NSP 62-20 REV 1 • 28 DEC 62

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REQUIREMENTS FOR STAGE STATIC TEST FACILITIES NRDS, NEVADA

Prepared Under Contract No. NAS 8-5600

Lockheed

MISSILES & SPACE COMPANY

A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION
SUNNYVALE, CALIFORNIA

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Approved

A. J. STEELE, Director
NSPD Engineering

M. C. Williams for

R. SMELT
Vice President & General Manager
Nuclear Space Programs Division

MASTER

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FOREWORD

This document is the first part of LMSC facility requirements for the NRDS Stage Static Test Facilities. It includes requirements for the Test Control Center and its associated access tunnels, Engine/Vehicle Test Stand No. 3 (the first of three test stands), and a Termination Area.

The second part of the requirements for the NRDS Stage Static Test Facilities is in the document entitled PRELIMINARY SERVICE SYSTEM REQUIREMENTS FOR THE NRDS VEHICLE TEST STANDS, NSP-62-18-Rev 1, dated 1 December 1962.

Hereafter, in this document, the Test Control Center is referred to as TCC, Engine/Vehicle Test Stand No. 3 as E/VTS-3, and Vehicle Test Stands No. 4 and No. 5 as VTS-4 and VTS-5. When the three stands are discussed in the collective sense, they are referred to as VTS.

The TCC shall be constructed to serve all three test stands, beginning with E/VTS-3 and following with VTS-4 and VTS-5 in the future.

The intent of this document is to provide data that will enable an Architect-Engineer to begin design of the Stage Static Test Facilities. More definitive design requirements will be furnished as the Program develops.

NSP-62-20 was initially submitted on 15 October 1962 in accordance with the requirement of Item 7 of Report 253 in RIFT DATA SUBMITTAL DOCUMENT, NSP-62-22, dated September 1962. This revision is in accordance with the updating requirements of Report 253.

In this document, the following words are used in the accompanying connotations:

Shall. Shall is used to express a definite, binding requirement.

Will. Will is used to express a declaration of purpose, choice, or intention.

Should. Should, would, and could express a recommendation or method of accomplishment.

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Section 1
GENERAL REQUIREMENTS

1.1 FACILITY FUNCTION

The primary function of the Stage Static Test Facilities is the captive test-firing of the integrated RIFT Stage. The first increment to these facilities shall consist of the Test Control Center and its associated access tunnels, Engine/Vehicle Test Stand No. 3, and a Termination Area adjacent to E/VTS-3. The second increment will include VTS-4, VTS-5, Termination Areas, associated tunnels, and additional service systems. All of the remaining facilities operated by LMSC at NRDS serve in support of the testing operation. The Stage Static Test Facilities shall be designed specifically to permit the following functions to be performed in support of RIFT nuclear-stage development:

- To direct and monitor Stage Transporter activities within the E/VTS-3 boundary fence
- To retract the test-pit cover remotely upon command of the stage transporter operator to TCC
- To receive the RIFT Stage with or without the NERVA Engine from the transporter
- To make umbilical connections remotely with stage held in firing position on the test stand
- To lift the stage and close the pit cover remotely for engine inspection. This operation is performed with only the electrical/electronic umbilical connections made

- To perform all fluid-flow (liquid and gas) operations as required; i.e., filling, emptying, cooling, purging, and venting
- To direct, control, and monitor all cold-flow, prefiring, static firing, and postfiring tests of the RIFT Stage and Instrument Unit
- To attenuate emitted nuclear radiation to provide in-flight nuclear-radiation simulation
- To perform signal amplification as required
- To terminate landline circuits originating at E/VTS-3 and landline circuits running from the Termination Room to the TCC
- To record and review test data
- To perform decontamination operations as required in order to ready the test stand for the next firing
- To perform minor maintenance and repair of electronic equipment at TCC.
- To serve as the training site for launch personnel

1.2 STAGE DESCRIPTION

The RIFT nuclear stage shall have the general configuration and dimensions shown in Fig. 1-1. The E/VTS shall be designed to permit handling of the stage, and all areas shall be sized according to the function described for that area. Dimensions shown on Fig. 1-1 are preliminary. More definitive information will be provided at a later date when stage design becomes firm.

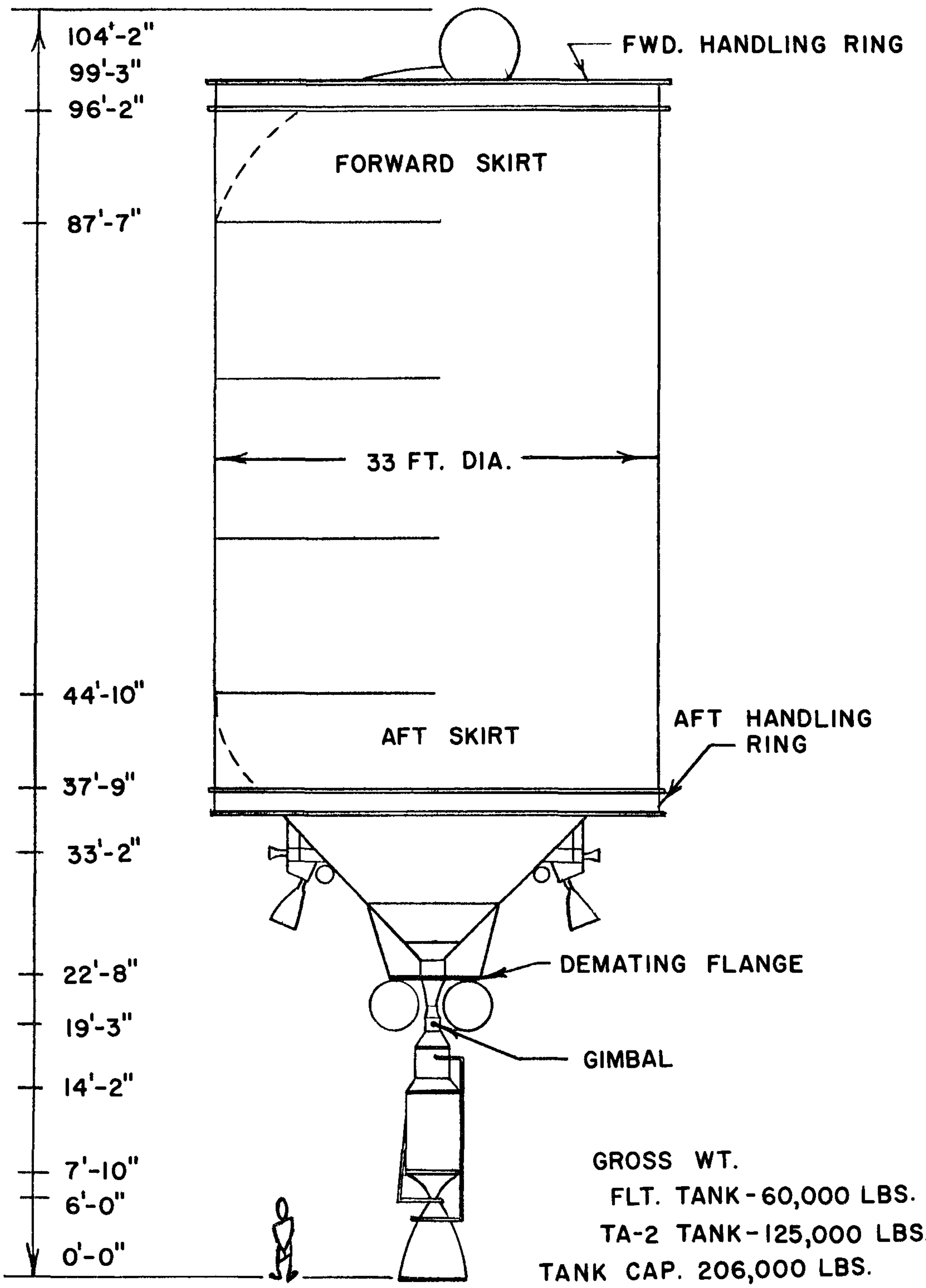

Fig. 1-1 RIFT Stage

1.3 NUCLEAR ENVIRONMENT

The RIFT Static Test Facility shall be so sited that Engine Test Facility operations do not restrict RIFT operations. In addition, RIFT facilities siting shall be accomplished in such a manner as to provide maximum utilization under normal operating conditions and reasonable utilization under abnormal operating conditions. For the purpose of definition in this specification, abnormal operating conditions are conditions involving source handling accidents and nuclear incidents. Handling accidents referred to herein are defined as those accidents involving an unshielded radioactive stage or engine, but which do not involve an excursion or criticality, (e.g., derailment or malfunction of the NERVA EIV Transporter or the RIFT Vehicle Transpoerter). Nuclear incidents are defined as incidents involving an excursion or accidental criticality. For all nuclear considerations and hazards, the 3.5 NERVA engine with 40-minute full-power runs shall apply.

1.3.1 VTS Siting and Shielding Requirements

1.3.1.1 E/VTS-3 and ETS-1 siting requirements. Three vehicle test stands will be utilized: E/VTS-3, VTS-4, and VTS-5. These stands shall be located generally on a line with ETS-1 and approximately normal to the prevailing winds of the area. E/VTS-3 shall be located to the west of ETS-1 at a distance sufficent to permit preparation for RIFT Stage tests to proceed without interruption from testing on ETS-1.

E/VTS-3 shall be sited in relation to ETS-1 to satisfy the following operational requirements:

- Unshielded personnel working aboveground on E/VTS-3 shall not be subjected to a radiation dose rate exceeding 10 mrem/hr from all sources during normal ETS-1 test operations.
- Upon the occurrence of a handling accident (e.g., EIV derailment or malfunction while handling a recently fired 3.5 NERVA engine) within the engine test complex, unshielded personnel working on E/VTS-3 shall not be exposed to a radiation dose rate exceeding 10 mrem/hr from all sources.
- RIFT personnel shall be able to occupy E/VTS-3 sixteen hours after the occurrence of a maximum credible nuclear accident on ETS-1. Under these conditions, the aboveground dose rate from the ETS-1 incident shall not exceed a dose rate at E/VTS-3 that would constitute an overexposure based on a 40-hour work week. (A maximum permissible whole-body exposure of 100 mrem from all sources for that week.)
- Upon the occurrence of a maximum credible nuclear incident at ETS-1 or at the closest point to E/VTS-3 within the ETS complex, unshielded RIFT personnel working aboveground on any of the Vehicle Test Stands at the time of the incident shall not be subjected to a total-body exposure exceeding 300 mrem from all sources as a result of the incident. This exposure value assumes personnel evacuation within one-half hour. Inadvertent cloud passage over E/VTS-3 shall require earlier removal of personnel to the test stand tunnel followed by evacuation.

Of the above-listed requirements, the A-E shall select the most stringent requirement in siting E/VTS-3 relative to ETS-1.

1.3.1.2 E/VTS-3, VTS-4, and VTS-5 siting requirements. At a specific point in the testing schedule, all three Vehicle Test Stands will contain a test stage in one phase or another of the testing program because of the pace of planned test operations. Therefore, it shall be required that preparation on one Vehicle Test Stand shall not be seriously hampered by normal or abnormal activities or incidents on adjacent test stands.

Personnel will be evacuated from all Vehicle Test Stands during the following operations:

- Full systems checkout of an integrated stage containing a fueled nuclear engine
- Transport or handling of a stage containing a fueled nuclear engine (with poison wires prior to test and without poison wires post-test)
- Test run of the full nuclear stage

All vehicle test stands shall be sited, relative to one another, to satisfy the following operational requirements:

- Occupation of E/VTS-3, VTS-4, or VTS-5 shall be required sixteen hours after a 3.5 NERVA engine 40-minute full-power test run on an adjacent vehicle test stand. Personnel exposure at this time shall not exceed a rate that would constitute an overexposure based on a 40-hour work week. (A maximum permissible whole-body dose of 100 mrem from all sources.)

- Occupation of a remaining vehicle test stand shall be required under the above conditions with the added nuclear parameter of a tested stage installed on each of the other two stands. Test firings will be a minimum of one week apart. This applies most critically to the center vehicle test stand with a stage on each of the outboard test stands.
- Occupation of any vehicle test stand shall be required 16 hours after the occurrence of a maximum credible nuclear incident on one of the other vehicle test stands or the transporter roadway. Personnel exposure under these conditions shall not exceed an integrated whole-body dose of 300 mrem from all sources based on a 40-hour work week.
- Unshielded RIFT personnel working aboveground on a vehicle test stand shall not receive a total whole-body dose in excess of 1700 mrem from all sources should a maximum credible nuclear incident occur on an adjacent stand.

1.3.1.3 <u>E/VTS-3 shielding requirements.</u> A primary requirement of the vehicle captive test program is the simulation of the in-flight nuclear-radiation environment at the stage propellant-tank bottom. To meet this requirement, the Engine/Vehicle Test Stands shall be designed to minimize perturbation of the radiation field. This requires that neutron and gamma radiation shields be located in the test pit adjacent to the reactor. It is required that the configuration of these radiation shields shall provide a captive test nuclear environment approximately equal to the in-flight nuclear environment. Consideration shall be given to the elastic and inelastic scattering of neutrons, scattering of gamma rays, and neutron-capture reactions for the materials used in the test pit and the shields. In addition, heat-generation rates shall be determined to provide the required cooling for the shields or shield materials and the test-pit liner.

The inside diameter of the shields shall be sized to allow the engine to gimbal $\pm 1.0^{\circ}$.

To facilitate shield design, the architect-engineer will be furnished a detailed inboard profile of the RIFT nuclear stage at an early date.

The test stand and umbilical tower shall be designed to permit RIFT personnel to occupy these structures and work in the immediate vicinity 48 hours after shutdown, provided the 3.5 NERVA engine assumed to have been operated at full power for 40 minutes has been removed. An additional assumption is that the test stand has been used earlier at one-week intervals for like captive tests. Personnel engaged in such work shall not be subjected to a dose rate that would exceed a whole-body dose of 100 mrem from all sources for a 40-hour work week to accomplish this requirement. To aid in attaining an acceptable dose rate, a reinforced dense-concrete cover shall be provided to cover the top of the radiation shield, as discussed in Section 2.1.1.

An additional requirement for the Vehicle Test Stands shall be access to areas in the umbilical tower to permit certain equipment adjustments. Shielding shall be required for the umbilical tower to permit the following operations:

- Occupation of the first floor of the umbilical tower will be required, in event of certain equipment malfunctions, for a 2-hour period approximately 1 hour after shutdown of a 3.5 NERVA engine full-power 40-minute run. Personnel performing this operation shall not be exposed to a dose rate exceeding 50 mrem/hr from all sources.
- Occupation of the umbilical platform will be required, in the event of an umbilical malfunction, for a 2-hour period at the time of removal of the stage from the test stand approximately 24 hours after engine shutdown. Personnel performing this operation shall not be exposed to a dose rate exceeding 50 mrem/hr from all sources.

1.3.2 TCC Siting and Shielding Requirements

The TCC shall be sited in relation to the VTS to provide as symmetrical a configuration as is feasible to minimize lengths of cable and utility lines as well as access-tunnel lengths. However, this requirement is secondary to radiation-shielding criteria and consideration of the features of the terrain.

Personnel assigned to the TCC will be involved in either test preparation or testing. Therefore, radiation exposure for these personnel shall be limited to a level as low as economic considerations permit. Since it is desirable to locate the Test Control Center in an area close to the Vehicle Test Stands, the facility should be located underground. The structure, including access tunnel, shall be designed to satisfy the following operational requirements:

- Radiation dose rates within the TCC shall not exceed 7.5 mrem/hr under any situation occurring from normal captive-test operations involving 3.5 NERVA engines fired on 40-minute runs.
- The dose rate at the access-tunnel entrance shall not exceed 200 mrem/hr from all sources 1-hour after a normal 3.5 NERVA engine 40-minute run.
- In case of a maximum credible nuclear incident on any VTS or its transporter roadway, personnel remaining in the TCC shall not be subjected to a total-body dose exceeding 700 mrem from all sources in a 10-hour period following the incident.
- In the case of a maximum credible nuclear incident on any VTS or its transporter roadway, the radiation dose rate at the access-tunnel entrance shall not exceed 2000 mrem/hr from all sources 10 hours after occurrence.
- The radiation dose rate inside the TCC from all sources, including two 3.5 NERVA engines (40-minute runs) fired one week apart on any two stands, shall not exceed 2.5 mrem/hr, immediately after shutdown of the second test.

Of the above-listed requirements, the A-E shall select the most stringent for consideration of the nuclear design parameters in the siting and design of the TCC and access tunnels.

1.4 OPERATIONS

The Stage Static Test Facilities will conduct all testing operations for the RIFT Stage. The following paragraphs present the operational requirements which serve as a basis for facility design.

1.4.1 Operational Plan

When the NRDS On-Site Transporter enters the boundary fence of E/VTS-3, the TCC will assume responsibility from the SAM Building for monitoring transporter activities.

The TCC will be the program-control point from which all cold-soak, prefiring, captive-test firing, and postfiring tests of the RIFT Stage will be directed, controlled, and monitored.

Just prior to the arrival of the on-site transporter carrying the stage, the pit cover of E/VTS-3 will be retracted remotely by the TCC. The pit cover not only provides shielding capability but also serves to reduce deterioration of the stage seating ring by weather.

Upon arrival at E/VTS-3, the on-site transporter operators position and lock the transporter over the test pit. The RIFT Stage is then lowered onto the the seating ring of the stage-support structure within a tolerance of ±0.5 inches with respect to the vertical centerline.

All umbilical connections are made except for the large liquid-hydrogen propellant feed and vent connections. This operation consists of making the connections for the forward, or upper, umbilical level and the aft, or lower, level. In the event that it is necessary to make a final visual engine inspection, the transporter can raise the stage and lower it back into position. This operation is made possible by providing the required additional length of umbilical cabling and flexible piping.

After connecting the LH_2 fill and the vent umbilicals, stage-tank purging operations are begun. Then continuous gaseous nitrogen (GN_2) purge is introduced into the area between the stage skirt and the cone-bottom to insure that gaseous hydrogen does not accumulate. At the same time, the outer circumference of the stage aft handling ring is purged continuously with GN_2 to prevent air from entering into the skirt area. A soft seal or gasket made of a durable radiation-resistant material, such as polyurethane, will also be used to seal the aft-handling-ring seating face.

When purging is complete, the stage is ready for the prefiring test operation as described in Section 1.4.2. The transporter stands by in position during these tests. In the event of a malfunction, the stage can be returned immediately to the SAM Building. If the prefiring tests are successful, the transporter withdraws.

The stage is now filled with LH_2 and the captive test firing program commences (refer to Section 1.4.2 for a description of this operation). After the test is completed, the reactor is shut down and the cooldown period begins. Postfiring tests are conducted during cooldown and are listed in Section 1.4.2. The cooldown period requires a minimum of 48 hours. The reactor core is cooled with gaseous hydrogen, helium, nitrogen, and air in that order.

The return of the transporter is timed to coincide with the end of the 48-hour cooldown period. All umbilical connections, including the cooling connections, are disconnected. The transporter lifts the stage and withdraws to the Demating Facility. Portable air blowers mounted on the transporter continue to provide cooling to the reactor core.

The test pit is now covered and decontamination operations begin, as described in Section 1.7.5. All equipment in the TCC and E/VTS-3 is then readied for the next test.

