Education and Training at SNL: Past and Present

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Sandia National Laboratories

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(An Annotated Briefing)

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Abstract

The purpose of this review was to provide insights and information to Sandia National Laboratories' (SNL) Education Council on the state of technical education and training at SNL in order to address the concern that a change in philosophy surrounding education had occurred. To accomplish this, the status of current and past technical training and education programs were compared, and significant changes at SNL were assessed for their impact on education and training. Major changes in education and training are in the advertisement of course offerings, the course delivery methods, and the funding mechanisms for student and instructor time as well as course costs. The significant changes in SNL which influenced technical training and education are the considerable increase in mandatory or compliance training, a fundamental shift in SNL's management structure from an institutional structure to a more business-like, project-budgeted structure, and the change in SNL's mission at the end of the Cold War. These changes contributed to less time for technical training, reduction of training funds, elimination of some training, and a Service Center approach to paying for training. Most importantly, the overall combined effect has resulted in a shift from a strategic to a tactical training approach. The Corporate Training Department (CTD) has maneuvered to accommodate these changes and keep abreast of constantly changing needs.

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Jerry McDowell (Directory, Center 15400) and Charline Wells (Manager, Org. 3020) contacted the Systems Studies Group in Center 9800 requesting a study be performed on the condition of technical education and training at Sandia National Laboratories (SNL). Tom Bomber and Celeste Drewien began investigating this issue in March 2002.

Purpose

- **Provide insights and information on technical training and education at Sandia by**
  - **Looking at past and current conditions and**
  - **Identifying potential factors that influenced changes.**

Purpose

A sub-committee of the Education Council, or the "Gang of Six", wanted a broader look at the data and information on technical training and education at Sandia. There was expressed interest in the role that INTEC (In-Hours Technical Courses) training provided to Sandia employees, particularly the Technical Staff, in comparison to what is presently available as equivalent opportunities. There was concern that a change in the philosophy surrounding education at SNL had occurred. Our primary goal in performing this study was

    i.)   to provide insights and information on technical training and education by comparing the past and present status of training opportunities and

    ii.)   to identify the factors that potentially affected training and education at SNL.

Our primary focus was on education and training at SNL/New Mexico; and, the data and observations in this report pertain to SNL/New Mexico's education and training program. However, many of the individual programs are also operated in California, and we could not always be sure that the data on the operation of these programs only contained completion and participation data from SNL/New Mexico. Therefore, some data for SNL/California may be included in some of the completion and participation data presented here. But we feel that its inadvertent inclusion does not effect our observations on the state of the SNL/New Mexico training and education program.

Questions To Be Addressed

- **What training was previously available?**
- **What was the structure of the programs?**
- Which types of courses were offered?
- **How/Where were the courses offered?**
- **Who taught the courses?**
- **How much time was spent in training?**
- **What was the cost of the courses and how were costs charged?**
  - **What case numbers?**
- **How/Where were the courses advertised?**
- **What has changed regarding training and education at SNL?**

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Overview

We approached this study by trying to answer some of the questions listed above. These questions provided a guide to our efforts and are used as a general outline for this presentation. We provide a historical background of training programs previously available, state the goals of those programs, and suggest what analogs exist in present programs. We try to define the structure of the programs, the costs and funding of the programs, and how courses are delivered and advertised. We were not able to collect significant data on the amount of time spent in training or on the demographics of the instructors. Although we were able to get some information on the types of courses offered, we do not provide a detailed comparison of courses offered.

Data Availability

- **Some historical data prior to 1976**
- **Corporate Training & Development Annual reports**
    - **From 1976 through 1989**
        - **Contain information on Training/Education Programs available, descriptions of programs, and INTEC courses offered, and numbers participating in or graduating from various programs**
    - **From 1995 to present**
        - **Contain information on people, partnerships, training delivery strategies, TEDS, program operations, Technical & Compliance training, budget, and course completions**
- **INTEC and OOH course catalogs**
- **TEDS**
- **R. Floran's study on education and training (Feb 2000)**
- **Ad-Hoc queries from Human Resources databases**
- **Organizational training programs and budget data**

Data Gap: 1990-1994

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Data Availability

Some limited historical data prior to 1976 was found. However, the primary data sources for this study were CTD annual reports, INTEC and Out-of-Hours (OOH) course catalogs, and recent budget information. The annual reports were available from 1976 through 1989 and varied only slightly in format over this entire time. They contain information on the programs available along with descriptions of the programs and numbers of participants or completions annually. In 1990 CTD was told not to spend the time and money to produce the reports with information that was thought to be of little use, so a gap in data exists from 1990 until 1995 when annual reports were published once again. The newer versions of the annual reports differ greatly from the older versions in that they contain information on the people in the Corporate Training & Development organizations, partnership information, training delivery strategies and information about the TEDS database. The data on program operations, budget and course completions/participants is presented at an aggregate overview level.

Robert Floran[1] performed a study assessing SNL as a learning institution. This study led to much of the recent trend data we have for the various programs offered through CTD and the current budget data.

Other data was obtained through Ad-Hoc queries from the Human Resources (HR) databases, the corporate financial database, and through personal contacts with the line organizations.

[1]*Robert Floran, "Are we still a Learning Organization?", (July 19, 2000)*

Data Availability Observations

- **Any data on Technical course completions from TEDs would require generating a special Ad Hoc query.**
  - **Even data on courses actually available at a specific time would require the generation of an Ad Hoc query by one of the database experts!**

- **Data on University degrees earned were obtained from an ad hoc query generated by HR specifically for this effort.**

- **Organizational training budget data (to be discussed later in the presentation) is very difficult to collect and not reported in any consistent manner.**

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TEDS, a training database, is maintained by the Human Resources organization. It contains very detailed information on Compliance course completions and easily reports completions by individuals and departments in order to generate Compliance records. However to obtain information, for example, on just Technical course completions requires an Ad hoc* query.

The quality of the data in TEDS on courses not sponsored by the CTD is questionable, because employees must submit their own completions data. Any internal or external courses taken by an employee can be reported as Organization Specific training. Therefore, the records of course completions in this category are not reliable.

We were able to obtain information on the numbers of university degrees earned through an Ad hoc query of the HR database; the query had been developed for CTD and could be easily modified to meet our needs.

We sought training budget data from Divisions 1000, 2000, 5000, 6000, 8000, 9000, and 14000. This proved difficult—in fact Division 1000 (except for Center 1700) did not respond. The data reported by the other Divisions was not recorded in any consistent manner. This was due in part to the multiple methods used by various Divisions (and Centers and Departments) to fund training. Despite these difficulties, the effort yielded some useful information.

CTD financial data was made available from FY99 forward. The budgeted amounts are the CTD's indirect funds; but the total costs are the budgeted amounts plus student labor estimated from an average rate of $64/hour.

*An Ad hoc query refers to a query performed by a knowledgeable database administrator. Such queries take a lot of time to construct and are not available to the general laboratories' population.

Data Availability Observations (cont.)

- **Historical data is very sparse**

- **Annual reports generally contained course completion data (except as noted 1990-1994), but metrics were not always consistent from year to year.**
  - **In some cases, the data were presented as completions; in other cases as participants.**
  - **Often the aggregation categories changes from year to year— sometimes presented by subject, sometimes by delivery mode.**

- **It is not possible to distinguish between a 3-hour short course or a 16-week course in some of the course completion data.**

- **The inconsistency makes drawing any conclusion from the data over longer periods of time very difficult.**

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Historical data on training and course completions is very sparse. Nanette Morton (2000) had some information on two of the oldest programs at SNL. Otherwise, historical information was derived from comments on and references to programs contained in the early Corporate Training Department's annual reports.

The annual reports existed from 1976 through 1989 when they were suspended. Later, in 1995, annual reports were again published but in a much different format. The reporting metrics such as course completions or participation, course length, and budget information changed from report to report. The categories in which the completion or participation data were reported also often changed. Sometimes the focus was on completions of participants by delivery mode; at other times, on completions by course type.

It is generally not possible to distinguish between a 3-hour course completion or a 16-week 32-hour course completion in the annual report data.

The general inconsistencies in the available data make it very difficult to draw any conclusions regarding trends over long periods of time.

Earliest Training Efforts

- **Technical Development Program (1959-1968)***
  - **To create a pool of engineers with graduate-level skills**
    - **Trained 465 employees total over 9 years until hiring MS level Tech Staff became the norm**
  - **Forerunner of current University Programs**
    - **Time and expenses paid**

- **Unified Science and Engineering Course (1960s)***
  - **To train all first- and second-level technical supervisors in a six-week course including lectures by SNL SME**
    - **Provided students a 23-book personnel technical library**
    - **Trained 25 to 30 per year and lasted 7 years**

* Reference: Nanette Morton

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What training was previously available? What was the structure of the programs?

