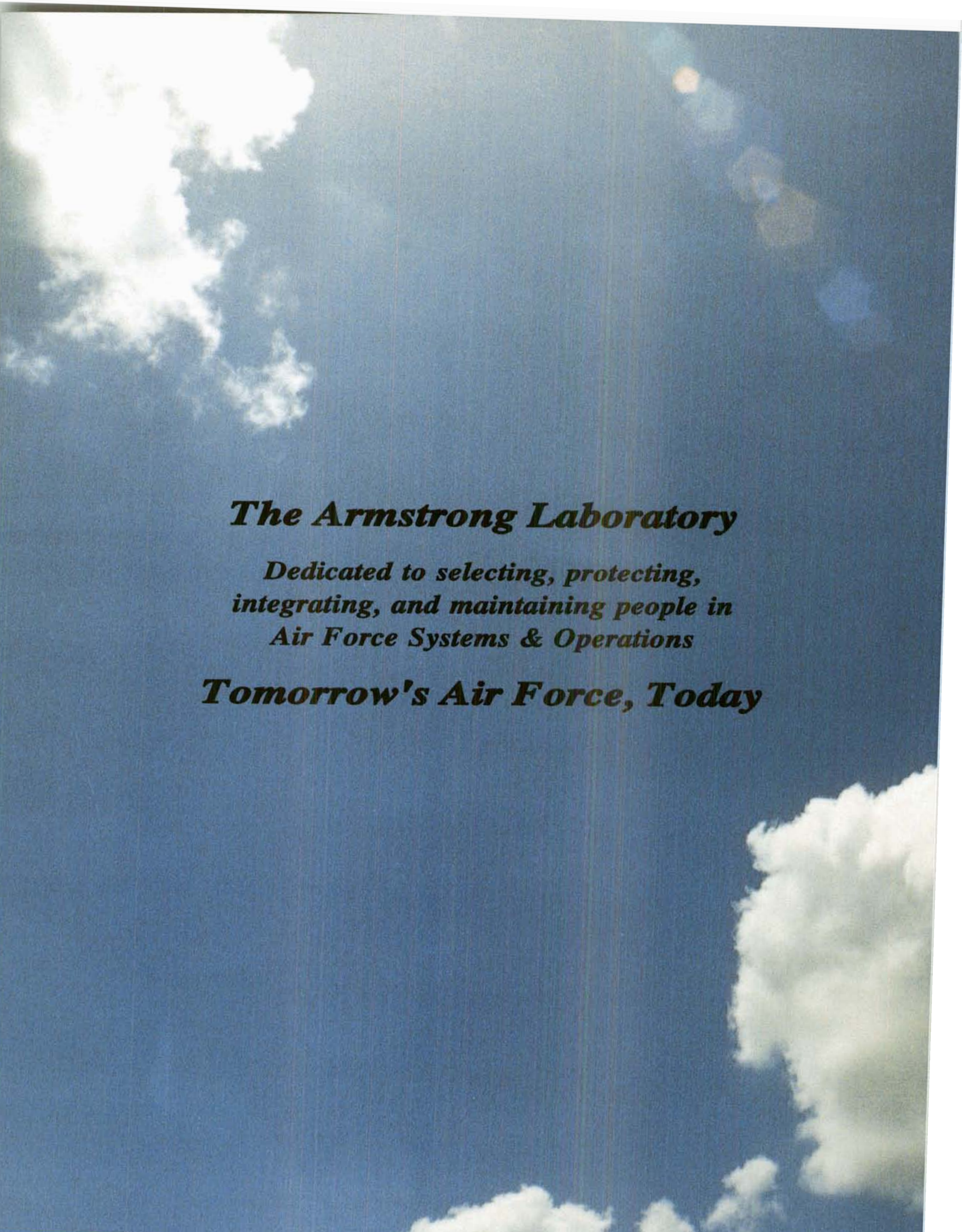
Multiship

Award-Winning Researchers

3-D Audio Display

ork Performance Analysis

Molecular Sieve Oxygen Generating System



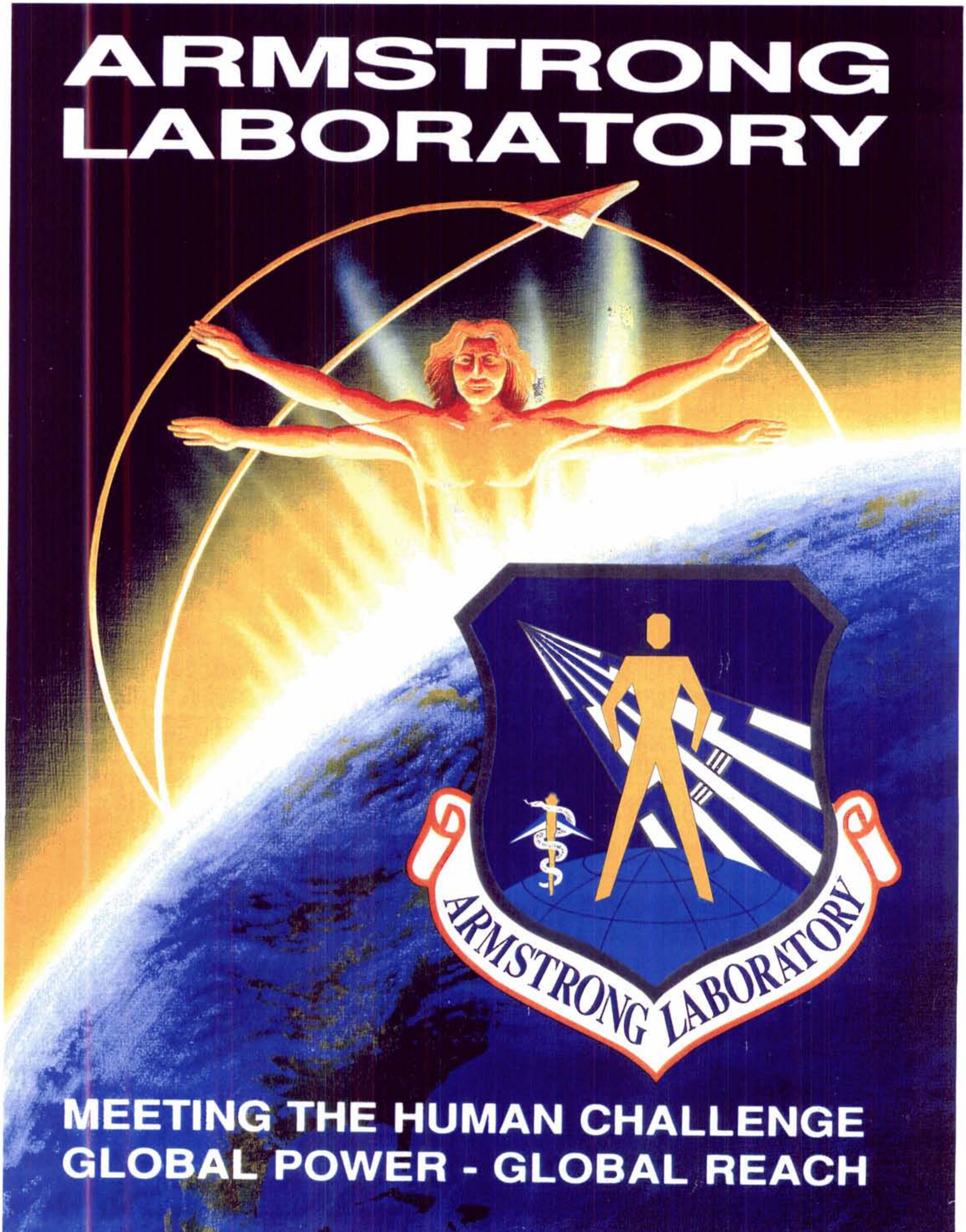
The Armstrong Laboratory

Dedicated to selecting, protecting, integrating, and maintaining people in Air Force Systems & Operations

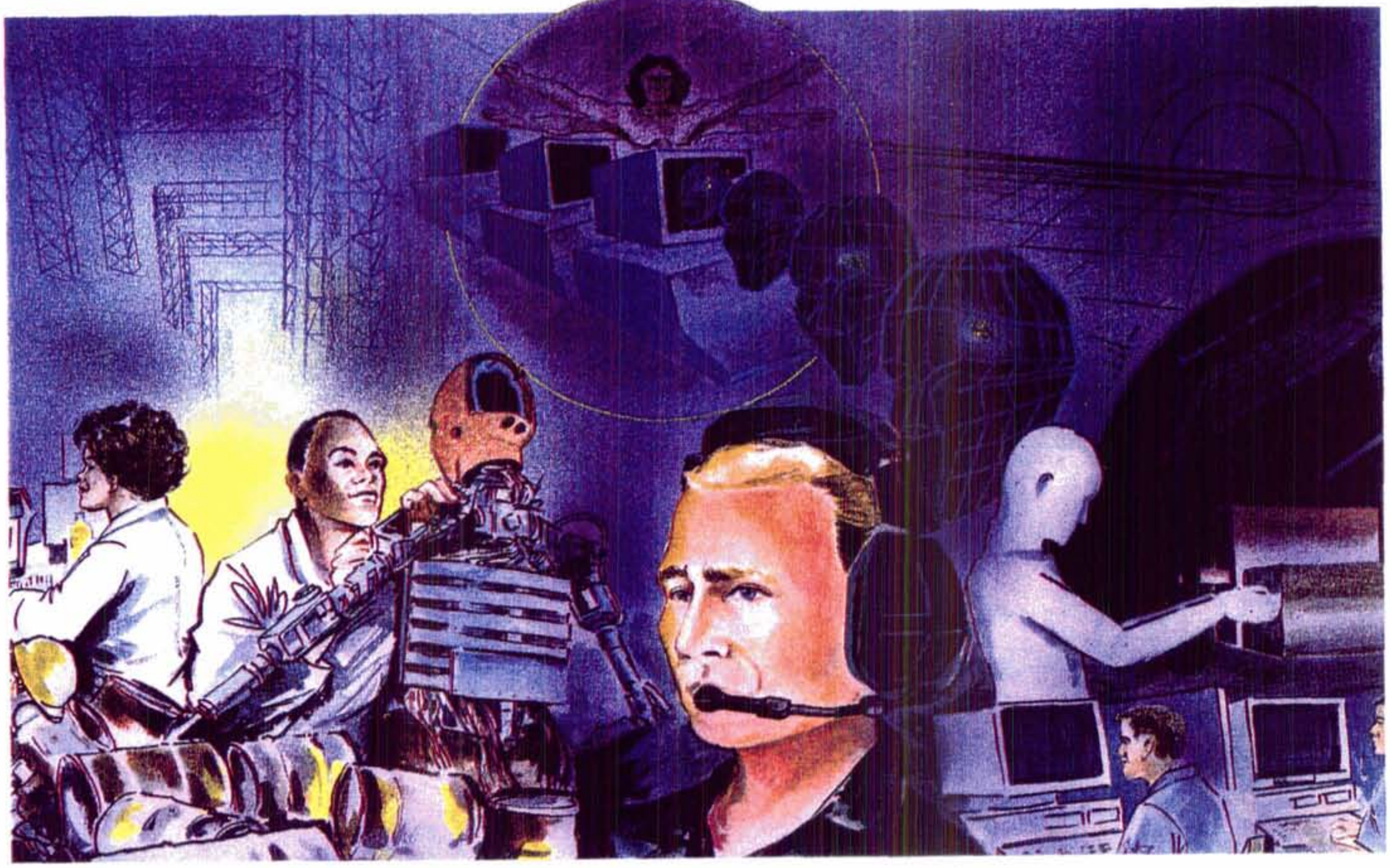
Tomorrow's Air Force, Today

For further information please call:

DSN: 240-3116
Comm: 210-536-3116


ARMSTRONG
LABORATORY
ARMSTRONG LABORATORY
MEETING THE HUMAN CHALLENGE
GLOBAL POWER - GLOBAL REACH

ARMSTRONG LABORATORY



Human-Centered Technologies Now Available for Licensing, as a Service, or under Collaborative Research Programs

Some Examples

- ✔ Crash Impact Protection Devices
- ✔ Gene Probes
- ✔ Computer-aided Human-Machine Interfaces
- ✔ Interactive Computer Tutoring Programs
- ✔ Auditory Displays
- ✔ Virtual Environments
- ✔ Logistics Management
- ✔ Laser Eye Protection

Tap into these and other technologies developed by Armstrong Lab's 700 scientists and engineers

Call, mail or fax your request

Office of Research and Technology Applications (ORTA)
Mr. Douglas Blair or Major Bruce Pollock
AL/XPTT
2509 Kennedy Circle
Brooks Air Force Base
TX 78235-5118
210-536-3817 • FAX 210-536-2810

- ❒ Human Engineering
- ❒ Computer-Based Training
- ❒ Simulation/Synthethic Environments
- ❒ Personal Protective Devices
- ❒ Man-Machine Interface
- ❒ Dental Equipment/Materials Testing
- ❒ Selection & Classification Systems - Personnel
- ❒ Directed Energy Bioeffects
- ❒ Environmental Toxicology
- ❒ Health Risk Assessment
- ❒ Drug Testing
- ❒ Selection/Retention Standards - Medical

Name______________________ Title______________________

Company______________________ Office Phone______________________

Address______________________ Fax#______________________

City______________________ State________ Zip Code______________

CALL OUR ORTA OFFICE AND FIND THE RIGHT PERSON IN ARMSTRONG LAB TO HELP **YOU**

ARMSTRONG LABORATORY

OVERVIEW

HUMAN-CENTERED SCIENCE & TECHNOLOGY

Dr Brendan Godfrey
Director

ARMSTRONG LABORATORY

ARMSTRONG LABORATORY

provides integrated, interdisciplinary technologies to enhance human military performance while protecting people and the environment.

Personnel assigned: 1539
FY95 budget: $196M

ARMSTRONG LABORATORY

AL PROVIDES BROAD RANGE OF HUMAN-CENTERED RESEARCH AND SERVICES

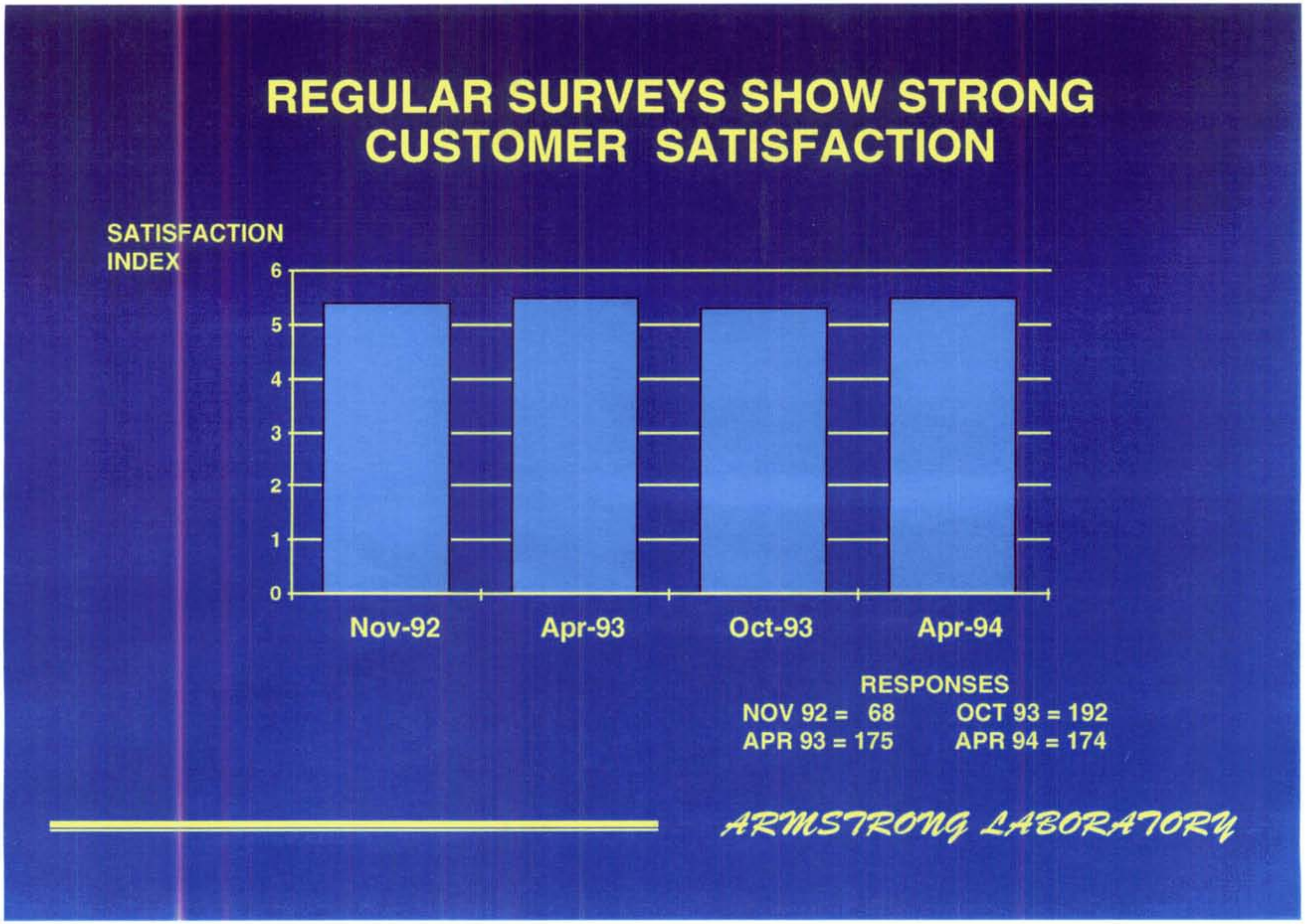
Research and Development (MFP6)

- Aircrew Performance and Protection
- Enhanced Aircrew Selection & Retention
- Manpower, Personnel, Training and Logistics
- Directed Energy Bioeffects
- Environmental Compliance and Remediation
- Occupational and Environmental Toxicology

Defense Health Program (MFP7/8)

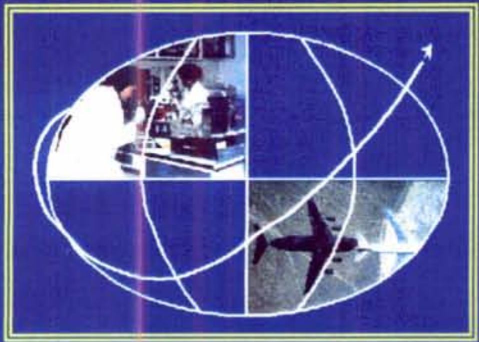
- Preventive & Health Services Assessment
- Occupational & Environmental Health Services
- Drug Testing and Epidemiological Reference Labs
- Hyperbaric Medicine


AL R&D MEETS PERVASIVE
NEEDS OF AIR FORCE AND OTHERS
ACC
AMC
AFSOC
HQ USAF
AETC
SPOs
AFMPC
ALC
AFSPC
TEST CENTERS
OTHERS
AFMC
NAVY
ARMY
HUMAN SYSTE
ARMSTRONG LABORATORY
ARMSTRONG LABORATORY


REGULAR SURVEYS SHOW STRONG CUSTOMER SATISFACTION
SATISFACTION INDEX
6
5
4
3
2
1
0
Nov-92
Apr-93
Oct-93
Apr-94
RESPONSES
NOV 92 = 68
OCT 93 = 192
APR 93 = 175
APR 94 = 174
ARMSTRONG LABORATORY

AL TECHNOLOGIES ENHANCE WARFIGHTING CAPABILITIES

Spatial Disorientation



Sustained Performance

Laser Eye Protection

Next Generation Escape System

ARMSTRONG LABORATORY

AL TECHNOLOGIES SAVE DEFENSE DOLLARS

Integrated Maintenance Information System

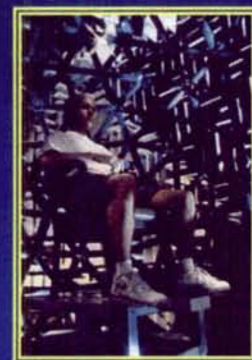
Advanced Hybrid Oxygen System

Aircrew Standards Research

Bioventing

ARMSTRONG LABORATORY

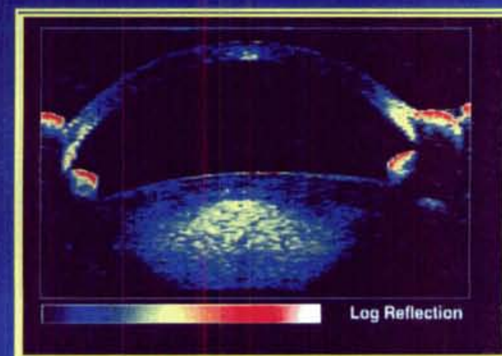
AL TECHNOLOGY ENHANCES U.S. ECONOMIC COMPETITIVENESS



3-D Audio

Fundamental Skills Tutor

Electroless Nickel Plating



Optical Coherence Tomography

ARMSTRONG LABORATORY

AL UNIQUE INTERDISCIPLINARY CAPABILITIES CRITICAL TO MANY ACCOMPLISHMENTS

Advanced High-G Protection

- Human Physiology
- Suit Design
- Cockpit Compatibility
- Training
- Crew Selection