1.4.2 Test Operations

The VTS, in conjunction with the TCC, must be capable of performing the following tests in support of RIFT nuclear stage development:

- Cold-soak tests on incoming stage (less engine)
- Prefiring tests
- Static-firing tests
- Postfiring tests

The accomplishment of the above tests will require provision for the following:

a. For cold-soak tests on stage less engine

   (1) Cold soak. After purging, fill stage with LH_2 to check for possible damage of insulation during shipment

(2) Check cryogenics systems, electrical systems, and subsystems

b. For prefiring tests

(1) Functional check of components, subsystems, and systems including: electrical, cryogenics, communications, propulsion, guidance (fault isolation to replaceable-module level)

(2) Checkout of stage data acquisition including data-channel calibration

(3) Checkout of stage control and monitoring

(4) Checkout of test-stand data acquisition

(5) Checkout of test-stand control and monitoring

(6) Checkout of instrument unit, control, and data acquisition

(7) Check of ground handling equipment operation, direction, and monitoring

c. For captive-firing tests (These tests must be performed with the SN Stage in a radiation environment as near as possible to in-flight radiation environment.)

(1) Control and monitoring of engine-stage GSE, and facilities

(2) Data acquisition and recording of data derived from stage and GSE, and facilities

(3) Display of facility-wide radiation safety

(4) Display of wind direction and velocity

(5) Monitoring of nuclear criticality

(6) Monitoring of acoustics

(7) Coverage, photographic and video

d. For postfiring tests

(1) Checkout and calibration of data instrumentation

(2) Combined systems and simulated countdown tests

(3) Data acquisition for component subsystems and system performance

No automatic data-reducing equipment will be located at the TCC. This function will be centralized at the SAM Building. All radiated telemetry data from any stage will be received at the SAM Building and, if required, will be transmitted to the TCC by coaxial cable. Refer to NSP-62-3, Section 6 for additional information.

1.4.3 Personnel Headcount

To accomplish the TCC and VTS functional responsibilities, the following levels of manpower are estimated. These figures are based on a three-VTS operation and reflect levels of personnel permanently assigned, present during tests, and present at peak loading.

Manpower Situation	Supervisory Types (LMSC, NSPD, AGC, WANL, MSFC)	Clerical	Engineers	Leadmen in TCC	Leadmen for VTS & Service Area	Technicians in TCC	Technicians for VTS & Service Area	Nontechnical	Grand Total
Total Permanently Assigned to TCC	6	3	19	4	7	27	30	-	96 (TCC -59) (VTS -37)
Total During Test in TCC	41	-	30	4	7	17	8	3	110 (TCC)
Total Peak Manning (Nontest)	12	5	36	4	9	27	34	2	129 (TCC -86) (VTS -43)

1.4.4 Personnel Flow

All personnel shall be able to approach, enter, and leave the TCC under all normal operating conditions with the following exceptions:

- During a test firing
- Immediately after a test firing (refer to Section 1.3.2)
- During stage movement
- When an excursion has occurred raising radiation levels at or near the entrance or in the access tunnel above LMSC acceptable limits (refer to Section 1.3.2)

Normal personnel entrance and exit to the TCC and the VTS shall be through the operational entrance of the TCC. When requirements dictate, entry will be made at the access-tunnel entrance. Personnel entering the TCC area will check in at the health physics room prior to work at the VTS. Health Physics will advise personnel of radioactivity levels within the TCC, access tunnels, VTS, and surrounding areas. Special precautionary instructions, area work permits, and dosimeters will be issued by Health Physics personnel as required.

Before leaving the TCC or VTS, personnel will check in at the health physics room and return work permits and dosimeters.

Emergency exits shall be provided for rapid personnel evacuation in the event of fire, excessive radiation levels in the TCC, or earthquake damage to normal exits. An emergency stairway shall be provided in the Termination

Room of E/VTS-3. Emergency escape hatches shall be provided in the TCC and the access tunnel, and shall be designed to maintain radiation protection of the underground structure. The umbilical tower shall have an emergency caged ladder from the lower level to the elevator penthouse; a grade-level exit shall also be provided at the tower. The Manager of Captive Test Operations in the TCC or his delegated supervisor shall have the sole responsibility of determining when the below-grade emergency exits shall be used. The order for emergency evacuation shall be given on the public address system.

1.5 ARCHITECTURAI AND STRUCTURAL

Details of the architectural and structural features of the Stage Static Test Facility are found in Sections 2, 3, and 4 of this document. The following paragraphs present more generalized architectural and structural features of the facility.

1.5.1 Building and Materials Concept

Materials of construction at E/VTS-3 for the stage support structure and the exhaust substructure shall be selected on the basis of minimizing residual radiation considering the economic and safety aspects as presented in Section 1.3. Reinforced concrete design must minimize activation of the reinforcing steel. This may be accomplished, for example, by locating the reinforcing rods as far from the radiation source as is structurally feasible, or by using additional concrete buffer layers.

The umbilical tower shield wall shall provide sufficient shielding so that special structural materials need not be used for the umbilical tower and the Termination Area.

All structures shall be designed to withstand Zone 3 earthquake levels, and the design shall be in accordance with requirements of the nuclear environment established in Section 1.3.

The TCC shall be a single-story structure designed for underground operation with the access tunnel providing a means of ingress and egress for the building when radiation levels require its use after a test.

The TCC should be designed with a minimum number of columns in the interior areas, consistent with other factors, and consideration shall be given to establishing a column spacing that will allow flexibility in future movement of interior partitions and afford maximum usability of space.

The estimated TCC personnel headcounts reflected in Section 1.4.3 shall be utilized in sizing sanitary facilities and office requirements and be utilized for determining air-conditioning heat loads. The TCC shall be habitable for the maximum headcount for a period of 20 hours without undue discomfort.

1.5.2 Radiation Seals and Doorways

All air-conditioning ductwork, electrical conduits, instrumentation cables, piping, and bulkhead doorways entering or leaving the access tunnels or the TCC shall be designed to prevent infiltration of dust particles that could influence the radiation level of air in the TCC or access tunnels. This seal shall also help maintain a positive air pressure within the TCC.

1.5.3 Sound Control and Ceiling

The objective of the TCC is to provide a proper environment in which the stage and stand checkout and subsequent recording and communication of data can be accomplished efficiently. Noise levels shall not exceed 40 db during normal personnel occupancy and checkout equipment utilization.

1.5.4 Floors and Walls

The floors of the Stage Static Test Facility should be designed to withstand uniform and concentrated loadings as detailed for each area in the summary below and in the Requirements Summary Chart, Section 4. The surface shall be smooth-finished and sealed with a suitable floor sealant, except in those areas where resilient floor tile is to be installed. A platform floor shall be required in the TCC Checkout and Control Room, and the Corridor and Termination Room of the Termination Area.(Refer to Section 3.1 for special platform floor requirements needed in the TCC Checkout and Control Room only.) The subfloor in these areas shall be a minimum of 18 inches below the platform floor, and shall be sloped to floor drains sized to remove any water which might infiltrate the area.

SUMMARY OF LIVE FLOOR LOADS

TCC	LB/SQ FT
Checkout and Control Room	250
Office Area	100
Briefing and Conference Room	100
Tape Storage Room	150
Emergency Food-Dispensing Area	100
Toilet Facilities	100
Health Physics and First Aid	100
Support and Maintenance Room	250
Material and Parts Storage Room	150
Mechanical and Electrical Room	250
Janitors Closet	100
Access Tunnel	150
VTS	
Umbilical Tower	
Lower Level	150
Grade Level	150
Aft Umbilical Level	150
Forward Umbilical Level	150
Elevator	150
Elevator Penthouse	150
Elevator Sump	100

	LB/SQ FT
Termination Area	
Termination Room	150
Mechanical Equipment Room	250
Hot Change Room	100
Cold Change Room	100
Substation	250
Corridor	150

All nonbearing walls and partitions shall be of incombustible material and of movable design for functional flexibility. The partition must provide interchangeability, inherent strength, and simplicity of erection and disassembly. Individual room areas shall be separated by floor-to-ceiling partitions. Modular offices shall be constructed of 8-foot-high movable partitions.

The interior surface of the perimeter walls shall serve as a finished surface. It shall be smooth and free of imperfections such as pockets or jags. If accoustical material is required on the surface, it shall be applied no lower than wainscot height.

The A-E shall make adequate drainage provisions in those areas classified as hot or warm for handling of waste materials after decontamination of walls and floors. (Refer to Section 1.7.5 and NSP 62-3-Rev 1.)

The A-E shall provide insect and rodent control in the Stage Static Test Facility designs.

1.5.5 Protective Coatings

All exterior concrete surfaces of the TCC, access tunnel, and Termination Area shall be waterproof. Interior surfaces shall be dry and waterproof. The interior walls and ceiling of the access tunnel and Termination Area, which might have to be decontaminated by means of a water spray, shall be painted with a phenolic-base paint.

At E/VTS-3, the surfaces of the exhaust substructure and the stage support structure shall be treated to permit repeated decontamination operations with mild reagents without impairing the finish. Such treatment shall minimize radioactive-particle impregnation and shall be able to withstand wall temperatures of approximately 300°F.

All surfaces above grade shall be treated similarly to those below grade except that the temperature requirement is reduced to 150°F.

1.5.6 Stage Static Test Facilities: Area Requirements

Functional area requirements are summarized as follows:

TCC	SQ FT
Checkout and Control Room	*12,000
Office Area	2,430
Briefing and Conference Room	540
Tape Storage Room	72

	SQ FT
Emergency Food-Dispensing Area	144
Toilet Facilities (Men and Women)	432
Health Physics and First Aid Room	240
Support and Maintenance Room	480
Material and Parts Storage Room	144
Mechanical and Electrical Room	A-E to determine
Janitors Closet	36
Access Tunnel	A-E to determine

*Area requirements are defined as 12,000 sq ft for stage checkout, test control and monitoring equipment, and data acquisition for a 3-test stand operation. To this must be added the area required for facility control and instrument unit equipment.

Vehicle Test Stand (Umbilical Tower)	SQ FT
Lower Level	225
Grade Level	225
Aft Umbilical Level	225
Forward Umbilical Level	225
Elevator	36
Elevator Penthouse	225
Elevator Sump	36

Vehicle Test Stand (Termination Area)	SQ FT
Termination Room	680
Mechanical Equipment Room	340
Hot Change Room	156
Cold Change Room	228
Substation	170
Corridor	400

1.6 ELECTRICAL

1.6.1 Electrical System Concepts

The State Static Test Facilities electrical system shall be designed to include substation, power distribution systems, lighting systems, equipment and instrumentation grounding systems, and emergency power systems. In addition, the following constitute electronic methods of controlling, recording, or communicating data or signals: instrumentation, power control, telephone, intercommunication systems, television monitoring, radio communication, and telemeter-data transmission by hard wire from the SAM Building.

The following principles should be considered in the design and operation of the electrical-power-distribution system at the TCC:

- Primary electrical power shall be independent of operations in other Stage Static Test Facilities.
- Reliable power shall be available to critical and essential loads.

- Equipment in the Checkout and Control Room shall not be on the same secondary power transformer with other electrical equipment subject to surge loads.
- Electrical power for the test and control of the stage must have close frequency control, but need not be synchronous.
- Power-distribution lines to the facility shall be properly sized to give voltage stability under all normal operating loads within ± 5 volts on the 120-volt side of the transformer.

1.6.2 Electrical System Operation

It is planned that the electrical-distribution system will be operated by LMSC personnel by one of the three following methods, depending on test-operation requirements. The system design shall provide LMSC personnel with the capability of utilizing operationally required alternatives.

- The utility system supplies power for all electrical loads. If the utility system fails, the engine-driven generator is automatically started and carries all critical and essential loads.
- The utility system supplies power for all electrical loads with the engine-driven generator operating in a no-load condition. If the utility system fails, the engine-driven generator is automatically switched to carry all critical and essential loads.
- The utility system supplies all noncritical loads and the engine-driven generator supplies critical and essential loads. If the utility system fails, the engine-driven generator continues to support critical

and essential loads. If the engine-driven generator fails, the utility system is automatically switched to carry all critical and essential loads.

In any of the three cases, battery backup shall be provided on an emergency basis for critical reactor and monitoring systems as described in Section 1.6.4.

Remote control of the Stage Static Test Facility power-distribution system will be at the TCC. The control board shall provide remote control of circuit breakers, starters, contactors, and motor generators only when manual control is not appropriate for reasons of safety or test operations.

All substations, motor generators, and electrical systems and equipment in the TCC area, VTS area, and VTS central service will be controlled from a facility monitoring console in the TCC Checkout and Control Room with control switches, indicating lights, and other monitoring readouts.

1.6.3 High-Voltage System

The electrical-distribution system in the Stage Static Test Facility shall be protected from power transients and damage caused by lightning and shorts in the electrical substations or in the NRDS high-voltage distribution system.

The high-voltage system from the existing NRDS site distribution network may be utilized as the public utility source unless site development plans dictate otherwise.

Power supplied by the public utility source and by the engine-driven generator shall be regulated so that after stepping down it will be 120/208v ±5v, 3-phase, 60 ±0.3 cycles per second. It is anticipated that GSE will provide further regulation where it is essential for equipment operation.

1.6.4 Emergency Battery Power

When electrical failure occurs, power for all critical and essential loads identified in Sections 1.6.9 and 1.6.10 will be supplied by an alternate power source as called out in Section 1.6.2.

In addition, the reactor-shutdown and engine-cooling equipment, radiation-monitoring and critical TV-monitoring equipment shall have emergency battery power sufficient for 24-hour operation in the event of failure of both sources of power. This battery power shall continuously float on the line to provide uninterrupted power to these loads and shall be of assured reliability to prevent a SCRAM condition on the reactor-control mechanism and as further reviewed in NSP-62-3.

1.6.5 Lighting

Battery-operated emergency lights shall be provided on all tunnelways, exits, and within the TCC at strategic locations and in the VTS Termination Rooms. These battery systems shall float on the line and self-charge from a 120-volt, 60-cycle, single-phase source.

General area-lighting requirements are based on work activities that are to be performed and on accepted lighting standards. The following are Stage Static Test Facility requirements.

	Footcandle Level (30 in. above floor)
TCC	
Checkout and Control Room	100
Office Area	70
Briefing and Conference Room	70
Tape Storage Room	70
Emergency Food-Dispensing Area	70
Toilet Facilities	30
Health Physics - First Aid Room	70
Material and Parts Storage Room	70
Mechanical and Electrical Room	30
Janitors Closet	30
Access Tunnel	
Tunnel Area	30
Tunnel Entrances (surface, to TCC and VTS Termination Area)	30
Vehicle Test Stand	
Umbilical Tower	
Lower Level	30
Grade Level	70

	Footcandle Level (30 in. above floor)
Aft Umbilical Level	70
Forward Umbilical Level	70
Elevator	30
Elevator Penthouse	30
Elevator Sump	30
Termination Area	
Termination Room	100
Mechanical Equipment Room	30
Hot Change Room	30
Cold Change Room	30
Substation	30
Corridor	30

1.6.6 Power Termination

All equipment and facility power lines for the Stage Static Test Facility shall terminate in breaker panels in the facility where the equipment is located. In addition, all equipment and facility power lines for the Checkout and Control Room shall terminate in circuit-breaker panel(s) located within that area of the TCC. A similar arrangement shall be provided at the E/VTS-3 Termination Room and Mechanical Equipment Room.

1.6.7 Receptacles

Receptacles shall be of the twist-lock design where possible, with 3 or 5-wire pin-connections. Specific types will be called out later as equipment requirements become defined. Explosionproof-type receptacles shall be required in the VTS and in those portions of the Termination Area where the possibility of hydrogen-gas infiltration exists.

1.6.8 Grounding

An effective grounding system shall be provided for the TCC and VTS power substations, lighting and power-distribution systems, and equipment, including necessary ground rods and mat, grounding conductors, and water connections.

An independent instrumentation and checkout-equipment grounding system shall also be provided. Detailed requirements for this system will be defined later.

1.6.9 Classification of Electrical Loads

Loads are divided into three classes: critical loads, essential loads, and noncritical loads.

Critical loads are loads which, if interrupted, would create a hazard to life or property.

Essential loads are loads which, if interrupted, would cause the shutdown of a test in progress with a subsequent costly loss of test data and objectives.

Noncritical loads are loads which, if interrupted, would not endanger life or property or cause the shutdown of a test.

The following listing of electrical loads is not necessarily complete or fully accurate. It will be corrected as required when new information becomes available. The following abbreviations are used for the three classes of loads:

Critical Load - C

Essential Load - E

Noncritical Load - NC

A percent utilization factor is reflected in the electrical-load summary chart for critical (C) and essential (E) loads to indicate emergency requirements.

1.6.10 TCC ELECTRICAL-LOAD SUMMARY

Load	kva	Class	Emergency Percent Utilization
Mechanical and Electrical Room			
Lighting	2.4	C	50
Air-Conditioning Pumps & Related Equipment	15	E	100
Air-Conditioning Blower	29	C	100
Air-Conditioning Compressor	50	E	100
Receptacles	2.2	NC	
Battery Charger	2	NC	
Material and Parts Storage Room			
Lighting	0.8	NC	
Receptacles	0.9	NC	
Support and Maintenance Room			
Lighting	2.7	NC	
Receptacles	2.9	NC	

TCC ELECTRICAL-LOAD SUMMARY (Continued)

Load	kva	Class	Emergency Percent Utilization
Office Area			
Lighting	8	NC	
Receptacles	2	NC	
Briefing Room			
Lighting	3.2	NC	
Receptacles	2.9	NC	
Tape Storage Room			
Lighting	0.5	NC	
Receptacles	0.9	NC	
Emergency Food-Dispensing Area			
Lighting	0.9	NC	
Receptacles	0.9	NC	
Toilet Facilities			
Lighting	0.8	NC	
Ventilation	0.5	NC	
Receptacles	0.9	NC	
Health Physics and First Aid Room			
Lighting	0.8	C	100
Receptacles	0.8	C	100
Radiation Monitors	5	C	100

TCC ELECTRICAL-LOAD SUMMARY (Continued)

Load	kva	Class	Emergency Percent Utilization
Tunnels (Entrances)			
Lighting	5	C	50
Air-Conditioning Compressor and Pumps	125	E	100
Blower	30	C	100
Checkout and Control Room			
Lighting	112	C	50
Receptacles	20	E	50
Intercom	1	C	100
Electronic Racks, Computer	400	E	50
TV	20	C	100
Radio	2	C	100
Hazard Monitoring	1	C	100

SUMMARY OF TEST CONTROL CENTER ELECTRICAL LOADS (CONNECTED)

Critical kva	Essential kva	Noncritical kva
195	610	47

TEST STAND ELECTRICAL LOAD SUMMARY

Load	kva			Class	Emergency Percent Utilization
	E/VTS 3	VTS 4	VTS 5		
Stage					
28v dc Power Supply	30	30	30	C	100

TEST STAND ELECTRICAL LOAD SUMMARY (Continued)

Load	kva E/VTS 3	kva VTS 4	kva VTS 5	Class	Emergency Percent Utilization
Termination Area					
Lighting	3.5	3.5	3.5	NC	
Heating	8	8	8	NC	
Receptacles	1	1	1	NC	
Electronic Rack	30	30	30	E	100
Radiation Monitors	5	5	5	C	100
Intercom	2	2	2	E	100
Mechanical Equipment Room					
Lighting	2.2	2.2	2.2	NC	
Exhaust Fan	10	10	10	NC	
Receptacles	3	3	3	NC	
Air-Conditioning Compressor	30	30	30	E	
Air-Conditioning Pumps and Related Equipment	2	2	2	E	100
Radiation-Shield Water System Circulating Pump	Loads specified in NSP-62-3			C	100
Radiation-Shield Water System Circulating Pump (Spare)	Loads specified in NSP-62-3			C	100
Lower Umbilical Platform					
Lighting	1	1	1	NC	
Umbilical Connect Mechanism	2	2	2	E	100

TEST STAND ELECTRICAL LOAD SUMMARY (Continued)

Load	kva E/VTS 3	kva VTS 4	kva VTS 5	Class	Emergency Percent Utilization
<u>Upper Umbilical Platform</u>					
Lighting	1.5	1.5	1.5	NC	
Receptacles	0.5	0.5	0.5	NC	
Umbilical Connect Mechanism	2	2	2	E	100
<u>Elevator</u>					
Lighting	.2	.2	.2	NC	
Propulsion	10	10	10	NC	
<u>Pit Cover</u>					
Drive Motor	10	10	10	NC	
<u>Tunnel</u>					
Lighting	16	16	16	NC	
Blower Fan	15	15	15	NC	
<u>Exterior Stand Areas</u>					
Area Lighting	5	5	5	NC	
Stage Lighting	40	40	40	C	100
Aircraft-Warning Lights	1	1	1	C	100
Horn	To be established			C	
Siren	To be established			C	
Security Lighting	To be established			NC	

SUMMARY OF TEST STAND ELECTRICAL LOADS (CONNECTED)

	Critical kva	Essential kva	Noncritical kva
E/VTS 3	76	154	87
VTS-4	76	154	87
VTS-5	76	154	87

1.6.11 Cable Trays

Cable trays shall be provided in the access tunnel to safely and efficiently route cables to the TCC cable spread under the platform floor area in the Checkout and Control Room and to the cable spread under the platform floor in the VTS corridor area.