The purpose of this historical perspective is to provide an understanding of the quantities, level, aims, and availabilities of education and training opportunities over time. Some employees may remember certain aspects of programs but not understand what happened to the program or if it has a present day counterpart. Hopefully, this section will fill in such information for the reader's benefit.

Earliest training efforts at SNL began in the 1950's. There was a Technical Development Program (TDP) from 1959-1968, designed to create a pool of engineers with graduate-level skills. The program trained 465 employees over the 9 years of its existence. These employees received Masters (MS) level courses, mostly in Mechanical Engineering, taught by SNL employees. The program terminated when hiring Technical Staff at the MS level became the norm—i.e. when SNL could hire to meet its demand. TDP was the forerunner of the University Programs. As with today's full-time University Programs, the employees participating in TDP were salaried and their expenses were paid[2].

Sandia also had a training program for both first and second level technical managers. This Unified Science and Engineering Course was a six-week course that included lectures by Sandia's subject matter experts (SMEs). Students were provided with a 23-book personal technical library. The program trained about 25-30 managers per year and lasted 7 years.[2]

[2]*Nanette Morton, private communication, (March 2002)*

Earliest Training Efforts (cont.)

- **Self-Study Program (1956-dissolved early 90s) participation was 400-800 people per year in the 1983-1987 time frame**
  - Used for self-improvement and/or correcting deficiencies in backgrounds (technical and non-technical)
  - Today's Distance Learning Program is the Self-Study Program of the Past

- **Out-of-Hours Program (1956-early 90s) participation ranged from 2000-3000 per year over the 1973-1987 time span**
  - Designed to develop skills/knowledge relating to current and future job assignments
  - Courses were offered during lunch or before and after work
  - Open to others on KAFB
  - Course topics ranged from trades and clerical training to graduate-level education in Science and Engineering
  - Phased out due to budget constraints and increased options through Distance Learning

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The Self-Study Program and Out-of-Hours Program were implemented in 1956[*] and in some respects still exist today (although not necessarily by those names) in the Distance Learning Program. The Self-Study Program was designed for self-improvement and correcting specific training deficiencies. Employees learned at their own pace, and completion was not required. The OOH Program was a large program, having 2000-3000 completions annually through the mid-'70s to early '90s. It was open to non-Sandians also. The program originated out of lunchtime conferences put on by Technical Staff, who were subject matter experts. As the program expanded, formal courses were offered during lunch or before or after work. Instructors were paid for preparation and teaching time. Course topics ranged from trades and clerical training to graduate-level education in Science and Engineering. Certificate programs were developed in certain subject areas like Computer Technology, Data Processing, and Scientific Programming. Courses lasted from 45-70 minutes and met one, two, or three times per week. A course catalog[3] put out in August 1987 contained over 160 pages with about 4 courses described per page! The program was phased out due to budget constraints and increased options available through local sources (Technical Vocational Institute) and Distance Learning[4].

[3]*Ruth N. Brooks, "A Catalog of Out-of-hours Courses to Aid Continuing Professional Development", SC-M-72-0336N (August 1987), 15th revision*
[4]*Belinda Holley, private communication, (June 2002)*

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[*]Sometimes determining the exact starting and termination dates for a program was difficult and generally was inferred from the references to the programs in annual reports or catalogues.

In-Hours Technical Training

- **INTEC (1972- 1994?) enrollment increased from 800 to 1800 per year during the 1975-1983 timeframe**
  - **Designed to promote the continued professional development of SNL's staff by**
    - **Satisfying demands of current programs,**
    - **Supporting/expanding technical option of future programs, and**
    - **Broadening opportunities for tech staff**
  - **Students attended class in-hours 2-3 hours/week for up to 16 weeks**
  - **Forerunner of today's Technical Program and some of the Distance Learning Program**
- **Stanford Center for Professional Development (ITV) (1973-present?) participation levels were around 30 to 40 per year in the 1970s and 80 to 90 per year in the 1980s**
  - **Designed to help employees enter the Doctoral Study Program and pursue their degree at Stanford University**
  - **Courses were offered in-hours**
  - **Delivered via video sometimes with proctor oversight**

The INTEC Program existed formally from 1972 through about 1994 with enrollments of 800 to 1,800 per year during the 1975-1983 timeframe. INTEC was designed to promote continued education of professional staff by training for current projects, preparing for future programs, and general broadening of background and opportunities. Students were allowed to charge the indirect corporate overhead case A290 to attend classes, which were taught in-hours. Instructors, who were often Sandians (courses were also taught by faculty from University of New Mexico (UNM) and New Mexico Institute of Mining and Technology (NMIMT) and industry professionals), had their time paid. Courses met 2-3 times per week and lasted for up to 16 weeks. About 100 courses were offered in 1992; most of which were full 16-week courses. A majority of students participated in live classroom lectures versus other Distance Learning delivery mechanisms[5]. The last course catalog[6] was published in 1992 for the Spring semester. INTEC is in some ways the forerunner of today's Technical Program and parts of the Distance Learning Program. The Stanford Professional Development Program, an in-hours program started in 1973 and often called the Stanford ITV program, helps employees prepare for the opportunity to obtain a Masters or coursework for a Doctoral degree from Stanford University. Alternately, it provides another mechanism for taking university courses. Participation ranged from 30-40 per year in the '70s to 80-90 in the '80s. In FY02 there was one Stanford TVI participant seeking a degree through the Tuition Assistance Program.

[5] "Education: Key to the Future", 12th Annual Report, Education & Training, (Summer 1988-Spring 1989)
[6] "INTEC, In-Hours Technical Education Courses, 20th Anniversary", (Spring 1992 Catalog)

Other Technical Training*

- **Special In-Hours Courses & Seminars started about 1972****
  - **Meet specific, short-term needs of line organizations**

- **In-Hours Stand Alone Computer Courses (ISAC) started about 1980***
  - **Offered mini/microcomputer & specialized technical short courses that did not qualify for INTEC consideration**

- **External (Short-Course) Training**
  - **Usually not monitored by the training organization although data can now be recorded in TEDS**

*CTD can support these programs if they are relevant to at least 3 of the Divisions
**These options were the forerunners of current Organization Specific training.
$0.53M (FY99) Organization Specific reported

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Other technical training opportunities have existed over time. The Special In-Hours Courses & Seminars started around 1972 and were designed to meet specific, short-term needs of line organizations. As with INTEC, the CTD could sponsor a course if at least 3 Divisions benefited from it[7].

The In-Hours Stand Alone Computer Courses, or ISAC, started around 1980. Initially, courses in mini- and micro-computers and specialized technical short courses—that did not qualify for INTEC consideration—were offered. ISAC-type training exists today in Distance Learning (NetG, Kemtah, etc.), Organization Specific, and Computer Science/Information Technology Programs amongst others.

External (to SNL) training takes various forms. Sandians have always attended conferences, workshops, and short courses that are not sponsored by Sandia. Tracking these is only possible if such information is voluntarily entered into today's TEDS database for education and training data. Some of these are entered into TEDS and would be categorized as Organization Specific.

The present Organization Specific Program, which lists about 3,000 courses taken internal and external to SNL[7], was funded to a level of about half a million dollars in fiscal year 1999 (FY99). These funds paid to administer the internally offered courses.

[7]*Charline Wells, private communication, (July 2002)*

Past Trades/TNG Training Programs*

- **Apprenticeship Program (1958-1988)**
  - **Number of participants varied from 10 to 45 annually over the 1970-1987 time frame**
- **Technical Institute Equivalency (TIE) Program (1960-1992?)**
  - **TIE had 200-450 annually participants in the mid-late 1980s**
- **ESA Trainee (TA Trainee) Program (1974-1988)**
  - **Number of trainees varied from a few to 18 per year**
- **Sandia-TVI-CEC Drafting Program (1974-?)**

*Originally, all corporately sponsored; no longer exist at corporate level.

- **The termination of these programs was primarily influenced by two factors:**
  - **Perceived and actual declines in the need for these skills (End of Cold War)**
  - **TVI's accreditation (DOE's no duplication of training policy)**

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In the past, there existed four programs for Trades and Technologists (TNGs) training. Starting in 1958 the Apprenticeship Program ran for 30 years, training 10-45 participants annually in 8 crafts areas: Machining, Electronics, Electrician, Mechanical, Painter, Structural, Mechanical Standards, and Materials Processing Technician. The program required 5 years of on-the-job training and a minimum of 144 hours per year of classroom instruction (through OOH or INTEC). The program was open to employees on a post and bid basis.

The Technical Institute Equivalency (TIE) Program offered on-roll employees the opportunity to achieve an education equivalent to an Associates degree. Seven curricula existed; each included 20 OOH courses to be completed over 5 years.