Situational Awareness

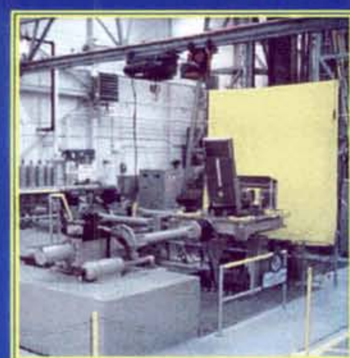
- Display Design
- Control Technology
- Performance Measurement
- Training
- Crew Selection

ARMSTRONG LABORATORY

RELIANCE LEADERSHIP ENHANCES AL PERFORMANCE

Chem-Bio

Toxicology



Biodynamics

Directed Energy Bioeffects

ARMSTRONG LABORATORY

HST COMMUNITY LEADS IN RELIANCE

ARMSTRONG LABORATORY

AL TIGHTLY INTEGRATED WITH SAN ANTONIO MILITARY COMMUNITY

USAF School of Aerospace Medicine (SAM)

- *Joint projects and personnel exchanges*

Air Force Center for Environmental Excellence (AFCEE)

- *Recipient and broker of AL environmental technologies*

Human Systems Program Office

- *Transition human-centered technology*

Air Education and Training Command (AETC)

- *Requirements, evaluations and subjects for aircrew training R&D*

Air Force Military Personnel Center

- *Repository for MPC database*

Lackland AFB

- *Facilities and subjects for training and selection research*

Kelly AFB

- *Bioremediation Test Site*

ARMSTRONG LABORATORY

AL TIGHTLY INTEGRATED WITH DAYTON MILITARY COMMUNITY

- Wright Laboratory
  - *Sensor/Windscreen Development*
  - *Laser Eye Protection*
  - *Environmentally Conscious Manufacturing*
- Aircraft SPOs
  - *IMIS Transition*
  - *Anthropometry*
  - *Helmet-Mounted Display*
- Joint Cockpit Office
  - *Joint Advanced Strike Technology (JAST)*
  - *Advanced Life Support*
- HQ AFMC
  - *Logistics Support Requirements*
  - *Technology Transfer*

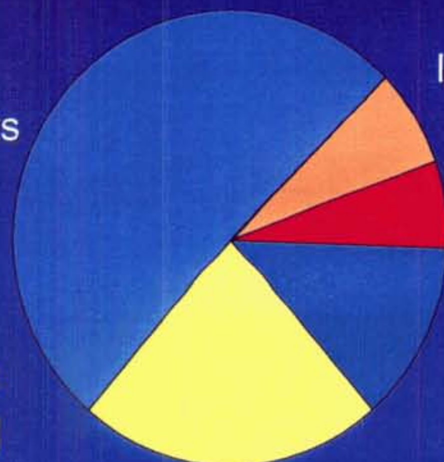
ARMSTRONG LABORATORY

AL TIGHTLY INTEGRATED WITH CIVILIAN COMMUNITY

- Collaborations and Faculty Appointments
  - University of Texas Health Science Center
  - Southwest Research Institute
  - University of Texas-San Antonio
  - St Mary's University
  - Wright State University
  - Ohio University
- Linkage to Community Economic Development
  - Texas Research Park
  - San Antonio 2000
  - Forum Entrepreneur

ARMSTRONG LABORATORY

AL WORKS CLOSELY WITH INDUSTRY AND ACADEMIA

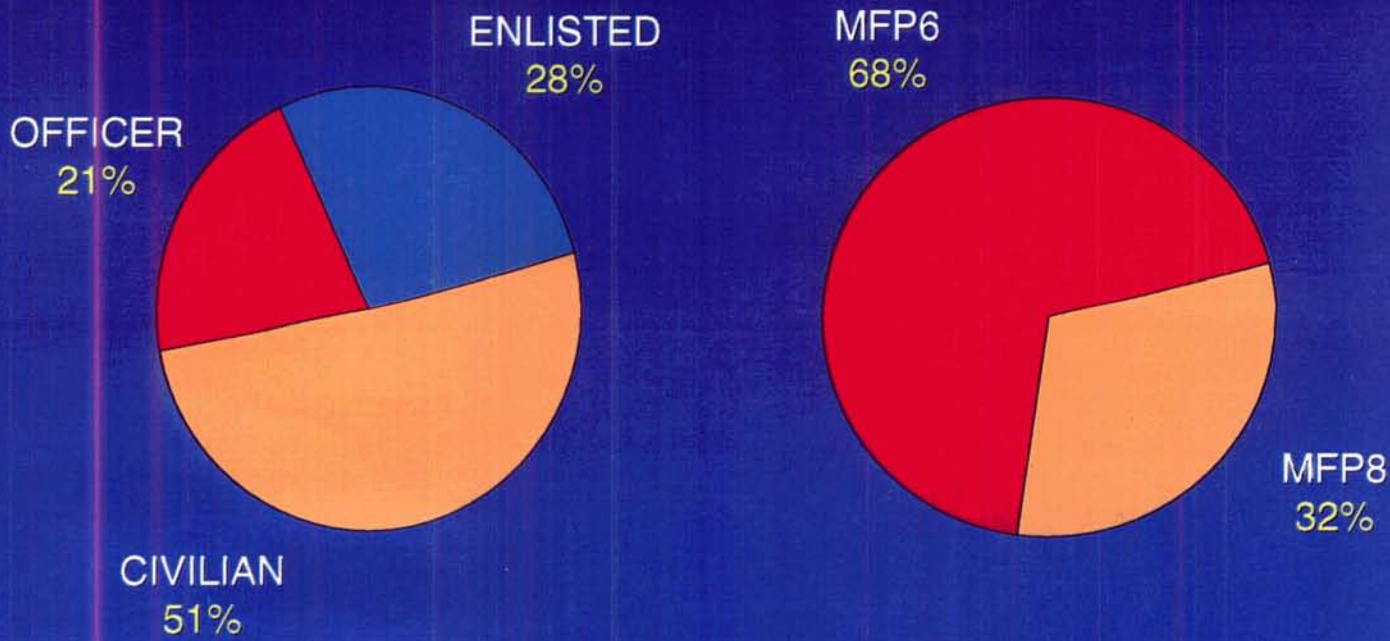


Out-source fraction is 74% and growing

ARMSTRONG LABORATORY

Based on total of FY 94 MFP 6 funds

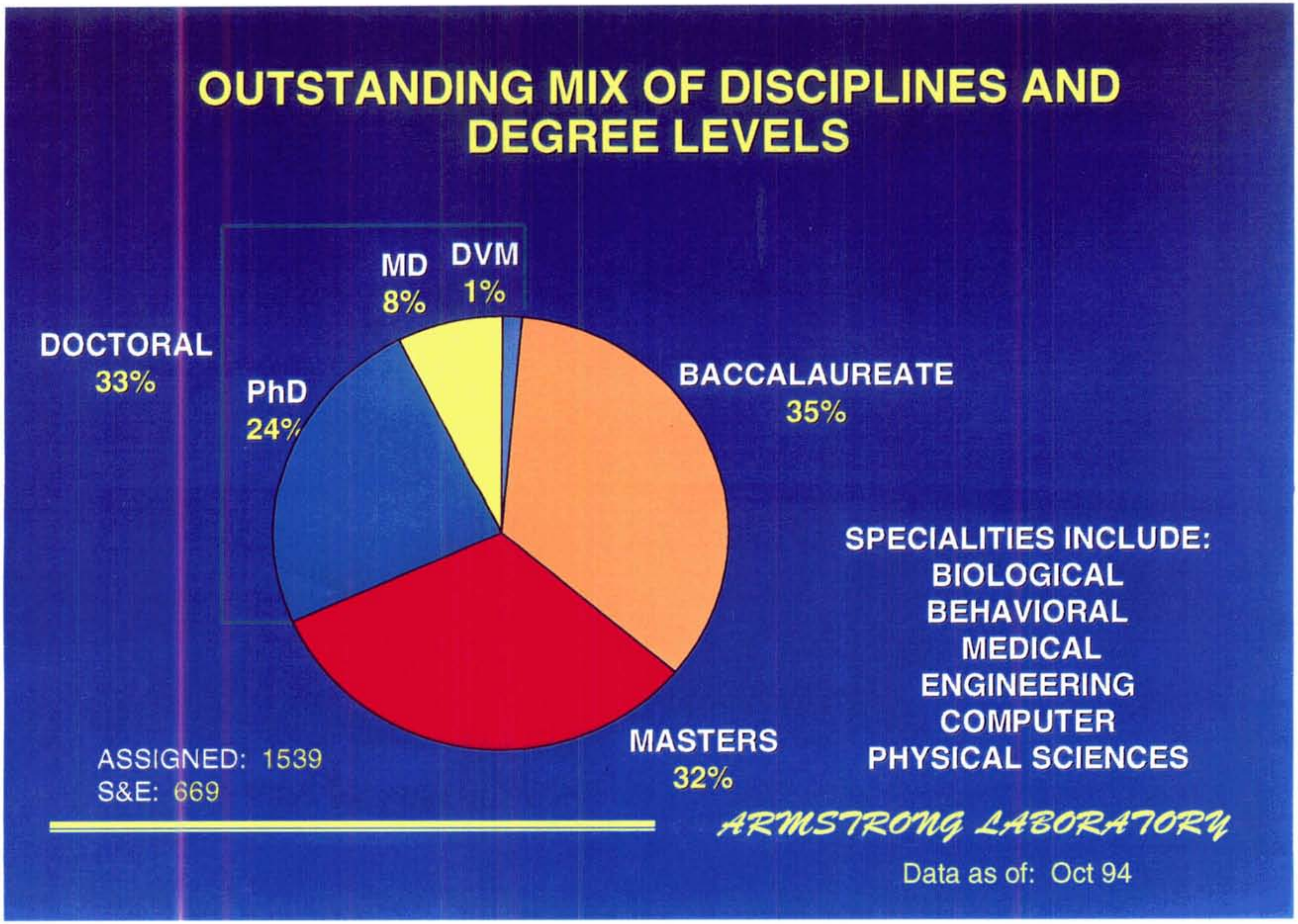
AL HAS EFFECTIVE MIX OF MILITARY/CIVILIAN AND MFP6/MFP8 PERSONNEL



TOTAL AUTHORIZED: **1588**

ARMSTRONG LABORATORY

Data as of: Oct 94


OUTSTANDING MIX OF DISCIPLINES AND DEGREE LEVELS
DOCTORAL
33%
MD
8%
DVM
1%
PhD
24%
BACCALAUREATE
35%
MASTERS
32%
SPECIALITIES INCLUDE:
BIOLOGICAL
BEHAVIORAL
MEDICAL
ENGINEERING
COMPUTER
PHYSICAL SCIENCES
ASSIGNED: 1539
S&E: 669
ARMSTRONG LABORATORY
Data as of: Oct 94

AL RECOGNIZED FOR TECHNICAL EXCELLENCE

Major Awards	13
Fellows (New)	10
Other Professional & Community Recognitions	35
Professional Society Officers	74
University Adjunct Faculty Appointments	52
Refereed Journal Articles & Book Chapters	164
Other Reports & Presentations	639
Patent & Invention Disclosures	27
Cooperative R&D Agreements	28

ARMSTRONG LABORATORY

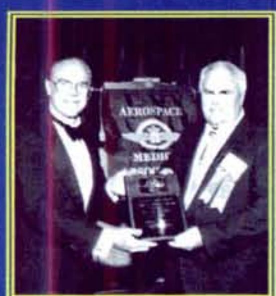
Totals for FY94

SEVERAL FY94 MAJOR AWARD WINNERS

Excellence in Military Medicine - LtCol Paul Morton

Harold Brown Award
Col Ronald Hill

AF Basic Research Award
Dr Johnathan Kiel



AsMA H. G. Moseley Award
Dr William Albery

R&D 100 AWARD
Lt Phillip Brown

IEEE Distinguished MemberAward
Dr Daniel Repperger

ARMSTRONG LABORATORY

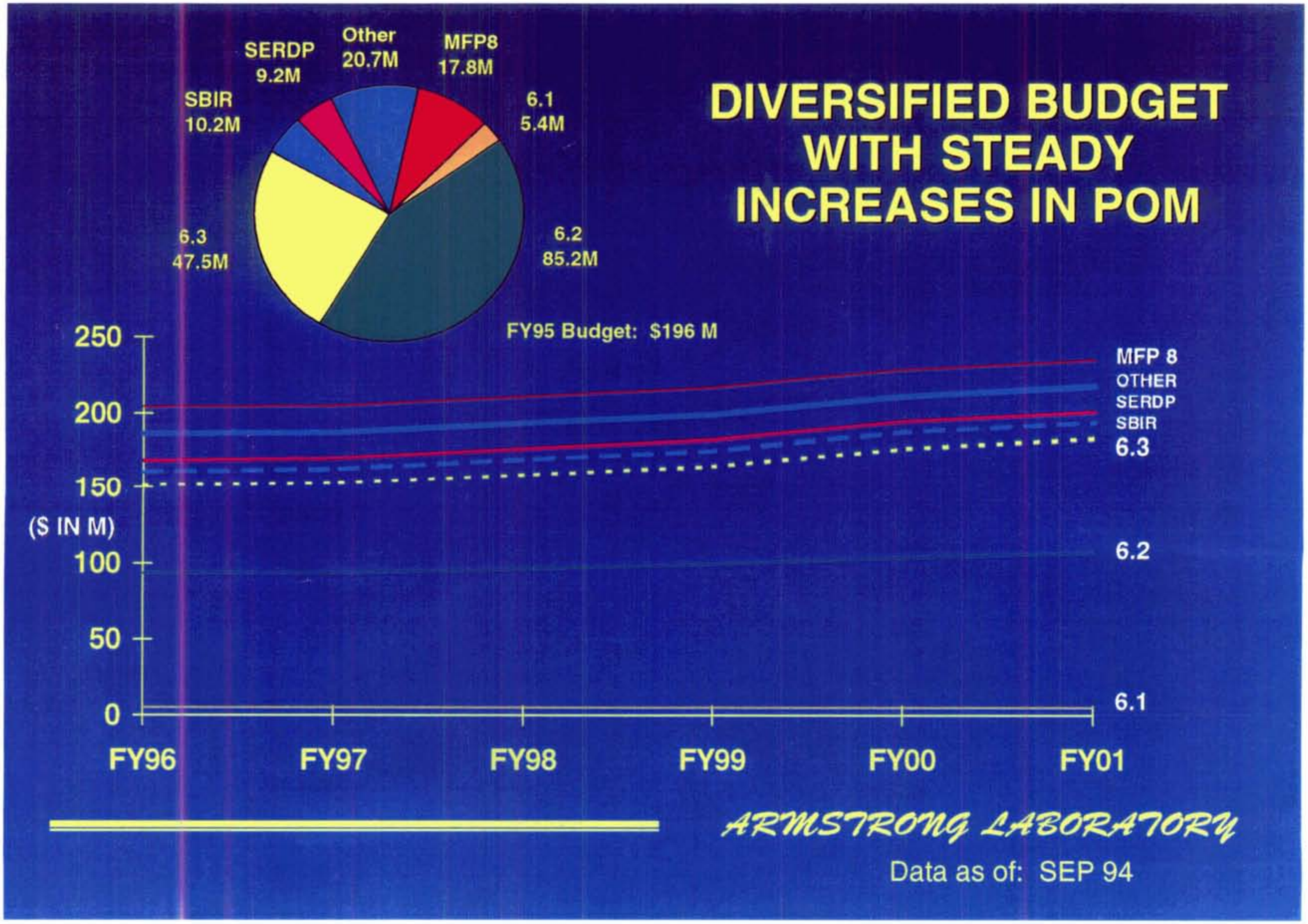
NUMEROUS MODERN FACILITIES

Virtual Environments Research Facility
Simulator Laboratory (Tempest)
Full Field of View Dome Display
Human-Centered Design Research Facility
Hyperbarics Facilities
Drug Testing Laboratory
High Speed Centrifuges
Advanced Spatial Disorientation Device
Biocommunications Laboratory
Acceleration/Impact Facilities
Environmental/Occupational Toxicology Facilities
Directed Energy Bioeffects Facilities
Propellants Disposal Pilot Plant
Bioremediation Laboratory
Accredited Vivariums

Centrifuge

Multi-Rad

ARMSTRONG LABORATORY



DIVERSIFIED BUDGET WITH STEADY INCREASES IN POM
SERDP 9.2M
Other 20.7M
MFP8 17.8M
SBIR 10.2M
6.1 5.4M
6.3 47.5M
6.2 85.2M
FY95 Budget: $196 M
250
200
150
($ IN M)
100
50
0
MFP 8
OTHER
SERDP
SBIR
6.3
6.2
6.1
FY96
FY97
FY98
FY99
FY00
FY01
ARMSTRONG LABORATORY
Data as of: SEP 94

TOMORROW'S AIR FORCE
Today

DEDICATED TO:

- *SELECTING*
- *PROTECTING*
- *INTEGRATING*
- *MAINTAINING*

PEOPLE *IN AIR FORCE SYSTEMS AND OPERATIONS*

ARMSTRONG LABORATORY

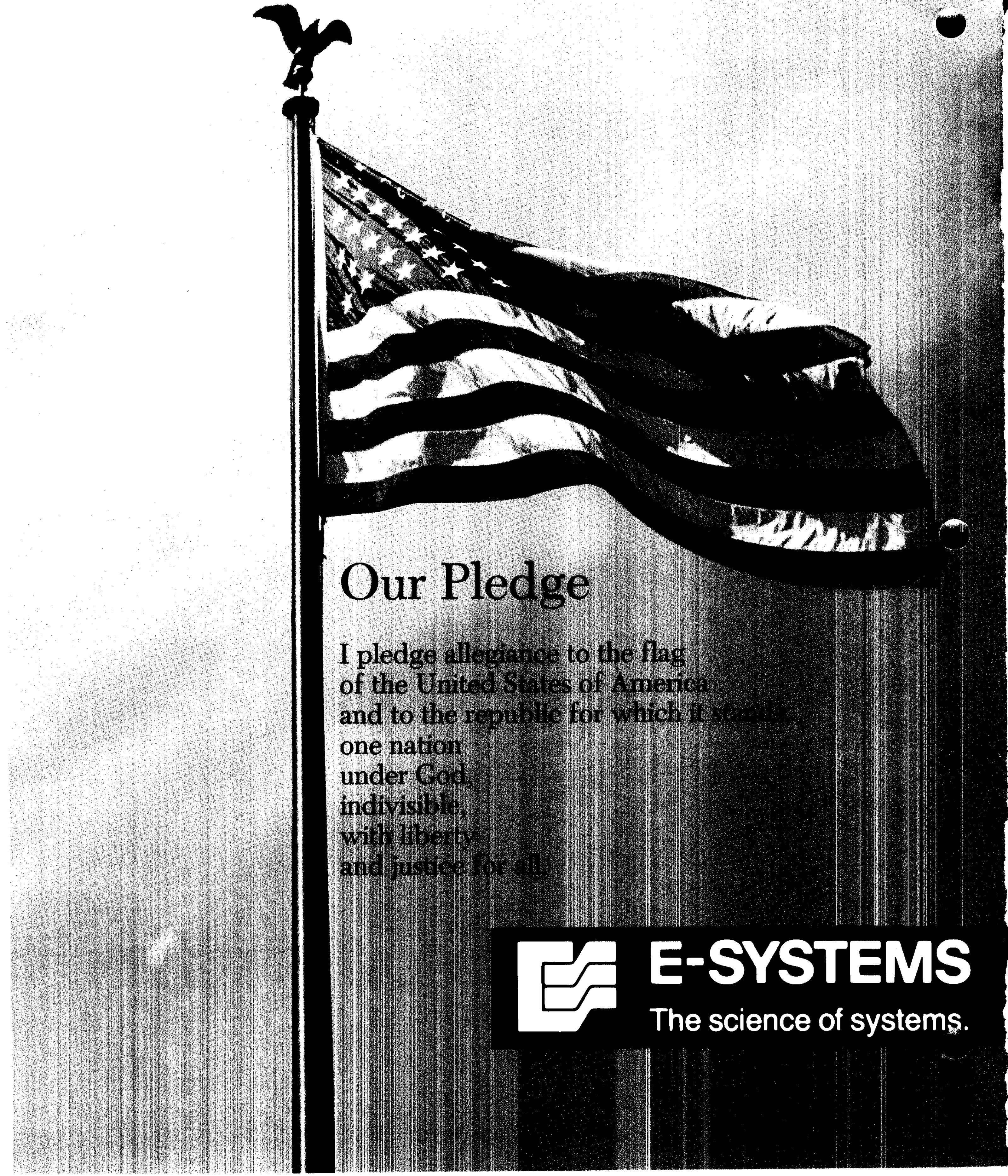
COMMEMORATIVE PROGRAM

PRIDE IN THE PAST ★ FAITH IN THE FUTURE ★

BROOKS AIR FORCE BASE

75

1917 – 1992


Our Pledge
I pledge allegiance to the flag
of the United States of America
and to the republic for which it stands
one nation
under God,
indivisible,
with liberty
and justice for all.
E-SYSTEMS
The science of systems.

Brooks Air Force Base Commemorative Program

Acknowledgements

Program Advisory Committee

Co-Chairmen
Major General Fredric F. Doppelt
USAF, MC, Retired
Chairman Brooks Heritage Foundation

George B. Irish
Publisher, San Antonio Light

Committee Members
Margaret Anderson
USAA

Brigadier General Claire M. Garrecht
USAF, NC, Retired

Madeleine Henggeler
Fiesta Magazine, San Antonio Light

Shelia Klein
Brooks Heritage Foundation

Curt Leathers
Coca-Cola Bottling Company of San Antonio

Jose H. Medellin
San Antonio Press, Inc.