Cable trays shall be provided to route all wires and cables for instrumentation, checkout equipment, intercom, closed-circuit television, radio, radiation and other hazard monitoring and warning systems.

Cables with power shall not be run in the same tray as those carrying instrumentation signals.

1.6.12 Telephone

Provisions shall be made for assigning a minimum of thirty (30) telephone-station numbers for interfacility and off-site communications at TCC and VTS area. Design shall allow twenty-five percent (25%) spare station assignments. Specific locations will be indicated as more detailed information becomes available.

1.6.13 Radio

Radio communication is required between the TCC and the NRDS On-Site Transporter while delivery or removal of a stage is being made at the VTS area.

1.6.14 Television

A closed-circuit TV system will be installed between the VTS area and the TCC to monitor stage operations. This system shall be extended to the Program Information Center (PIC) in the Administrative and Engineering Building. Figure 1-2 reflects a typical camera and monitor installation with further details to be called out as information becomes available.

The NRDS On-Site Transporter may also require that it monitor the cameras on the stand to supplement its own TV camera for emplacement or removal of a stage. If this is required, a remote receptacle will be needed for the transporter to pick up the TV-camera signal from the stand. The TCC function will be to monitor these activities by television.

1.6.15 Public Address System

The Stage Static Test Facility shall be wired in as a part of the NRDS public address system as referred to in NSP-62-16. Specific locations of speakers and microphone(s) shall be defined as requirements become firm.

1.6.16 Intercom System

The Stage Static Test Facility shall be connected to the NRDS central intercom network, and in addition shall have its own network for test conducting and

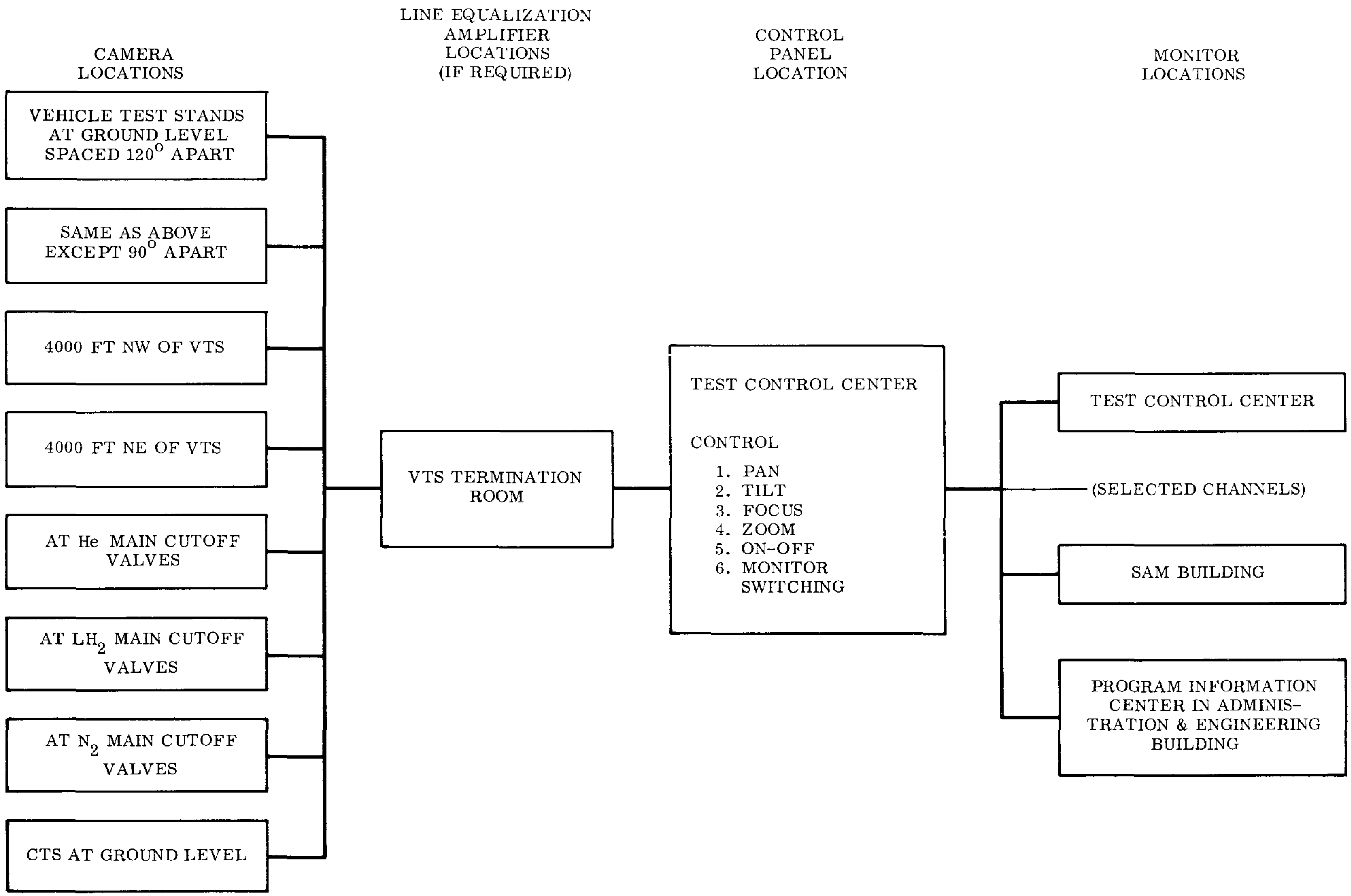

Fig. 1-2 Typical TV System For E/VTS-3, VTS-4, and VTS-5

checkout requirements. Operational requirements, station locations, and equipment criteria will be detailed in a LMSC communication study to be issued later. The A-E shall make provisions for adequately sized conduit to house intercom wires.

1.6.17 Countdown Clock System

A countdown clock system shall be provided for the Stage Static Test Facility area the details of which will be provided later. The A-E shall make provisions for adequately sized conduit to house control wiring.

1.6.18 Timing System

The NRDS master control timing system shall provide a circuit to the Stage Static Test Facility. Details of termination points and equipment requirements will be given later when requirements are better defined. The A-E shall make provisions to effectively house timing circuit wires.

1.7 MECHANICAL

1.7.1 Air-Supply Concept

Air-flows to the TCC and access tunnels and subsequently to the VTS Termination Areas shall be continuous and of assured quantity and pressure differential relative to the outside air to insure the safety of personnel in these areas. The fresh-air intake shall be at a point where clean air within the maximum permissible concentration (MPC) levels can normally be drawn into the system. Adequate filtering elements shall be installed in the air-filter system to insure that distributed air shall, under all NRDS operating conditions, not exceed radiation-environment limits in accordance with NRDS criteria for MPC levels. Fresh air intakes shall be located sufficiently distant from the VTS and the central service area to preclude interruption of air supply in the event of a maximum credible hydrogen explosion and to preclude intake of hydrogen gas in the event of an LH_2 spill.

It is planned that the operation of the air-conditioning system to the TCC and VTS Termination Room be continuous on an around-the-clock basis. Recirculating and fresh makeup air shall be distributed to rooms in the Zone 1 area (see Fig. 1-3) at 1 in. water (min.) positive pressure differential. Rooms in the Zone 2 area shall have a positive air-pressure differential maintained at 3/4 in. of water (min.). Air in Zone 3 areas in the access tunnels and VTS Termination Areas shall be maintained at 1/2 in. of water (min.) positive pressure differential. Loss of air to the atmosphere at these points shall be limited by airlocks and dampered louvres. It is important that a sufficient volume of air be allowed to circulate to the VTS termination rooms during captive firings to insure maintenance of a minimum positive pressure differential of 1/2 in. of water. Air velocity in the air-distribution system shall be kept low enough to avoid excessive transmission noises within the ducting and diffusers.

1.7.2 Air-Conditioning System

The air-conditioning and supply system for the TCC and VTS Termination Areas shall be planned as a system that will stabilize air temperatures (heated or cool) according to the following room-temperature and air-change requirements:

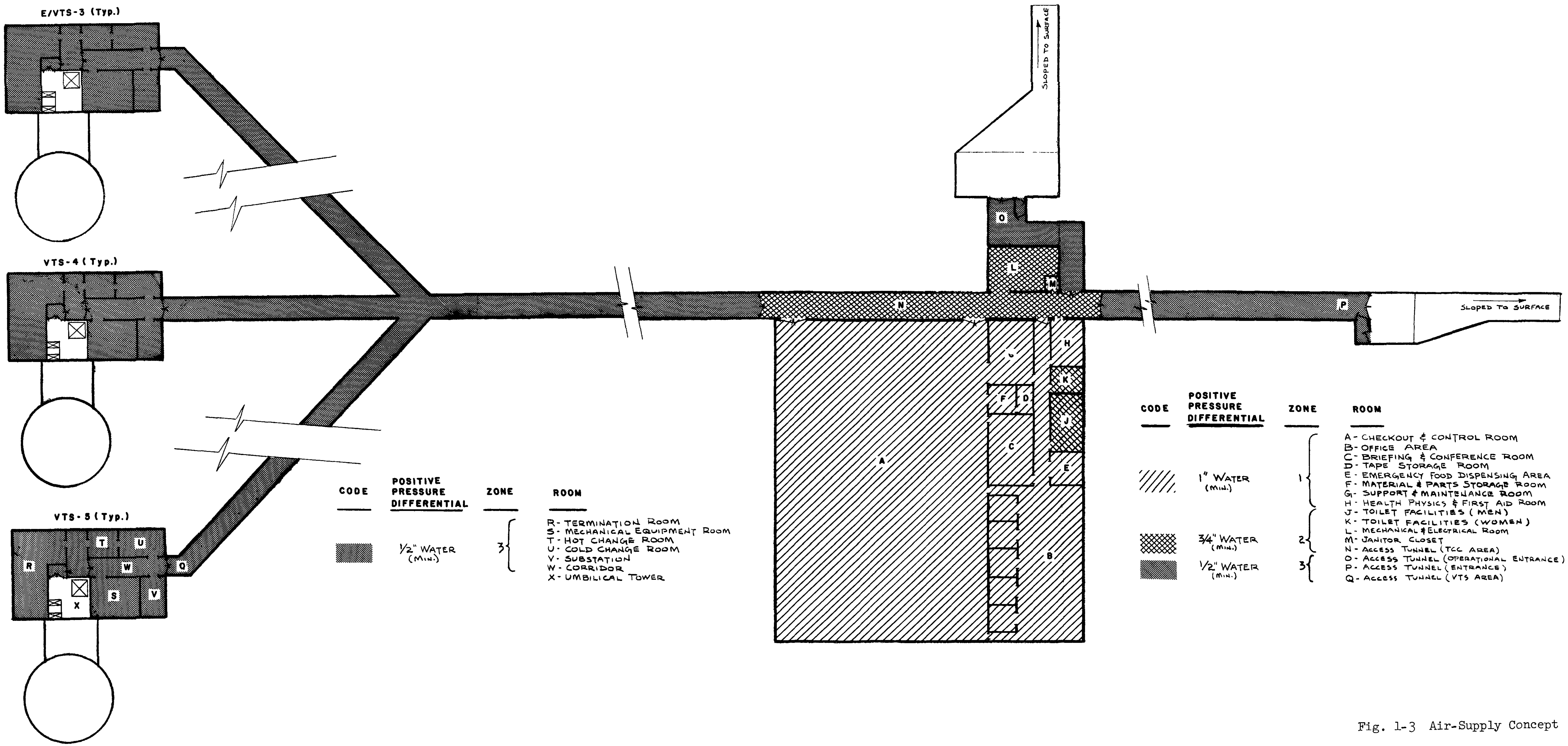

Fig. 1-3 Air-Supply Concept

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SUMMARY OF AREA TEMPERATURE REQUIREMENTS

	Dry-Bulb Temperature (°F)	Air Changes Per Hour
TCC		
Checkout and Control Room	72° ±2	5
Office Area	75° ±5	5
Briefing and Conference Room	75° ±5	7
Tape Storage Room	75° ±5	5
Emergency Food-Dispensing Area	75° ±5	5
Toilet Facilities	75° ±5	10*
Health Physics - First Aid Room	75° ±5	5
Support and Maintenance Room	75° ±5	5
Material and Parts Storage Room	75° ±5	5
Mechanical and Electrical Room Janitors Closet Access Tunnel	Not required by LMSC A-E to determine	A-E to determine
Vehicle Test Stand		
Termination Room	72° ±2	10
Mechanical Equipment Room Hot Change Room Cold Change Room	Not required by LMSC A-E to determine	10 10* 10*
Substation		10
Corridor		10

*Separate exhaust to atmosphere

Temperature levels shall be based on normal TCC and VTS termination-room headcounts as referenced in Section 1.4.3, and the TCC and VTS Electrical Load Summary as referenced in Section 1.6.10. It is assumed that normal operations will be considered as a full-day cycle and be based on the following:

- Light fixtures to remain on at all times
- Checkout-equipment electrical loads to be present seventy-five (75) percent of the time
- TV-circuit electrical loads to be present one-hundred (100) percent of the time
- Service and convenience-receptacle electrical loads to be present twenty (20) percent of the time

Relative humidity in the Stage Static Test Facility shall be controlled to a maximum of 50 percent. The area under the platform floor in the checkout and control room and VTS area shall not be used as an air plenum or distribution duct.

The air positive pressure-head differential in Zone 1 shall be achieved by appropriately sized blower(s) with a standby unit available for use when mechanical or driving-motor failure occurs with the unit on stream. Blower-motor controls shall be so designed that when failure occurs, the standby unit is automatically energized to assume the load. A warning light shall flash in the TCC facility monitoring console indicating a failure of one unit and the operation of the standby unit.

A pressure-sensing device(s) shall be located in an appropriate location in each zoned area and upon detecting deviation of ±5 percent of that indicated for the zone requirements shall activate the blower-motor speed control in such a manner as to correct the situation. A warning light shall flash in the TCC facility monitoring console to indicate an abnormal condition.

An air-filtering system consisting of standard filter elements and absolute filters shall be provided. Under normal operating conditions, it is not expected that the absolute filters will be required and they would be bypassed. The absolute-filter elements shall conform to diactyl-phthalate (DOP) tests required by AEC and shall restrict passage to particle diameters of 0.3 microns or less. Separate filter elements shall be provided to remove traces of radioiodine.

The normal air-filtration method is to be determined by the A-E to meet following particle-count requirements which are to be measured within the checkout and control room area:

Particle-Count Tolerance (max.)	50,000 particles per cubic foot of air
Particle-Size Limit (max.)	10 microns
Particle-Collection Method	Greenberg-Smith Impinger or equivalent
Particle-Count Method	10x microscope (100 diameter magnification) with light field technique

An airborne particulate monitoring system shall be installed as per Section 1.8.3 with a sensor to be located at the discharge end of the blower. When the concentration levels of the airborne particulate and radioactive gases at the discharge side of the blower exceed the NRDS MPC's, the air-supply system shall immediately and automatically take all steps to stop the discharge of air to the atmosphere from Zone 3 areas and close off the intake of fresh air. Air will be recirculated within the closed TCC and access-tunnel system until such time as the outside air conditions are within NRDS MPC levels that the filters can effectively handle or the filter-element problems have been corrected and the airborne particulate radiation countdown has been brought to acceptable levels. An indicator light shall flash on the facility monitoring console when the pressure drop across the filter elements is excessive or abnormal.

1.7.3 Ventilation

Air exhaust from the toilet facilities is to be vented directly to the atmosphere. Dampers are to be provided in the system to provide the necessary air changes and Zone 2 pressure differential. In case of emergency conditions, the dampers are to be closed automatically.

The air distribution shall be so designed as to permit individual rooms to vent directly to the atmosphere in case of fire in the checkout and control room, material and parts storage room, tape storage room, health physics room, support and maintenance area, or mechanical and electrical room. The control of dampers in these bypass vent ducts shall be actuated by sensors in the fire-detection system as described in Section 1.7.4. These facility controls are further detailed in Section 1.8.6. The A-E shall investigate the effect of venting to the atmosphere in case of fire on the ability of the air-supply system to maintain the pressure differentials called out by zones. The worst case shall be examined; i.e., fire in the checkout and control room during a period when radiation levels in the atmosphere are high.

1.7.4 Fire Protection

An automatic CO_2 discharge system shall be utilized in the TCC and VTS Termination Areas with automatic discharge limited to those periods when personnel are not in the facility. Manual switches shall provide zone or individual room discharge and readouts of switch positions shall appear on the facility monitoring console and at the NRDS Fire Department headquarters.

No portable extinguisher that develops a toxic fume, leaves a residue, or can cause injury to personnel shall be utilized in attempting to extinguish electrical fires.

The number of portable extinguishers shall be determined by conditions within the various areas. They shall be standard, commercially available equipment.

A fire-alarm system shall be provided that meets LMSC and NRDS requirements. Refer to NSP-62-3 for further details.

1.7.5 Decontamination of Facilities and Equipment

The following areas shall be capable of being decontaminated:

- Access tunnel: walls, floors, and exposed mechanical and electrical equipment
- Termination Area: all rooms
- Umbilical Tower: all levels
- Stage support structure
- Exhaust substructure

Raw-water connections shall be provided where necessary. Decontamination shall be accomplished by such methods as hosing, scrubbing, or mopping. At E/VTS-3 in particular, mild reagents will be required in addition to water. In this regard, all surfaces to be decontaminated shall have a protective coating as described in Section 1.5.5.

1.7.6 Water System

The Stage Static Test Facilities shall be provided with potable cold water for drinking fountains, health physics room, toilet, and janitorial facilities.