The Engineering and Science Assistant Training (TA Trainee, originally ESA Trainee) Program was an affirmative action program that provided opportunities for graded employees to advance to the ESA level. Employees were reassigned to organizations, and salaries were increased as they advanced through the 4-year program.

The Sandia-Technical Vocational Institute (TVI)-Career Enrichment Center (CEC) Drafting Program may have some similarity to today's Advanced Technology Academy. The decision to drop all of these programs was impacted by budget constraints, a change in SNL's mission, and the perceived and/or actual change in the need for these skills. Another factor contributing to the decision to drop these programs was the accreditation of TVI and the DOE's policy of not duplicating existing capabilities.

Support Staff & Management Training

- **Support Staff Training (1971-present)**
  - **During the early 80s these programs were expanded and improved.**
  - **Today, much of the training is available through Sandia Business School (SBS) and Office Administrative Assistance (OAA) programs.**
    - **$1.60M (FY99) SBS**
    - **$0.09M (FY99) OAA**

- **Management Training (1985-present)**
  - **Today, extensive management training is available through Leadership & Management Program and other programs.**
    - **$0.99M (FY99)**

- **The implementation of the management programs was primarily influenced by:**
  - **changes in management structures within SNL**
  - **a series of employee surveys stating technical managers lacked people and management skills**

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Although non-technical, we would like to mention the training opportunities available for support staff and management at SNL. The support staff training initiated in the early '70s and expanded for several years thereafter. There existed a MAS/MLS Trainee Program, which was a University Program, and Secretarial/Clerical Training and Development. In the '80s the support staff training expanded to Secretarial Skills Building, Secretarial/Clerical Work/Training & Orientation, In-Hours Courses for Administrative Personnel (INCLAS), and Office Automation Programs. Today, much of the same training is available through Sandia Business School (SBS), Office Administrative Assistant (OAA) Training Program, and Distance Learning. The costs of SBS and OAA were $1.6 million and ~$0.1 million in FY99, respectively.

Management training originated in the mid-'80s; the same time frame when Sandia was undergoing management changes. Management training expanded over time as a result of a series of employee surveys indicating that technical managers at SNL lacked both people and management skills. Today, even more management training is available through the Leadership & Management Program, funded at $1.0 million in FY99, including the management curricula, and the Breakfast Lecture Series.

In short, education and training at Sandia for these two areas is thriving and healthy.

University Programs

- **Educational Aids Program/Tuition Assistance Program (EAP/TAP) (1956-present)**
  - Provides tuition for university credit courses and degree programs that relate to a SNL job or SNL's mission
- **University Part-Time (UPT) (1968-present)**
  - Half-time work, half-time study to obtain graduate degree on accelerated basis often to support reclassification to MTS, MLS, (or previously MAS)
- **Work/Study Program(1974-1980)**
  - For minorities and disadvantaged HS graduates to pursue 4-yr degree program in Science or Engineering while working at SNL during the summers

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Today's University Programs are a compilation of programs that originated over the history of SNL. The very earliest program was the general Educational Aids Program that is today's Tuition Assistance Program. Since 1956, the aim of the program has been to provide tuition for university credit courses and degree programs that generally relate to a SNL job or SNL's mission. The early program paid for student time—up to 7 hrs per week to attend class—if the student achieved at least Junior status at the university; this is no longer the case.

There is also a group of special university programs. The University Part-Time Program began formally in 1968, enabling employees to work half-time and attend school half-time. The initial emphasis was more focused on enabling job advancement, encouraging employees to obtain a degree on an accelerated basis rather than on their own time.

A 4-year Work/Study Program existed in the '70s. It was an affirmative action effort to allow minorities and disadvantaged high school graduates to pursue a 4-year degree in Science or Engineering while working at SNL during the summers. This program no longer exists.

University Programs:
University Full-Time (UFT) (1981-present)

- **Special Masters Microelectronics Program/Special Masters Program (SMMP/SMP) (19??-present)**
  - **Initially, to meet urgent staffing requirements of the microelectronics organizations**
  - **Currently, allows qualified, BS-level employees to acquire advanced technical knowledge in certain areas**
- **Specialized Engineering Development (SED) (1985-1989)**
  - **For technical staff, especially in weapon-related jobs, to receive MS degree**
- **Doctorial Study Program (DSP) (1968-present)**
  - **Allows exceptional MS-level staff to obtain PhD from selected universities**
- **One Year on Campus (OYOC) (1968-present)**
  - **Provides MS in Science or Engineering at approved universities to SNL ~~women and~~ minorities new-hires with BS degrees**
  - **This is a AA program**

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The University Full-Time Programs are designed for advanced degree recipients. The Special Masters Program exists today but had roots in both the Special Masters Microelectronics Program and the Specialized Engineering Development Program—both implemented to meet specific needs of SNL. The Special Masters Program is now like the Doctorial Study Program in that on-roll exceptional staff members are allowed to obtain degrees from selected universities. The employee's time and expenses are paid. The One Year On Campus (OYOC) Program is essentially an affirmative action program, initially encouraging women and minorities, particularly external hires with Bachelors degrees, to pursue a Masters in Science or Engineering at approved universities. However, recent statistics show that women are adequately represented in the SNL Technical Staff, so women are no longer qualified for this program. Again, employee's time and expenses are paid.

University Program Trends in Degree Completions
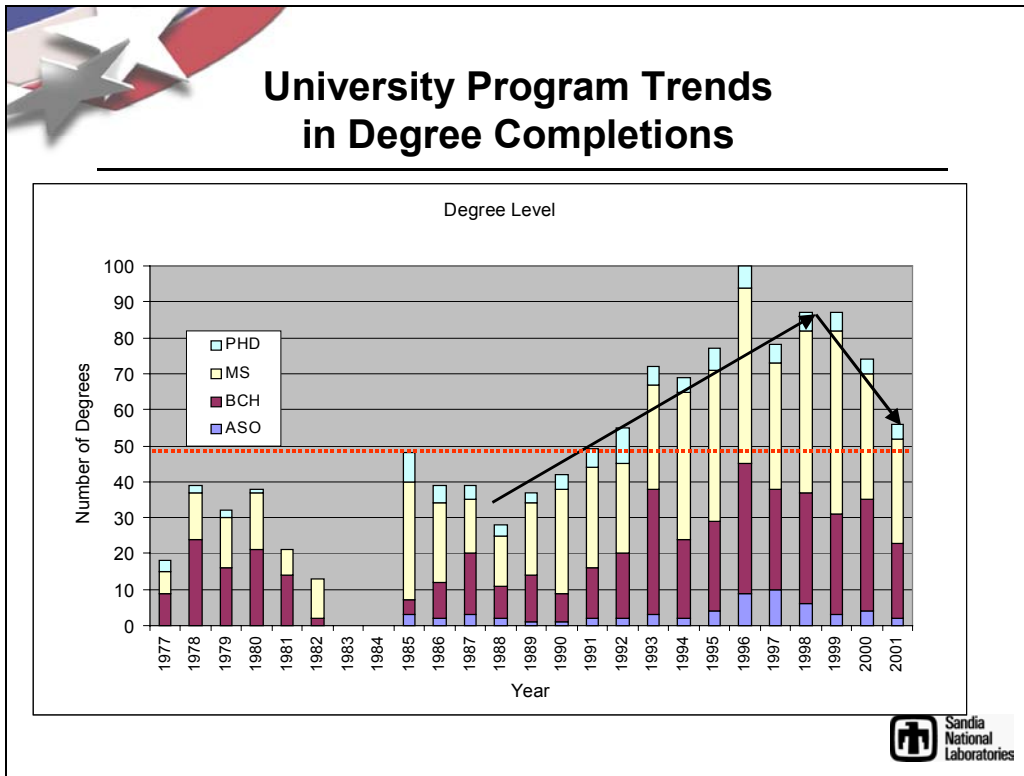
In this graph, the University Programs' degree completions[8] are plotted by year since 1977; a gap in data exists for 1982 and 1983. The latest data comes from an Ad hoc query of the HR database while the older data came from the data archives at CTD. We observe degree completions of about 30-50 per year, until the '90s when the number of degree completions soared to 80-100 per year. During the '90s, there existed a hiring freeze and also a change in policy about University Programs selection (to be discussed later). Presently, the number of degrees has declined towards the more historical average value. Recall that in the '60s, about 50 employees per year received Masters degrees. The number of completions will probably not continue to decline, since there was a successful effort to increase the number of candidates in the last three years.

The data shows that the post 1990s increase in degrees granted was largely due to increases in the number of Masters and Bachelors. Also in 1996 and 1997, there were more Associates degree completions than in any other years.