Victoria Rich
Victoria Rich Communications

George E. Stallé
San Antonio Light

Resource Editors
Lloyd Crain
Paul Faaborg
Fernando Cortez
Marlin Zimmerman

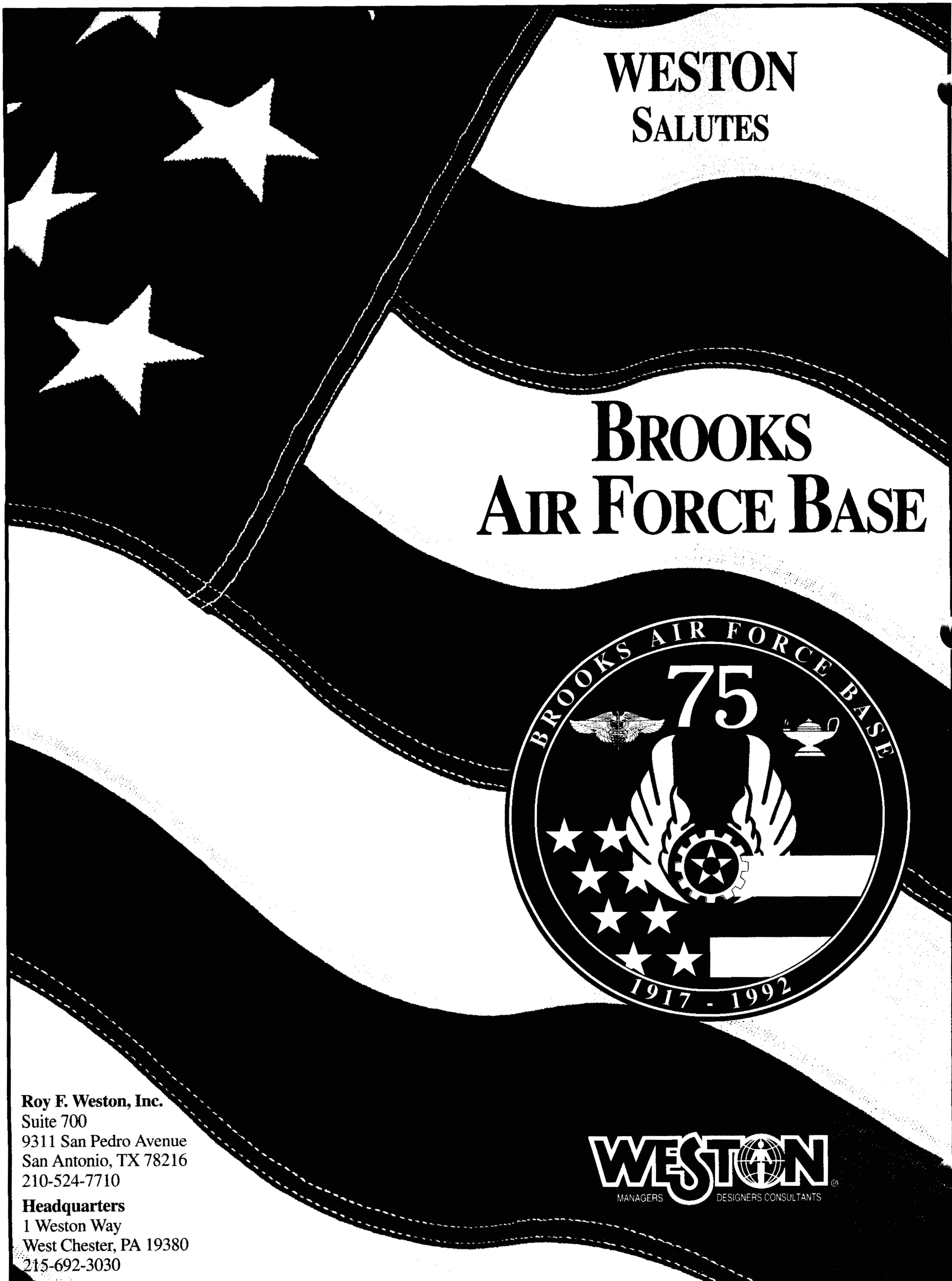
Writers
Dr. Ed Alcott
Jack Walker
Shelia Klein
Herb Klein

Special thanks
Art Direction by Pauline Giordani, Creative Services
Manager of the San Antonio Light
Editing assistance by Janet Bye, Promotion
Coordinator of the San Antonio Light
Printing by San Antonio Press, Inc.

Cover: Major Henry C. Pratt, the first commander of Brooks Field, standing in front of his JN-4 (Jenny).

WESTON SALUTES

BROOKS AIR FORCE BASE



Roy F. Weston, Inc.
Suite 700
9311 San Pedro Avenue
San Antonio, TX 78216
210-524-7710

Headquarters
1 Weston Way
West Chester, PA 19380
215-692-3030

WESTON
MANAGERS DESIGNERS CONSULTANTS

Brooks Heritage Foundation

The Brooks Heritage Foundation was founded in 1987 as a private non-profit organization to preserve the history and heritage of Brooks Air Force Base. The purpose of the Foundation is to make the public aware of the important role of aerospace research, development, and education in sustaining the national security of the United States. In addition, the Foundation will assist in developing and supporting Schriever Heritage Park, the Sidney J. Brooks Memorial, the USAF Aeromedical Evacuation Annex, and overseeing acquisitions for the Edward H. White II Memorial Museum in Hangar 9, which is dedicated to early aviation and flight medicine/research.

The Foundation is working to form a common bond that will unite those to whom Brooks has meant so much. This is being done in various ways, including building membership from around the country; helping Brooks preserve more of its heritage by restoring and refurbishing the World War II structure that houses the Aeromedical Evacuation Annex and its exhibit dedicated to 50 years of Flight Nursing; helping to complete the final phase of development of the Sidney J. Brooks Memorial; and finally, by helping Brooks Air Force Base celebrate its 75th Anniversary.

The Foundation wants those who have served and those who are now serving to have every reason to have ..."PRIDE IN THE PAST...FAITH IN THE FUTURE!"

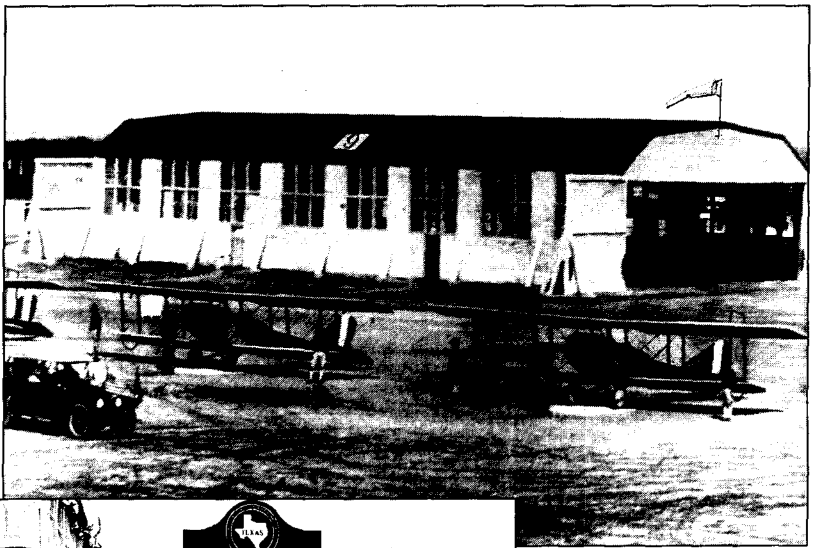
Founder Members

First Chairman
Mr. Robert (Bob) Billa

Current Chairman
Major General Fredric F. Doppelt
USAF Medical Corps (Ret.)

Colonel George Weinbrenner, USAF (Ret.)
Major General Howard R. Unger, USAF Medical Corps (Ret.)
Mr. James T. Pearce
Mr. Norbert Gonzales
Mrs. Betty J. Burke
Mr. Bill Roth
Lieutenant Colonel Joseph Euretig, USAF
Major General P.D. Straw, USAF (Ret.)
Brigadier General Claire M. Garrecht, USAF NC (Ret.)
Colonel Eugene Shanahan, USAF (Ret.)
Colonel Willard (Bill) Barnes, USAF (Ret.)
Dr. Billy Welch
Colonel Herbert Klein, USAF (Ret.)

Edward H. White
Memorial Museum



Hangar 9 as it appeared in the early 1920's.

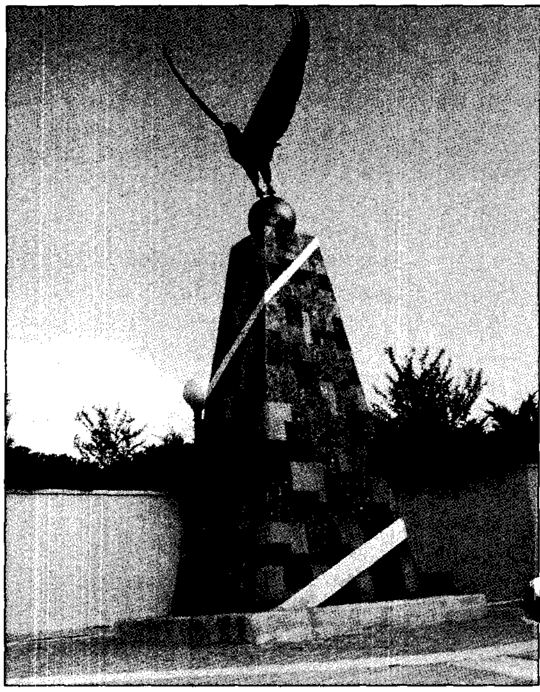
Parents and widow of Edward H. White at the dedication of restored Hangar 9 in 1970.

Built in 1918, Hangar 9 was one of sixteen original hangars built at Brooks Field. It remains the oldest aircraft hangar in the United States Air Force. With a combined base and community effort in 1969, Hangar 9 was restored and now houses the Museum of Flight Medicine and other related exhibits depicting the history of Brooks Air Force Base. In 1970, Hangar 9 was dedicated as a memorial to Edward H. White II, a native of San Antonio, who lost his life in the Apollo I capsule fire.

In addition to housing the museum, Hangar 9 has become a popular place to hold social functions. Gourmet dinners are regularly held in the hangar and retirement receptions are held there following ceremonies at the Sidney J. Brooks Memorial Eagle.

The hangar holds a special place in the hearts of all who have served at Brooks. The creaky windsock, still flying on the roof, is a constant reminder of the glory days of flying.

Sidney J. Brooks
Memorial Park

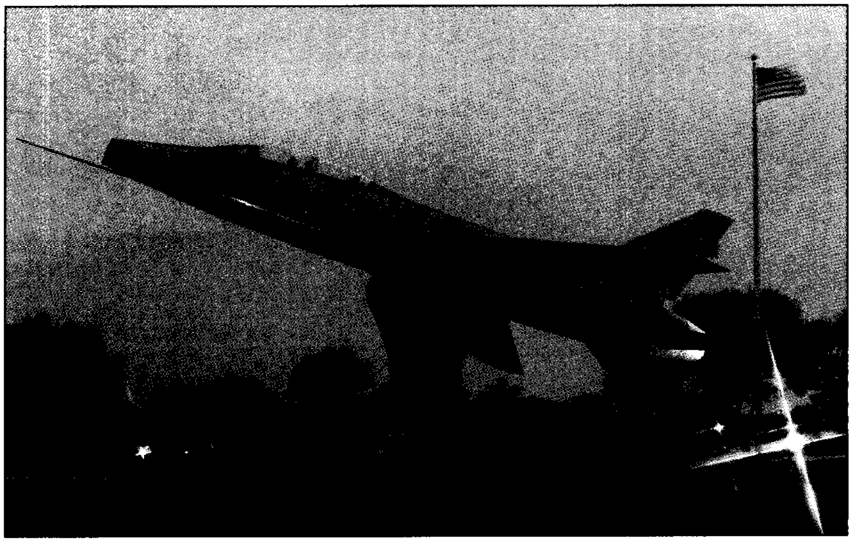


As part of the 70th anniversary of Brooks Air Force Base in 1987, a commemorative garden was dedicated to the memory of Sidney Johnson Brooks. Within this garden is a twelve-foot marble and granite monument topped by a five-foot bronze eagle. The monument and eagle were designed and sculpted by Lieutenant John Cmar, who was assigned to Brooks at that time. The park itself was constructed by volunteers from the base community, both civilian and military. At the dedication on November 13, 1987, several members of Sidney Brooks' family were present and the monument was unveiled by Major General (Retired) Eugene Eubank. While a lieutenant in flight training, General Eubank served as a pall bearer at Lieutenant Brooks' funeral.

On a plaque at the base of the eagle is an inscription that reads:

"To all the U.S. Airmen (Officers and Civilians) of those early years, few in number, great in spirit—the seekers, the pathfinders, the builders. They dared the heights and saw beyond their times."
-Anonymous

Schriever Heritage Park



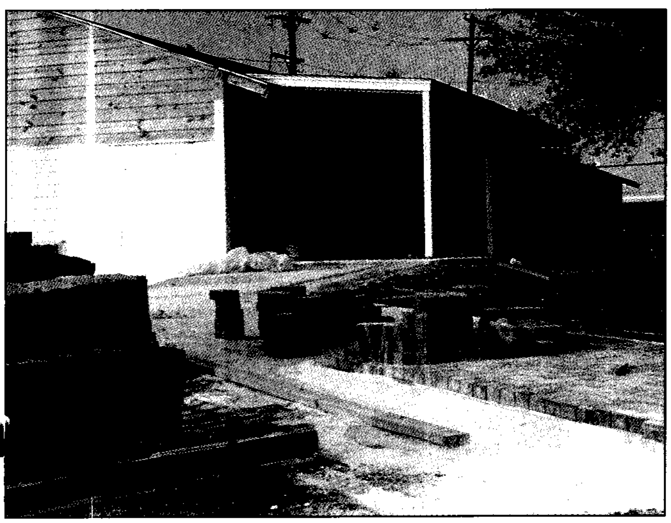
In October 1986, the Aerospace Medical Division (AMD), now the Human Systems Center (HSC), celebrated its 25th anniversary. During the celebration, a special ceremony took place—the dedication of Schriever Heritage Park, named for General (Retired) Bernard A. Schriever, first commander of the Air Force Systems Command (AFSC). The park features a mounted F-100F Supersabre replica of AMD's "Weightless 2" aircraft which was used in early astronaut weightless training.

General Schriever was born in Germany and moved with his family to New Braunfels, Texas when he was seven years old. He received his early education in San Antonio and graduated from Texas A&M in 1931. He began his military career the same year in the Field Artillery. He entered flight training at Randolph and received his wings and commission as a second lieutenant. He completed a degree in aeronautical engineering at the Air Corps Engineering School and a master's degree in mechanical engineering (aeronautical) at Stanford University.

In June 1954, General Schriever was named the commander of the Air Research and Development Command. In this capacity, he directed both the nation's highest priority project—the development of the intercontinental ballistic missile program—and the development of the Air Force's initial space programs.

General Schriever became the driving force for the creation of the Aerospace Medical Division within Air Force Systems Command, thus consolidating all the life and behavioral sciences for aerospace support. General Schriever believed this integration would command facilities so comprehensive and well established that the Aerospace Medical Division would become the human systems advocate for the nation, the Air Force and the entire free world. In time, this division would change its name to the Human Systems Division (and later HSC), signifying its emphasis on programs that integrate human factors into the design, development, testing and operations of Air Force Systems.

USAF Aeromedical Evacuation Annex



To commemorate the 75th Anniversary of Brooks Air Force Base and to honor 50 years of Flight Nursing, the Brooks Heritage Foundation moved, renovated and refurbished a World War II structure (Building 754) to house the Aeromedical Evacuation Annex to the Edward H. White II Memorial Museum. The building, located adjacent to Hangar 9, will contain memorabilia relating to the history of Aeromedical Evacuation and Flight Nursing, but also will be the site of the "Honor Wall" recognizing those individuals and corporations that helped make the museum a reality. Leading from the Annex there is a Memorial Walkway with engraved paving stones recognizing current and de-activated Aeromedical Evacuation Squadrons, as well as individuals, corporations and Life Members of the Brooks Heritage Foundation. The building was formally presented to Brooks Air Force Base by the Brooks Heritage Foundation on November 13, 1992 on the 75th Anniversary of the death of Cadet Sidney Johnson Brooks. (Building and Memorial Walkway under construction).

Sidney J. Brooks Jr.

The death of Sidney J. Brooks Jr. all those decades ago remains, in many ways, a mystery.

A cadet aviator at Kelly Field, he was making the short flight back from Hondo on November 13, 1917, when his JN-4A aircraft suddenly plummeted.

Brooks, on his final flight prior to being commissioned as a first lieutenant, became the first San Antonian to die in World War I activities.

His friends and officials with the American Flying Corps speculated at the time that Brooks may have fainted in the cockpit, his body stressed out from an anti-typhoid serum injection he had been given earlier in the day.

Medical science at the time knew little about the strain flying can put on the body. Today, the problems of space medicine are routinely tackled in the laboratories at Brooks Air Force Base, named for Brooks three months after his death.

The base, located on San Antonio's South Side, is headquarters for the Air Force Human Systems Center, which includes the School of Aerospace Medicine, among other missions. It provides medical education and services to test human performance.

Brooks was born in San Antonio, graduating from high school here in 1913 and entering the University of Texas at Austin the following fall. He fell ill in January 1915 and returned to San Antonio, where he joined the staff of the San Antonio Light as a reporter.

With war brewing in Europe, Brooks entered the Citizens' Training Camp in the summer of 1916.

Eager to become a military aviator, he attended the required ground school in Austin before transferring to Kelly Field to complete his training.

Progressing through the ranks, he lacked only a final, cross-country flight to receive his commission as a first lieutenant.

He and several other cadet aviators had flown to Hondo, about 40 miles from San Antonio, on November 13, 1917. After a short rest, they began their return to Kelly Field. Brooks' craft was approaching the edge of the landing field when it abruptly turned nose down and crashed.

The crash shocked Brooks' survivors, but some reported eerie premonitions of his death.

Stuart McManus, a longtime friend who worked as a night clerk at the Menger Hotel, told mutual friends that Brooks had visited him the night before the fatal crash. Brooks, McManus said, was worried he would not be able to solo successfully.

McManus assured his friend he would do fine.

The young aviator's fiancee, Lottie Jean Steele, later spoke often of her feeling that Brooks had reached out to her as his plane crashed.

She was in the backyard of her Terrell Hills home that afternoon, she said, when she heard Brooks twice call out to her. Several hours later, she heard that he had crashed, just at the time she heard the call.

A garden on the grounds at Brooks — a memorial to the base's namesake — was completed for the 70th anniversary celebration for the Air Force base in 1987. Within its grounds is a 12-foot marble and granite monument topped by a five-foot bronze eagle.

The inscription reads:

"To all the U.S. Airmen, (Officers, and Civilians) of those early years, few in number, great in spirit — the seekers, the pathfinders, the builders. They dared the heights and saw beyond their times."

Brooks Field
1917-1948

A history of Brooks AFB is in a real sense a history of American military aviation. Being one of the oldest continuously active U.S. air bases, Brooks has been the site of a number of important events in aviation history. From its first mission, the training of Army pilots, Brooks has evolved into one of the world's largest aerospace medical research centers, and serves as a human-centered advocate for the Air Force in weapon system design and development.

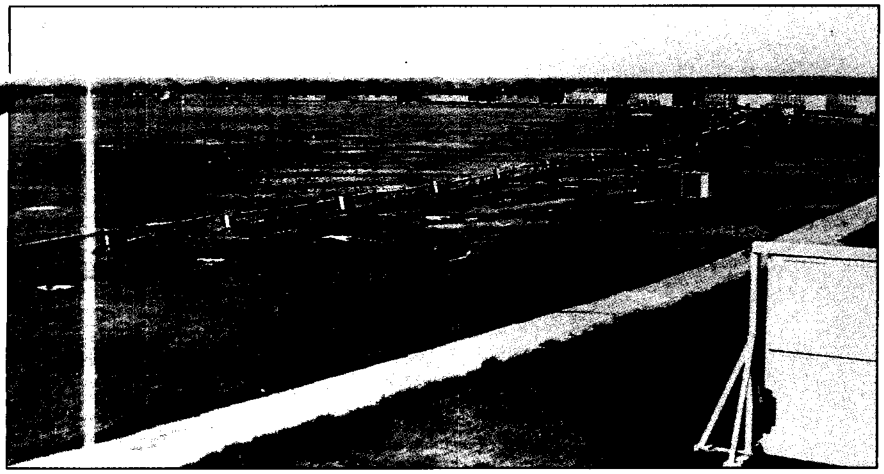
Brooks was a war baby, born of necessity to train pilots for World War I duty. Ground was broken for the facility on December 8, 1917 and it was formally established under the command of Major Henry C. Pratt on February 16, 1918. The army was looking for a good location for a new flying field where changing seasons would not interfere with training schedules. While the fields around San Antonio were being selected and planned, a delegation of French and American aviators from the front lines were sent to Brooks to approve the layout and construction. The site of 873 acres was so heavily covered with mesquite and undergrowth that the Military Affairs Committee of the Chamber of Commerce constructed a tower overlooking the land so the inspection officers could better view the terrain. When complete, the field was small, runways were merely packed dirt and the planes used were the JN-4 (Jenny) type.