Raw cold water may be provided instead of cold potable water for the mens and womens toilets and urinals and for decontamination purposes.

1.7.7 Sanitary Sewer System

Waste-disposal provisions shall be provided for waste matter from the toilet facilities, drinking fountains, and janitor-closet sink and sumps. Refer to NSP-62-3 and Sections 3 and 4 of this document.

1.7.8 Periscopes

Periscopes shall be provided in the TCC for viewing each VTS. Provisions shall be made for three future periscope locations.

These periscopes shall be equipped with nonbrowning, shielded optics. The following features shall be incorporated.

- Direct mechanical linkage between eyepiece and the viewing prism to permit operator control of prism by moving the eyepiece
- Magnification range 2x to 10x
- Hooded, monocular eyepiece
- 4 x 5 Speedgraphic camera and camera mount with optical train that will permit photography of view obtained by operator through the same system

1.8 HAZARD-MONITORING SYSTEMS

1.8.1 Health Physics Radiation and Contaminate Monitoring System Concept

A Health Physics Radiation and Contaminate Monitoring System (HPRCMS) shall be provided in the Stage Static Test Facility areas similar in concept and scope to the system outlined in Fig. 1-4. The system has the primary purpose of personnel safety, and the gathering of radiation data for scientific or test purposes is secondary. This system shall have battery backup to insure continuous operation for 48 hours under all conditions.

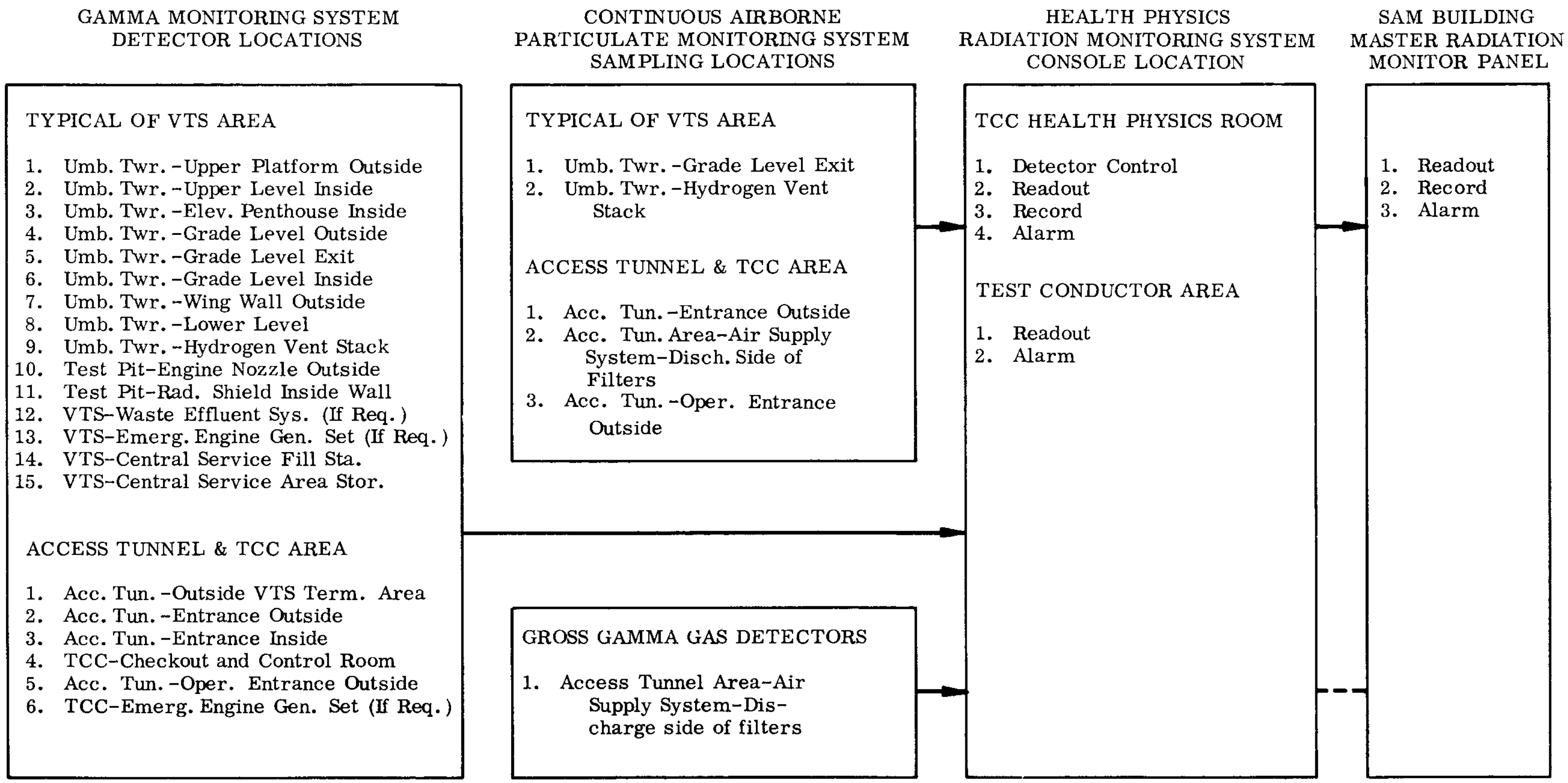


Fig. 1-4 Health Physics Radiation and Contaminate Monitoring System

The HPRCMS console shall be capable of performing the following radiation and contaminate monitoring functions:

- Gamma Monitoring System
- Continuous Airborne-Particulate Monitoring System
- Gross Gamma Gas Monitoring System
- Portable Continuous Air Monitor (may have readouts and alarm indications on the console)

Two HPRCMS consoles are required: one to be located in the health physics room and the other in the test conductor area. Details for the instrumentation in each console are defined in Sections 1.8.2, 1.8.3, and 1.8.4.

In addition, radiation measurements for operational and scientific data shall be required at such locations as the inside wall of VTS neutron shield, ground half of umbilicals, umbilical tower, and area surrounding the VTS. The purpose of these measurements is as follows:

- To evaluate amount of air and ground scattered radiation and its effect on attenuation of RF signals
- To determine radiation environment in which GSE and stage peripheral equipment are operating at NRDS
- To obtain data for flux-mapping studies

1.8.2 Gamma Monitoring System

The Gamma Monitoring System shall be a multichannel readout system with remote detectors capable of continuously recording radiation levels to the TCC. Each channel of the system shall consist of a detector element, a plug-in station unit, and a basic control unit. In addition, the system shall include an alarm, alarm-reset button, alarm flashing-light panel, and remote-calibration control. This system shall have all readouts, recording, alarm and detector-control features incorporated in the HPRCMS console in the health physics room and only readouts and alarms on the HPRCMS console in the test conductor area.

The detectors used in this system shall have the following features:

Type	Ionization Chamber
Radiation to be measured	Gamma
Internal Calibration Source	Sr^{90} (sealed)
Range	1 mrem/hr to 10^3 mrem/hr (3 consecutive decade ranges 0-10, 11-100, 101-1000)
Alarms	Flashing readouts block denoting location and audible alarm

DETECTOR LOCATION: TYPICAL OF VTS AREA

Qty	Location
1	Umbilical Tower - upper platform outside
1	Umbilical Tower - upper level inside
1	Umbilical Tower - elevator penthouse inside
1	Umbilical Tower - grade level outside
1	Umbilical Tower - grade level exit
1	Umbilical Tower - grade level inside
1	Umbilical Tower - wing wall outside
1	Umbilical Tower - lower level

DETECTOR LOCATION: TYPICAL OF VTS AREA (Continued)

Qty	Location
1	Umbilical Tower - hydrogen vent stack
1	VTS Test Pit - engine nozzle outlet
1	VTS Test Pit - inside wall of shield
1	VTS Waste effluent system (if needed)
1	VTS Emergency engine generator set (if needed)
1	VTS Central service fill station
1	VTS Central service area storage
2	Spares

DETECTOR LOCATION: ACCESS TUNNEL AND TCC AREA

Qty	Location
1	Access tunnel outside VTS termination area
1	TCC checkout and control room
1	Access-tunnel operational entrance (outside)
1	Access-tunnel operational entrance (inside)
1	Access-tunnel entrance (inside)
1	TCC emergency engine generator set (if needed)
2	Spares

1.8.3 Continuous Airborne-Particulate Monitoring System

The Continuous Airborne-Particulate Monitoring System shall be a completely self-contained system designed to continuously monitor the airborne-particulate matter at personnel-exit points and in the TCC air-supply system and permanently record these levels. The system shall feature a moving filter tape capable of prolonged unattended operation. The speed of the filter movement shall be adjustable.

The system shall have each air-sampling unit housing located as close as possible to the air-sampling location with consideration given to servicing the unit. The readouts, alarm, alarm flashing lights, and recorders shall be incorporated in the HPRCMS console in the health physics room, and duplicate readouts and alarms shall appear on the HPRCMS console in the test conductor area.

The following sampling locations shall be provided:

SAMPLING LOCATIONS: TYPICAL OF VTS AREA

Qty	Location
1	Umbilical Tower - grade level exit
1	Umbilical Tower - hydrogen vent stack

SAMPLING LOCATION: ACCESS TUNNEL AND TCC AREA

Qty	Location
1	Access-tunnel operational entrance (outside)
1	Access-tunnel entrance (outside)
1	Access-tunnel area (air supply system - discharge side of filters)

1.8.4 Gross Gamma Gas Monitoring System

A Gross Gamma Gas Monitoring System shall be provided to supplement the Continuous Airborne-Particulate Monitoring System. The detector shall be located near the airborne-particulate sampling point located at the access-tunnel area (air-supply system - discharge side of filters) with readouts, alarms, remote calibration control, resets, etc., located on the HPRCMS console in the health physics room and duplicate readouts and alarms to appear on the HPRCMS console in the test conductor area. The sensitivity of the detector shall be determined by the NRDS maximum permissible concentration (MPC) for release of radioactive gases into the atmosphere.

1.8.5 Portable Continuous Air Monitor

Two portable continuous air monitors shall be required for the TCC area. These systems shall feature a local sampler, vacuum pump, local alarm, permanent recording capability, and a variable-speed moving filter.

1.8.6 Facility-Monitoring Equipment

All critical facility systems (electrical and mechanical) necessary to the safety of personnel and maintenance of critical electrical-equipment functions in the Stage Static Test Facility shall have readout and control capability on the facility monitoring console.

These critical functions shall include but are not limited to the following:

- Air-supply blower motor operation
- Pressure drop across the air-supply normal and absolute filters

- Automatic damper on the outside air-supply duct
- Automatic dampers at pressure differential zones
- Fire-ventilation dampers in exhaust ducts to the outside air
- Pressure-differential readouts for each zone
- Pressure differential at access-tunnel entrance and the VTS termination area
- Dry-bulb temperature readout in the checkout and control room
- Relative humidity readouts in the checkout and control room
- Engine-driven generator operation including electrical amperage load, voltage, and phase characteristics
- Utility power electrical amperage load, voltage, and phase characteristics
- Emergency battery-system amperage load and voltage characteristics
- Access-tunnel bulkhead door to VTS termination area

The facility monitoring console shall also provide spare front panel space and spare terminal points for all readout circuits to allow additional recording devices to be installed as required.

All facility equipment not critical to the safety of personnel and maintenance of critical electrical equipment functions in the Stage Static Test Facility shall have locally mounted readouts and controls.

1.8.7 Warning and Emergency Systems

1.8.7.1 Evacuation System. A manually actuated Evacuation Alarm shall be required for the TCC. This device shall be a distinctive alarm to alert facility personnel to standby emergency conditions and that an evacuation of the facility will be necessary. The control for this alarm shall be located on the facility monitoring console in the test conductor area.

1.8.7.2 Hazard Approach Systems. A Hazard Approach Warning System shall be required to permit the operator at the facility monitoring console to advise and warn personnel within the Stage Static Test Facility of the approach of the NRDS On-Site Transporter or of any other hazard that might endanger personnel within the confines of the facility.

This device should be a siren or air-actuated multihorn system. Controls for this device shall be located on the facility monitoring console.

1.8.7.3 Warning Lights. A system of flashing red, amber, and green lights, operated from the facility monitoring console and the HPRCMS console in the health physics room shall be required. These lights shall be located in strategic locations to indicate to personnel the condition of the hazard existing. These lights shall particularly be located in the TCC and in the Termination Area and Umbilical Tower.

1.8.7.4 Hydrogen-Leak Detection System. A gaseous hydrogen monitoring and alarm system shall be provided for detecting leaks, spills, or other inadvertant escape of hydrogen which could cause a concentration sufficient to burn or otherwise ignite. The sensors shall be located at strategic points where leakages are likely to occur. Anticipated locations are reflected in Fig. 1-7 with readouts and alarms to be located locally in the VTS area and in the facility monitoring console.

1.8.8 Anti-Intrusion System

Anti-intrusion detectors shall be located at the bulkhead door entrance to each VTS termination area, TCC operational-entrance airlock, access-tunnel entrance airlock, and at the NRDS On-Site Transporter fence entry point, and at the Central Service Area.

Alarms and flashing lights from the system shall appear on the facility monitoring console at the test conductor area in TCC.

1.8.9 Criticality Alarm System

Detectors shall be located in the stage support structure as close to the reactor as possible to indicate when accidental criticality has occurred. A system of flashing lights and audible alarms shall be operated in the VTS and TCC area with detector readouts and alarm controls to appear on the HPRCMS console in the test conductor area. Readouts and flashing lights only shall appear on the HPRCMS console in the health physics area. The warning system shall continue to sound or display until an acknowledgement button is pressed in the test conductor area. (See Fig. 1-6 for a typical system for NRDS.)

1.9 ACCEPTANCE TESTING

Facility acceptance test procedures shall be required. The A-E shall prepare these procedures for acceptance of the facility by the customer immediately upon completion of the design of the facility. The procedures shall be approved and the tests witnessed by the customer and the RIFT contractor.

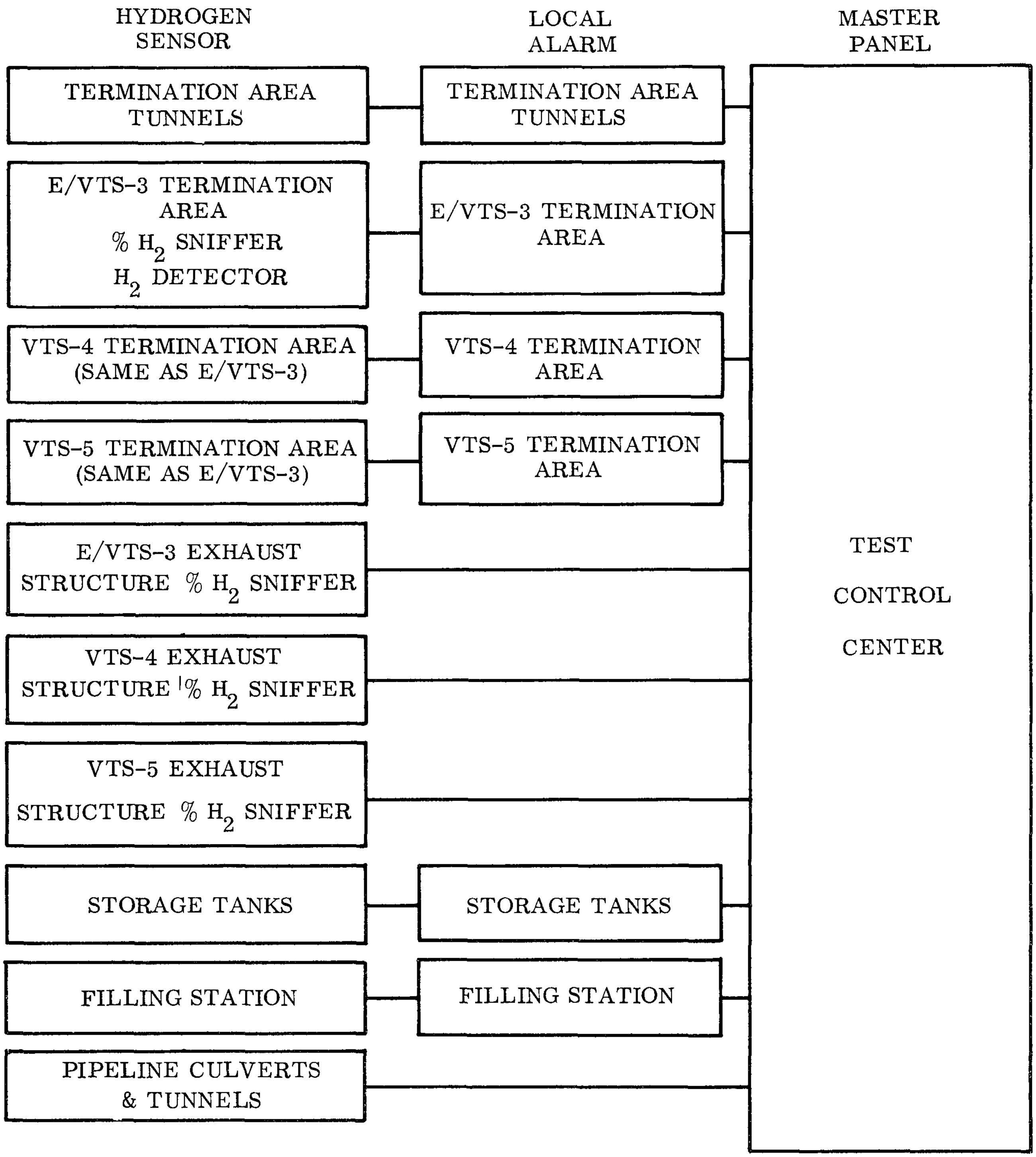


Fig. 1-5 Hydrogen Monitoring and Alarm System

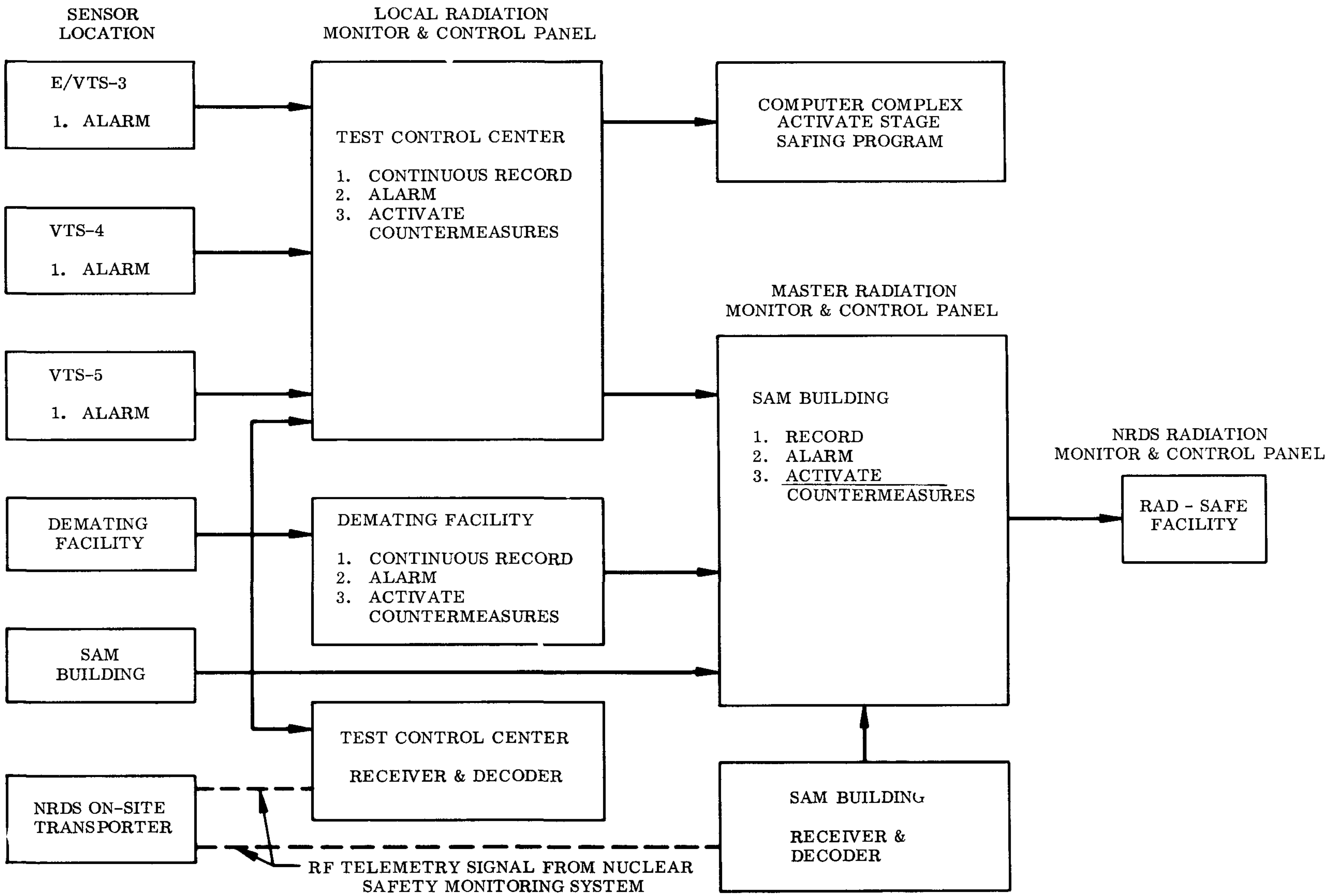


Fig. 1-6 Criticality Alarm System

The test procedures shall be designed to include a complete shakedown and checkout of all facility systems and equipment to ensure vendor and contractor compliance with the applicable specifications.