[8]*Patti Cover, Ad-Hoc HR database query, (2002)*

Non-technical vs Technical Degree Trends
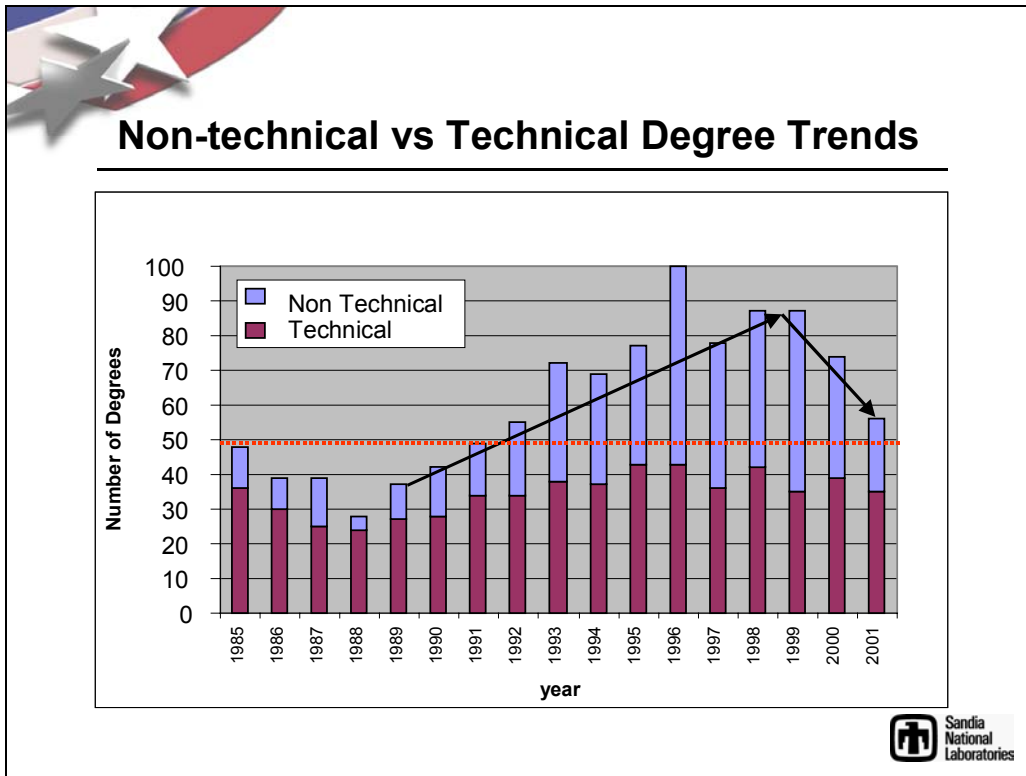
In this graph, the degree completions were categorized as either non-technical or technical fields based upon the field of study. It can be seen that most of the increase in degrees granted are in the non-technical degree area. The average number of non-technical degrees grew from about 10 in 1989 to up to 50 per year in 1996. The number of technical degree completions grew slightly on the same time frame.

While causality cannot be established, this increase in non-technical degrees (generally in business) does seem to coincide with SNL's move to a more business-type program structure versus the former more institutional model of SNL. However, there were also other changes in the University Programs that will be discussed on the next chart.

**University Education Policy
Then and Now**

Then	Now

• **Then**
• **Funding**
   – **Tuition and allowable expenses paid by corporate education indirect cases**
      • **except for SMP and DSP where line organization paid for allowable expenses.**
   – **Student time was charged to A294**
• **Student Selection Method**
   – **Prior to the early 90s, a committee accepted students and their disciplines of study**
   – **In the early 90s, Sandia's policy for University Programs was liberalized "any university studies would eventually benefit the lab", and only manager approval generally adequate.**
	• **Now**
	• **Funding**
	   – **Essentially same**
	• **Student Selection Method**
	   – **In 1997, Sandia re-instituted a committee selection process for all programs.**
	   – **In 1999, a quota (14%) was established to allow for administrative degrees based on the percent of the administrative population in SNL.**

A comparison of then and now for funding and student selection methods of special (non TAP) University Programs is presented above. Originally, tuition and allowable expenses were paid by CTD and the student time was charged to the corporate overhead case A294. From the early '90s to 1996, line organizations funded their employees in these programs; since 1996, the CTD pays for tuition and allowable student expenses through their indirect budget[9]. Student time is being charged to the overhead case A294.

In the late '80s through early '90s, SNL was trying to make a more efficient and business-like management structure. The Education Council along with many other councils and committees were disbanded, and HR became a center rather than a vice presidency. This changed the student selection method from one of committee review to essentially anyone approved by a line manager. Evidently, SNL senior-level management believed that "any university studies would eventually benefit SNL". The change in student selection policy seems to correspond to the increased enrollment in University Programs and percentage of non-technical degrees.
In 1997 a committee selection process was re-established; this seems to correlate with the decline in degrees in the following years, particularly in the non-technical degrees. The reintroduction of the committee also coincided with a drop in the number of Administrative Staff in the Special Degree Programs. In 1999 a quota was established to counteract the perceived bias against non-technical applicants. Administrative Staff can now participate in the program to a level that is consistent with their representation in the Labs' population (presently about 14%)[9]. Recall that the early MLS/MAS Trainee program was a University Program enabling Administrative Staff to get Masters degrees.

[9] *Patti Cover, private communication, (July 2002)*

Current Programs and Trends
1996 to 2001

	FY 1996*	FY 1997*	FY 1998*	FY 1999*	FY 2000*	FY2001
Sandia Business School Information System, Financial, Procurement	2,940	3,037	1795	5052	2,426	3,503
Leadership and Management Pre-Management, New management, Other	1,370	2,424	1961	1,336	1,985	1,671
Technical Software, Weapons, Project Management, Lab Initiatives	3,214	2,126	1078	891	2,042	1,694
University Courses	1,168	1,747	1779	1563	1,300	1,386
Organization Specific	N/A	283	1,775	3,244	3,470	6,362

*These are course completions from the FY 2000 report

- **Technical completions were down in FY98 and FY99 when Bob Floran did a study. Since then, the numbers are back up to more traditions levels (~1700/yr).**

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Current Programs

The current structure of programs offered by the CTD is summarized along with number of completions in the above table. These categories for tracking course completions were formalized in 1999 in support of Floran's study. The CTD staff re-categorized course completions data back to 1996. This chart shows the Sandia Business School, Leadership and Management, Technical, University, and Organization Specific Programs numbers of completions per year from FY96 through FY01. The CTD continued to use these categories and the FY00 and FY01 data were found in the respective annual reports. Technical completions were at a low of about 900 in FY99, and Floran's report noted the declining trend in Technical completions when recommending increased funding. However, the Technical completions rebounded to over 2000 in FY00, a year before the Corporate Strategic Reinvestment funding recommended in the study became available. We note that the completion statistics have been quite variable and difficult to use to identifying trends. For example, the Technical completions vary by as much as 1000 in 3 of 6 years.

The Organization Specific Program has dramatically increased in numbers of completions. However this increase is probably due to an increase in reporting course completions by the line organizations, who have found TEDs to be a good tool to track Compliance data, rather than any major increase in actual course completions[10].

[10]*Charline Wells, private communication, (July 2002)*

Current Trends

- **Since 1996**
  - **Number of overall course completions (outside of Compliance completions) has been growing modestly.**
    - **Number of Technical course completions has averaged about 1700 per year with a high of over 3000 and a low of just under 900.**
    - **$1.2M (FY99) Technical**
  - **The trend in non-university Technical courses has been towards "Distance Learning" delivery versus live instruction.**
  - **Mandatory course completions have grown dramatically from just over 14,000 in 1996 to a high of 87,000 in 2000.**
    - **Web-based/On-line learning has been used effectively to manage the cost of the Mandatory training requirements.**
    - **$13.08M (FY99) Total (including student labor costs)**
      - **$11.15M Corporate Required**
      - **$1.93M ES&H**

  •Factors influencing Mandatory training include: Tiger Team, National Security Issues, Computer Security Issues, Ethics, Diversity/EEO&AA

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In these two charts, we try to summarize trends since 1996. Outside of Compliance completions, the number of overall course completions has been growing modestly. The Technical completions have averaged about 1,700 per year, which is comparable to INTEC days. For FY99, Technical Program cost $1.1 million[11]. The trend in non-university Technical course delivery has been towards Distance Learning versus live classroom instruction.

The greatest change over the past 5-6 years is the dramatic increase in Mandatory course completions. The corporate requirements for Diversity/EEO&AA, Computer Security, Security, Ethics, Environment Safety & Health (ES&H), and Records Management resulted in the number of Compliance course completions growing from just over 14,000 in FY96 to as high as 87,000 in FY00. The factors that influenced Mandatory training include the Tiger Team and onset of ES&H course requirements, Lockheed-Martin's requirement by the U.S. government to have Ethics training at all of its facilities, the Diversity stand-down, the security stand-down, and Department of Labor laws. These two stand-downs came in FY99. Much of Compliance training is now web-based or on-line, minimizing delivery costs and making better use of employees' time since no traveling is involved. The average time per course in FY01 was 38 minutes.