Building plans for the base were generated by the Detroit architectural office of Albert Kahn, who designed a curved 16-hangar line facing an open field with camp buildings arranged behind the flight-line to the north. A railroad entered the site from the northwest and ran to the supply buildings. All construction of the Base was of wood frame. Interestingly, one of the original aircraft hangars, now a Base museum, has the distinction of being the oldest wooden hangar remaining in the Air Force.

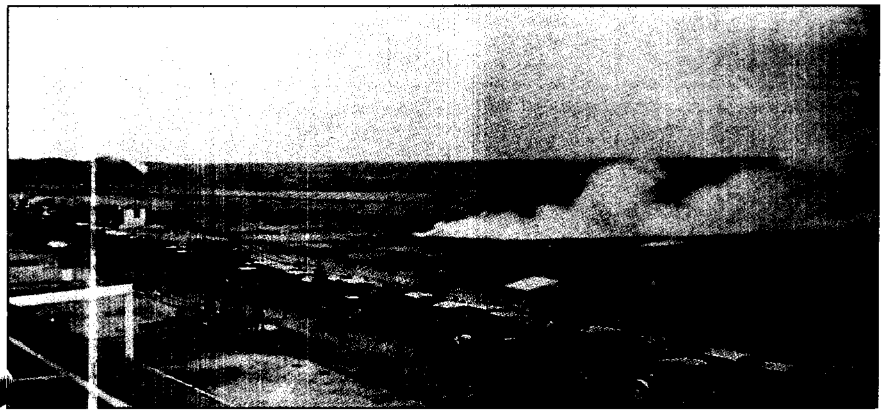
Brooks Field's first mission was to train Army flying officers as instructors in the Gosport System of flying instruction. The system, devised by the English Royal Air Force, was as simple as it was unique. It provided for a speaking-tube between the student-pilot and instructor to teach and correct the student while in flight. After the close of World War I, the Gosport School was closed, but its training methods were so successful that the War Department required that the Gosport System be made

Two aviators displaying the Gosport System. This system allowed the instructor pilot to talk with the student during training

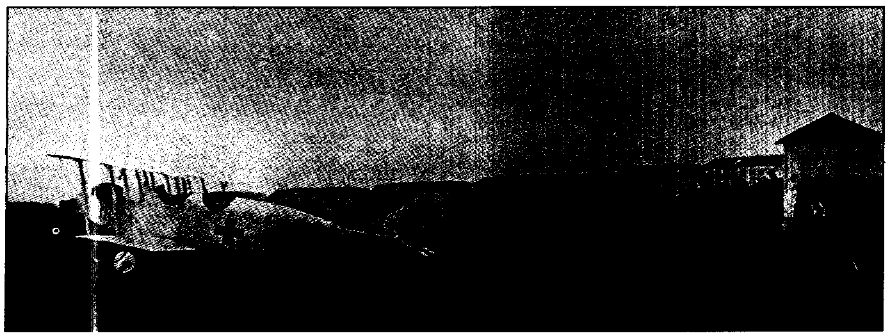
The original staff at Brooks Field. Major Pratt, the first commander, is kneeling in the center.



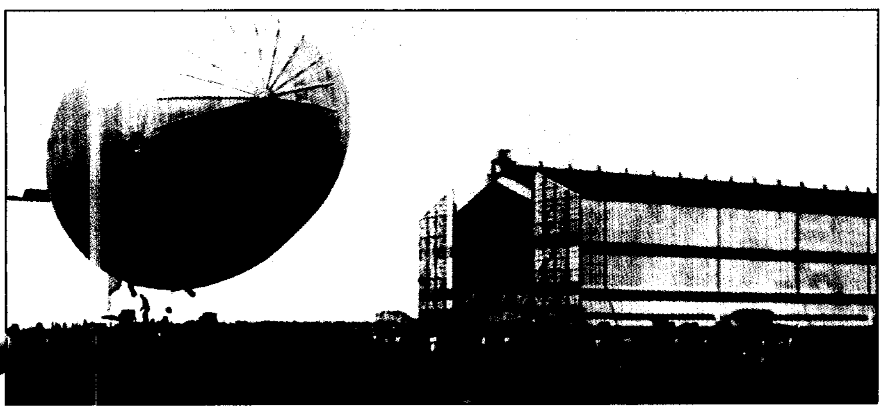
JN-4 (Jenny's) on the ground at Brooks in the 1920s.



Sham Battle, November 30, 1918



Hospital Ship preparing for action.



Balloon and hangar during airship days (early 1920s).

mandatory for all Army flying fields in the US.

Brooks was formally named Brooks Field on February 4, 1918. The name Brooks was used to honor Cadet Sidney Johnson Brooks Jr. (1895-1917), who was the first native San Antonian to die in World War I-related activities. During its first year of operation, Brooks Field became the site of an American-German Sham Battle that first demonstrated the joint coordination of air power with the other Service Branches. Ten thousand spectators came to see the show.

After World War I, the Army developed a Balloon and Airship School at Brooks. Its new mission was to train pilots for lighter-than-air (hydrogen-filled) airships. A huge balloon hangar of over 91,000 square feet was constructed facing a half-semicircle arrangement of hangars. However, a series of disasters with these airships resulted in the suspension of these operations in June 1922.

Following the close of the Balloon and Airship School, Brooks became the Primary Flying School for the Air Corps. The first class consisted of 183 students with a one-to-six ratio of instructors to students. Soon basic training was added to flight training. Students were trained for four months in each area. Although the number of cadets eliminated for deficiencies was high, some of the most renowned names in military and civil aviation took their flying lessons at Brooks. Among its notable graduates were Charles Lindbergh (the first man to make a solo trans-Atlantic flight), Nathan Twining, and Thomas D. White. Other noted fliers were Robert G. Breen, R. C. Candee, Barry F. Giles, Willis H. Hale, Marvin E. Gross, F. V. Kimble, L.C. Craigie, and David M. Schlatter.

Among the more noted instructors were Claire Chennault, leader of the "Flying Tigers," who wrote the first two texts of flying instruction and also set an open cockpit altitude record of 40,800 feet; Russell Maughan, first pilot to make a "dawn to dusk" flight across the U.S.; Captain W. C. Ocker, first "blind flight" instructor; and Lieutenant Carl J. Crane, who wrote the world's first manual for instrument flying. In addition, Elwood Quesada became a pioneer in mid-flight refueling. Many pilots who trained at Brooks became senior officers of commercial airlines, and many more became airline captains. Dozens of student fliers finished their military service wearing four stars. An equal number became air commanders of World War II.

Charles Lindbergh

Charles Lindbergh (1902-1974) was born in Detroit, Michigan and grew up in Minnesota. At 20 years of age he took his first airplane flight and first parachute jump. The following year he bought his first airplane, a surplus Jenny, for $500 and learned to fly. He enlisted in the Army as a cadet in 1924, and completed the courses on military flying at Brooks and Kelly Fields.

When he began his primary training at Brooks, he already had 325 hours of flying time. When he reported for duty in his own battered war surplus Jenny, he was told in very strong language to get the contraption off Brooks Field. To everyone's surprise he was able to take off and fly to nearby Stinson Field.

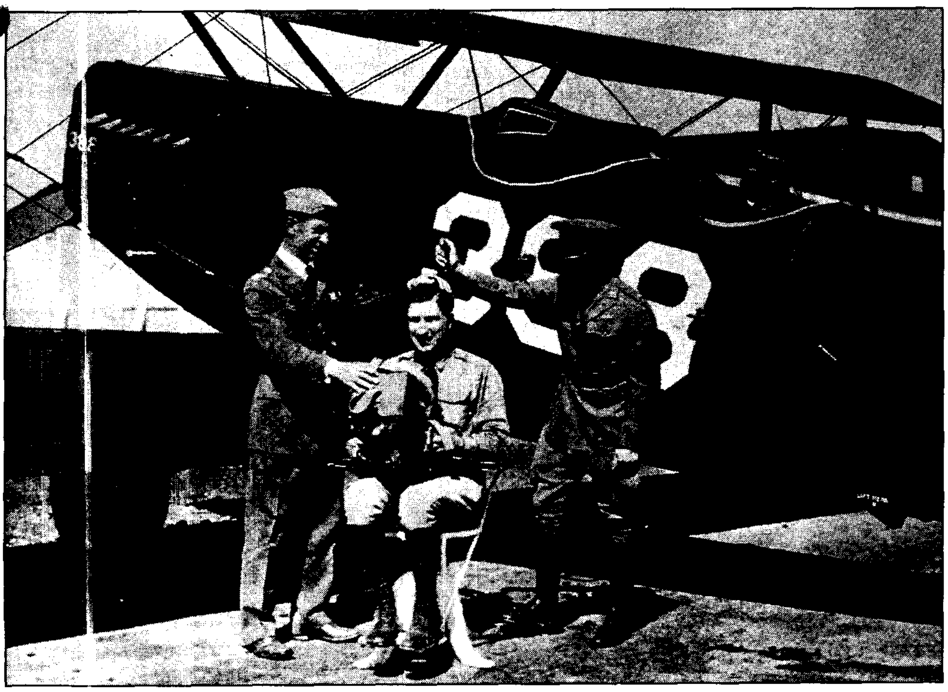
Upon graduation, Lindbergh was rated as an airplane pilot and commissioned a second lieutenant in the Air Corps Reserve. He helped fly the airmail when the military took over that responsibility. In his world-famous solo flight across the Atlantic in a Ryan monoplane, Lindbergh flew the 3,610 miles in 33-1/2 hours. He was an international hero from the moment he touched down in Paris. The plane, built on special order for Lindbergh, was powered by a 223-horsepower Wright J-5-C engine, and carried 450 gallons of fuel. In recognition of his courageous trans-Atlantic flight, Lindbergh was promoted to colonel and awarded the Distinguished Flying Cross. He received numerous other decorations and awards around the world.

Lt. L. C. Craigie

Lieutenant L.C. Craigie-first military aviator to fly America's first jet: the Bell XP-59. He received his wings at Brooks in 1924. On his recent 90th birthday, Lieutenant General Craigie flew right seat in a B-25 that led a formation of P-51's in a fly-by over March AFB. He plans to try it again in another 90 years!

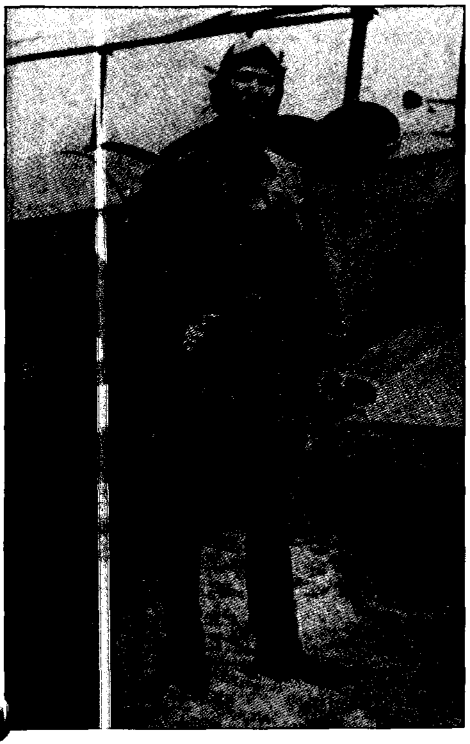
Below: Charles Lindbergh and Claire Chennault (third and fourth from left) during their days at Brooks.

William C. Ocker



William C. Ocker and unidentified Brooks personnel demonstrating the Ocker Box to pilot sitting in a Barany Chair.

Maj. William R. Ream



Pioneer flight surgeon and first to die in an aircraft accident. (World War I).

One of the great pioneers of aviation was Col. William C. Ocker (1880-1942), known as the Father of Instrument Flying. In fact, 1990 marked the 60th anniversary of the Army Air Corps' adoption of instrument flight instruction as advocated by Col. Ocker.

In 1912, Col. Ocker joined the aviation section of the Signal Corps, where he remained for the rest of his military career. He began his career as a corporal in aviation mechanics, developing an intense interest in flying. He spent his off-duty hours lending mechanical expertise to the Curtiss Company Flying School, and they appreciated his help so much that they taught him how to fly. Ocker qualified for a pilot's license from the Aero Club of America in 1914, and thus became one of the elite, a flying sergeant.

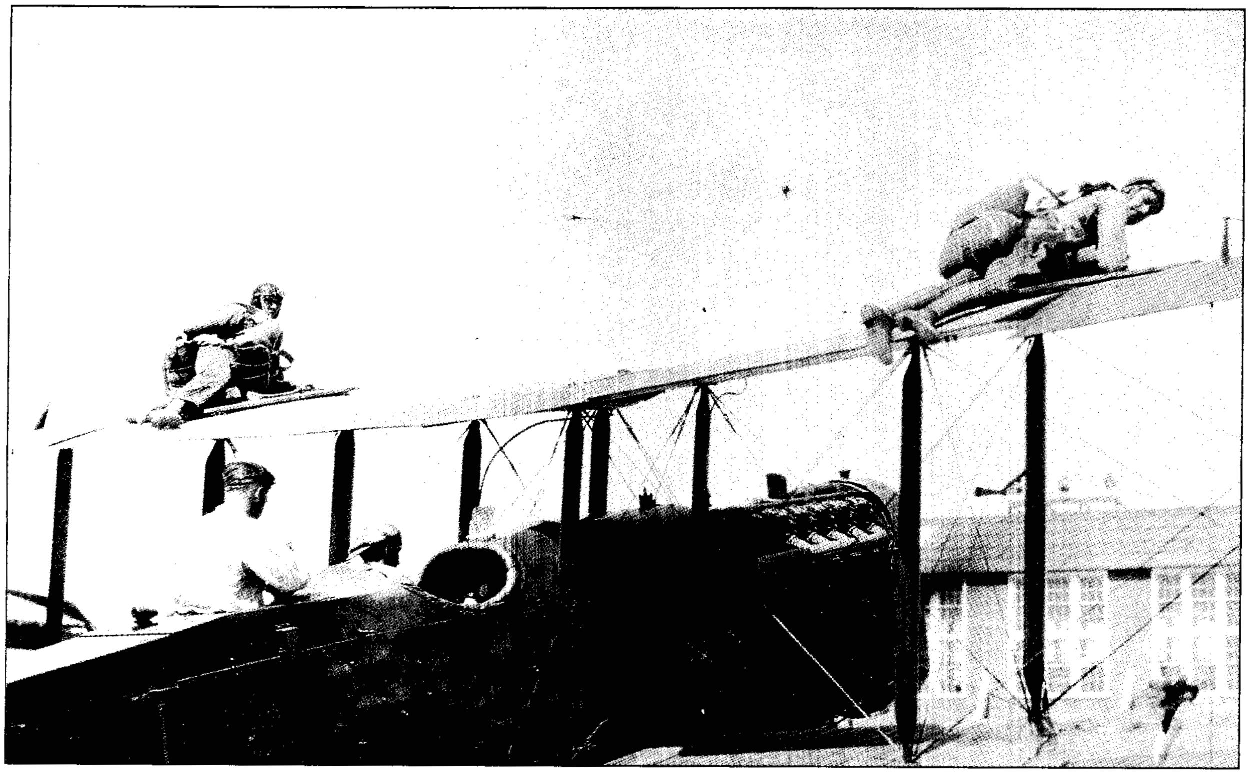
Instrument flying, at first called blind flying, meant flying without being able to see the ground, either because of cloud cover, night flying or fog. Pilots had fuel and altitude gauges on some of the earliest planes, but no instrument displayed the orientation of the aircraft. This shortfall caused many pilot deaths. One of the main problems of early aviation was the macho image of the pilots, who believed their natural instincts were better guides than any instrument aids. Ocker noted that it was a sign of weakness for pilots to admit they needed instruments to fly. He recalled that expert pilots could "fly by the seat of their pants" in fine sunny weather, but not in blind flight conditions.

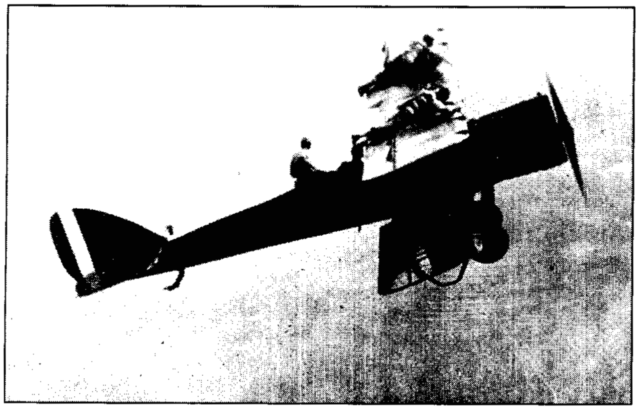
Flight surgeons were aware of pilot disorientation and vertigo, but they were unable to offer solutions to the problem. Ocker came up with an answer by inventing a device later called the Ocker Box. The box contained a bank and turn indicator, a compass and a flashlight. The entire device could be mounted on a Barany Chair. When a subject viewed the instruments in the box while the chair rotated, the instruments indicated the correct movements even though these movements were at odds with human senses. This concept, when used on an airplane, permitted blind flying in adverse weather conditions, thus establishing the importance of instrument flying.

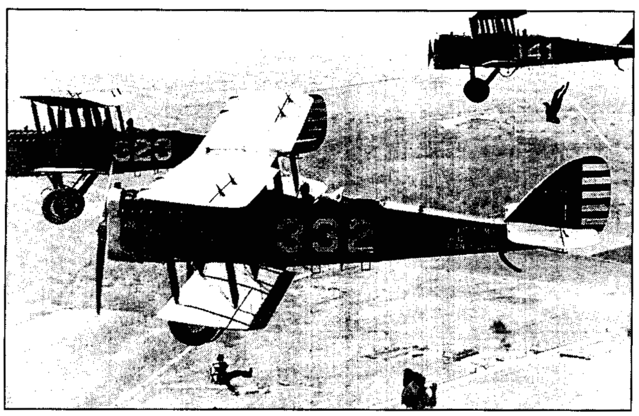
Ocker found it difficult to convince many older pilots of the correctness of his findings. Nevertheless, he noticed that pilots who had once been trapped in fog or blind flying conditions were enthusiastic about the new method. To prove his faith in blind flying, Ocker, with a safety observer, successfully piloted the first cross-country trip with only instruments as his guide. This historic flight took place on June 24, 1930, from Brooks AFB to Scott Field, Illinois, a trip of about 900 miles.

It was not until World War II that instrument flying was firmly established in the military. Ocker's early efforts in instrument flight instruction were duly honored when Orville Wright wrote in 1934 that Col. Ocker was the "greatest missionary of instrument flying."

Paratroop Jump

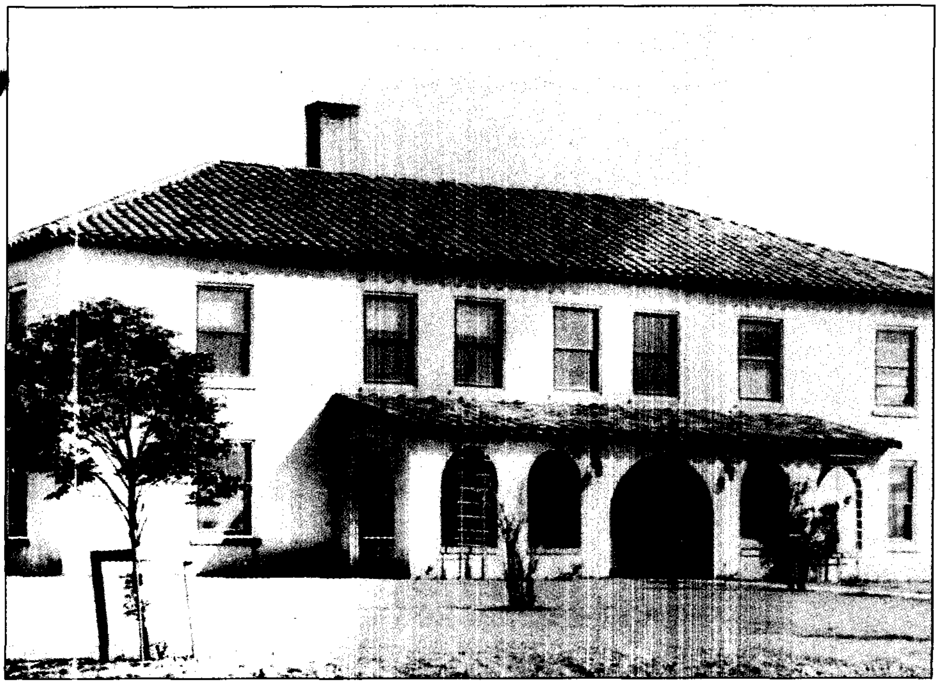






Paratroop jumps 1929

In 1928, Brooks Field became the site of early experiments in paratroop jumps, perhaps even the first paratroop jump, although there is some ambiguity concerning this record. Following a number of trial runs, an official paratroop demonstration was held for a large audience on September 28, 1929. Dignitaries were present from various world capitals. The demonstration included two formations of nine DeHavilands and three Douglas transports. The DeHavilands circled the field at 2,000 feet and dropped 18 men while the transports dropped three padded containers, holding machine guns and related equipment, from 3,000 feet. Four minutes after the leap, the machine guns were fired from positions on the ground. This demonstration confirmed the practicality of tactical paratrooper warfare, which would be used on many occasions during World War II.