Section 2

SPECIFIC REQUIREMENTS FOR ENGINE/VEHICLE TEST STAND NO. 3 AND THE TERMINATION AREA

Specific requirements for Engine/Vehicle Test Stand No. 3 and the Termination Area as set forth in this section are in addition to the general requirements in Section 1. The requirements in this section are grouped in accordance with their location in a structure or area.

2.1 ENGINE/VEHICLE TEST STAND NO. 3

E/VTS-3 shall consist basically of three structures:

- The stage support structure - at grade level
- The exhaust substructure - below grade level
- The umbilical tower - covers the height of the stage and extends below grade to the Termination Area

The stage support structure and the exhaust substructure shall be initially designed to receive the 3.5 NERVA stage with a dead load of 500,000 lb. Similarly, the shield wall and the umbilical tower structure shall be designed for a future height increase of about 30 feet to accommodate the longer 3.5 NERVA stage tank. A concept of E/VTS-3 is presented in Fig. 2-1. This drawing, except for the plot plan, is for illustration purposes only in order to clarify requirements and is not to be construed as definitive design.

The plot plan, however, is an exception in that the relationship of the various structures as shown is an LMSC requirement. This configuration shall be oriented by the A-E to satisfy the following:

- Tunnel distance from each VTS to the TCC shall be minimized
- Engine exhaust shall be directed generally 90 degrees to the prevailing wind, thus enabling the exhaust to be carried away without coming back over the test stand

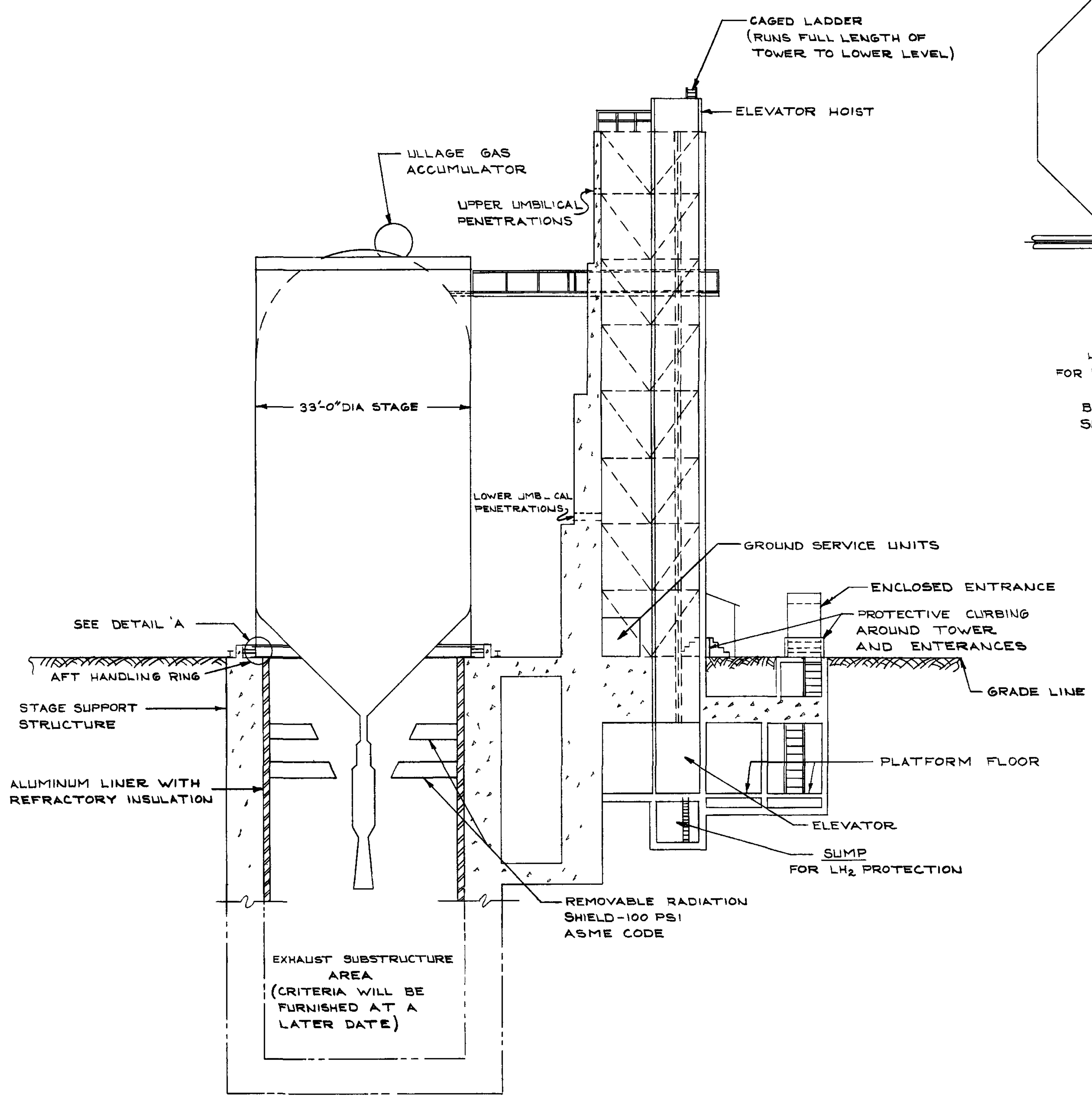
2.1.1 Stage Support Structure

The stage support structure shall support the stage, provide an airtight seal between the stage aft handling ring and the stand, and attenuate radiation. The structure shall be of reinforced concrete with a gastight aluminum liner, backed with refractory insulation.

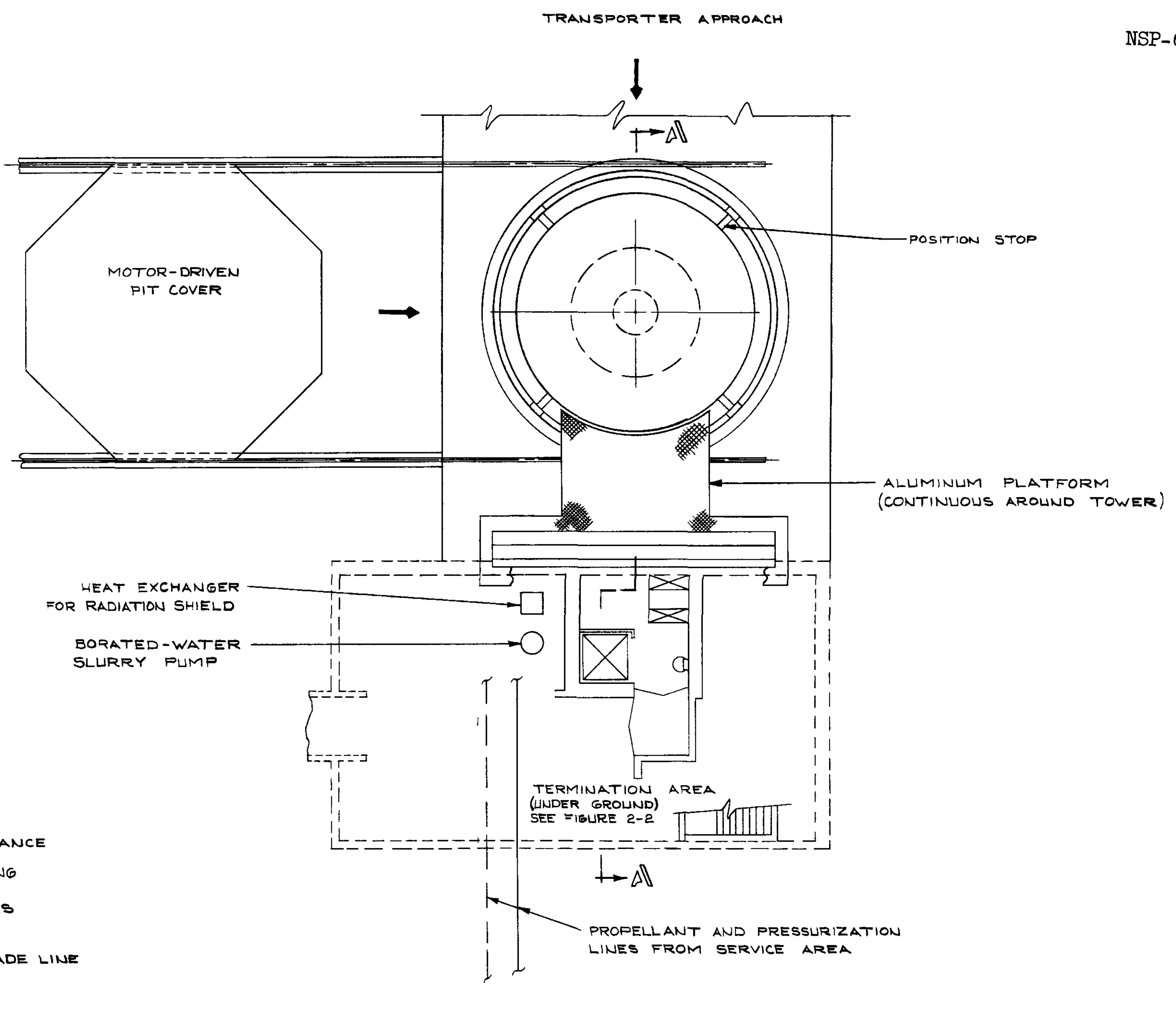
The structure shall be provided with a motor-driven, reinforced dense-concrete test-pit cover to protect personnel from residual radiation in the substructure. The cover shall be mounted on wheels and travel on a track spanning the test pit. Direction of travel shall be at 90 degrees to the direction of the transporter approach path. The electric motor shall have both remote and manual operating capability.

As a safety precaution to prevent gaseous-hydrogen accumulation in the stage area bounded by the stage skirt and the aft bulkhead, and to prevent air from leaking into this area from the outside, the following shall be provided:

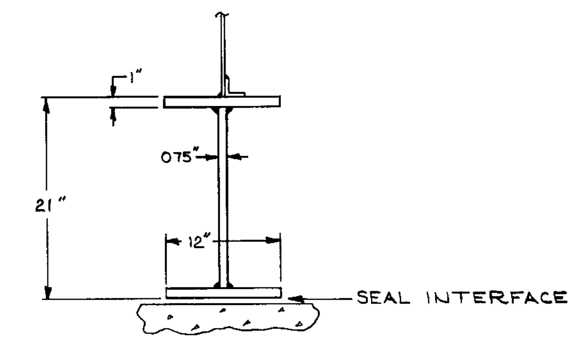
- Capability for continuous GN_2 purge on the inner side of the skirt in the region of the skirt-bulkhead joint and on the outside of the



SECTION A-A
SCALE: 1/8" = 1'-0"



PLAN
SCALE 1/8" = 1'-0



DETAIL "A"
SCALE 1/8" = 0-1'

Fig. 2-1 Engine Vehicle Test Stand No. 3

PRELIMINARY AS OF 12-28-62
FIGURE 2-1

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interface of the aft handling ring and the stage-support-structure seating ring

- A gasket having the ability to withstand radiation damage at 200°F at the seating ring. The flange of the aft handling ring is 12 inches wide and its centerline diameter is 33 feet. To permit proper handling of the stage by the transporter, the curb clearances shown in Fig. 2-1 are minimum

The concrete curb shall contain four remotely operated position stops spaced at 90-degree intervals to prevent movement of the stage resulting from vibration of the engine during static firing.

As mentioned in Section 1.3.2, neutron and gamma shields shall be located in the stage support structure adjacent to the reactor to minimize perturbation of the radiation field and to achieve, as closely as possible, simulation of in-flight nuclear-radiation environment at the stage propellant-tank bottom.

One concept of this radiation shield, used as an illustration only, is shown in Fig. 2-1. The shield is filled with borated water and has the capability of being removed from the substructure. Shield overall thickness is approximately 3 feet and shall be constructed in accordance with the ASME Code for 100 psig working pressure. A closed-loop borated-water circulating system would be required for the radiation shield. This system should maintain 125°F minimum water temperature for maximum solubility of ammonium pentaborate. The system, located at grade level at the rear of the stand, would include a heat exchanger and slurry pump. The radiant heat picked up during engine firings is exchanged to a demineralized and deoxygenated cooling-water circulating system as illustrated in Fig. 3, NSP-62-18 Rev 1.

It is emphasized at this point that the shielding design is tentative. In order to arrive at a realistic in-flight radiation environment, extensive calculations will be required to develop this design. LMSC has developed the computer programs for this effort, but considerable computation time is required before an optimized shield configuration will be provided to the Architect-Engineer.

Provision shall be made to supply remotely a vacuum of 1 psia for the engine turbine exhaust. This operation will occur at engine startup time and shall have a maximum duration of 30 seconds. NERVA-engine dimensions will be supplied to the A-E as soon as they are available.

2.1.2 Exhaust Substructure

The exhaust substructure shall be constructed of reinforced concrete and designed to accommodate the engine-exhaust deflector system. The Architect-Engineer will be furnished the necessary data for completing design of the exhaust substructure when it becomes available.

2.1.3 Umbilical Tower and Appurtenances

2.1.3.1 Description. An umbilical tower shall be provided to support umbilical cables and piping, service hoses and lines, connection and removal mechanisms for umbilical couplings, and deluge piping. The wall of the tower facing the stage support structure shall be of reinforced concrete for shielding the tower structure, cables, piping, and other equipment from reactor radiation.

2.1.3.2 Tower penetrations. Umbilical cabling and piping shall penetrate the concrete face of the tower through radiation-protected access holes. Penetration levels are shown in Fig. 2-1. Such an arrangement will provide versatility in handling the stage. It will permit the stage to be lifted sufficiently to permit access to the aft bulkhead with a "cherrypicker" without disconnecting the umbilical panels. This operation will always be performed prior to making the LH_2 propellant feed line connection. The LH_2 supply line shall not enter the tower but penetrate the wall at a point as close as possible to the tower, still leaving space for maintenance work. Such an arrangement will provide maximum shield-wall protection. All outdoor valves shall have removable weather-protective housing. The umbilical-coupling handling system, which will be LMSC-furnished equipment, shall provide the capability for remote connect and disconnect of the forward and aft umbilical panels when the stage is in the firing position.

2.1.3.3 Shielding. Umbilical-tower shielding requirements are stated in Section 1.3.2. In addition, the shield wall of the umbilical tower shall extend on both sides a sufficient distance to provide adequate shadow shielding for the umbilical tower and the Termination Area. This also is necessary to protect equipment installed outdoors from the scattering of neutron and gamma radiation.

2.1.3.4 Elevator. The umbilical tower shall be equipped with a personnel and service elevator of 2-ton capacity to run from the floor of the Termination Area to the forward umbilical level. Access shall be provided to the elevator penthouse for maintenance purposes.

2.1.3.5 Sump. A sump shall be provided below the bottom-floor level of the elevator to protect the Termination Area from an LH_2 spill.

2.1.3.6 Ladder and platforms. A caged emergency ladder shall be provided from the floor of the Termination Area to the elevator penthouse.

Access to the stage from the tower shall be from fixed platforms. Platforms shall be nonskid and nonsparking with protective railings. The upper platform shall be of a density to attenuate residual, direct, or scattered radiation from the reactor, stage, and substructure.

2.1.3.7 Entries and curbs. There shall be two entries to the umbilical tower. A single air-lock type door shall be located in the Termination Area to separate it from the tower in order to maintain the positive 0.5 in. water pressure (see Fig. 2-2).

The other entry shall be for grade-level access. It shall be enclosed to provide weather protection, and shall be located 3 feet above grade level. Access stairs shall be provided. A 3-foot-high curb shall be installed at the base of the umbilical tower and around the enclosed entry to preclude flooding the Termination Area with water or LH_2.

2.1.4 Lighting and Communications

Lightning protection, grounding grid, aircraft-warning lights, personnel warning system, public address, and telephone system shall be furnished for the test stand and umbilical tower.

Night firing is not planned. However, test-stand lighting shall be provided for the following night-time operations:

- Placement of stage in test stand so that stage is concentric with test stand within 0.5 inches. Lighting will be provided for remote, visual verification of correct alignment
- Umbilical checkout, purging and fueling, and prefiring tests
- Remote viewing and detection of malfunctions such as stage-tank frost

Lighting fixtures and installation will be compatible with a hydrogen-handling operation, and shall be of a noninterfering type.

2.1.5 Roads and Paved Areas

Access roads, parking for 20 cars, and paved areas as required for servicing and operation of the Engine/Vehicle Test Stand and the Termination Area shall be provided.

2.2 TERMINATION AREA

The Termination Area is conceived as a single-story, underground, reinforced-concrete structure with access to the base of the umbilical tower elevator. This concept is expressed in Fig. 2-2. The area is designed to serve as a common facility in the event another test stand is built adjacent to E/VTS-3 in the future.

2.2.1 Termination Room

The termination room shall be designed to house facilities for terminating landline circuits originating at E/VTS-3 and landline circuits running from the termination room to the TCC. In addition, space shall be provided to house emergency batteries and signal-amplification equipment.

An emergency stairway exit with weather protection at grade level shall be provided. A curb shall be installed around this exit to prevent flooding of the Termination Area by water or LH_2.