The Corporate Required training cost $11.15 million, and the ES&H required training cost $1.93 million in FY99. The amount for Corporate Required training includes the cost of student time (often as much as 85% of the total cost of training), which is directly paid for with corporate overhead. This is the largest expenditure for training at SNL and much of it is charged directly to corporate cases.

11CTD Student Estimated Labor Training Costs Summary FY '99 (4/25/2000)

The trends in University Programs since 1985 can be summarized as follows. The number of degrees earned has increased; a majority of these degrees were at the BS and MS levels. The largest increase in degrees came in the non-technical disciplines. An average annual increase of 30 degrees occurred since 1985. Technical degrees on the other hand increased only slightly in number. The number of degree completions seems to be leveling off at the historical average of about 50 per year. We did note a difference by degree level between non-technical and technical completions. Seventy percent of technical degrees are advanced degrees, while 49% of non-technical degrees are advanced (MS level only) degrees.

Financially, the University Programs is a large program, when the cost of student labor is considered. In the early '90s, the indirect budget for the University Programs was about $1.7M. During the mid '90s, this amount dwindled to about $1 M. As of 2001, the indirect budget for the program was about $1.2 M with corporate investment critical skills added. This $700,000 increase to fund more MS level candidates was made in FY01, bringing the total FY01 budget to almost $4 million dollars, when student labor is included.

New Programs

- **Information Technology/Computer Science Retraining (IT/CS) Program (2000-present)**
  - **4-Track program to meet critical current needs in area**
  - **Corporate overhead pays student salaries**
  - **$2.09M (FY01) proposed + $2M honored investment**
- **Materials Science Program (1999-present)**
  - **Five-course program with lectures, lab demonstrations, case studies, and lessons learned discussions**
  - **Courses now in Service Center**
  - **$0.10M (FY01) proposed**
- **Division 2000 Needs (2002)**
  - **$0.15M for FY02**

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Several new programs have been started within the Technical Program area in the past few years. These programs include: Information Technology/Computer Science Retraining (IT/CS, also known as the RISE Program), Materials Science and Advanced Manufacturing, Computer Science/Software Engineering Skills Enhancement, Nuclear Weapons Intern Program (NWIP), and a new effort with Division 2000. Some of these efforts originated outside of the CTD but were brought into the CTD through joint programs or totally absorbed by the CTD for programmatic or budgetary reasons.

The IT/CS Program is a post and bid program aimed at individuals desiring to retrain or enhance their training in Computer Science and Information Technology. A sponsoring organization is identified for employment of the students after completion of the program. Based on budget forecast information obtained for FY00, the proposed FY01 cost exceeded $4 million.

The Materials Science Program, originally sponsored by Center 1800 in partnership with CTD, has been placed into the service center. This is a five-course program; one course in Biomaterials is currently being taught.

The newest CTD effort is focused on providing courses to meet the needs of employees in Division 2000 based on a detailed needs survey. In FY02, the level of funding in this area was $0.15 million. Divisions with higher organization numbers have, maybe somewhat jokingly, stated that CTD addressed the needs of Divisions 1000 and 2000, so at one division per year it will be many years before their Division's needs will be addressed. However, the large focus of training in computer science, information technology, and software engineering is very cross-cutting and benefits many Divisions.

New Programs

- **Computer Science/Software Engineering Skills Enhancement Program (2000-present)**
  - **High priority course needs addressed to upgrade staff IT skills**
  - **50 CS courses in program; 20 offered at no cost**
  - **$0.45M (FY01) proposed**
- **Nuclear Weapons Intern Program (1998-present)**
  - **2-year program that provides formal instruction, seminars, site visits, and rotational assignments and requires a research project for completion**
  - **Designed under Knowledge Management effort**
    - **Maintain weapon system engineering skills**
  - **Potential for MS degree from NM Tech and UNM**
  - **Defense Program funded ($6.3M for 30 students)**
    - **¾ time annually**

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The Computer Science/Software Engineering Skills Enhancement Program is offering high priority courses needed to upgrade staff's Information Technology skills. Many of the courses are less than a week in length. About twenty courses are available and free of charge. These courses are not only in computer software applications but are more technical courses in networking, operating systems, and databasing. The program had a proposed funding level of about a half a million dollars in FY01.

The Nuclear Weapons Intern Program (NWIP) is jointly sponsored—it is funded by Defense Programs at a level of $6.3 million for 40 students, ~30 of which were SNL employees, for the FY01-FY02 program offering; the CTD helps with course development and administration. The program was developed under the Knowledge Management Program in an effort to maintain SNL weapon system engineering skills. Individuals were participating in a 2-year ¾-time program that included formal instruction, seminars, site visits, and rotational assignments. A research project is required for completion and a Masters level degree can be achieved by taking some additional courses at either UNM or NMIMT. The degrees earned in this program are included in the data presented in previous charts on university degrees awarded.

The Advanced Manufacturing Program (not shown) is a joint effort with Division 14000 and its trades training effort. The proposed funding level for these two efforts was $0.1 million in FY01.

New Programs Feedback

- **Nuclear Weapons Intern Program***
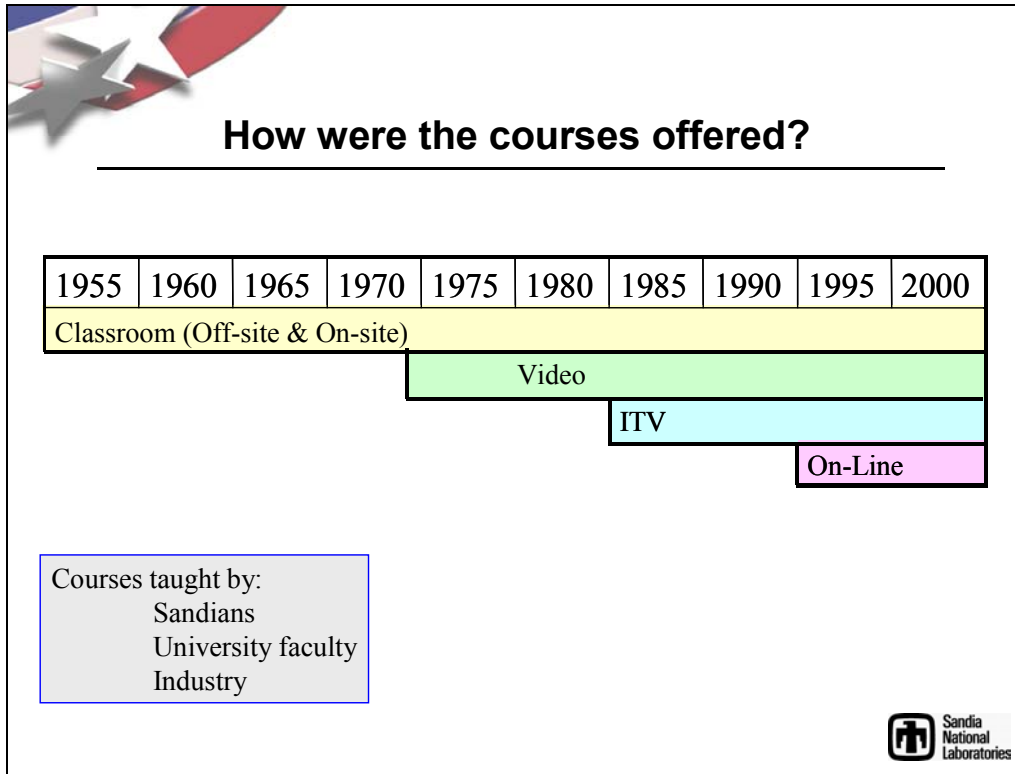 - *Program has undergone critical review to improve its efficiency and has been changed to a 1-year program.*
- **Information Technology/Computer Science Retraining Program****
  - *The number of positions to be filled is declining, as are the number of applicants, and in this economy Sandia can now hire into this skill area.*
- **Materials Science Program*****
  - **Motivation:** TNGs desired to broaden their understanding and to network
  - **Instructors:** Many volunteered
  - **Students:** High participation and some courses taught twice
  - **Courses:** 4 8-10 week courses; 1 short course. All well-received
  - **Future:** To continue breadth of field courses with SNL favor
    8-10 week length
    Each course should be taught about once every 3 years
  - **Need:** Corporate help to arrange time, advertise, and **pay instructors**

References: *Keith Almquist, Bill Cook, & *** Duane Dimos**

We contacted individuals familiar with the Nuclear Weapons Intern Program, IT/CS, and the Materials Science Programs in order to get some feedback about these programs. Keith Almquist (Manager, Org. 9811), who was involved in a review of the NWIP, informed us that the program was being changed from a 2-year to 1-year program based on extensive feedback from students, their managers, and program overseers. Bill Cook (Manager, Org. 66542) informed us that the IT/CS Program has experienced a decline in the number of applicants and that the customer base needing CS/IT employees has diminished as earlier students filled many positions. Additionally, qualified CS/IT individuals are once again available in the job market at Sandia salary levels so that hiring is again an option for SNL. Feedback on the Materials Science Program was that it met with success in all aspects except the course delivery by video to SNL/CA. There were volunteers to teach the course, and they received very positive feedback from students. The demand was large enough to teach some courses twice. Courses were taught during noon to make them more readily available, but feedback suggests this is not a necessity for future courses. Four 8-10 week courses and one short course have been offered through this program. Duane Dimos (Manager, Org. 1801) suggested that the 8-10 week courses that have broad overview and a SNL flavor are more desirable than college-type courses that offer in-depth theory of a subject. He stated that the most important issue for the future of the Materials Science Program is that Sandia instructors be paid for their teaching time. Evidently, instructor's time is paid for by CTD but instructors do not receive additional pay even when the courses are taught over lunch.