First Brooks Field home of the School of Aviation Medicine. Now the home of the 648 Support Group Commander.

The School of Aviation Medicine

In 1922, the Air Service concentrated all of its flight training at two fields in San Antonio. Primary training was consolidated at Brooks, and advanced training was given to Kelly Field. During the nine years that primary training was at Brooks, there were 2,237 student graduates. Since flight training programs were accompanied by accidents, it seemed logical to place the School of Aviation Medicine where air training occurred. Orders directing the school to be moved from its former location in New York to Brooks Field in Texas were given in June 1926. The School moved into the first permanent structure at Brooks Field in 1927.

When the construction of Randolph Field in San Antonio was completed in 1931, the decision was made to relocate the School, along with the Primary Flying School, to the newly completed facility. At a time when other air fields were receiving new programs and the fortunes of the Air Corps in general seemed to be on the rise, Brooks had lost its two most important organizations.

Nevertheless, the successful integration of medical research, hardware design, and functional operation fundamentally shaped the evolution of modern aircraft and aviation equipment. The School was transferred back to Brooks in 1959 upon the consolidation of medical research and development activities.

Aerial Observation Center

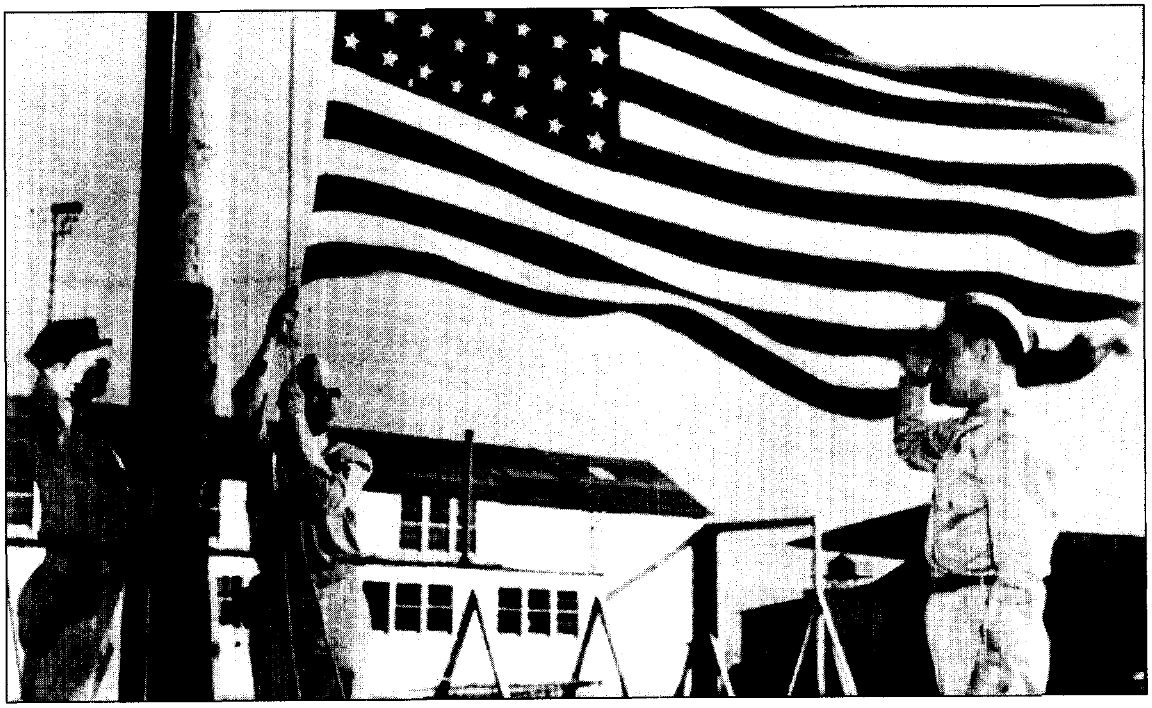
By 1931, a number of observation squadrons and a medical detachment had been transferred to Brooks Field. The observation focus of Brooks became the most hotly debated aspect of the Air Corps during these years.

One faction of the Air Corps considered observation to be an important auxiliary service. Another recommended more emphasis be placed on the primary services needed to secure control of the air (pursuit) and to destroy hostile targets behind enemy lines (bombardment).

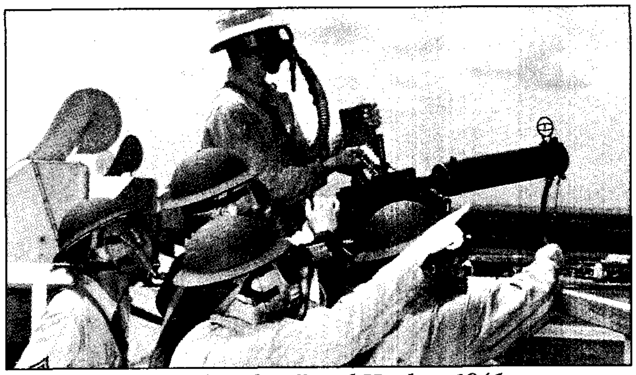
By the early 1930s, proponents of bombardment had begun to make themselves heard. In 1933 the War Department concluded that an increase of combat and long-range reconnaissance planes and a corresponding decrease of observation and training aircraft were needed to rectify the perceived imbalance. By the late 1930s, most of the Group had been transferred, leaving only the 22nd Observation Squadron to become the foundation of future aviation activities at Brooks.

Brooks Field then entered a decade of low-profile activity that ended when the military threats of World War II became apparent. In fact, although some minor alterations had taken place, most of the original plan for the base had been preserved, so that on the eve of a new world war, Brooks Field epitomized World War I-era planning and architecture.

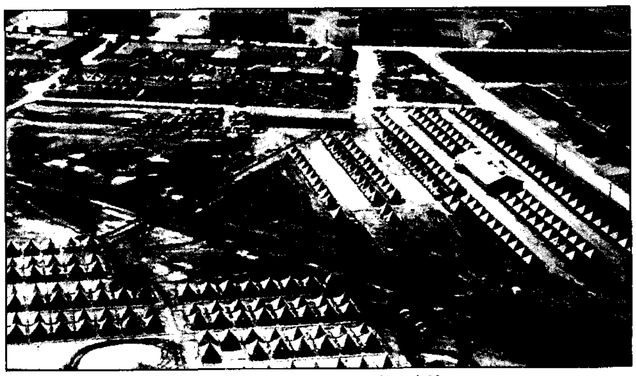
WorldWar II



Private Joe McCord stands retreat, Brooks Field 1941



On watch at Brooks after Pearl Harbor 1941



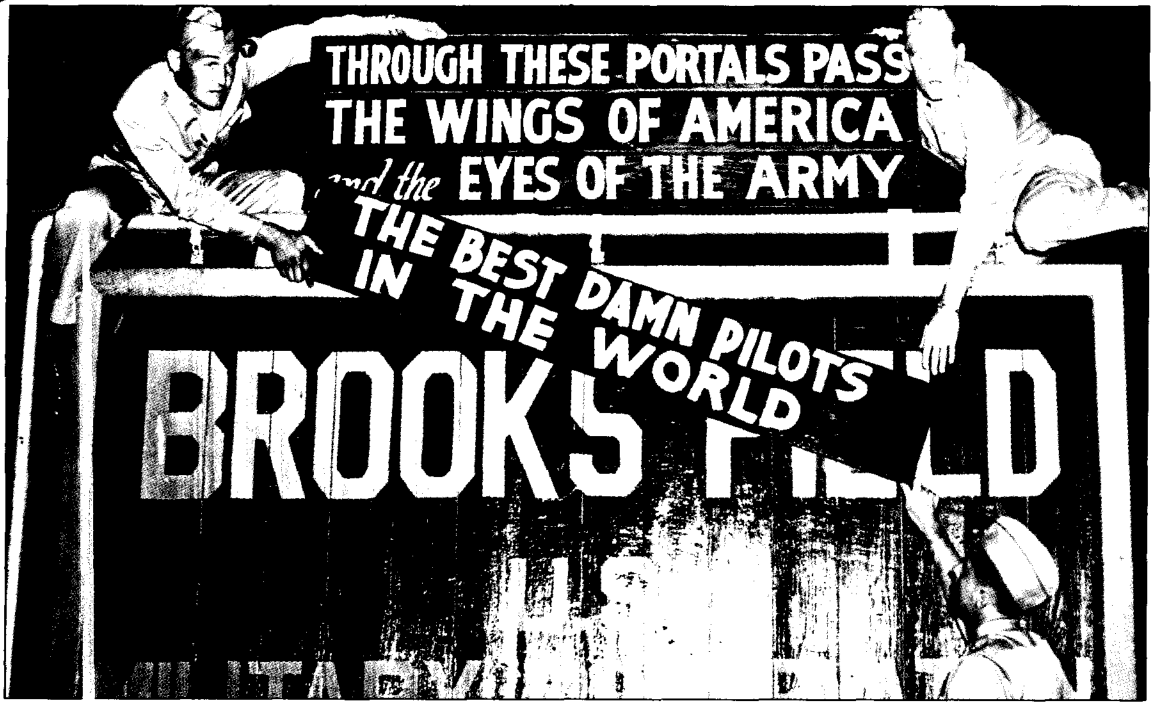
Brooks Field preparing for war (1941)

The quiet that had typified the 1930s was replaced at the end of the decade by the realization that war was inevitable. By September 1939, plans were finalized to establish an advanced program of flight instruction at Brooks to relieve pressure at Kelly Field.

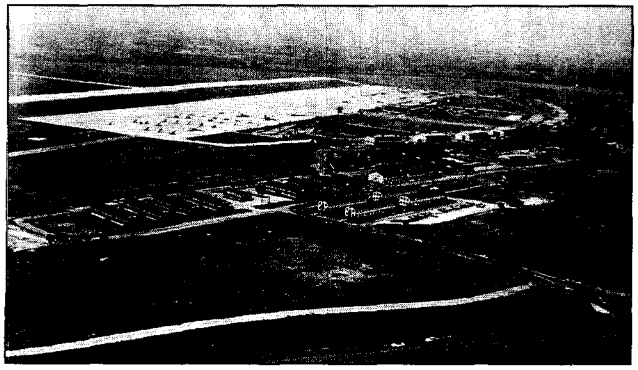
The School for Combat Observers at Brooks represented the continuation of the observer program that had begun with the Balloon and Airship School in 1919. During the early years of World War II, this program sought to train nonpilot military observers and pilot-observers. The mission of the School, which graduated approximately 50 Combat Observer pilots in three classes, was to prepare combat observers for aerial reconnaissance and support the ground troops by carrying cameras in stripped pursuit ships, or serving in bombing ships as a combination copilot, navigator, bombardier, photographer, radioman and aerial gunner.

By early 1941, it was clear that this effort at observation training was not adequate to meet the needs of modern aerial units. The curriculum in general was lacking, because war experience in observation had not been available for two decades and instructors were forced to draw heavily on obsolete methods and practices. The War Department then designated Brooks as the Army Air Force's Advanced Flying School (Observation) and a new program was instituted that placed observation training under the larger umbrella of the Advanced Flying School. Concurrent training of pilots and observers was instigated with stipulations that only fliers were trained as advanced single engine pilots and only nonpilots as observers.

Although new recommendations were offered that would be appropri-



Enthusiastic pilots at Brooks Field (1941)



Brooks Field in the late 1940s

Decontamination Unit practicing on a B-25 during WWII

ate to the needs of the Allies in World War II, the program was never the success envisioned. Many policymakers believed that the observation program was based on outdated World War I precepts rather than the needs of World War II. The view that nonpilot observation was of little help to the U.S. war effort and represented something of a military anachronism resulted in the discontinuation of observation training at Brooks Field in 1943.

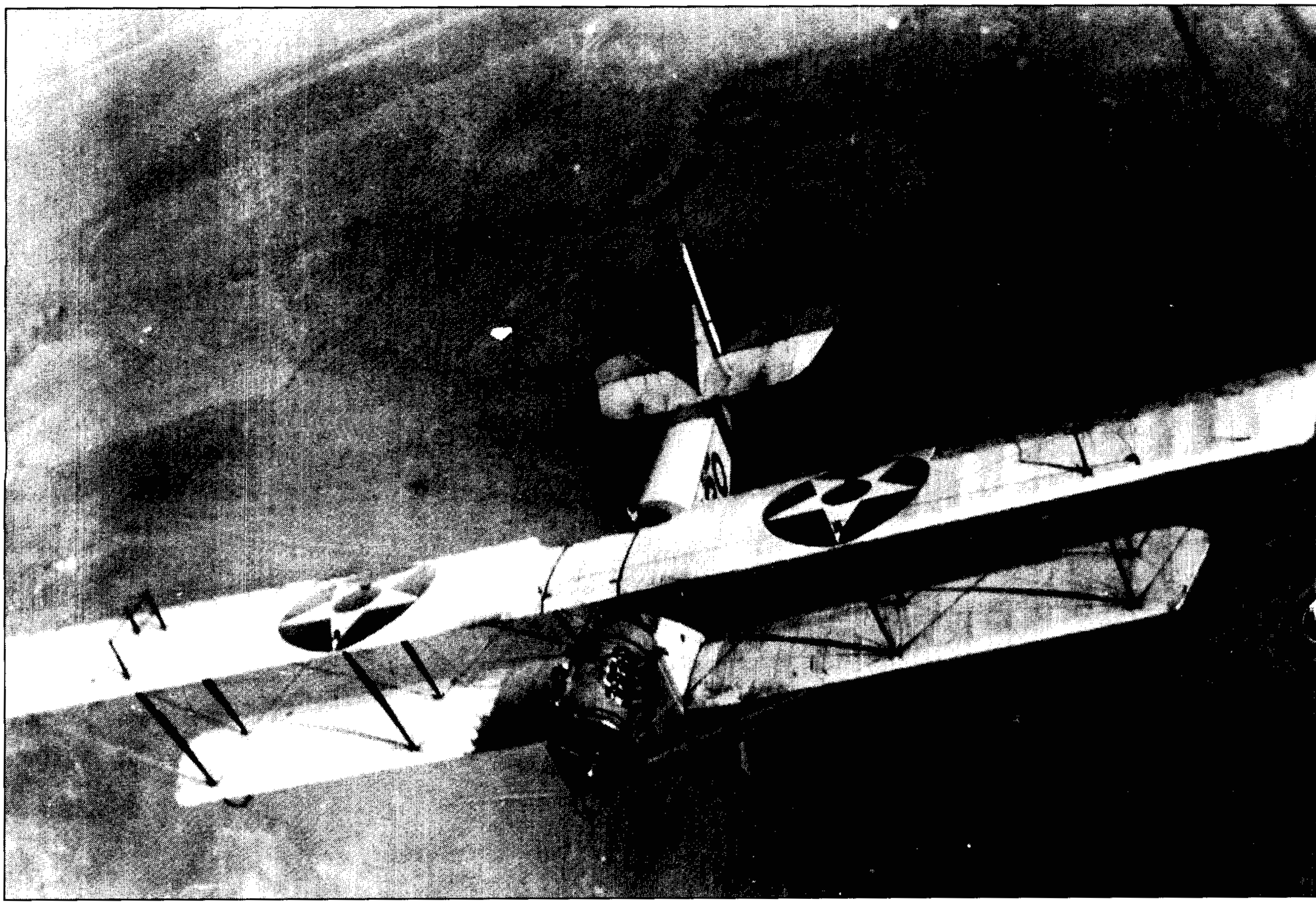
Although observation training at Brooks Field during the early 1940s was not a success, the advanced training program of military pilots between February 1940 and the end of World War II was a success. In January 1941 Brooks Field became home to an Air Corps Advanced Flying School that trained pilots to fly B-25s.

Participants in the Woman's Air Corps reported for duty at Brooks in 1943. The WACs replaced men, who were needed for combat, for clerical and hospital laboratory work, as well as for duty in the field's post office and bakery.

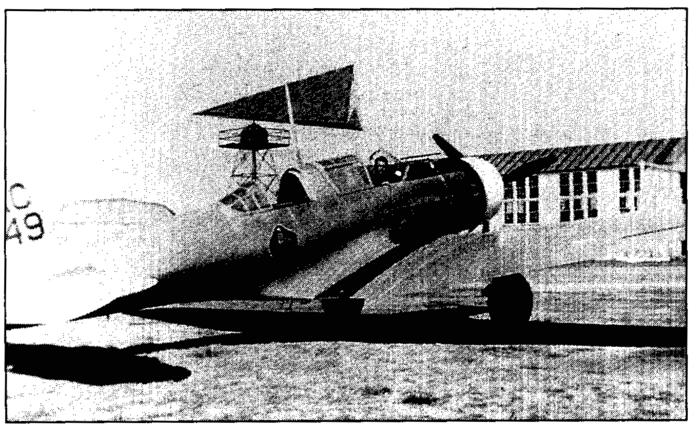
There were also great changes on the base. By the end of the war, the size of the field and the number of buildings at Brooks had increased dramatically.

Although pilot training ended in 1945, the immediate postwar years witnessed continued tactical and reserve flight activities at Brooks. Units from the 3rd, 10th, and 14th Air Forces were stationed here, along with the Alamo Wing of the Reserves and the 182nd Air National Guard Squadron. Air Evacuation flights of military patients were flown into and out of San Antonio from Brooks Field. But all flight operations at Brooks closed when the last plane took off on June 23, 1960.

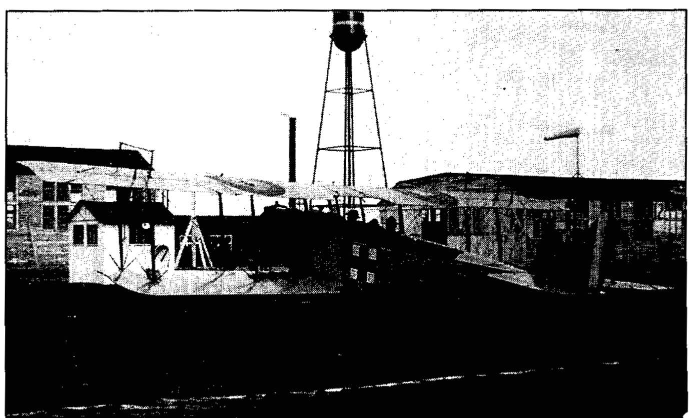
Brooks Aircraft



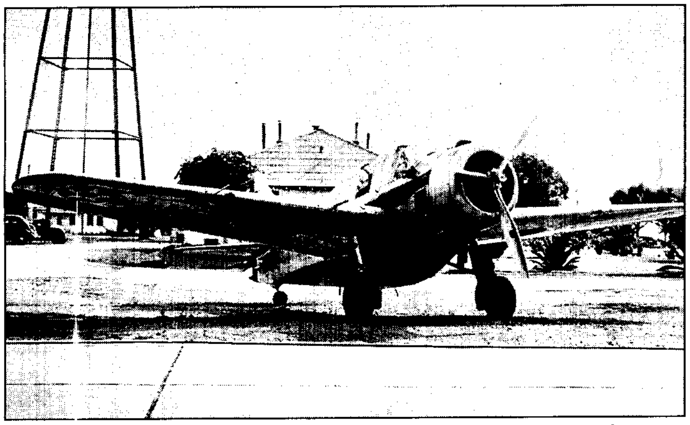
JN-4 (Jenny) in flight over Brooks in the late 1920s



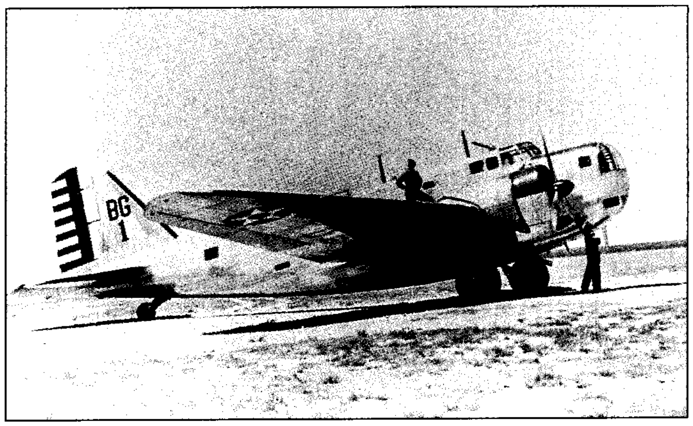
P-25 on the ground in the late 1930s



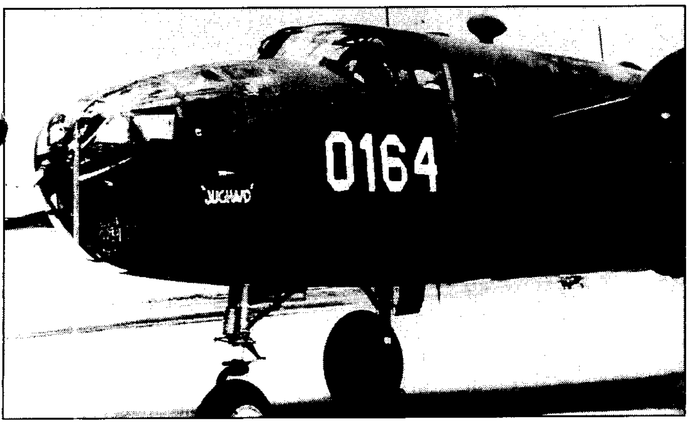
JN-4 (Jenny) configured as a hospital ship. It was the first military aircraft used for Air Evacuation.