Personnel and equipment shall enter the termination room from the corridor through a two-leaf metal door.

All cabling running in the access tunnel from the Test Control Center shall enter a subfloor upon reaching the wall boundary of the termination room via the subfloor under the main corridor. The termination room shall also have a subfloor for the entire floor area to provide maximum versatility of operation.

All cable leaving the termination room and entering the umbilical tower passes through the side wall and into the vertical cableway as shown in Fig. 2-2.

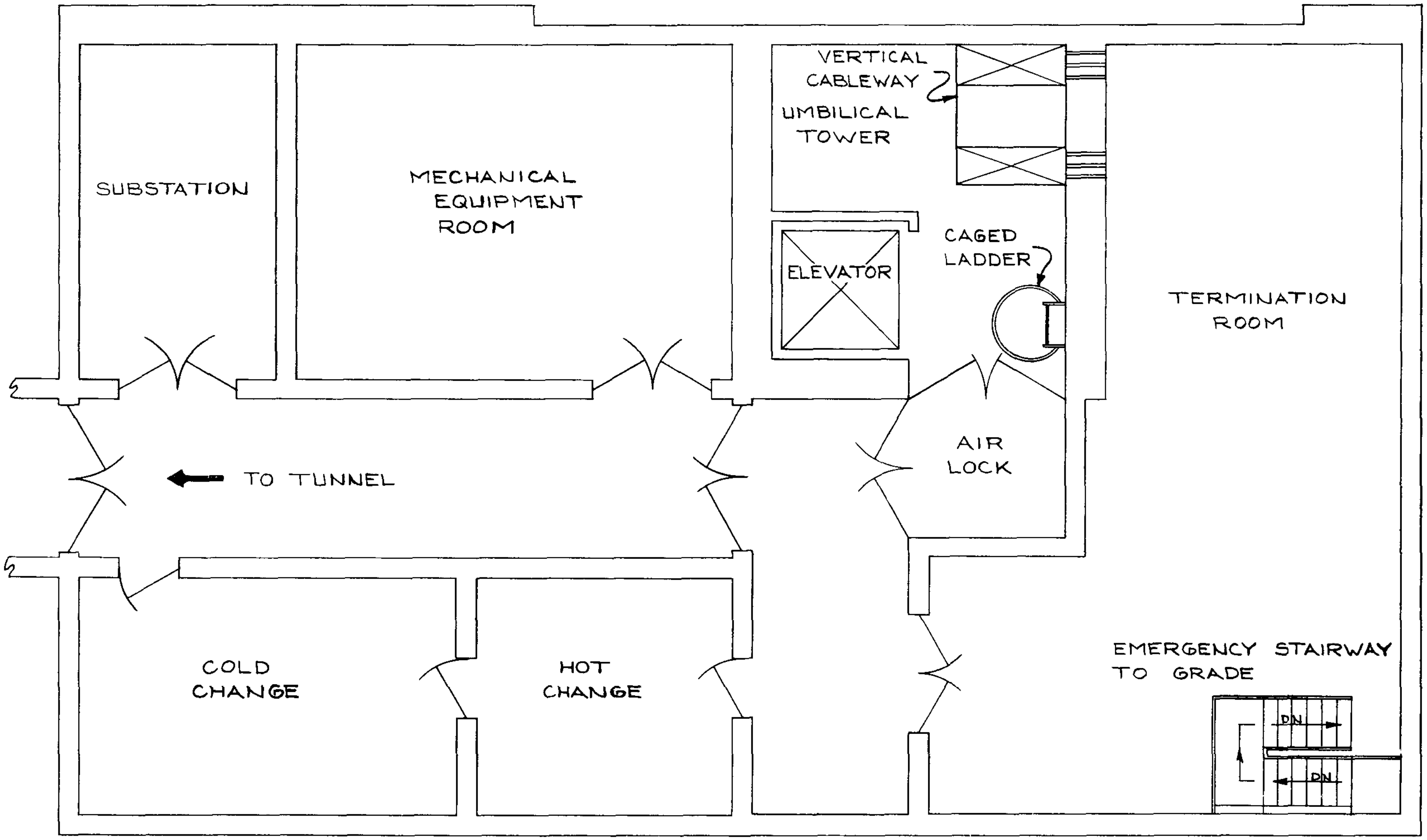

Fig. 2-2 Proposed Termination Area For E/VTS-3

2.2.2 Mechanical Equipment Room

The Termination Area shall require heating, ventilation, and air-conditioning in accordance with the specific requirements of each area. The mechanical equipment room shall be sufficiently sized by the A-E to house the heating, ventilating, and air-conditioning equipment; emergency generator; and any other mechanical equipment necessary to operate E/VTS-3.

Personnel and equipment shall enter the mechanical equipment room from the corridor through a two-leaf metal door.

2.2.3 Substation

A room for a substation shall be provided as shown in Fig. 2-2.

2.2.4 Umbilical Tower Lower Level

The umbilical tower lower level is shown in Fig. 2-2. Personnel and equipment access to the elevator is from the corridor and through the air-lock door.

2.2.5 "Hot" and "Cold" Change Rooms

A "hot" change room shall be provided for the removal and disposal of contaminated overalls, head covers, gloves, and shoe covers. A bench, hampers, and a personnel hand-and-foot-type monitor shall be provided for this area in accordance with NRDS nuclear-safety requirements. The "hot-cold" change shall be arranged to provide health physics control between hot and cold areas at E/VTS-3.

Personnel, after working on the test stand, must pass through the hot and cold change rooms before returning to the TCC or before gaining access to the mechanical equipment room or the substation.

One shower shall be provided as an access between the hot and cold change in the hot change room. Additional showers shall be provided for the cold change room. Toilets shall also be distributed between the hot and cold areas in accordance with head count. They shall be equipped with standard fixtures in accordance with local building codes. Drains from the showers shall discharge into the appropriate system. Toilet and lavatory drains shall discharge into a sanitary sewage system.

The cold change room shall be provided with lockers and benches sized in accordance with head count. Lockers shall have no legs, shall be mounted on a raised concrete slab, and shall be provided with a 45-deg metal sloping top.

A personnel hand-and-foot-type monitor shall be installed near the entrance to the stairwell as a final check before entering the cold areas of the facility. Space shall be provided for the storage and issuance of protective clothing, respirators, and other safety equipment. This space should be accessible to the hot change room and the cold shower side.

2.2.6 Corridor

The corridor shall provide access to all of the rooms in the Termination Area (refer to Fig. 2-2 and the Requirements Summary in Section 4). The entire corridor floor area shall be of the platform type as described in Section 2.2.1. The corridor layout will accommodate entry to a "future" umbilical tower.

2.2.7 Radiation Level

There will be no requirement for personnel to occupy the Termination Area during a test firing of the nuclear stage and engine. However, access to the Termination Area will be required 1 hour after the test firing has been terminated. Personnel performing operations in the Termination Area 1 hour after a test firing shall not be exposed to a dose rate exceeding 50 mrem/hr from all sources.

The Termination Area shall be so designed that the total integrated dose to the equipment within the Termination Area from a 1×10^7 Mw-sec run shall not exceed 10^6 fast neutrons per square centimeter.

The Architect-Engineer shall determine and use the most stringent criterion for shielding design.

2.2.8 Radiation Zones

As shown in Fig. 2-2, there are two radiation zones in the Termination Area: warm and cold. They are separated by a gasketed bulkhead door which is closed during and after a test until radiation monitors on the warm side indicate an acceptable radiation level. The warm zone consists of the termination room, the lower level of the umbilical tower, the hot change room, and the applicable portion of the corridor. The cold zone consists of the mechanical equipment room, the substation, the cold change room, and the applicable portion of the corridor. As described in Section 2.2.5, personnel can gain access to the cold zone only from the warm zone by passing through the hot and cold change rooms. However, when the radiation level in the warm zone is at an acceptable low level, personnel and equipment may pass through the bulkhead door from the cold to the warm zone.

2.2.9 Lighting

Lighting intensities shall be in accordance with Section 1.6.5. In the termination room and mechanical equipment room, lighting fixtures shall be fluorescent, with line filters and shields for radiation and noise suppression. In the remaining rooms and corridor of the Termination Area, hydrogen-vaporproof incandescent lighting fixtures shall be provided. All lighting fixtures in the area of the stage support structure and all levels of the umbilical tower shall be hydrogen-vaporproof and incandescent.

Section 3

TCC AND ACCESS-TUNNEL SPECIFIC REQUIREMENTS

3.1 CHECKOUT AND CONTROL ROOM

An area of 12,000 sq ft is required by LMSC to house instrumentation consoles, switching and patching racks, cable spreads, and test conductor consoles, and to perform stage checkout, test control, and monitoring functions. To these requirements must be added the area required for facility control and instrument-unit equipment.

The following functions shall be performed by personnel in this area:

1. The Stage Control and Monitoring System comprises the equipment that commands the stage to assume a desired condition during a particular step in the checkout procedure or to function in a desired way at a particular step in the firing-test sequence. The commands to the stage may be originated manually at a console of the system or may originate from either the automatic-checkout system or the test-control system, to either of which the stage controls may be slaved. Inasmuch as some control of the stage is accomplished via simulators, the latter can be regarded functionally as a part of the stage control and monitoring system. The system also comprises the analog recording and display apparatus that is used to monitor the condition of the stage or to serve as backup for the digital data system.

2. The Stage Checkout and Data System comprises the apparatus used to artifically stimulate the stage, to generate stage-conditioning commands to which the stage controls may be slaved as noted above, to convert data-channel outputs as they are received from the stage into computer language, to make comparisons of data outputs with correct quantities, and to make magnetic-tape recordings of stage-test data in digital form.

3. The Stand Control and Monitoring System performs for the VTS equipment the same functions as the Stage Control and Monitoring System performs for the stage systems.

4. The Stand Checkout and Data System performs for the VTS systems the same functions as the Stage Checkout and Data System performs for stage systems.

5. The Test Control System comprises the apparatus required to generate sequences of commands to both the stage and the stand control systems that cause the captive-test program of events to take place, and incorporates such manual control of the test program as is needed.

The following typical equipment will be incorporated into integrated electronic consoles and instrumentation racks within this area to perform the noted functions:

1. Computer complex
2. Master test-control console
3. Television console
4. Auxiliary display and control consoles

5. Magnetic-tape recorders
6. Address and control decoder
7. Checkout-data demultiplexers
8. Analog-to-digital converters
9. Digital-to-analog converters
10. Ground-equipment test sites
11. Test stations
12. Cable-termination and patch panels
13. Power-supply units
14. Oscillograph and strip-chart recorders
15. Data-acquisition equipment
16. Operational-test equipment
17. Warning-system display console
18. Central-timing control
19. LH_2 storage and transfer console
20. Facilities-monitoring console
21. HPRCMS console

LMSC will provide a detailed floor layout of the Checkout and Control Room after receipt of requirements for NASA equipment to be installed in this room.

The electronic and other equipment in this room shall be supported on a platform floor constructed with removable sections with at least 18 in. clear access under the sections. The finished surface shall be true and level to $\pm 1/16$ in. over the entire floor area, and it shall be on the same level as all other areas of the TCC to avoid the need for ramps or elevators. The structure must be capable of withstanding a concentrated load of 1000 lb with span deflection not to exceed 3/32 in. and shall be capable of carrying a uniform live load of 250 lb per sq ft with a span deflection of not more than 1/32 in. Platform-floor sections shall be easily removable by one person, be interchangeable with each other, and capable of being easily reinserted into the platform-floor framework. Sections shall not be bolted down or attached in any manner to the framework. Positive contacts shall be provided in the floor structure to give electrical continuity for grounding all of the metal of the floor.

All support members and frames shall be free of sharp edges or burrs capable of damaging cable insulation.

The platform floor shall be of incombustible materials with a resilient floor covering 1/8 in. thick minimum, with an indention resistance of 200 lb/sq in. The resilient tile shall not peel off when casters are rolled across the top, of if a suction cup is used to remove the section from the floor.

Cutouts for cable openings shall be made at the time of installation of check-out equipment. The cutouts shall be edged along the periphery by 3/4-in. rigid plastic edging, and shall be provided with a foam-rubber sealer pad for sealing and spacing cables.

The reinforced-concrete subfloor shall be capable of withstanding concentrated loads imposed when the platform-floor structure is loaded to 1000 lb concentrated and 250 lb/sq ft uniform live load. The concrete surface is to be troweled to a smooth finish and treated with a floor sealant for easy maintenance.

The ceiling shall be at least 10 feet clear from the platform floor. Accoustic levels under normal occupancy and checkout equipment activity shall be limited to 40 db by sufficient use of accoustic materials.

A minimum of two double doorways 6 feet wide clear by 7.5 feet high without a raised threshold shall be required for equipment movement in addition to personnel entrances. Doorway seals shall be as referenced in Section 1.5.2. Panic-type door hardware, opening only from the inside, shall be installed on the double doors, and standard door hardware with locks shall be installed on other doors. Glass windows shall be installed in all doors opening into an aisle. Partition requirements shall be in accordance with Section 1.5.4.

In the Checkout and Control Room, the A-E shall provide at least one emergency escape hatch as further referenced in Section 1.4.4. Hardware on the hatch shall open from the inside, but by special key the door can be opened from the outside.

The fluorescent light fixtures utilized shall be of the noninterference ballast-type and shall produce light intensities of 100 footcandles on a maintained basis measured 30 in. from the floor. Lighting circuits shall be arranged for two light-level (60 fc) operation in checkout areas as will be determined when a checkout equipment layout is available. A breaker panel(s) shall be located in the Checkout and Control Room for all lighting and power circuits in that area. Further details are found in Section 1.6.

Conditioned air shall be delivered to the area to meet requirements as called out in Section 1.7.1. The area below the platform floor shall not be used as a plenum or air-distribution system. Automatic dampers with manual-switch override shall be required to vent air directly to the atmosphere and the air-supply system shall be capable of purging the air of smoke, etc., at the rate of 30 air changes per hour. Fire-protection facilities are called out in Section 1.7.4.

3.2 OFFICE AREA

An area of approximately 2430 square feet is required to accommodate LMSC supervisory and engineering personnel who are permanently assigned to the Stage Static Test Facilities. The office area shall be immediately adjacent to the Checkout and Control Room for coordination and supervisory purposes. Within this area, five modular offices are required, each capable of holding four supervisory personnel. Office requirements are based on the following criteria:

- Supervisors whose administrative headquarters are in the TCC have 4- or 5-man offices which they share.
- One multiperson office for operations management and one for engineering management are provided even though the users are not administratively quartered in the TCC, because of the frequency of occupancy of these personnel.
- Engineers whose administrative place of work is the TCC are provided with individual desks.
- Transient engineers and permanently assigned leadmen are assigned 4-man tables and chairs.

Office requirements based on the above criteria are:

a. Offices

1. Operations Management (4 men)
2. Stand Operations and Maintenance (5 men)
3. Stage Test (5 men)
4. Test Systems (4 men)
5. Engineering (5 men)
6. Liaison (5 men)

b. Engineer's desks - - - - - - - - - - - - 14

c. Stenographer's desks - - - - - - - - - - 5

d. Tables (4-man) - - - - - - - - - - - - - 8

A file-bank area for blueprints and engineering orders is required for ten cabinets. The modular office construction shall be in accordance with Section 1.5.4.

Office-type receptacles with 120-v, 60-cycle, single-phase power are required in sufficient numbers for typewriters, calculating machines, etc. These shall be three-prong twist-lock type.

3.3 BRIEFING AND CONFERENCE ROOM

Pretest and post-test operations require an area in which all personnel associated with a stage static firing can be briefed or debriefed by the test conductor and NSPD management. A rectangular area approximately 18 feet by 30 feet is planned for this purpose. This area will also be used for engineering coordination meetings with TCC personnel, as a training room, as a slide or motion-picture project area, and as a data review area where unusually large drawings or strip charts can be spread out on a wall or table surface.

During a stage static firing, it is expected that only test personnel responsible directly for equipment operation or test conducting will be allowed in the Checkout and Control Room. Other personnel associated with the test and assigned to the TCC or who have a valid reason to be present shall be accommodated in this room as an observation area. It is necessary that a long wall of this room front on the Checkout and Control Room, preferably behind the test conductor's console. This wall shall have a glass window for the greater portion of its length with the glass at a height that will allow seated personnel in the briefing and conference room to reasonably see test-conductor activities and stage-monitoring displays in the Checkout and Control Room. This window shall be covered by a view-shielding device or material when the room is not being used as an observation area or when classified data is on view on either side of the window. Partition construction and accoustic requirements are called out in Section 1.5.4.

Two standard-width doorways shall be provided: one opening into the office area and the other into the Checkout and Control Room. Keyed locks shall be provided on door hardware. A full-room-width blackboard and a standard-sized pull-down projector screen shall be provided at one end of the room. The other long wall shall have a clipping device or tackable edge that will allow long drawings or charts to be wall mounted. The room shall be filled with conference tables in line, with chairs and side chairs to hold 50 persons. Area for a portable lecturn shall be provided.

A one-way ceiling speaker(s) connected to the test conductor's intercom circuit shall keep personnel in the room informed of test activities. If additional test-monitoring displays or communication wires are brought from the Checkout and Control Room, a cable trench or subsurface duct in this area will be required. A wall jack connected to ceiling speakers is required at the location where the projector will be placed. A minimum of one electrical receptacle shall be provided on each wall with 120-v, 60-cycle, single-phase power. At the door entrances, a two-position or split wall switch shall be provided for light control to allow part of the room near the projector screen or monitoring displays to be darkened while the balance of the room is lighted.

3.4 TAPE-STORAGE ROOM

This area is planned for storage of clean magnetic tapes and oscillograph paper and to provide ready access to previously programmed tapes and punched cards. Only active and in-work materials are to be stored at this location. It should be immediately adjacent to the Checkout and Control Room. The room is planned as rectangular in shape with 72 square feet of area containing approximately six tape storage racks or cabinets.

3.5 EMERGENCY FOOD-DISPENSING AREA

This area shall contain a drinking fountain and sufficient automatic dispensing machines of sandwiches, food snacks, and liquid drinks to sustain personnel during an emergency for at least a 12-hour period of time (see Section 1.4.3 for headcounts during test periods). The area is planned as 144 square feet.

A potable water supply and waste-drain service shall be provided in the area.

3.6 TOILET FACILITIES

Toilet facilities for men and women based on maximum personnel headcounts as referenced in Section 1.4.3 are to be provided. It is to be assumed that the clerical help (total 5) shall be women.

The floor surface and the wainscot area around urinals shall be of a material that is washable, easily maintained in a sanitary manner, nonporous, acid resistant, and of a nonslip nature. A floor drain shall be required at all urinals.

Hot and cold water is required for all lavatories.

Mirrors, shelves, and paper-towel and protective seat and other dispensers and receptacles shall be installed in convenient locations. Area for a comfort sofa shall be provided for use in the women's toilet.

3.7 HEALTH PHYSICS AND FIRST AID

An area of approximately 240 square feet is required for a dual-function room. One side of the health physics room is to front on the access tunnel and is to be equipped with a glass service window so that all personnel entering or leaving the TCC area may be checked and given special work permits, instructions, or dosimeters depending on their work station. Additional equipment in this area shall include a desk, work bench for calibrating, servicing, and repairing portable radiation detectors, and a storage cabinet for supplies.