How were the courses offered?

1955	1960	1965	1970	1975	1980	1985	1990	1995	2000

Classroom (Off-site & On-site)

Video

ITV

On-Line

Courses taught by:
    Sandians
    University faculty
    Industry

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How were courses offered? Who taught the courses?

New course delivery mechanisms have come on the scene over the 45 years of corporate training and education. Until 1974 when instructional video became available at SNL, all courses were taught by instructors in a classroom environment. The number of video course offerings increased dramatically from 24 to 70 in just 6 years, marking the advent of Distance Learning. In 1985, Instructional Television (ITV) became available. University courses taught nationwide could now be attended while at SNL. Other delivery mechanisms arrived with the desktop computer and the internet. Most Corporate Required training courses were computer or web-based by the mid- to late '90s. Satellite broadcast seminars and interactive video are also new course delivery mechanisms.

As far as we could determine, the effect of live classroom instruction versus other delivery techniques upon education quality has not been quantified. In the INTEC program of 1988-1989, "approximately 1/3 of the courses, involving 3/4 of the current enrollments, are presented in a live-interactive environment. The remaining courses are received on the instructional television network."[12]

SNL has made investments in infrastructure and maintenance costs to support offering courses through the various delivery mechanisms and facility operations. Distance Learning classroom, Interactive Video facility, and Computer Education classrooms all exist in support of these options.

[12] *"Education: Key to the Future", 12th Annual Report, Education and Training, Sandia National Laboratories (Summer 1988-Spring 1989), pg. 24*

Training Time*

- **The total average time spent in training per employee in 1999 was 45 hours per year.**
  - **27 hours (60%) in Mandatory training**
  - **18 hours (40%) in education and development training which was defined as voluntary or discretionary career enhancing-opportunities**
- **These number of hours have probably increased in 2000 and 2001.**
  - **Increased numbers of course completions in Technical, Organizational Specific, and Mandatory**

*Reference: R. Floran's white paper on education and training (Feb 2000).

How much time was spent in training?

From Robert Floran's white paper, we have some estimates of the amount of time spent in training during FY99. The data was calculated from the TEDS database, which contains information on Compliance courses taken and their average times as well as on other courses recorded in TEDS. It was reported that each employee spent 27 hours annually or 60% of the training hours in Mandatory training.

We note that about 8-10 hours of Mandatory training is required for all employees. The 27 hours may be biased towards the high side in Mandatory training due to the diversity and security corporate-wide stand-downs in FY99. However, there has been a significant increase in the number of completions in Mandatory training during FY01, suggesting that the number of training hours may have increased even without the stand-downs. The estimate was that there were 18 hours spent on other discretionary training recorded in TEDS. The accuracy of this estimate of time spent in discretionary training is suspect, because not all such training is recorded in TEDS. Also, time required to take the courses has been reduced by the on-line access and by the test-out option available on-line. Another estimate of annual mandatory and discretionary training time would probably be a useful piece of data.

Funding Training

- **In the early 90s, A290 funding of time to attend and teach class was eliminated.**
  - **Prompted by the excessive Tiger Team charges.**
  - **AMCO decided to distribute overhead training dollars to the line organizations.**
    - **A290 budget was at $10M**
    - **beginning of the "charge-back" system**
  - **A290 was reinstated in 1997 for Mandatory training and approved training only.**

- **Impacts:**
  - **Delivery of training became less centralized, more distributed.**
  - **With some exceptions, student time (~85% of the total training cost in FY99) is now generally paid for by the line organization or center support.**

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What was the cost of the courses and how were courses charged?

Funding of training changed during the late '80s and early '90s, when A290 was eliminated due to early Tiger Teams charges to A290. SNL initially wanted to track costs of the ES&H efforts, but eventually decided that ES&H was simply part of the job and should be charged to projects. To ensure A290 charging for ES&H stopped, the A order was closed. Unfortunately, A290 was also the A order used to support student time for other training and education. The Administrative Management Council (AMCO) assumed that the amount originally used for this training (about $10M) would be available to line organizations. This allowed line organizations to pay for only the training they required. No actual budget was established for the line organizations; but rather, a charge-back system was established by the financial organization when AMCO dissolved. Course offerings became part of the charge-back system, and employees paid for courses through center overhead or project funds. Eventually the CTD created a training "service-center" through which CTD's course delivery and support cost could be recovered in the course charge. As a result of this decision, training programs became less centralized (line organizations can now buy training outside Sandia), and with few exceptions, student time (about 85% of the total training cost) is paid for by line organizations.

As the number of Mandatory training requirements grew, line organizations complained about training costs. A290 was re-introduced in 1997 to help with labor charges on Compliance training, but not general education training. To monitor the overhead case, an oversight committee was created; and, they decide what are allowable Compliance and other training charges to A290.

Training Budgets

- **Sources of training budgets**
  - **CTD indirect budget from Corporate**
  - **CTD revenue from the service center**
  - **Corporate investment in critical skills retention**
    - **which is year to year**
    - **has been funded for 2 years (FY01 & FY02)**
  - **Organizational training budgets**
    - **Overhead**
    - **Project**

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The only Corporate Training & Development budgetary information available is for the period after the elimination of A290. Records from FY95 forward itemize the amount of indirect budget provided by corporate to cover operational costs along with the revenue generated from the service center. In FY01 and FY02, Joan Woodard (Executive Vice President) has made available additional corporate investment funds for strategic and critical skills retention programs. The skills retention investment does not represent a long-term commitment. The funding amount is reviewed and set independently each year. In addition, organizations have their own training budgets under Task 1.03 and training may be charged directly to project cases.

The corporate investment budget has been used for the New Programs (IT/CS, Materials Science and Advanced Manufacturing, Computer Science/Systems Engineering), increased participation in Special-Degree University Program, and web-based training. Leadership and Management Programs are jointly covered by overhead and investment budgets.

The CTD's indirect budget is used for design and development of training curricula, support systems, University Programs administration, ES&H training requirements and administration, Technical & Compliance administration, Distance Learning, and Sandia Business School requirements and administration.
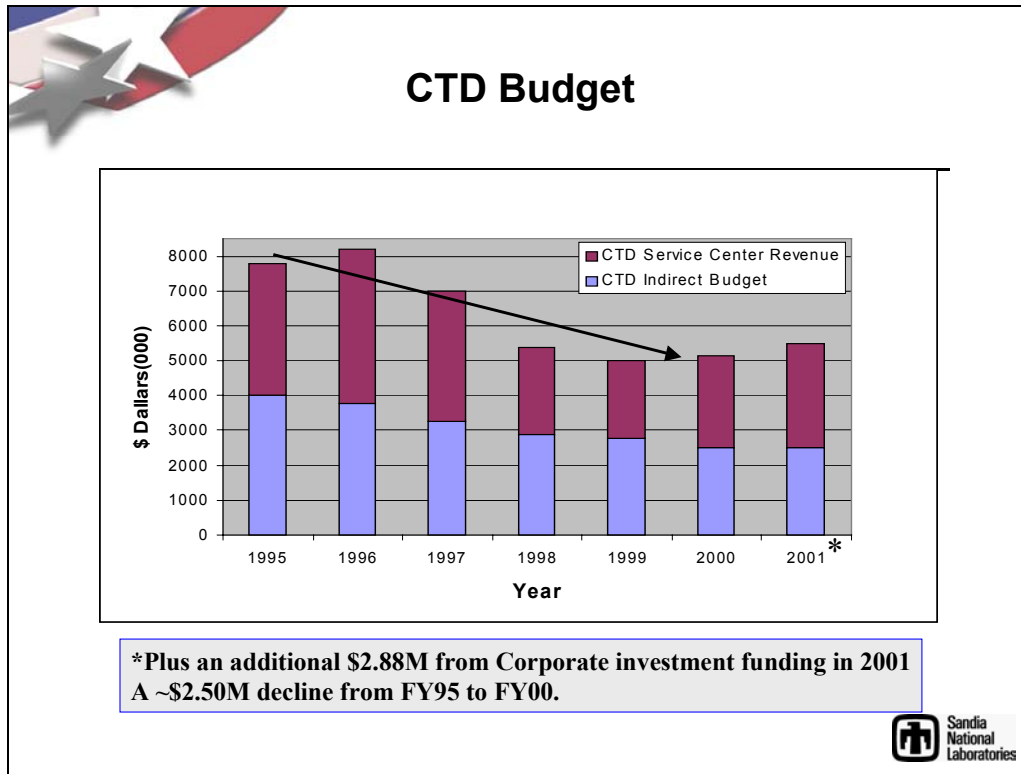
The CTD's budget had declined about $2.5 million from 1995 until 1999. The decline occurred in both the indirect budget and the revenue generated through the service center. The indirect budget was about $2.5 million in FY00 and FY01 with the revenues generated in the service center increasing slightly starting in FY00. It is unclear that any trend truly exists in the data aside from the large overall decline in budget and revenue between FY95 and FY00. As noted previously, the Executive VP through a corporate investment added $2.88 million to the FY01 total education and training budget and again added money to the FY02 budget[13]. The addition of $2.88 million from corporate investment to the CTD budget brings the total back into the FY95-FY96 CTD budget range, but still less than the $10 million (before A290 was eliminated temporarily) combined with the then CTD indirect budget of ~$2M.