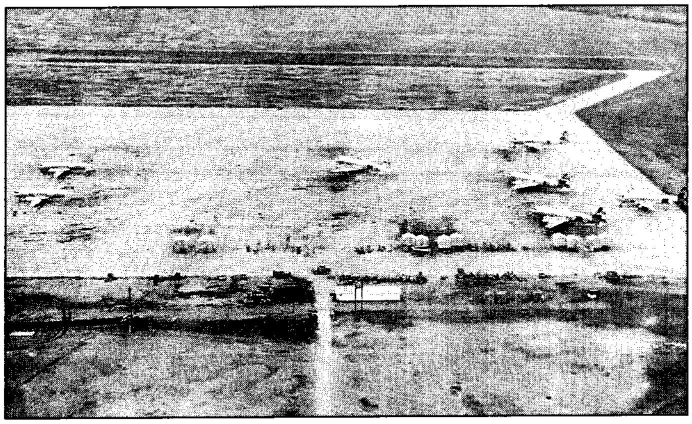
O-47A on the ground in 1938. These aircraft were used in Brooks' Observation Mission.



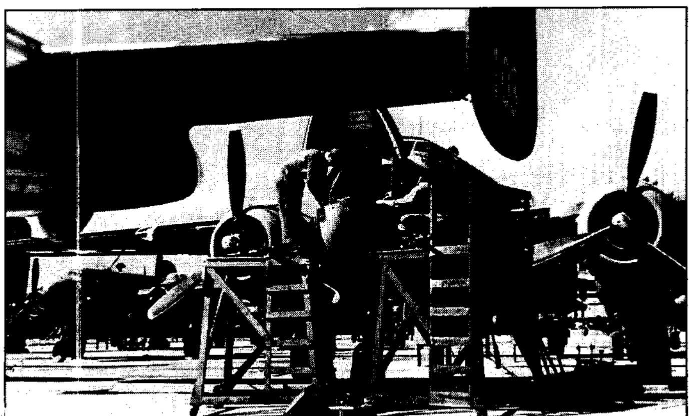
B-18 in the early 1940s



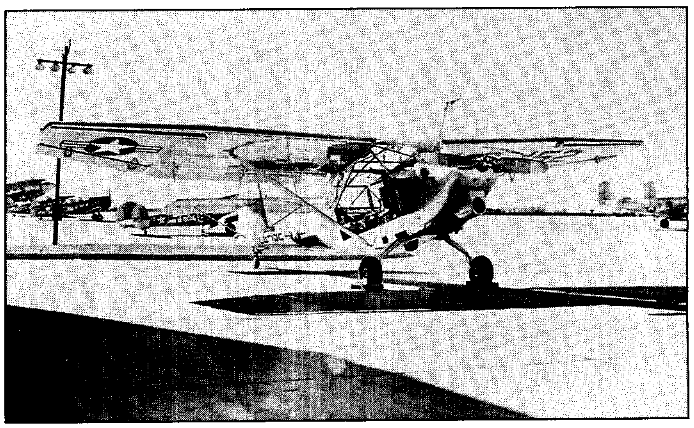
"Jughead", Brooks' most famous B-25



C-54 aircraft, used for air evacuation, on the ground in the 1950s.



B-25's and their maintenance crews, late 1940s



L-13 ambulance plane

Brooks Aircraft

B-26s on the line in 1946

B-26s in flight over Brooks in 1946

Brooks Air Force Base 1948-1990

School of Aerospace Medicine

Shortly after the close of World War II, the air arm of the U.S. Army became the U.S. Air Force. One of the immediate needs of the USAF was a medical service. Although technology had produced supersonic and stratospheric aircraft, man was the limiting factor in their use. Airmen were subjected to extremes of the environment and to emotional and physical stresses due to the growing complexity of aircraft.

Although the School of Aviation Medicine at Randolph AFB and the Aeromedical Laboratory at Wright-Patterson AFB were involved in aeromedical research, a single central organization was needed to combine aeromedical research, education, and training along with a clinical facility to care for injured pilots who were at that time scattered among Army hospitals.

The history of the School of Aviation Medicine and the School of Aerospace Medicine parallels the development of aviation medicine. When Sidney J. Brooks was killed in November 1917, little did anyone realize that his death would be the catalyst for a new specialty in medicine. Lt. Colonel Theodore C. Lyster, the first chief surgeon, Aviation Section, for the U.S. Army Signal Corps, directed the establishment of a medical research board to study the effects of aviation on pilots and the possible medical problems which could result from flying various aircraft. Aviation medicine was born.

The Medical Research Laboratory was opened in 1918 at Hazelhurst Field, Mineola, Long Island, New York. Its major emphasis was changed from research to education. Physicians, soon called flight surgeons, were trained in aviation medicine. In 1922, the laboratory's name was changed to the School of Aviation Medicine. It moved to Brooks Field in 1926 and remained there until 1931, when it moved across town to Randolph Field.

The school continued to train physicians in aviation medicine and did minimal research to support its studies. In 1945, the School of Air Evacuation merged with the school and began an expanded role in teaching aeromedical evacuation concepts to nurses, medical technicians and physicians. With the establishment of the United States Air Force as a separate service in 1947, the focus on aviation medicine as a unique specialty was renewed. Both programs moved to Brooks Air Force Base in 1959.

In 1961, the school was renamed the USAF School of Aerospace Medicine and became part of the Aerospace Medical Center. This action combined aerospace medical research, education and clinical treatment under one center designed to study flight and its effects on the individual, as well as the various systems which support the crew member while in flight.

Today, the USAF School of Aerospace Medicine is an integral part of Brooks Air Force Base. It is the sole Air Force training institution for the aerospace medicine program, flight nursing, environmental health (military public health), bioenvironmental engineering and aerospace physiology. The school is an internationally recognized educational institution, and participates in training and educational exchanges with many nations.

A Commitment to Excellence.

H-E-B

Serving Texans Since 1905.

FlightNursing

Flight Nursing began as a concept in 1930 when a civilian pilot, flying over a town that had been devastated by a tornado, envisioned moving the sick and injured to medical facilities via airplanes while nurses and technicians cared for them. Lauretta M. Schimmoler formed the Aerial Nurse Corps of America with the purpose of providing trained and qualified personnel to fulfill her vision. It took twelve years before her concept became a reality, as the medical departments of the services and the American Red Cross would not fully endorse her idea.

Two incidents in January 1942 gave impetus to the development of flight nursing as an on-going entity. The first was the mass movement of sick and wounded soldiers from the Burma-Indochina region to the United States, which prompted Brigadier General David Grant, Air Surgeon for the Army Air Corps, to call for the development of a training school for nurses and technicians.

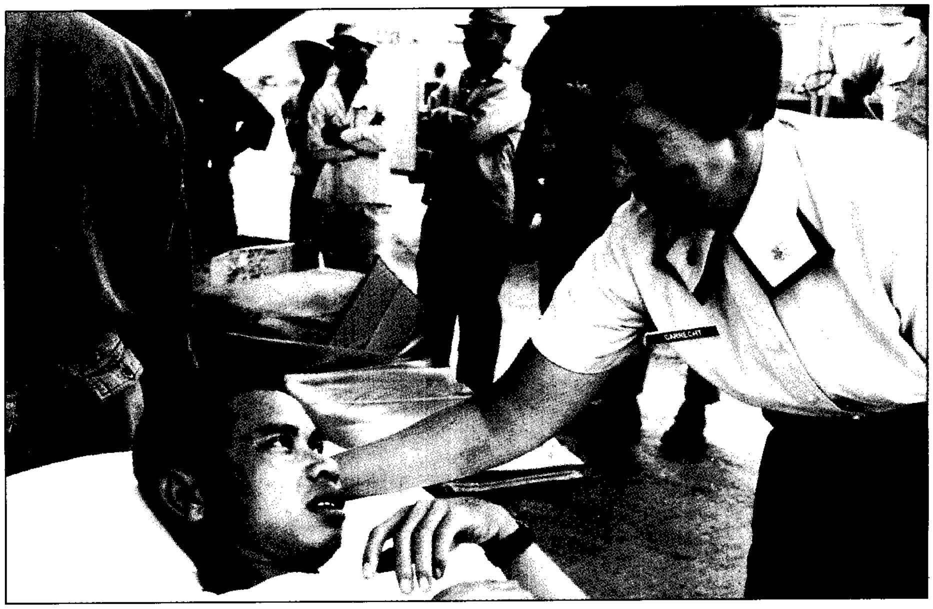
C-47 mock-up used in early 1940s for training flight nurses & technicians

The second came as a result of a flight from Karachi, India. During this flight, 2Lt. Elsie Ott served as the sole flight nurse on an aircraft loaded with patients that undertook a seven-day mission westward across Arabia, Africa and the southern Atlantic Ocean, to Bolling Field, Washington, D.C. Ott tended her charges with minimal assistance during the flight, and upon completion wrote down her recommendations for future flights. Many of her suggestions remain in place today as vital components of the Aeromedical Evacuation System.

In May 1942, the proposal for a School of Air Evacuation was developed and a call went out for volunteers from the Army Nurse Corps to train in this new nursing speciality. The School of Air Evacuation officially opened in October 1942 at Bowman Field, Kentucky. Two squadrons of nurses and technicians were trained, but due to the need for their expertise in North Africa and the Western Pacific area, they did not graduate. They departed Kentucky on December 25 for their respective areas of assignment. The first official graduation of flight nurses and medical technicians occurred February 14, 1943.

Since 1942, the School of Evacuation has been located at Bowman Field, Kentucky; Randolph Field, Texas; Gunter Air Force Base, Alabama; and Brooks Air Force Base, Texas. More than 11,500 nurses and 7,800 technicians have been trained in the specialty of flight nursing. Additionally, 17 nations have sent nurses and technicians to learn the tech-

C-9 Trainer at the Department of Aerospace Medicine.



Major Claire Garrecht, USAF, NC, comforting a patient prior to evacuation.

niques and skills required to care for patients in the airborne environment. Three nations have developed their own programs using the USAF as a model.

Flight nurses and aeromedical evacuation technicians provide care to the sick and wounded in a variety of aircraft: passenger, cargo, bombers and tankers. During the Korean War, two aeromedical evacuation squadrons were the first Air Force units to be awarded the Meritorious Unit Citation. Flight nurses moved the first patients out of Vietnam in 1954, airlifting injured French soldiers to France and Algeria following the fall of Dien Bien Phu. In 1975, flight nurses and medical technicians assisted in returning the Vietnam prisoners of war to the United States. During the most recent conflict, Desert Storm, flight nurses and aeromedical technicians used the Total Force concept, integrating medical crews from the active duty, reserve and guard forces. They provided in-flight patient care on three different aircraft in the Theatre of Operations, Europe and the United States.

Flight Nurses and aeromedical evacuation technicians also have given their lives in the performance of their duties. Seventeen nurses and 13 technicians were killed during World War II. Three flight nurses were killed during the Korean Conflict. No nurses or technicians were killed during the Vietnam War; however, one nurse and two technicians were killed while airlifting orphans from Saigon during Operation Babylift. One flight nurse was a German prisoner of war in Europe; and 13 nurses and 13 technicians were forced to utilize the skills they learned in survival training when their aircraft crash- landed in Albania and they had to make their way to friendly forces in Italy.

Whether during periods of conflict or peace, natural disaster or individual emergency, flight nurses and aeromedical evacuation technicians have been there to ensure that people receive the best care possible while en route from the battlefield or hospital to a definitive care facility. Their area of responsibility knows no boundaries, as they have moved critically ill infants in the United States and severely burned teenagers from Russia to Texas for expert medical care. The Flight Nurse and Aeromedical Evacuation Technician programs look forward to the 21st century, when they will be able to utilize the latest developments in technology in a vibrant, yet youthful, program that reaches out to those in need while providing the highest quality patient care in the airborne environment.

Aeromedical Evacuation

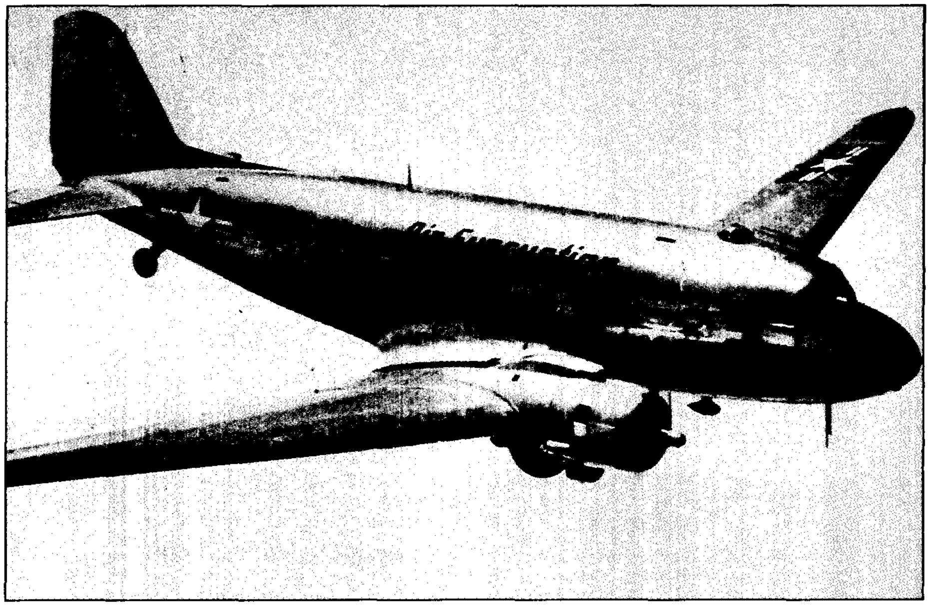
Legend has it that the first air evacuation of injured soldiers occurred during the Franco-Prussian War, when wounded men were airlifted in hot air balloons from the city of Paris. Whether fact or fiction, this act spurred the imagination of those involved in the development of the airplane.

The first ambulance plane was constructed in 1910, but failed to carry patients, as it crashed on its maiden test flight. The first actual air evacuation of wounded military personnel took place in April 1918 at Flanders, France, during World War I. At Gerstner Field, Louisiana, in February 1918, Major Nelson Driver and Captain William Ocker converted a Jenny biplane into an air evacuation aircraft. This was done to assist the return of pilots who crashed their planes in locations inaccessible to automobiles. The doctor could fly to the crash site, treat the pilot, and transport him back to a hospital for further care.

Between 1918 and 1930, eight different aircraft were either modified or specifically designed to be air ambulances. These aircraft could carry up to six stretcher patients and/or ambulatory patients depending upon the size and design of the aircraft. Most patients were transported on these aircraft with only the pilot in attendance. Despite this foray into the construction and utilization of airplanes for air evacuation purposes, military authorities did not support large scale use of aircraft for the transportation of the sick and wounded, nor did they assign or develop a cadre of personnel to accompany patients when being transported.

In the 1930s, some efforts were made in the civilian community to transport patients via aircraft. Due to the high cost it did not catch on, and with the advent of World War II many aircraft were utilized to support the war effort.

Brigadier General David Grant recognized the need for sick and wounded soldiers to be moved as quickly as possible, with competent medical care being given while they were airborne. So was born the School of Air Evacuation. Grant also conceived the idea of using transport planes, which



C-47- post World War II. This aircraft was used extensively during and after World War II to transport patients.

C- 9 Nightingale, the first jet aircraft specifically configured for aeromedical evacuation.

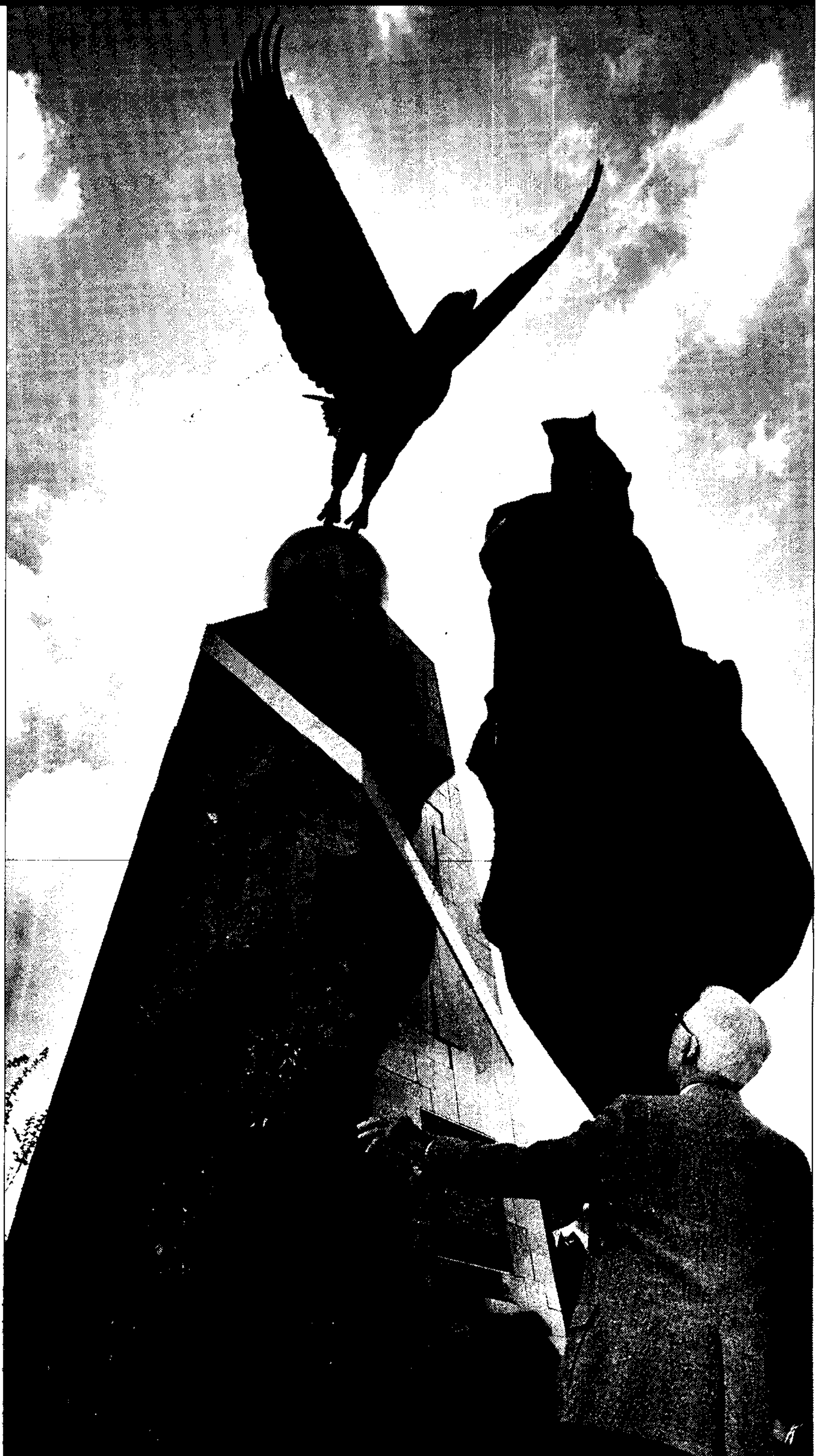
BROOKS AIR FORCE BASE

1917-1992

The
San Antonio Light
is proud to
be a sponsor of
the Brooks Air
Force Base 75th
Anniversary
Celebration.

We thank
the men and women
at Brooks Air
Force Base
whose dedication
and service
have contributed
so much to our
community
and our country.

San Antonio Light
Your Paper.
1881-1992



BROOKS MEMORIAL
Photo taken during dedication ceremony on November 13, 1987. The occassion marked the 70th Anniversary of Brooks Air Force Base. The memorial is named for Sidney J. Brooks Jr., a native of San Antonio who died in an aircraft accident in 1917, the year the base was founded.

C-122 transport evacuating wounded during Korean conflict.

took supplies, and equipment to the battle areas, to bring patients back from the front for extended care.

During World War II, aeromedical evacuation crews airlifted over one million men from the front lines. General Dwight Eisenhower, following D-Day in Normandy, stated, "We evacuated almost everyone (350,000) from our forward hospitals by air, and it has unquestionably saved hundreds of lives, thousands of lives."

During the Korean War, aeromedical evacuation initially was not used, as ships transported wounded soldiers from Korea to Japan. However, following the airlift of 4,689 casualties over a hazardous five-day period, aeromedical evacuation became the preferred method of moving wounded soldiers from the combat area to hospitals in the rearward area.

In 1954, the first aircraft specifically designed to carry patients was introduced. The Convair C-131A Samaritan was, for all intents and purposes, a flying hospital. It could carry 37 ambulatory or 27 stretcher patients, or any combination of both. It was primarily used to ferry patients between military hospitals in the United States.