In addition, all radiation and hazard monitoring and warning equipment shall readout, record, and alarm and be controlled by the HPRCMS console in this area. In addition, certain readouts from the facility monitoring console that affect personnel safety shall appear on a console in this area. Provision shall be made to wall mount a portable gas analyzer near the facility monitoring console.

An intercom station connected with the NSPD central intercom network and a microphone station on the public address system for the Stage Static Test Facility area are required.

In the first-aid portion of this room, an area is required for an examining table, medical-supply cabinet, emergency air-breathing apparatus, portable stretcher, and a lavatory with hot and cold water supply. The doorway entrance into the first-aid area shall be 4 feet wide and shall exit into an aisle wide enough to allow a wheeled guerney to be turned into the aisle.

An electrical service receptacle with 120-v, 60-cycle, single-phase power is required on all walls in the health-physics area and on two walls in the first-aid area. The fluorescent light fixtures shall be of the noninterference type. The HPRCMS and facility monitoring consoles and paging equipment in the health-physics area are to be supplied with power from the emergency battery power system in case of failure of other electrical power supply. Cabling from the Checkout and Control Room shall be in a cable trench with removable cover plate(s) that are flush with the floor surface.

3.8 SUPPORT AND MAINTENANCE ROOM

An area of 480 square feet shall be required for five electronic work benches, and a supporting amount of cabinets and a cable-reel rack. This area is intended to be utilized for emergency light repair or modification of checkout equipment where it is determined that such repair can be most efficiently and economically performed in the TCC area. All major repairs or modifications are to be performed in the SAM Building. A grouping of consoles may have to be temporarily stored or worked on in this area prior to shipment to the SAM Building for which a clear area near the door is required. A double door 6 ft wide by 7.5 ft high is required.

Fire-protection requirements are stated in Section 1.7.4.

Electrical service receptacles for the 5 technicians benches are required, with each bench having at least one receptacle. Power to these receptacles shall be 120/208v ±5v, single phase, 60 ±0.3 cycles per second. One receptacle shall be installed on each wall with 120/208v ±5v, three phase, 60 ±0.3 cycle per second power. The fluorescent light fixtures shall be of the non-interference ballast type.

Any cabling from the Checkout and Control Room, if required, shall be in a cable trench with removable cover plate(s) that are flush with the floor surface.

3.9 MATERIAL AND PARTS STORAGE ROOM

An area of 144 square feet is required for storing a minimum of spare components, hand tools, and electronic meters. A split door 3 ft 6 in wide by 7 ft high is to be provided with the bottom section to have a service counter. The door hardware shall allow the door to close as a unit and be key locked.

Two 120-v, 60-cycle, single-phase service receptacles shall be provided in the area. Refer to Section 1.7.4 for fire-protection details.

3.10 MECHANICAL AND ELECTRICAL ROOM

This area is provided for electrical switch-gear and protective devices, emergency battery and intercom battery racks, a GN_2 station; in addition, it can be used for the engine-driven generator and air-conditioning equipment. The area shall be located far enough away from the Checkout and Control Room to attenuate any rf noises that may originate from equipment in this area.

All cables to equipment in this room shall be in a cable trench in the floor with a removable cover plate(s) flush with the floor surface. The floor surface shall be troweled to a smooth finish and shall be sloped to a floor drain. All rotating equipment shall be mounted on a concrete footing sized to support the unit and damper vibrations. All piping and ductwork shall have vibration-damping material connections near the unit.

If any air-breathing engine is installed in the room, the exhaust shall be direct-vented to the atmosphere with adequate provision to prevent air infiltration through the vent when the engine is not running.

Provision shall be made to vent directly to the atmosphere in an emergency, and the air-supply system shall be able to purge the air at 30 changes per hour.

All air-supply duct work shall at regular intervals be provided with an access door for service and vacuuming of the duct.

A double doorway shall be provided of adequate height and width to permit all equipment to be installed or removed with a minimum of disassembly.

An electrical service receptacle for 120-v, 60-cycle, single-phase power shall be provided on each wall. A 480-v, 60-cycle, single-phase service receptacle shall be provided on one wall.

All utility piping shall be color coded to applicable NRDS standard. The colored markings shall be properly spaced and located for maximum visibility and shall indicate direction of fluid flows.

3.11 JANITOR CLOSET

An area of 36 square feet is planned for storing all janitorial equipment and a working supply of paper products required to maintain the facility. A service sink with hot and cold water supply is required.

3.12 ACCESS TUNNEL

An access-tunnel system shall be required for personnel access to the TCC and to the VTS termination room areas. The access tunnel shall also provide for:

- Air-distribution ductwork to the TCC
- Cable trays for instrumentation and other signal-carrying wires
- Electric power cables
- Roadbed for transportation of material, tools, and electronic equipment from the TCC to the VTS area

The access tunnel shall be a structure designed to withstand Zone 3 earthquakes and be capable of providing radiation protection to personnel in the tunnel or TCC area. Minimum inside dimensions of the tunnel shall be 8 ft high and 8 ft wide.

If it is necessary for a roadway or trackage for the NRDS On-Site Transporter to cross directly over any part of the access tunnel, then that part of the tunnel shall be designed to accommodate vehicle loads and radiation levels from a possible excursion over the tunnel. Refer to NSP-62-3 for siting requirements.

Floors shall be designed to withstand the following loads:

Concentrated load	1000 lb
Uniform load	150 lb/sq ft

Walls and ceilings shall not be left with any pockets or jags in the cement work. The floor is to be troweled finished. Protective wall coatings are in accordance with Section 1.5.5.

The A-E is to investigate the need for providing a radiation trap in the access tunnel between the TCC and the VTS termination room. The slope of the access tunnel shall be kept to a minimum. From the VTS termination room the tunnel shall slope to a higher elevation for a minimum of 50 feet before sloping to the TCC.

A bulkhead door shall be installed at a point in each tunnel closest to the VTS termination area to prevent direct passage of liquid or gaseous hydrogen or radioactive airborne particles from entering the tunnel. An automatic pressure-sensing damper shall permit normal air discharge to the termination room but shall close when tunnel pressures cannot be maintained at 1/2 in. of water or when termination-room pressures exceed tunnel pressures because of an accident on the stand. The bulkhead door is to be manually operated and equipped with hardware on either side to prevent accidental entrapment of a person in the Termination Area. A system of interlock, audio alarm, and warning lights shall operate in conjunction with the bulkhead door and shall be monitored from the facility monitoring console.

At the access-tunnel entrance, an airlock for personnel traffic is required with seals to assure maintenance of positive pressure differential of 1/2 in. of water (min.) in the access tunnel and to avoid subjecting personnel to air buffeting when entering or leaving the tunnel. A doorway 7-1/2 ft wide clear and 7-1/2 ft high with adequate seals is required for equipment movement.

For entry to the TCC during periods of low radiation between tests, an operational and equipment-access doorway shall be provided at a point closest to the TCC with entry at grade level of the access tunnel. A labyrinth-type wall construction shall maintain the shielding capability of the TCC and access-tunnel construction. An airlock and doorway for equipment movement shall be provided with the same requirements as that at the access-tunnel entrance.

Outside the operational and equipment-access doorway, a paved surface shall slope from the ground surface to the subsurface level of the access tunnel, providing a portal area for three vehicles to be parked. At the ground surface grade, a paved parking area shall be provided for approximately 50 vehicles with parking-area lighting provided. At the portal area, provision shall be made for a shoe cleaner installation. Adequate drainage is to be provided in the portal to prevent water from entering the tunnel.

It is planned that no vehicles from the surface will be allowed to enter the access tunnel. Vehicle traffic within the tunnel shall be restricted to the use of electric carts capable of passing each other in the tunnel.

An undetermined number of cable trays 18 in. in width are required; they are to be wall mounted and to provide a useful cross-sectional area of at least 100 square inches for cables. All cable-tray sections are to be grounded, and tray construction shall be such that they are free of sharp corners or burrs and that all bolt or screw heads within the cable area shall be flush with the surface. The quantity and weight of cable cannot be specified at this time. Wires carrying power shall not be paralleled with instrumentation wires in cable trays, and shall be located in an independent duct on the opposite tunnel wall. The A-E shall design insect, rodent, and reptile control features into the cable trays. The light level in the tunnel shall be maintained at 30 footcandles. Provision shall be made for 120-v, 60-cycle, single-phase receptacles conveniently placed in the tunnel area.

Provision for conveniently placed water outlets shall be made for decontaminating the access-tunnel walls and floor. Decontamination shall generally be by use of small quantities of water sprayed from a manually held hose or by scrubbing or mopping procedures. Instrumentation and power cable joints in these areas will have to be protected. The floor of this tunnel shall slope toward floor drains or sumps which shall be connected to a waste-disposal system as referred to in NSP-62-3.

All utility piping shall be color coded as called out in Section 3.10.

Section 4

STAGE STATIC TEST FACILITIES REQUIREMENTS SUMMARY

Section 4 consists of the Stage Static Test Facilities Requirements Summary definitions, and a tabulation of the Reference Notes against the applicable paragraphs in NSP-62-20-Rev 1.

4.1 STAGE STATIC TEST FACILITIES SUMMARY CHART

The schedule on page 4-15 (Fig. 4-1) presents a concise summary of the Stage Static Test Facilities requirements. This summary is designed to serve as a reference and cross index for obtaining information; however, because of its format it does not, and cannot, represent a full listing of the requirements contained in this document. In addition, it emphasizes internal requirements and lists only a few external facilities requirements.

4.2 FACILITIES REQUIREMENTS SUMMARY DEFINITIONS

The following Facilities Requirements Summary Definitions define the requirements listed at the top of the summary.

4.2.1 Architectural and Structural

1. Head count: maximum number of personnel occupying area at any one time.
2. Area square footage: minimum floor area required by LMSC.
3. Special widths (ft): special room width requirements to accommodate LMSC operations.

4. Special door widths and heights (ft): special width and height requirements to accommodate LMSC operations.

5. Ceiling heights: minimum ceiling or overhead clearance requirements.

6. Access-ceiling space: requirement for an accessible space above suspended ceiling for concealing cables and piping.

7. Sound control (db): acoustic treatment of ceiling, walls, wainscot, or floors to meet requirements for maximum allowable decibel limit in particular areas (40 db recommended in all work areas except shops).

8. Weather stripping: requirement for assuring proper levels of dust control, sound control, and/or differential pressurization in certain areas.

9. Floor loads (lb/sq ft live loads): maximum design live loads in pounds per square foot required for LMSC operations.

10. Special foundations: requirement for special support for equipment or operations.

11. Access-floor space: requirement for a clear cableway under the entire floor which is readily available from the top by means of removable load-bearing panels.

12. Cable trenches: requirement for cableway trenches with removable load-bearing panel covers. Extent and location shall be determined from approved equipment layouts.

13. Cable trays: requirement for suspended metal trays of dimension to accommodate cabling.

14. Resilient floor: requirement for a "soft" walking floor that is durable and easily maintained in a clean and dustfree condition.

15. Hard floor: requirement for a durable, dustfree hard surface subject to concentrated wheel loads or to an area that does not require a resilient floor.

16. Dustfree floor: requirement for a floor which is comparatively free of dust. (Not as stringent a requirement as for a "clean room," which denotes an absolutely clean floor.)

17. Sparkproofing: safety requirement because of the presence of an explosive dust or gas within a room.

18. Wet condition: moderate-to-large quantities of water will be used in the area.

19. Dry condition: this area to be physically dry without any possible water source. Controlled humidity is not a part of this requirement.

20. Cold radiation zone: an area that is outside a radiation zone or is shielded to acceptable limits from any radiation source.

21. Warm radiation zone: an area that is exposed to moderate radiation and contamination.

22. Hot radiation zone: an area that is exposed to maximum radiation and contamination.

23. Emergency exits: safety requirement for personnel egress due to an emergency caused by fire, smoke, liquid, gas explosion, and/or radiation.

24. RF shielding: requirement for grounded shielding to either contain or keep out radio-frequency intereference.

25. Protective coating: special coatings required to satisfy special conditions such as decontamination washdown.

26. Platform: raised floors required within a room.

4.2.2 Heating, Ventilation, and Air-Conditioning

1. Temperature (deg F): required temperature limits within an area in fahrenheit degrees.
2. Humidity (percent maximum): required humidity limits within an area in percent of relative humidity.
3. Exhaust: requirement for exhausting area without supply ducts or environmental control.
4. Ventilation: requirement for air changes without environmental control.
5. Dust control: requirement for a mechanical means, such as by weather stripping,filters and differential pressure, to control the transfer of dust between areas.
6. Pressure differential (in.): required amount of plus or minus atmospheric pressure required relative to adjacent areas in inches of water, with existing exterior atmospheric pressure considered as zero.
7. Contamination control: requirement for a mechanical means of controlling the transfer of contaminated dust, gas (air), or liquid between areas.
8. Air changes/hour: number of required air changes per hour in a relatively closed room or area.
9. Special filters: absolute filters that conform to diactyl-phthalate (DOP) tests required by AEC.
10. Concealed ductwork: requirements to conceal ductwork in ceiling, walls, partitions, or floors.

4.2.3 Piping and Plumbing

1. Potable water: requirement for water suitable for drinking.

2. Raw water: an acceptable water requirement in certain areas; not desirable, however.
3. Hot water: requirement for available heated water. Standard requirement is for $140^{\circ}F$; special requirement for $180^{\circ}F$ to $200^{\circ}F$.
4. Cold water: requirement for cold water source in the area.
5. Demineralized water: requirement for processed water.
6. Plant air (100 psi): requirement for shop air at required pressure.
7. Instrument air (15 psi): requirement for compressed dry air at required pressure.
8. Inert gas: requirement for inert gas at required pressure.
9. Other gases: requirement at required pressure.
10. Steam: requirement for steam in an area.
11. Sanitary waste: requirement for sanitary waste service from an area.
12. Contaminated waste: requirements for disposal and storage of contaminated waste that is not to be mixed with sanitary or other waste systems.
13. Floor drains: required means of disposing of wastes in certain areas.
14. Sumps: required means of collecting wastes in certain areas.
15. Umbilical piping: special ground-to-vehicle piping.

4.2.4 Fire Protection

1. Wet pipe: automatic wet-pipe sprinkler fire-protection sprinkler system required.
2. Dry pipe: manually controlled open-head deluge system required.
3. Deluge: automatic open-head deluge system required.
4. CO_2: carbon-dioxide fire protection by means of a piped system required.
5. Portable extinguisher: requirement for portable CO_2, soda-acid, foam, or high-pressure-water hand-operated extinguishers.

6. High hazard: occupant fire-hazard designation (from uniform building code) where highly combustible materials exist.
7. Moderate hazard: occupant fire-hazard designation (from uniform building code) where slow-burning combustible materials exist.
8. Nonhazard: occupant fire-hazard designation (from uniform building code) where no combustible materials exist.

4.2.5 Electrical

1. Light intensities (fc): required footcandle lighting intensities at 30 inches above floor.
2. 120v receptacles 1-phase: required 120-volt, single-phase, 60-cycle electrical outlets.
3. 240v receptacles 3-phase: required 240-volt, three-phase, 60-cycle electrical outlets.
4. 480v receptacles 3-phase: required 480-volt, three-phase, 60-cycle electrical outlets.
5. 240v receptacles 1-phase: required 240-volt, single-phase, 60-cycle electrical outlets.
6. DC receptacles: required 28-volt dc electrical sources.
7. Instrumentation grounds: required grounding-system connections for LMSC instrumentation.
8. Equipment grounds: required ground-system connections for LMSC equipment.
9. Special fixtures: requirement for special lighting fixtures including noninterferring fluorescents, etc.
10. Emergency power: requirement for emergency power source for the area.

11. Emergency lighting: requirements for emergency lighting source for the area.

12. Emergency monitoring: requirement for emergency monitoring of radiation levels in the area during power failure.

13. Emergency ventilation: requirement for emergency ventilation or purging system.

4.2.6 Mechanical Specialties

1. Cranes: material-handling requirement for cranes in an area.
2. Monorails: material-handling requirement for monorails in an area.
3. Hoists: material-handling requirement for hoists in an area.
4. Elevators: requirement for vertical transportation of personnel and freight to or from an area.
5. Tracks: requirement for standard and/or special-gage tracks for ground handling equipment.
6. Plug doors: special plug-type radiation-shielding doors required for protection of personnel and equipment.
7. Shielding doors: special sliding-type radiation-shielding doors required for protection of personnel and equipment.
8. Shielding windows: special fixed-type windows for radiation shielding of personnel.
9. Periscopes: special viewing apparatus required for operations.
10. Turntable: required ground handling equipment.
11. After cooling: special cooling system to prevent oxidation of core of a "hot" engine required for operations.

12. Consoles: required test-operations support equipment.
13. Transfer drawers: manually controlled shielded pass-through drawer in shielding wall.
14. Plug penetrations: required spare plugs through walls to provide for installation of future equipment. (Also required sealed plugs for umbilical-tower cabling).

4.2.7 Hazards Monitoring

1. Fire detectors: areas that require fire-detection devices.
2. Fire alarms: areas that require audible and/or signal alarm system actuated by fire detectors, flow meters, etc.
3. Radiation detectors: areas that require radiation detectors.
4. Radiation alarms: areas that require radiation alarms.
5. Warning devices: required warning devices originating from the various operation warning and monitoring systems.

4.2.8 Communications

1. Telephone receptacles: required telephone outlets tied into the central telephone system.
2. Intercom receptacles: required intercommunication outlets connected into the RIFT complex system.
3. P.A. speakers: required conduit terminal boxes for public address speakers.
4. Remote-operation telephone receptacles: required receptacles for closed LMSC telephone system.

5. Radio receptacles: required outlets for radio-reception speakers or phones.
6. Special receptacles: required special outlets for closed-circuit television and other special operational circuits.
7. Public pay telephones: required telephone receptacles for public telephones for personal or private use.

4.2.9 Radiation Effects and Shielding

1. Shielding required: rooms where radiation shielding is to be provided.
2. Radiation source: rooms that will contain a radiation source.

4.2.10 Alarm and Supervisory System

1. Anti-intrusion detector: required safety device to detect presence of personnel in danger zone.
2. Intrusion alarm: required alarm actuated by anti-intrusion detectors.

4.2.11 Remote Viewing

1. Television cameras: areas requiring remote coverage by closed-circuit TV cameras.
2. Television monitors: areas requiring closed-circuit TV monitors for remote viewing.

4.2.12 Remote Handling

1. Manipulators: required devices for remote disassembly and assembly operations.
2. Vertical bridge cranes: required devices for remote manipulator and material handling.

3. Remote operated doors: required radiation-shielding doors operated in a hot zone.

4.2.13 Decontamination

1. Decontamination system: required water wash-down system, manually and remotely controlled.

4.3 REFERENCE NOTES

The tabulation of Reference Notes gives the note number as it appears on the summary and the column opposite shows the applicable paragraph or paragraphs in NSP-62-20-Rev 1 which contain more detailed information relating to the requirement.