The decrease in CTD indirect budget from FY95 to FY00 was a corporate decision. We can only speculate about the reason for the decline in the service center revenues over that time frame. In years of perceived tight budgets, line organizations may be less apt to fund training. Also, in FY99-FY01 there was a great amount of Organization Specific training, which may not have been purchased through CTD. The line organizations could have been purchasing training outside of SNL. Other possibilities exist.

[13]Charline Wells, private communication, (July 2002)

Organizational Training Budget

- **Corporate Indirect for Training is Task 1.03**
  - **$.786M in 2000**
  - **$1.103M in 2001**
  - **$.689M through April 2002**

- **Queried Divisions 1000, 2000, 5000, 6000, 8000, 9000, & 14000 on Task 1.03 expenditures and funding training**
  - **Roughly 40 to 60% of the budget is spent on technical training.**
  - **Based on a sample of most large centers, roughly another $1.5M of project money was spent on training.**

> **It is not possible to tell how much of these training dollars are spent in the CTD service center.**

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We investigated the Task 1.03 budgets, which are used corporate-wide as an indirect case for training, to determine how much is earmarked for training by line organizations. We found that about $1.1 million had been charged to Task 1.03 in FY01. Unfortunately this is not the whole story as training charges could go to other tasks, but we have no way of tracking such charges.

The amount in Task 1.03 seemed to be small, so we queried the larger divisions within SNL to understand how they financed education and training. Division 1000 (with the exception of Center 1700) did not respond. For the divisions that responded, we can estimate that another approximately $1.5M of project money was also spent on training and that roughly 40-60% of their Task 1.03 money is spent in technical training. Since it is not possible to tell how much of these total training dollars are spent in the CTD service center, we cannot simply add this amount to the CTD budget to determine even an approximate overall SNL's budget for training.

A picture of the total amount of money spent on education and training at Sandia, which would include travel expenses and course fees that Sandia pays for external training, is not available.

Organizational Training Budget:
Some Observations

- **Areas with high amounts of**
  - **Work For Others**
  - **Service Work or**
  - **Manufacturing Work**

  have definitive budgets for training, and most of the training is in technical training.

- **Areas that are predominately R&D do not use Task 1.03 to pay for technical training.**
  - **Training costs are charged directly to projects.**

  A high percentage of reported organizational training is in software and computer-based topics.

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The responses from the Divisions indicate that centers predominately research and development (R&D) in nature require training to be charged directly to projects and do not budget much money in Task 1.03, so the amount of money spent on training in these areas of SNL is unknown. For instance, the Task 1.03 budgets in Division 1000 after removing Center 1700's $120,000 were minimal for each Center. And Division 8000 did not put any money into Task 1.03. The areas with high amounts of Work For Others, service work, or manufacturing work have well-defined budgets for training, and they reported that most of the training is technical in nature. For example, the Integrated Correlation and Display System (ICADS) program, a DoD program, has 3 FTEs dedicated to training efforts per year, and Centers 5700 and 5900 have budgets of well over $400,000 set aside for training annually. The Integrated Information Systems (IIS) has variations from one department to another in their funding practices, but most departments allow for every employee to take at least one to two courses per year to keep abreast of rapidly changing technologies and/or to career broaden.

We questioned the Divisions about the types of training employees are taking; the responses indicated that a high percentage of the training was in software and computer-based topics.

Getting the Word Out

THEN	NOW
• **THEN**	• **NOW**
• **Corporate Training Department**	• **Corporate Training Department**
– **Brochures, phone calls, etc**	– **Brochures, phone calls, etc**
• **INTEC and OOH had semi-annual course catalogs.**	• **CTD On-line Web-site**
	– **Links to TEDS and NETG**
• **Weekly Lab Bulletin had Education & Training section**	• **Sandia Daily News**
• **Electronic only in 1997**	– **Write-ups or 1-2 lines listing at end of document**
• **Stopped publication in 1999**	• **Email**
	– **Course announcement to potential interested personnel**
	• **Job Postings**
	– **For retraining and critical skill retention programs**
	• **Internal Organizational Information**
	– **E.g., Pilot Program for Division 2000**

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How and where were the courses advertised?

Advertising of CTD education and training opportunities changed from a paper-based approach on a regular calendar schedule to a multi-media approach on a more random schedule. Until 1992, INTEC and OOH course catalogs were published on a semester-oriented basis. The demise of these programs in the 1993-1994 timeframe removed the necessity of publishing such documents. The Weekly Lab Bulletin was also used for advertising and contained an Education and Training section that not only announced course offerings but also provided directions on enrollment into courses and programs. The Lab Bulletin went electronic only in 1997, and then in 1999 publication was stopped altogether. This could be a factor contributing to the reduced numbers of Technical completions reported in FY99.

The present methods of advertising are the CTD web-site, the electronic emailing of the Sandia Daily News, email and paper flyers from the CTD directly, job postings (electronic) for retraining programs, such as the IT/CS Program and NWIP, and internal organization information. Other advertisement forms are brochures for new employee orientation and a statement in the employee's Benefits package.

Observations on Getting the Word Out

- **CTD Web Site is <u>not</u> for the inexperienced user**
  - **Must know to go to NETg or TEDS to look for a course offering at SNL**
  - **SNL web site for NETg is often problematic**
    - **URLs cannot be found**
  - **TEDs is not a course catalog. It does not**
    - **Categorize by subject matter**
    - **Show a calendar of course offerings**
    - **List courses offered by university programs or direct you to university course options**

The user can not browse for courses as with a course catalog concept.

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The CTD web-site contains information on the programs offered in addition to TEDS, ES&H courses, and NETg (National Education & Training Group) courses. However, the CTD web-site is not for the inexperienced user looking to take a class. First, the user must know to look in the TEDS catalog and be able to provide the course number or title to find information about CTD sponsored and Organization Specific courses. However, if the user is looking for certain ES&H courses or offerings from NETg, then the user must know to look under the Interactive Video Facility link. There are some additional issues with using the site. Often the links to NETg are not working. And, TEDS has "catalog" as a sub-category, but the user cannot browse for a course as one might expect with a course catalog concept. We looked for a course in "radar" and found none. We looked for courses in Calculus and found none. We find between 1,300-1,500 courses listed in TEDS and can only with much difficulty determine what is available in a classroom environment. If you know specifically of a SNL course offering that you want to take, then TEDS can be helpful.

Thus, the web-site as presently designed is a poor mechanism for course advertisement.

Observations on
Getting the Word Out (cont.)

- **Sandia Daily News**
    - **Not everyone reads SDN**
    - **Items at the end are easy to miss**
    - **No special schedule of announcements, i.e. semester schedules**
    - **Former Weekly Bulletin was a good source.**
- **Email**
    - **Assumes we know all interested parties a priori**
- **Job Postings**
    - **Targets individuals willing to make career changes**
        - **A very small percentage of the training participants**
- **Internal Organizational Information**
    - **Somewhat limited audience, not conducive to career broadening**

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The other forms of advertisement have some advantages and disadvantages. The Daily News is daily, and if employees know and remember to check daily for course offerings in the bottom section, then they may eventually find some course they are interested in pursuing. Not everyone reads the Daily News and items at the end are easy to miss—particularly because there is no Education and Training sub-section. In addition, it is tedious to watch for a course that you might want to take instead of seeking one out. Email of a class or several course offerings to the entire Labs is just now being performed. Previously, email was sent to a more limited audience, but that assumes that CTD knows all interested parties a priori, and this practice does not encourage career broadening because potentially interested individuals can be inadvertently left off distribution. Large-scale lab-wide emailing of course offerings may become so annoying that employees will begin to divert these emails from their mailboxes.