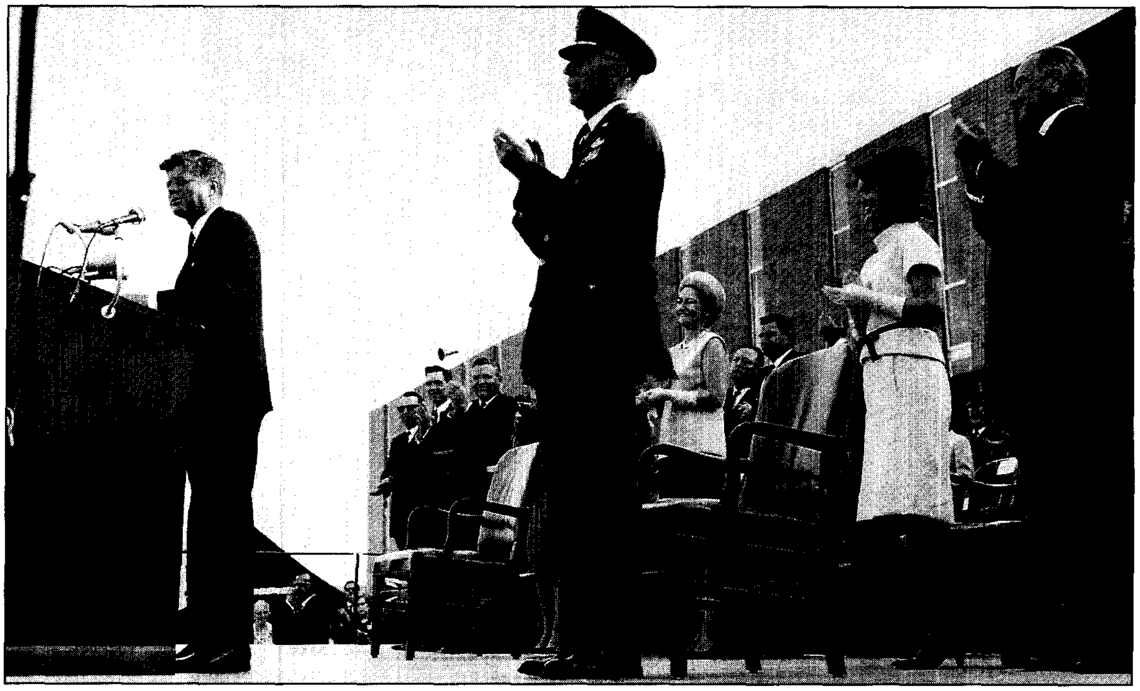
The first jet aircraft specifically designed for aeromedical evacuation entered into service on August 10, 1968. Since that time, the C-9A Nightingale has been the mainstay of peacetime aeromedical evacuation in the United States, the Pacific and European Theatres of Operation.

Long-range transport of patients in peacetime has been accomplished using the C-141 Starlifter, while the mainstay of wartime transport has been the C-130 Hercules.

Aeromedical evacuation is not just a wartime activity. During periods of peace, it is utilized to transport military personnel, dependents, retirees and Department of Defense personnel assigned overseas from small clinics/hospitals to large medical centers for extended and special care. Brooks Air Force Base was the hub of aeromedical evacuation in the 1950s and early 1960s.

Aeromedical evacuation also conducts humanitarian missions to transport individuals from anywhere in the world to medical centers offering specialized care. The recent transport of two severely-burned Russian teenagers from their homeland to Brooke Army Medical Center serves as a shining example of aeromedical evacuation's commitment to worldwide transport of the sick and injured, in times of peace, natural disaster or war.

The Space Years



President John F. Kennedy at the podium with M/General Theodore C. Bedwell, Lady Bird Johnson, Jackie Kennedy, and Vice President Lyndon B. Johnson.

On November 12, 1948, the first ever panel meeting to discuss medical problems of space flight was held at Brooks Air Force Base. The following year a Department of Space Medicine was created in the School of Aviation Medicine. It was the first advocated and was headed by Dr. Hubertus Strughold, "The Father of Space Medicine".

Progress in the space program depended on human subjects. Indeed, the first man to enter the space environment was the Russian, Yuri Gagarin, who launched into space on April 12, 1961. In the United States, the first manned space flights were those of the Mercury series. Many of the human subjects were Air Force basic trainees who volunteered for pressure chamber, isolation, and weightlessness studies.

One of the first was Airman Donald R. Farrell, a finance specialist stationed at Randolph AFB, Texas. In 1958, he volunteered to test the "space cabin simulator" that the School of Aviation Medicine had received in 1954. Although his seven-day stay in the tiny cabin seems tame today, at the time there were many unanswered questions, regarding the physical and psychological, on the effects of long-term isolation. The significance of the feat was highlighted by the fact that Lyndon B. Johnson, then Senate Majority Leader, was at Randolph AFB on February 16, 1958, to greet Airman Farrell when he emerged from the Chamber.

Consequently, there was a tradition of space research when the National Aeronautics and Space Administration (NASA) asked Brooks personnel to prepare a small life-support capsule for a Rhesus monkey (named Sam after the School of Aviation Medicine). In 1959, Sam, after being trained at Brooks to do simple tasks, was lofted into a research rocket, ejected in flight, and later recovered. The purpose of the flight was to test the escape system developed by NASA for the Mercury Astronauts. The success of this test and a following primate test confirmed the competence of Aerospace Medical Research at Brooks.

For four decades, the School of Aviation Medicine had focused its research, teaching, and clinical mission on the medical needs of the flier. Now it was proposed that the Center become the single agency for studies in the life sciences and aerospace medicine. Thus the Aerospace Medical Center became the Aerospace Medical Division in 1961, incorporating the USAF School of Aerospace Medicine (formerly the School of Aviation Medicine), much of the former Aerospace Medical Center and several other laboratories around the country. Brooks Air Force Base and its Aerospace Medical Division commanded virtually all Air Force facilities for aerospace medical research, development and testing; for postgraduate training of medical officers, nurses, and technicians in aerospace medicine and its related specialities; as well as for clinical diagnosis and treatment of fliers afflicted with disorders in these areas of medicine.

One of the most important events in the history of Brooks Air Force Base, and indeed the Aerospace Medical Division, was the visit of President and Mrs. John F. Kennedy on November 21, 1963. His speech that day focused the world's attention on the United States' commitment to put a man on the moon.

Kennedy Visit

November 21, 1963—The Texas air was crisp and clear at Brooks AFB as 12,000 people gathered to dedicate a new complex of buildings recently added to the USAF School of Aerospace Medicine. Tens of thousands lined the way from San Antonio International Airport, cheering as President John F. Kennedy made his way to Brooks to dedicate the new complex. His speech that day would be his last official act as President of the United States. Less than 24 hours later, he was killed by an assassin's bullets.

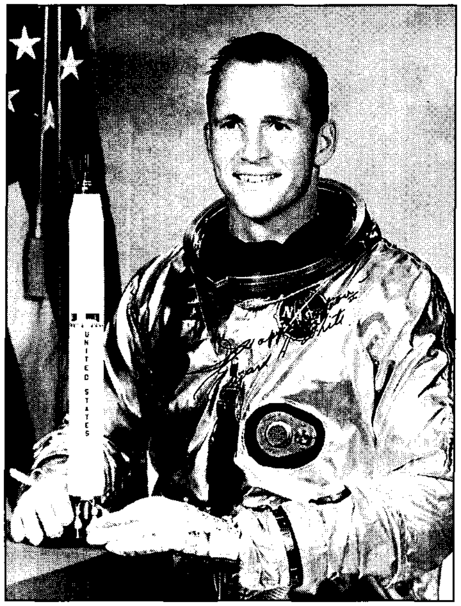
President Kennedy's address to the group gathered in front of the headquarters building of the Aerospace Medical Division was brief, but appropriately keyed to the business at hand - man's space effort. He praised the pioneers who manned the School of Aerospace Medicine and the Aeromedical Division, noting that these unsung heroes were making history every day.

In concluding his speech, Kennedy stressed the critical need to continue our space effort by quoting from Frank O'Connor, an Irish author. In one of his books, O'Connor tells how, as a boy, he and his friends would make their way across the countryside. When they came to an orchard wall that seemed too high for them to scale, they took off their caps and tossed them over the wall. Then they had no choice but to follow them up and over the top.

"This nation has tossed its cap over the wall of space—and we have no choice but to follow it...we will climb this wall with safety and with speed—and we shall then explore the wonders on the other side."

President and Mrs. Kennedy left for Fort Worth that afternoon. The next day, November 22, 1963, President Kennedy went to Dallas.

Edward H. WhiteII



Edward H. White II was born in San Antonio, Texas. His father, an Air Force general, took him aloft in an old T-8 trainer when Ed was 12. No one ever questioned that the boy would become a flier. He graduated from the U.S. Military Academy at West Point in 1952. He earned a Master of Science degree in Aeronautical Engineering from the University of Michigan in 1959. After attending the Air Force Test Pilot School at Edwards AFB, he was selected as an astronaut by NASA in September 1962.

His great moment came in 1965 when he was selected to pilot the Gemini 4 space mission, a four-day event that began on June 3. This space mission circumnavigated the earth 62 times.

During the third revolution, Ed White opened the hatch while his spacecraft was over the Indian Ocean. He stood in his seat and fired his "zip gun" thruster and became the first American to "walk" in space.

Returning to earth after the successful mission, White said: "I felt so good, I didn't know whether to hop, skip, jump, or walk on my hands."

Two years later, tragedy took the lives of astronauts Ed White, Roger Chaffee, and Gus Grissom. While preparing for a pre-launch Apollo I mission on January 27, 1967, an electrical spark ignited combustible materials in the pure-oxygen atmosphere of their cabin. The three perished in the fire.

Although space-related endeavors waned at Brooks in the 1970s, some projects continued. Studies were conducted on nuclear survivability, decompression, sustained accelerative forces, cardiographic and other medical data for NASA's space shuttle system, as well as for other space research.

In the early 1980s, Brooks began its Military Space Biotechnology program, using the space shuttle to conduct medical experiments in space. Researchers at Brooks explored the need for crew protection and performance enhancement for men in military space systems. An operating location was established at the Johnson Space Center in Houston to improve coordination with NASA.

Some of the first experiments involved tests in visual functions, since astronauts had noted both increased and decreased ability to see in space. The goal of the tests was to predict vision changes and develop methods to minimize decrements. Also in the 1980s, a short-arm centrifuge for space application was studied as a method to prevent the physiologic deconditioning of space caused by weightlessness. The current protective measures employed in the shuttle's extra-vehicular operations evolved directly from 20 years of joint studies by NASA and Brooks pesonnel on altitude decompression sickness.

Current work at Brooks attempts to develop medical protocols for treatment of exposure to the vacuum of space (ebullism). Beginning in 1991-92, all astronauts were trained for G exposure at Brooks. Additionally, a crew reentry anti-G-suit was developed at Brooks, as were oxygen toxicity studies.

Within a lifetime, the age of aviation was born and brought man to the moon. These achievements were possible with the support of aerospace medicine and the technology developed at Brooks AFB.

Vietnam & Force Modernization

The Vietnam War was an agonizing period in American history. America was not willing to use its full military potential to win the war and its continuation made it increasingly unpopular. American military advisors were already serving in Southeast Asia when the Aerospace Medical Division (AMD) was established at Brooks Air Force Base in 1961. They contributed to the war effort by sending medical teams and dental operating units to the conflict area. Although it might seem odd for a medical division, they were involved in the early development of the gunships used in Southeast Asia. The aircraft allowed the pilot to operate rapid-fire guns that pointed out the side of the aircraft. Research for the side-firing Gatling gun was accomplished at AMD's Aerospace Medical Research Laboratory (AMRL) in Dayton, Ohio. When the Seventh Air Force asked for additional body armor protection, they synthesized mission data and wound ballistics and worked with body armor technologists to develop a new flak jacket.

Air evacuation became another significant Brooks contribution. Researchers developed advanced equipment to treat patients aboard aircraft, including therapeutic oxygen systems that provided some humidity for patients with respiratory difficulties. Other inventions were digital electronic thermometers and electronic stethoscopes that could be heard over the noise of aircraft engines. The School of Aerospace Medicine (SAM) aided in the development of the Modular Air Transportable Hospitals. SAM personnel also worked with members of the Army and Navy to develop joint-service prisoner of war medical evaluation forms and procedures.

As the United States began disengagement from Vietnam, it was a time of budget cuts, the Arab oil embargo, inflation and military downsizing. Military money could only go to projects with clearly defined customers that addressed operation problems. Brooks' research was narrowed from theoretical to applied. Yet, the base and its mission grew with the addition of the USAF Occupational and Environmental Health Laboratory (USAFOEHL) in 1976. Over the years, USAFOEHL developed the capability to analyze chemicals in virtually any substance. It gave advice concerning the actions and reactions of chemicals and responded to the site of any accidents, including those with the potential for radiation leakage. Additionally, Brooks personnel helped the Air Force's B-1 program by developing its oxygen generating system. Missile systems were also undergoing modernization, and the technical workforce continued its support for the ICBM through its research into the toxicity of missile fuels and ways of detecting leaks before they could injure launch site personnel.

Technology Transition

The Aerospace Medical Division at Brooks Air Force Base was a single point manager for all human-centered activities for aircrew effectiveness. Over the years, they enlarged and incorporated those laboratories whose mission was also human-centered. Thus, Brooks embraced the missions of research, teaching, health care, training selection and medical support for crew effectiveness activities. In essence, this technical organization assumed the unique position of surveillance over the field of interest that the original Medical Research Laboratory of the Army Signal Corps established and maintained during World War I, and it would involve itself in the much more complex scientific community which had developed since World War II.

In the early 1980s AMD expanded its mission with the addition of a series of advanced engineering and development programs. Prior to this time, the division developed technology but did not control its programs past their basic research and exploratory development phases.

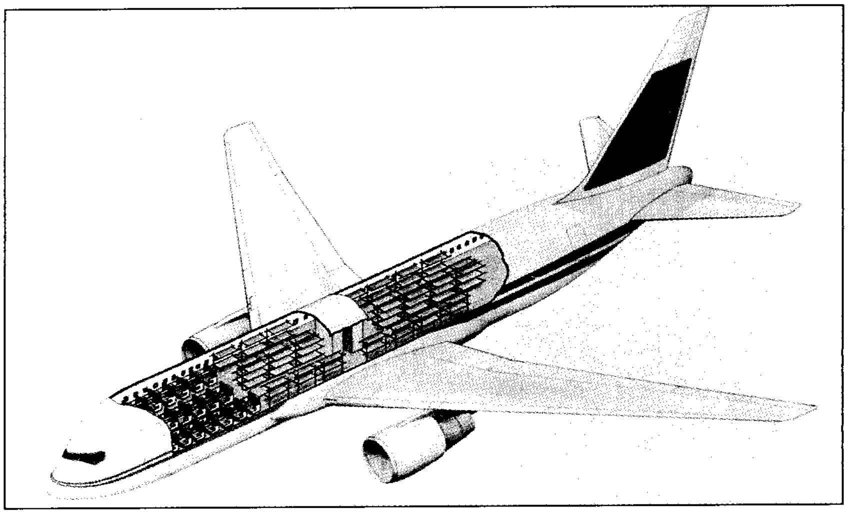
In addition, the AMD's role as the Air Force's human-centered advocate was strengthened with the assignment of the Air Force Human Resources Laboratory to Brooks in 1983. This Laboratory was the principle Air Force organization charged with the sciences and technology for choosing, preparing, and placing people at the heart of Air Force weapons systems and combat capability. Its mission maximized Air Force effectiveness through research and development to enhance the selection, classification, assignment, evaluation and effectiveness of training planning, design, delivery, evaluation, and management; and provided simulators and training devices to improve the effectiveness of aircrews and maintenance personnel.

The Laboratory was incorporated with the belief that the Air Force laboratories could more rapidly translate scientific discoveries and technical innovations into engineering solutions and weapons enhancement. The Aerospace Medical Division at Brooks Air Force Base became the free world's largest concentration of human, life and behavorial science personnel.

By the early 1980s there was a need to develop beyond exploratory research and provide the full spectrum for acquisition of human-centered technologies. Thus an Acquisition Office was developed to act as a bridge between laboratory technology and weapon systems production. By the end of the decade, acquisition mushroomed into 200-plus organizations responsible for advanced development, full-scale engineering development, and procurement of Life Support Systems, Chemical Warfare Defense Systems and other related systems.

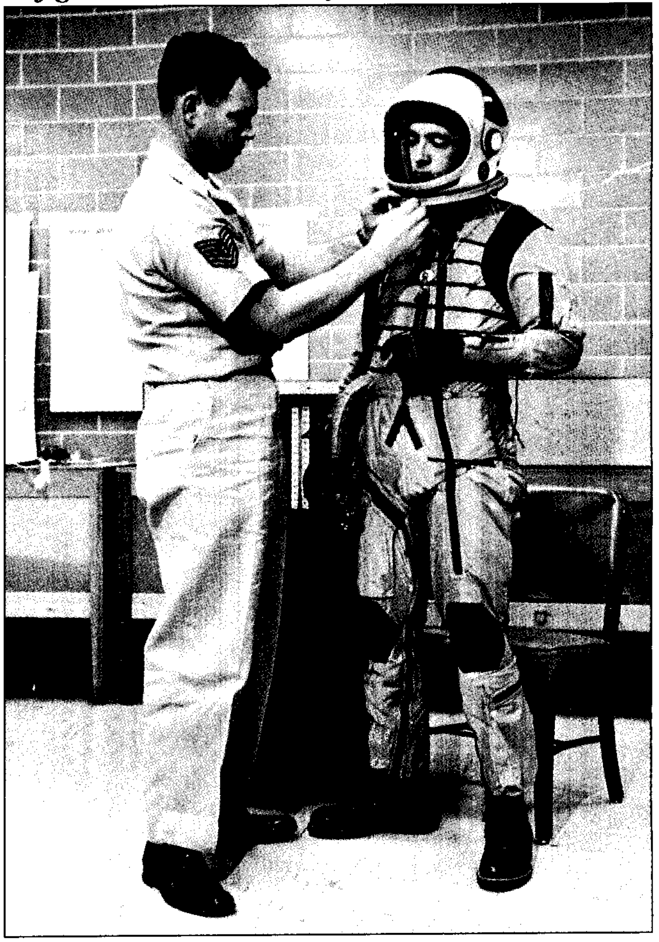
To emphasize the importance of its acquisition identity in meeting the human challenges of weapon systems development and operational support, the Aerospace Medical Division changed its name to the Human Systems Division (HSD) in 1987. The same logic was used to realign the program management for the Life Support System Program Office the following year. The System Program Office's realignment emphasized the importance of human systems advocacy, independent of weapons systems. It also gave the Human Systems Division at Brooks Air Force Base a new and significant status.

Systems Developed & Tested At Brooks



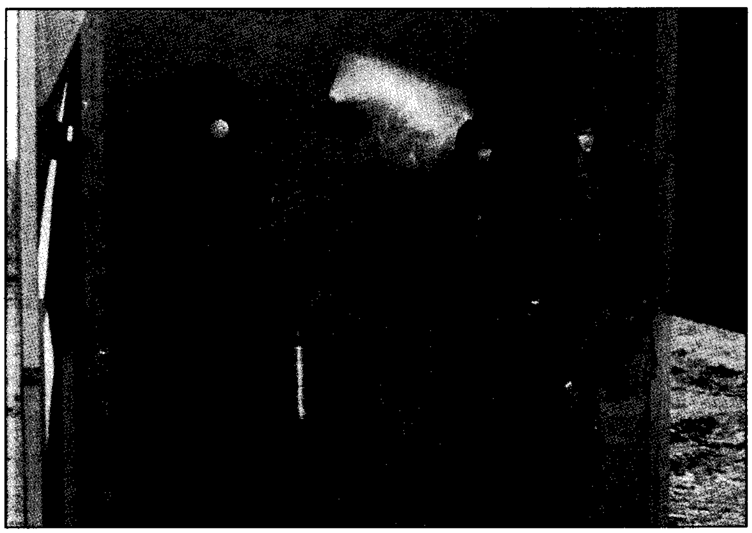
Civil Reserve Air Fleet - In times of war, civilian 767-200 or 767-300 aircraft would be configured as shown to carry wounded.

Early helmet-mounted Heads Up Display (HUD)



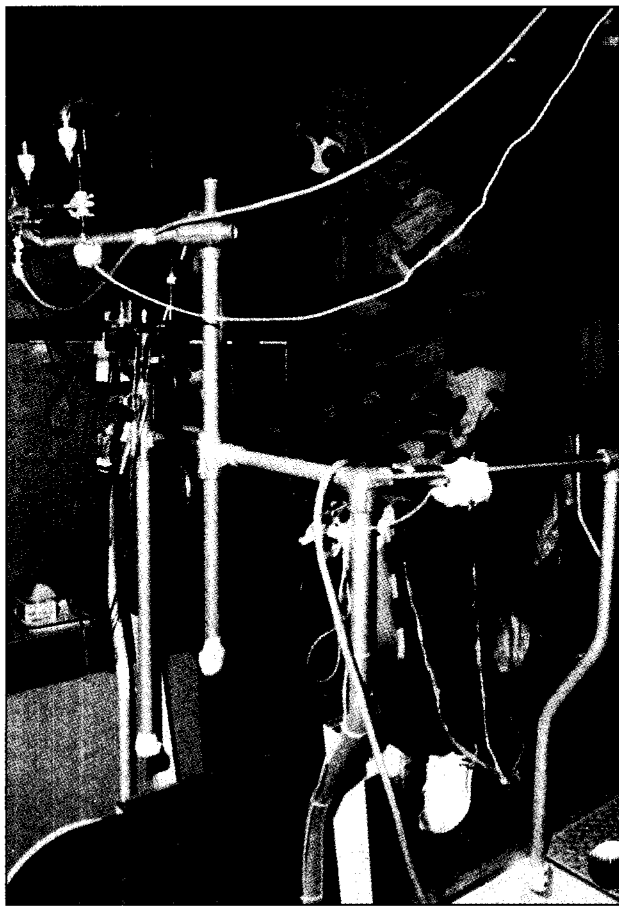
Early pressure suit developed at Brooks.