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12	1.7.2	1-41
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26	1.6.5	1-28
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REF: NSP-62-20

STAGE STATIC TEST FACILITIES

REQUIREMENTS SUMMARY (INTERIOR)

ENGR BUHRIG/SOEHNGEN
DEPT. 32-30
DATE

ARCHITECTURAL AND STRUCTURAL

ROOM OR AREA	HEAD COUNT - MAXIMUM	AREA SQUARE FOOTAGE	SPECIAL WIDTHS FT.	SPECIAL DOOR WIDTHS FT.	SPECIAL DOOR HEIGHTS FT.	CEILING HEIGHTS FT.	ACCESS - CEILING SPACE	SOUND CONTROL DB.	WEATHER STRIPPING	FLOOR LOADS - LBS/SQ. FT. (LIVE LOADS)
TEST CONTROL CENTER										
CHECKOUT & CONTROL ROOM	65	12000		6	7.5	10		40	●	250
OFFICE AREA	55	2430				10		40	●	100
BRIEFING & CONFERENCE RM.	50	540	18			10		40		100
TAPE STORAGE ROOM	1	72				10				150
EMERGENCY FOOD DISPENSING AREA	4	144				10				100
TOILET FACILITIES	NA	432				10			●	100
HEALTH PHYSICS - FIRST AID	3	240			4	10		40	●	100
SUPPORT & MAINT ROOM	6	480		6	7.5	10			●	250
MATERIAL & PARTS STG.	1	144		(2)		10			●	150
MECH. & ELECT. ROOM	2	●		●	●	●			●	250
JANITORS CLOSET	1	36								100
ACCESS TUNNEL	NA	NA	8	6	7.5	8			●	150
VEHICLE TEST STAND										
EXHAUST SUBSTRUCTURE										
STAGE SUPPORT STRUCTURE										
UMBILICAL TOWER										
LOWER LEVEL		225				11				150
GRADE LEVEL		225				↕				150
AFT UMBILICAL LEVEL		225				↕				150
FORWARD UMBILICAL LEVEL		225				11				150
ELEVATOR		36								150
ELEVATOR PENTHOUSE		225				8				150
ELEVATOR SUMP		36	(1)			6				100
VERTICAL CABLE WAY			(1)							
TERMINATION AREA										
TERMINATION ROOM	10	316		6		(1)	●		●	150
MECHANICAL EQUIP ROOM		340		6		↕	●			250
HOT CHANGE ROOM		156				↕				100
COLD CHANGE ROOM		228				↕				100
SUBSTATION		170		6		↕				250
CORRIDOR		400		6	7.5	(1)				150

ROOM OR AREA	SPECIAL FOUNDATIONS	ACCESS - FLOOR SPACE	CABLE TRENCHES	CABLE TRAYS	RESILIENT FLOOR	HARD FLOOR	DUST-FREE FLOOR	SPARK-PROOFING	WET CONDITION	DRY CONDITION	COLD RADIATION ZONE	WARM RADIATION ZONE	HOT RADIATION ZONE	EMERGENCY EXITS	RF SHIELDING	PROTECTIVE COATING	PLATFORM(S)
TEST CONTROL CENTER																	
CHECKOUT & CONTROL ROOM	(3)	(5)			●	(8)	●			●	●			(10)		(11)	
OFFICE AREA					●		●			●	●						
BRIEFING & CONFERENCE RM.					●		●			●	●						
TAPE STORAGE ROOM					●		●			●	●						
EMERGENCY FOOD DISPENSING AREA					●		●		●		●						
TOILET FACILITIES					●		●		●		●						
HEALTH PHYSICS - FIRST AID			(6)		●		●		●		●						
SUPPORT & MAINT ROOM			(6)		●		●			●	●						
MATERIAL & PARTS STG.					●		●			●	●						
MECH. & ELECT. ROOM	●		(6)			●			●		●						
JANITORS CLOSET						●			●		●						
ACCESS TUNNEL	(4)			(7)		●			●		●			(10)		(11)	
VEHICLE TEST STAND																	
EXHAUST SUBSTRUCTURE	(1)								●				●			●	
STAGE SUPPORT STRUCTURE	(1)								●				●			●	
UMBILICAL TOWER																	
LOWER LEVEL						●	●	●	●			●		●			
GRADE LEVEL						●	●	●	●			●		●			
AFT UMBILICAL LEVEL						●	●	●	●			●		●			●
FORWARD UMBILICAL LEVEL						●	●	●	●			●		●			●
ELEVATOR										●		●					
ELEVATOR PENTHOUSE										●		●					
ELEVATOR SUMP						●	●		●			●					
VERTICAL CABLE WAY										●		●					
TERMINATION AREA																	
TERMINATION ROOM	(1)	(5)			●	(8)	●	●		●		●		(10)		(11)	
MECHANICAL EQUIP ROOM	(1)					●	●	●	●		●					↕	
HOT CHANGE ROOM						●	●		●			●				↕	
COLD CHANGE ROOM						●	●		●		●					↕	
SUBSTATION	(1)					●	●			●	●					(11)	
CORRIDOR	(1)	(5)			●	(8)	●			●	(9)	(9)					

HEATING, VENTILATION, AND AIR CONDITIONING

ROOM OR AREA	TEMPERATURE 75° F	HUMIDITY % MAXIMUM	EXHAUST ONLY	VENTILATION ONLY	DUST CONTROL	PRESSURE DIFFERENTIAL IN	CONTAMINATION CONTROL	AIR CHANGES/HOUR	SPECIAL FILTERS	CONCEALED DUCT WORK
TEST CONTROL CENTER										
CHECKOUT & CONTROL ROOM	(12)	50			(14)	+1		5	(18)	
OFFICE AREA	±5	50			(14)	+1		5		
BRIEFING & CONFERENCE RM.	±5	50			(14)	+1		7		
TAPE STORAGE ROOM	±5	50			(14)	+1		5		
EMERGENCY FOOD DISPENSING AREA	±5				(14)	+1		5		
TOILET FACILITIES	±5		●			±1/2		10		
HEALTH PHYSICS - FIRST AID	±5	50			(14)	+1		5		
SUPPORT & MAINT ROOM	±5	50			(14)	±3/4		5		
MATERIAL & PARTS STG.	±5	50			(14)	±3/4		5		
MECH. & ELECT. ROOM				●		±3/4			(16)	
JANITORS CLOSET				●		±3/4				
ACCESS TUNNEL				●		±1/2	(15)		(18)	
VEHICLE TEST STAND										
EXHAUST SUBSTRUCTURE										
STAGE SUPPORT STRUCTURE										
UMBILICAL TOWER										
LOWER LEVEL				●						
GRADE LEVEL				●						
AFT UMBILICAL LEVEL				●						
FORWARD UMBILICAL LEVEL				●						
ELEVATOR				●						
ELEVATOR PENTHOUSE				●						
ELEVATOR SUMP										
VERTICAL CABLE WAY				●		±1/2				
TERMINATION AREA										
TERMINATION ROOM	(12)	50				±1/2		10		
MECHANICAL EQUIP ROOM				●	(14)	↕		↕	(16)	
HOT CHANGE ROOM			●	●		↕		↕		
COLD CHANGE ROOM			●	●		↕		↕		
SUBSTATION				●		↕		↕		
CORRIDOR				●		±1/2		10		

PIPING AND PLUMBING

ROOM OR AREA	POTABLE WATER	RAW WATER	HOT WATER	COLD WATER	DEMINERALIZED WATER	PLANT AIR - 100 PSI	INSTRUMENT AIR - 15 PSI	INERT GAS	GASES OTHER	STEAM	SANITARY WASTE	CONTAMINATED WASTE	FLOOR DRAINS	SUMPS	UMBILICAL PIPING
TEST CONTROL CENTER															
CHECKOUT & CONTROL ROOM													●		
OFFICE AREA															
BRIEFING & CONFERENCE RM.															
TAPE STORAGE ROOM															
EMERGENCY FOOD DISPENSING AREA	●			●							●				
TOILET FACILITIES	●		●	●							●		●	●	
HEALTH PHYSICS - FIRST AID	●		●	●							●				
SUPPORT & MAINT ROOM						●									
MATERIAL & PARTS STG.															
MECH. & ELECT. ROOM	●			●		●					●		●	●	
JANITORS CLOSET	●		●	●							●				
ACCESS TUNNEL	●			●								●	(17)	(18)	
VEHICLE TEST STAND															
EXHAUST SUBSTRUCTURE												●			
STAGE SUPPORT STRUCTURE															
UMBILICAL TOWER															
LOWER LEVEL															
GRADE LEVEL	●			●		●									(19)
AFT UMBILICAL LEVEL	●			●		●									(19)
FORWARD UMBILICAL LEVEL	●			●		●									(19)
ELEVATOR															
ELEVATOR PENTHOUSE															
ELEVATOR SUMP														(1)	
VERTICAL CABLE WAY															
TERMINATION AREA															
TERMINATION ROOM														●	
MECHANICAL EQUIP ROOM	●			●		●							●		
HOT CHANGE ROOM			●	●							●	●	●		
COLD CHANGE ROOM	●		●	●							●		●		
SUBSTATION											●		●		
CORRIDOR														●	

FIRE PROTECTION

ROOM OR AREA	WET PIPE	DRY PIPE	DELUGE	CO_2	PORTABLE EXTINGUISHER	HIGH HAZARD	MODERATE HAZARD	NON-HAZARD
TEST CONTROL CENTER								
CHECKOUT & CONTROL ROOM				(20)	(20)		●	
OFFICE AREA							●	
BRIEFING & CONFERENCE RM.				●	●		●	
TAPE STORAGE ROOM							●	
EMERGENCY FOOD DISPENSING AREA							●	
TOILET FACILITIES				●	●			●
HEALTH PHYSICS - FIRST AID							●	
SUPPORT & MAINT ROOM				●	●		●	
MATERIAL & PARTS STG.				●	●		●	
MECH. & ELECT. ROOM				●	●		●	
JANITORS CLOSET							●	
ACCESS TUNNEL					●		●	
VEHICLE TEST STAND								
EXHAUST SUBSTRUCTURE								
STAGE SUPPORT STRUCTURE								
UMBILICAL TOWER								
LOWER LEVEL			●				●	
GRADE LEVEL			●			●		
AFT UMBILICAL LEVEL			●			●		
FORWARD UMBILICAL LEVEL			●			●		
ELEVATOR					●		●	
ELEVATOR PENTHOUSE				●			●	
ELEVATOR SUMP						●		
VERTICAL CABLE WAY				●			●	
TERMINATION AREA								
TERMINATION ROOM				(20)			●	
MECHANICAL EQUIP ROOM				●			●	
HOT CHANGE ROOM								●
COLD CHANGE ROOM					●			●
SUBSTATION				●			●	
CORRIDOR					●		●	

ELECTRICAL

ROOM OR AREA	LIGHT INTENSITIES FC	120 V RECEPTACLES 1-PH	240V RECEPTACLES 3-PH	480 V RECEPTACLES 3-PH	240 V RECEPTACLES 1-PH	DC RECEPTACLES	INSTRUMENTATION GROUNDS	EQUIPMENT GROUNDS	SPECIAL FIXTURES	EMERGENCY POWER	EMERGENCY LIGHTING	EMERGENCY MONITORING	EMERGENCY VENTILATION
TEST CONTROL CENTER													
CHECKOUT & CONTROL ROOM	100	●					(21)	(22)	(23)	(25)	(26)	(27)	(28)
OFFICE AREA	70	●						●					
BRIEFING & CONFERENCE RM.	70	●						●					(28)
TAPE STORAGE ROOM	70												
EMERGENCY FOOD DISPENSING AREA	70	●						●					
TOILET FACILITIES	30	●											
HEALTH PHYSICS - FIRST AID	70	●					(21)	●	(23)	(25)	(26)	(27)	(28)
SUPPORT & MAINT ROOM	70	●					(21)	(22)	(23)				(28)
MATERIAL & PARTS STG.	70	●						●					(28)
MECH. & ELECT. ROOM	30	●		●				●		(25)	(26)		(28)
JANITORS CLOSET	30												
ACCESS TUNNEL	30	●						(22)		●	(26)		
VEHICLE TEST STAND													
EXHAUST SUBSTRUCTURE													
STAGE SUPPORT STRUCTURE													
UMBILICAL TOWER													
LOWER LEVEL	30	●						●	(24)				
GRADE LEVEL	70	●		●				●	↕				
AFT UMBILICAL LEVEL	70	●						●	↕				
FORWARD UMBILICAL LEVEL	70	●						●	↕				
ELEVATOR	30							●	↕	●			
ELEVATOR PENTHOUSE	30	●						●	(24)				
ELEVATOR SUMP													
VERTICAL CABLE WAY													
TERMINATION AREA													
TERMINATION ROOM	100	●		●				●	(24)	(25)	(26)		
MECHANICAL EQUIP ROOM	30	●		●				●		(25)			
HOT CHANGE ROOM	↕	●						●					
COLD CHANGE ROOM	↕	●						●					
SUBSTATION	↕	●						●					
CORRIDOR	30	●											

MECHANICAL SPECIALTIES

ROOM OR AREA	CRANES	MONORAILS	HOISTS	ELEVATORS	TRACKS	PLUG DOORS	SHIELDING DOORS	SHIELDING WINDOWS	PERISCOPES	TURNTABLE	AFTER COOLING	CONSOLES	TRANSFER DRAWERS	PLUG PENETRATIONS
TEST CONTROL CENTER														
CHECKOUT & CONTROL ROOM									(32)			●		●
OFFICE AREA														
BRIEFING & CONFERENCE RM.														
TAPE STORAGE ROOM														
EMERGENCY FOOD DISPENSING AREA														
TOILET FACILITIES														
HEALTH PHYSICS - FIRST AID												●		
SUPPORT & MAINT ROOM												●		
MATERIAL & PARTS STG.														
MECH. & ELECT. ROOM														
JANITORS CLOSET														
ACCESS TUNNEL							(31)							
VEHICLE TEST STAND														
EXHAUST SUBSTRUCTURE														
STAGE SUPPORT STRUCTURE														
UMBILICAL TOWER														
LOWER LEVEL														
GRADE LEVEL														
AFT UMBILICAL LEVEL														(38)
FORWARD UMBILICAL LEVEL														(38)
ELEVATOR				(29)										
ELEVATOR PENTHOUSE														
ELEVATOR SUMP														
VERTICAL CABLE WAY														
TERMINATION AREA														
TERMINATION ROOM														(36)
MECHANICAL EQUIP ROOM														
HOT CHANGE ROOM														
COLD CHANGE ROOM														
SUBSTATION														
CORRIDOR														

HAZARDS MONITORING

ROOM OR AREA	FIRE DETECTORS	FIRE ALARMS	RADIATION DETECTORS	RADIATION ALARMS	WARNING DEVICES
TEST CONTROL CENTER					
CHECKOUT & CONTROL ROOM	(33)	●	(34)	(34)	(35)
OFFICE AREA		●			
BRIEFING & CONFERENCE RM.					
TAPE STORAGE ROOM	●				
EMERGENCY FOOD DISPENSING AREA					
TOILET FACILITIES					
HEALTH PHYSICS - FIRST AID	●	●	(34)	(34)	(35)
SUPPORT & MAINT ROOM	●	●			
MATERIAL & PARTS STG.	●	●			
MECH. & ELECT. ROOM	●	●			
JANITORS CLOSET					
ACCESS TUNNEL	●	●	(34)	(34)	(35)
VEHICLE TEST STAND					
EXHAUST SUBSTRUCTURE	●	●	(34)		
STAGE SUPPORT STRUCTURE	●		(34)		
UMBILICAL TOWER					
LOWER LEVEL	●	●	(34)	(34)	(35)
GRADE LEVEL	●	●	↕	(34)	(35)
AFT UMBILICAL LEVEL	●		↕		
FORWARD UMBILICAL LEVEL	●		(34)		
ELEVATOR					
ELEVATOR PENTHOUSE					
ELEVATOR SUMP					
VERTICAL CABLE WAY					
TERMINATION AREA					
TERMINATION ROOM	●				
MECHANICAL EQUIP ROOM	●				
HOT CHANGE ROOM	●				
COLD CHANGE ROOM	●				
SUBSTATION	●				
CORRIDOR		●			

COMMUNICATIONS

ROOM OR AREA	TELEPHONE RECEPTACLES	INTERCOM RECEPTACLES	P.A. SPEAKERS	REMOTE OPR. TEL. RECEPT.	RADIO RECEPTACLES	SPECIAL RECEPTACLES	PUBLIC PAY TELEPHONES
TEST CONTROL CENTER							
CHECKOUT & CONTROL ROOM	●	(36)	(37)	●	(38)		
OFFICE AREA	●		(37)	●			●
BRIEFING & CONFERENCE RM.	●	(36)		●			
TAPE STORAGE ROOM							
EMERGENCY FOOD DISPENSING AREA							
TOILET FACILITIES							
HEALTH PHYSICS - FIRST AID	●	(36)	(37)	●			
SUPPORT & MAINT ROOM	●		●				
MATERIAL & PARTS STG.	●		●				
MECH. & ELECT. ROOM	●		●				
JANITORS CLOSET							
ACCESS TUNNEL	●	(36)	(37)				
VEHICLE TEST STAND							
EXHAUST SUBSTRUCTURE							
STAGE SUPPORT STRUCTURE							
UMBILICAL TOWER							
LOWER LEVEL			(37)				
GRADE LEVEL	●	(36)	(37)				
AFT UMBILICAL LEVEL	●	(36)					
FORWARD UMBILICAL LEVEL	●	(36)					
ELEVATOR							
ELEVATOR PENTHOUSE							
ELEVATOR SUMP							
VERTICAL CABLE WAY							
TERMINATION AREA							
TERMINATION ROOM	●	(36)					
MECHANICAL EQUIP ROOM	●	↕					
HOT CHANGE ROOM	●	↕					
COLD CHANGE ROOM	●	(36)					
SUBSTATION							
CORRIDOR							

RADIATION EFFECTS AND SHIELDING / ALARM AND SUPERVISORY SYSTEM / REMOTE VIEWING / REMOTE HANDLING / DECONTAMINATION

ROOM OR AREA	SHIELDING REQUIRED	RADIATION SOURCE	ANTI-INTRUSION DETECTOR	INTRUSION ALARM	TELEVISION CAMERAS	TELEVISION MONITORS	MANIPULATORS	VERTICAL BRIDGE CRANES	REMOTE OPERATED DOORS	DECONTAMINATION SYS.
TEST CONTROL CENTER										
CHECKOUT & CONTROL ROOM			(39)	(39)	(40)	(40)				
OFFICE AREA										
BRIEFING & CONFERENCE RM.										
TAPE STORAGE ROOM										
EMERGENCY FOOD DISPENSING AREA										
TOILET FACILITIES										
HEALTH PHYSICS - FIRST AID										
SUPPORT & MAINT ROOM										
MATERIAL & PARTS STG.										
MECH. & ELECT. ROOM										
JANITORS CLOSET										
ACCESS TUNNEL			(39)	(39)						(41)
VEHICLE TEST STAND										
EXHAUST SUBSTRUCTURE	●	●			●					●
STAGE SUPPORT STRUCTURE	●	●			●					●
UMBILICAL TOWER										
LOWER LEVEL	●									●
GRADE LEVEL	●				(40)					●
AFT UMBILICAL LEVEL	●				●					●
FORWARD UMBILICAL LEVEL	●				●					●
ELEVATOR										
ELEVATOR PENTHOUSE										
ELEVATOR SUMP										
VERTICAL CABLE WAY										
TERMINATION AREA										
TERMINATION ROOM	●				●					
MECHANICAL EQUIP ROOM	●									
HOT CHANGE ROOM	●									
COLD CHANGE ROOM	●									
SUBSTATION	●									
CORRIDOR	●									

LEGEND: ● REQUIREMENT (1) REFERENCE NOTE

Fig. 4-1 Stage Static Test Facilities Summary Chart