Barany Chair used in early aviation medicine to test pilots orientation ability.



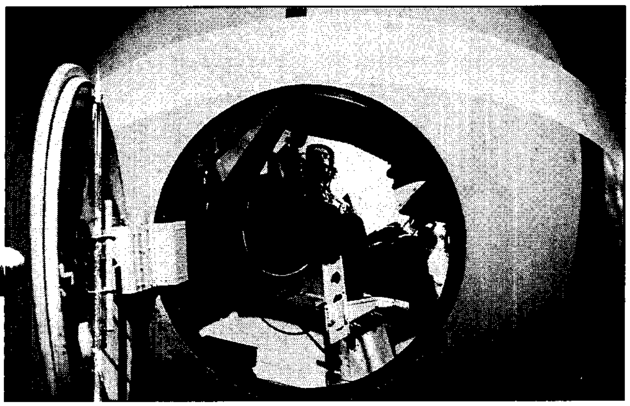
Chemical Defense Don-Doff Trials - testing how quickly you can put on and take off chemical defense gear when contaminated.

Laser Sight Designator



Thermal testing of Chemical Defense Gear

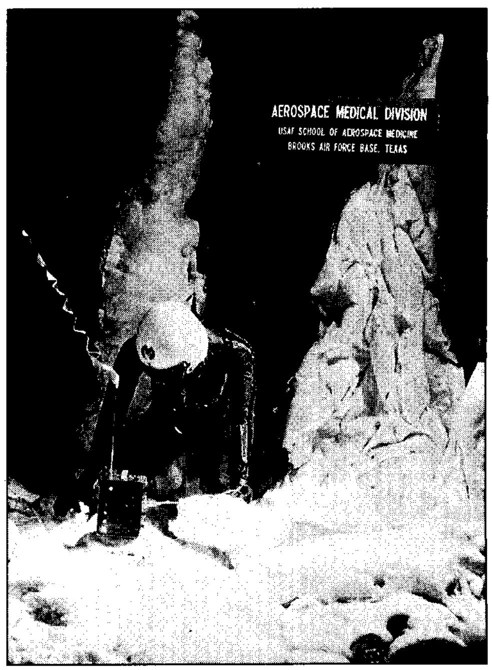
Combat Edge - Positive Pressure (Forced Air) Breathing Vest designed specifically for pilots of high performance aircraft.



Rotational Simulator used in early astronaut training. The simulator is on display in Hangar 9.

Tactical Aircraft Eye Respiratory System (TAERS)

Automatic/Self-deployed Water Survival Gear

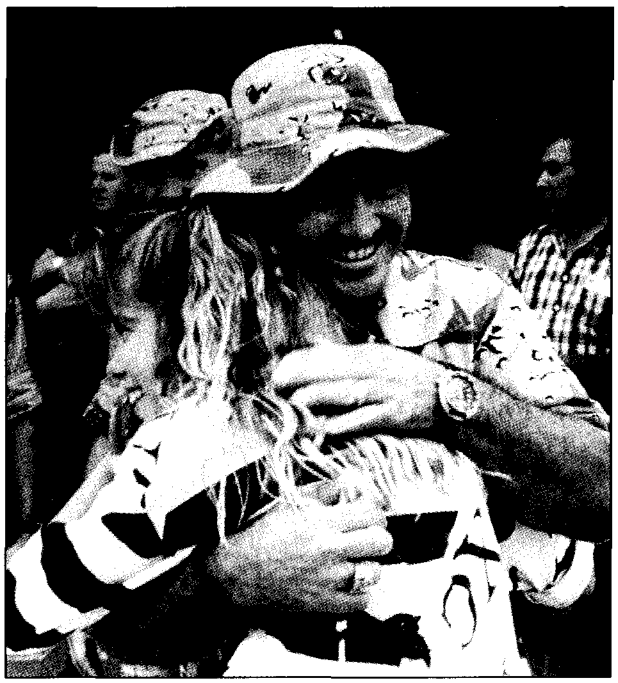


Cold Weather Survival Training

Consolidations, War&NewChallenges

The 1990s ushered in a whole new era. For several years the Department of Defense (DoD) had been looking for better, leaner, smarter and more cost-saving ways to do business. However, this process was intensified with the unexpected collapse of communism in Eastern Europe and the demise of the Russian empire. Americans expected a peace dividend, believing the size and cost of the DoD should be reduced. Ironically, as downsizing became the buzz word, Brooks Air Force Base grew – one of four Air Force Super Laboratories, the Armstrong Laboratory, was formed at Brooks. It incorporated four complete labs, the Air Force Human Resources Laboratory, the Air Force Drug Testing Laboratory, the Harry G. Armstrong Aerospace Medical Research Laboratory, and the Air Force Occupational and Environmental Health Laboratory, as well as the laboratory function of the USAF School of Aerospace Medicine.

The Air Force Center for Environmental Excellence (AFCEE) also was formed and located at Brooks. This organization has the monumental task of restoring closed installations to their original state and of ensuring that future installations are environmentally safe.



TSgt. Fred Bedson, team leader for the 6570 Security Police Team on deployment day in support of Desert Shield.

DesertShield/Storm

On August 2, 1990 troops from Iraq invaded neighboring Kuwait in an attempt to annex the oil-rich country. The United States and a coalition of 27 other countries sent in troops that eventually numbered 685,000. When diplomacy failed, action began on January 16, 1991. The war was over the following month, but not before the vast superiority of USAF technology was displayed to the world.

The Brooks war effort was expressed in several ways. A major Air Force goal during Desert Storm was to minimize noncombatant casualties. The U.S. Central Command asked the Human Systems Division to estimate the number of possible noncombatant casualties following attacks on certain military targets. Along with contractors, Brooks personnel developed a study of specific weapons, tactics, delivery platforms, rules of engagement and casualties.

USAFSAM's Department of Aerospace Nursing made significant contributions by recognizing the need for specific kinds of training prior to actual war involvement.

Brooks sent two groups of flight surgeons and one decontamination team to provide medical support in this Middle East conflict. Additionally, a full security police team was dispatched along with two personnel from the Occupational and Environmental Health Directorate of the Armstrong Laboratory.

Brooks was prepared to aid the war effort with a Multi-Man Intermittent Cooling System, various aspects of chemical warfare defense protection, laser eye protection, pilot fatigue studies and other related needs of personnel in combat.

Desert Storm gave the Air Force the opportunity to take technology off the shelf, rush it into production and provide for the immediate needs of troops in Saudi Arabia. The Air Force had a need, and the Brooks Air Force Base team responded.

KoritzMemorial

Koritz Memorial Garden is located at the entrance of building 180, Kilday Hall. The garden is dedicated to Major Thomas F. Koritz, Resident in Aerospace Medicine from 1987-1989. Major Koritz was killed in action near Basra, Iraq on January 17, 1992 while piloting an F-15E.

TheFuture

Consolidations continued in 1992 with the merging of the Air Force Systems command and the Air Force Logistics Command into a new organization called the Air Force Materiel Command (AFMC). As part of the new Command, the Human Systems Division at Brooks again changed its name to the Human Systems Center (HSC). Although the Air Force will be smaller, it will be flexible enough to respond, on short notice, to a wide range of regional crises and contingencies. According to AFMC's first commander, General Ronald W. Yates, "We are a new command with a new culture, stronger than ever, and postured to help Air Force war fighters deliver global reach, global power."

Without doubt, Brooks Air Force Base will remain an important part of that new culture, and as it has for the past 75 years, will continue to serve the needs of Air Force personnel worldwide. Brooks Air Force Base is looking to the future and is ready to meet all challenges.

Dayton Daily News

Volume 118
Number 271

Dayton Daily News (ISSN 0897-0920)
POSTMASTER: Send Address Changes to P.O. BOX 1287, Dayton, OH 45401.
Second-class Postage Paid at Dayton, OH 45401

Dayton, Ohio, Saturday, June 10, 1995

The First Cox Newspaper

50¢

AF goes to bat for Wright-Pat

By Tom Price
WASHINGTON BUREAU

WASHINGTON — In its latest defense of plans to consolidate activities in the Miami Valley, the Air Force describes the Dayton area as a "biomedical center of excellence" with "one of the Air Force's premier operational bases."

In documents given to the Defense Base Closure and Realignment Commission, the Air Force repeated its rejection of a Texas proposal that would keep the Human Systems Center, School of Aerospace Medicine and Armstrong Laboratory at Brooks Air Force Base near San Antonio.

The Air Force has proposed moving the facilities — involving about 2,500 jobs — to Wright-Patterson Air Force Base.

Adding to previously made financial arguments in favor of the move, the Air Force's latest rationale says Dayton is an excellent site for consolidating aviation science and technology.

An aide to Rep. Tony Hall, D-Dayton, called the documents "critical" to making the case for consolidation at Wright-Pat.

"The financial case was addressed by the computer runs," said Michael Gessel, Hall's chief aide for military matters. "What had not been addressed up to this point was the military value of the move, and military value is the principal criterion upon which the commission will base its decision."

The Air Force told the commission that Wright-Pat already is "the largest research, development and acquisition complex in the free world."

Wright State University is "the only civilian degree-granting institution for aerospace medicine in the country," the Air Force said.

Military medical research also would benefit from proximity to medical programs at Ohio State University, the University of Cincinnati, Kettering Medical Center's Cox Heart Institute, Hipple Cancer Research Center, the Wright-Pat and VA medical centers, Armstrong Laboratory activities already located at Wright-Pat and "numerous commercial laboratories specializing in research and development, medical and environmental testing and biomedical research," the Air Force said.

The documents indicate the the Air Force plans to fold t' acquisition functions of t Human Systems Center into Aeronautical Systems Ce' currently located at Wright-P

Wright-Pat would house a Human Systems Institute taining Armstrong Labc and the School of Aer Medicine. The base closu mission will make recor tions to the president b

WPAFB 13 June 95

Mr. Hill / - long-term savings w/ WP
- keystone - adds mil value

Keep open
- prepare to expand its mode

From LAB space? didn't see much at WP

outstanding elements of senior people
1) synchrotron

* BAFB - magnificent facilities -
duplicate near term facilities -

2 { Epidemiology LABS - built out cost → over 20 years → NPV better →

* consolidate in order to integrate →

GM15 → SES → work in SPO

radiation - R&D →
* man machine - interface
Wright Lab →

military value →

Brooks 80% in new facilities - just about to be occupied

* substantial deviation

Containment → Base left w/o infrastructure support / support 20 miles away

* synergy / team - Lee King

* Housing → at BAFB * good housing expanded

HSC
* MAN + MSC ...
* consolidated

— * Farrell's concerns

WP ~~II~~

* NPV → different WP for Customers *
[illegible] (7)

* Rome LAB number – customers

* real value → long-range savings

AF/gen Bluem

R&D, Acquisition AFMC →
– infrastructure conund in lean system –
what can we do w/ least impact on rest of AF

Man – machine
– important – work should be done together
– integrate scientists + engineers *

Gen Yates → move out of system command AFMC –
1980s
– BAFB (1) high [illegible]
(2) nuclear issue → [illegible]
(3) commands – acquisition (VS). other
– integrated system management ~
IWSM
people should understand weapon must be integrated [illegible]

made command

– integrated product teams [illegible]

international & congressional affairs

– ~~Dr. Mottler~~ Modern Aerospace Training

1

1 Signing
2 interruptions to research → contracting out
3

something unclear → why upfront at forward *

* engineers, technologists, medical people together

quality / value —

produce things people need

* There must be application

— more all personal — 20% to more → lucky

- all pop not moved [illegible]

- more closed staying in place
  - 20-25% will move

reduction of personnel

- numbers

* scientists + engineers *

- Mil Con
- accreditation → Bm
WP
Personnel

- Movement - committee secretary → will move →

- Mr - making [illegible] -

To achieve preeminence through piloted flight simulation for the purpose of integrating and assessing advanced aerospace technologies and systems in realistic mission environments...

Traditionally, the Branch has analyzed and tested flight control systems. Although these programs have continued, the emphasis now is in bringing together many advanced technologies and exploring their interactions, effects, and synergism. Complete aircraft systems are simulated in realistic battle environments providing the means by which weapon system strengthes and weaknesses can be evaluated under realistic mission conditions.

Simulating multiple-pilot, multiple-aircraft scenarios in real-time involves a geometric increase in complexity over traditional single aircraft simulations. Integrating multiple aircraft into a single realistic mission simulation requires monitoring the relative positions of each airplane and the bullets and missiles they fire, as well as providing visual displays so that every player in the engagement has a point of reference from which to assess his situation.

The MS-1 and LAMARS simulators utilize an over-the-shoulder video camera to record the pilots' movements and reactions.

...Develop and maintain a modern simulation facility capable of simulating realistic air/land battle engagements...

In response to the need to simulate full mission scenarios, a complete Tactical Mission Simulation (TMS) capability is being implemented. The cornerstone of this new capability is Mission Simulator One (MS-1). Within its 40 foot projection sphere, the MS-1 provides a high-fidelity visual environment for air-to-air combat simulations. Modifications to the Large Amplitude Multi-Mode Aerospace Research Simulator (LAMARS) enable it to perform as a secondary TMS cockpit in addition to its primary role as an aircraft flying qualities simulator. Completing the TMS capability are Manned Combat Stations (MCS). These simplified flying stations allow more pilots to participate in air combat scenarios without the expense of additional high-fidelity simulators. Tieing all TMS cockpits together is a network of high-speed digital computers necessary to create realistic, assessable air combat simulations.

Rounding out the facilities are the special-purpose sub-systems which control sight, sound and motion effects and provide feedback from the pilot's controls. Computer generated graphics systems provide scene generation for out-the-window views and in-cockpit instrumentation.

The LAMARS' large amplitude motion capabilities provide vital pilot cueing, essential in aircraft flying qualities research.

...Perform multi-disciplinary technology programs in conjunction with outside organizations...

Facilitating the transfer of technology from the laboratory to the field is one of the objectives of the Branch. Examples include simulation support for advanced development programs on fighter aircraft such as the X-29 and the Short Take-Off and Landing Maneuver Technology Demonstrator (STOL/MTD) version of the F-15. In addition to accommodating technology transfer, information gathered from research projects such as these can then be applied in other flight technology programs.

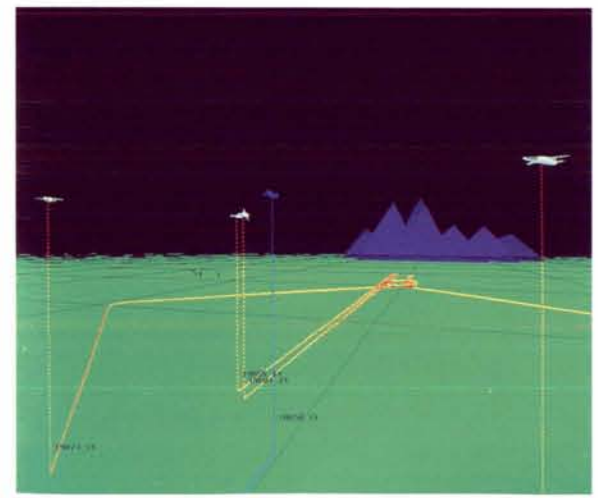
The Branch also pursues advancement in military flight technology by providing simulation support for Advanced Development Program Office (ADPO) studies such as the Integrated Control and Avionics for Air Superiority (ICAAS) program. In this multi-disciplinary effort, electronic and aerospace engineers, technicians, computer systems analysts, and simulation programmers from the Branch work together to provide a simulated air combat environment in which the flight and attack management avionics systems and the pilot-vehicle interface can be effectively evaluated.

The Branch utilizes specially modified aircraft to perform in-flight simulation. In-flight simulation allows the characteristics of new aircraft control system designs to be evaluated under actual flight conditions. The Branch's in-flight simulator aircraft, the NT-33A and NC-131H, have contributed to the development of new aircraft such as the B-1 and B-2 bombers, the space shuttle, F-15, F-16, and Advanced Tactical Fighter (ATF) aircraft. The Variable Stability In-flight Simulator Test Aircraft (VISTA), an NF-16D aircraft, is being developed as a new high-performance in-flight simulator.

The VISTA aircraft currently being developed, will be operated under Branch management.

...Conceive and conduct in-house research and development that advances the state-of-the-art in flight simulation, technology integration, and other flight vehicle areas of focus.

By combining past development efforts with newer programs, the Branch is continually advancing engineering flight simulation technology. Advancements are made each time a new simulation program calls for innovative solutions. This might include the need to create a generic cockpit capable of performing the role of several different airplanes, or a programmable, modular aircraft sound effects system with the flexibility to be quickly reconfigured to support different aircraft systems, or an advanced simulation computer interconnect capability that allows more data per unit-time to be processed and distributed throughout the simulation. Whatever the application, these one-of-a-kind requirements prompt solutions and systems which are themselves advancements in the art of simulation.



The test director's console is prepared so he can see the simulation unfold in real-time from an electronic "God's-eye view."

For more information, contact Chief,
Control Integration and Assessment Branch,
WRDC/FIGD, Wright-Patterson AFB,
Ohio 45433-6553, 513-255-5474

Future Branch programs may include simulation support for the Multi-System Integrated Control (MuSIC) program in which propulsion control, attitude control, and weapon delivery systems are integrated into a total weapon system for assessment. A new flying qualities assessment program, Post Stall Combat Air Maneuvering (PSCAM), will look into the effectiveness of missile launches at extremely high angles of attack. Future projects may also include research and development work for ground launched orbit-and-return single stage vehicles such as the National Aerospace Plane and Special Operations Force vehicles. The Vision of the Branch will remain constant. Only the technological components will change to incorporate advancements in flight and battle technology.

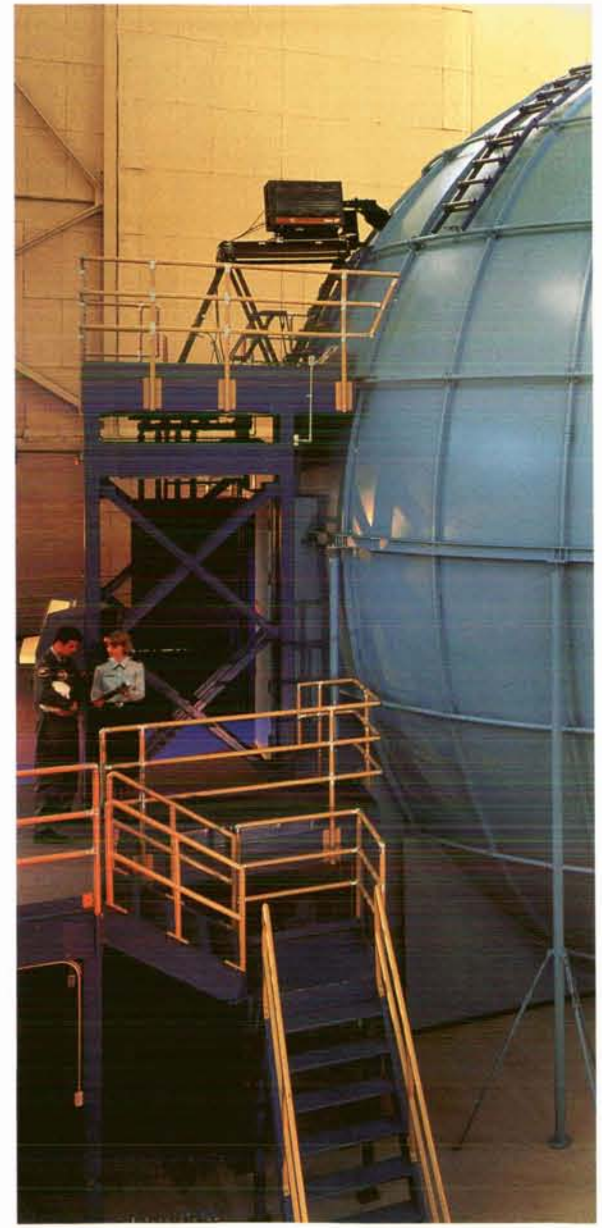
Engineering Flight Simulation

The Control Integration and Assessment Branch

The Control Integration and Assessment Branch is one of four branches of the Flight Control Division of the Flight Dynamics Laboratory. The Flight Dynamics Laboratory is one of five laboratories and four directorates comprising the Wright Research and Development Center. Dedicated to the advancement and transfer of technology for military application, the Branch uses ground-based and in-flight aircraft simulations for integrating and assessing aerospace technologies. Through simulation runs and post-simulation data analysis, the optimum combination of integrated technologies can be determined.

Ground-based simulations provide opportunities to safely and securely gather data that will increase aircraft performance, survivability, and strike effectiveness. Because these are simulations and not "real life" events, participants are not at risk. Neither is classified technology at risk of being compomised. These simulations have an additional benefit in that they neither create a negative impact on the environment nor do they consume unrenewable resources. In short, ground-based simulations amass much needed information while using cost effective and environmentally responsible methods.

For testing in which ground-based simulations cannot provide the level of detail and realism necessary for the evaluation of specific aircraft flying qualities or control system responses, specially modified aircraft known as in-flight simulators are used. These in-flight simulators provide information necessary to enhance the flying qualities of existing aircraft as well as demonstrate control system viability for future designs.



The Mission Simulator One (MS-1) furnishes the primary tactical mission simulation environment for programs such as the Integrated Control and Avionics for Air Superiority (ICAAS) technology development program.