Job postings of education/training opportunities truly target a small audience willing to make a career change.

Internal organization information, such as the local knowledge of the Materials Science Program within Center 1800 or the new effort in Division 2000, is useful; but, again it is limiting the audience and not conducive to career broadening.

Summary of Changes Surrounding Training & Education at SNL

- **Change in advertising of courses**
  - No more course catalogs or calendar of events (Date: 1993)
  - Lost the Lab Weekly Bulletin (Date: 1997-1999)
- **Change in funding of courses**
  - Eliminating A290 temporarily (Date: 1992-1997)
  - Moved from corporate overhead to charge-back then service center system (Date: early 90s)
  - Service center and line organizations had to cover more student time except for University Programs (Date: early 90s)
  - Use of overhead funds dictated by organizations
    - Doesn't necessarily go towards training
- **Change in sponsorship of courses**
  - Local offerings more common

SUMMARY: What has changed regarding training and education at SNL?

In the following several slides, we summarize our insights and information on changes that might have affected training and education at SNL. There was a change in advertising as we just mentioned. The CTD staff felt that the loss of the Lab Bulletin had a negative impact on participation in training and may explain some of the loss in revenue in the service center for FY99 and FY00. The loss of a broad overview of course offerings on a regular basis seems to be the biggest change in advertising techniques. Anecdotal evidence suggests that the elimination of the A290 case that paid student and instructor time led to an environment in which individuals were not taking courses, because they did not have a case to which they felt they could legitimately charge their time as well as the CTD service center cost for the course. (Note that this is not the case for the special University Programs, which fall under A294.) The corporate allowance for A290 that was supposedly made available to the line, does not appear to be invested in training as the budget in Task 1.03 runs about $1 million compared to the original estimate of $10 million for the A290 case. The A290 overhead case now allows 8 hours of Compliance, Diversity, and/or Leadership and Management training for every employee. The change in the funding structure also affected the sponsorship of the courses. Line organizations could now use their own money to hire an outside vendor to develop courses and train their people without going through the CTD, so that CTD's ability to leverage resources declined.

**Summary of Changes Surrounding
Training & Education at SNL**

- **Change in mandated/required courses (Date: starting with Tiger Team in 1989)**
  - **Have increased by more than a factor of 3 since 1995**
  - **Affected focus of CTD**
  - **Requires time from employees—away from projects**
- **Change in SNL organization**
  - **Eliminated Department Managers in 1992**
  - **Evolved to a more business-like and project budget structure (and away from the institutional structure) (Date: early 90s)***
  - **Re-organized to provide more diverse missions in SNL's Divisions (Date: late 90s)**
- **Change in mission (Date: since end of Cold War)**
  - **Requires more diverse set of skills for broader technical base**
  - **Perceived and actual reduced needs for certain skill sets**

*Not as strongly affected by change in SNL's contractor, but by Narath

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The change in training funding resulted from the initial high Tiger Team charges. The number of mandated/required courses has increased considerably since the inception of the Tiger Team in 1989. Course completions have increased by more than a factor of 3 since 1995 due to new mandatory course requirements. The ramifications of the increase in mandated courses are that they have affected the focus of the CTD and have required more time from employees, thus reducing the time for discretionary education and training.

The changes in Sandia's internal organizational structure have also affected training within SNL. The elimination of the department manager level in 1992 helped evolve SNL into a more business-like, project budget structure. Under this structure the line managers became focused on assuring funding to cover employees and the program managers were focused on getting a project completed within schedule and budget constraints. This clearly eliminated the institutional structure that SNL had enjoyed since its founding. The main impact was the loss of focus on employees' education and training. This was confounded by the elimination of the A290 case.

Additionally, the Labs were re-organized to provide for more diverse missions within each Division, as SNLs' mission changed at the end of the Cold War. The more diverse missions required a broader technical base that was not so easily accommodated by previous education and training efforts. Also because of an actual and perceived lack of need for certain skill sets, a conscious decision was made to reduce the training and hiring of Trades and Technologists, thus greatly affecting the Trades and Technologists training within SNL.

**Summary of Changes Surrounding
Training & Education at SNL**

- **Change in course delivery mechanisms**
  - **From 16-week classroom environment to numerous other options**
  - **Focus on Distance Learning (Date: starting in the mid '70s)**
  - **Improved efficiency in course delivery and cost**
- **Change in values**
  - **Courses not part of performance review**
  - **None (or very small) Education Council**
- **Change from Strategic Approach to a Tactical Approach?**
  - **Providing courses needed by organizations**
  - **May not be career-broadening courses**

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Changes came in the course delivery mechanisms, changing from a 16-week instructor-led classroom environment to numerous other options. Distance Learning—video, instructional television, computer-based courses—was offered enabling many more course options to employees. Improved efficiency—course delivery when an employee has time to take the course and reduced cost by reducing instructor costs and even students' time in getting to and from a course—has been sited as a reason behind the emphasis towards Distance Learning. However, the courses are generally short courses aimed at fulfilling a specific need and not aimed at general preparation for future needs or career broadening.

Anecdotal evidence indicates that attitudes towards education have changed—perhaps not intentionally but as an unintended consequence of all the other changes. There is a perception that education is not as valued as it was in the past and employees are not encouraged to seek additional education and training[1]. Courses no longer factor into performance review. And, the Education Committee has dwindled. There is concern that SNL is not investing in people for the future.

We question if possibly the biggest change affecting training and education at SNL has been a shift from a strategic training approach to a more tactical approach, whereby employees get only the training they need but are not provided access to more career broadening courses. The strategic approach favors more liberal training policies (i.e. corporate funding of student time), focuses on broadening the employee's technical base, and prepares employees to meet less well-defined future needs. The tactical approach focuses on meeting just the required technical training needs, which have more measurable (i.e. near-term) effects.

**Overall Observations About
Technical & Organization Specific Training**

- **Numerous technical training opportunities are available.**
  - **Degrees through University Programs**
  - **Individual courses through**
    - **CTD**
      - **Technical courses**
      - **Organization Specific courses**
    - **Distance Learning courses**
      - **Netg program**
      - **Satellite seminars/courses**
  - **Short courses through**
    - **External vendors**
    - **SNL sponsored**
- **Total number of course completions in the Technical and Organization Specific areas has grown over the last few years.**
  - **However, we don't know how to compare**
    - **the 800 to 1,800 32-hour/16-week INTEC completions per year in the mid-70s through 80s with**
    - **the current 1,700 Technical and 6,362 Organizational Specific completions in 2001.**

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Our general observations about Technical and Organization Specific training at SNL are that there are numerous courses available and that total course completions in these areas have grown over the past few years. However, we don't know how to compare the 800 to 1,800 32-hour/16-week INTEC completions per year in the mid-'70s through mid-'80s with the current 1,700 Technical and 6,362 Organizational Specific completions in FY01. Also, it is likely that there are not the same number of courses taught by SNL subject matter experts that there once was. Today's course completions are in short courses that generally require less than 18 hours of training during a 1-week time frame. However, from a purely numerical metrics standpoint, it is hard to make a case for a problem in education and training at SNL.

**Overall Observations
About New Training Programs**

- **Materials Science Program may be a good model for technical training at SNL.**
  - **If efforts are made to sustain it.**
  - **Caveat: unsuccessful when video-linked to SNL/CA**

- **RISE Program may be on the decline.**
  - **Seeing reduced numbers of applicants**
  - **Sponsoring organizations have filled their needs.**
  - **In current economy, SNL can recruit qualified candidates.**
  - **Caveat: phasing out program after needs met**

- **Nuclear Weapon Intern Program is currently undergoing a major revamping to improve its effectiveness.**

- **The new effort with Division 2000 seems to be of the same format of the Materials Science Program.**

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Our observations on the CTD's new training efforts are the following:

The Materials Science program seems to be a good model for Technical training at SNL. It offered face-to-face interactions with SNL subject matter experts and enabled employee networking. But a fundamental change needs to be made to sustain it, particularly by paying instructors and/or the instructors' time to prepare and teach courses.

The IT/CS Program may be on the decline, because it is seeing reduced numbers of applicants and sponsoring organizations have filled most of their needs. Also in the current economy, SNL can recruit qualified candidates instead of training to fill needs. If the program has met its purpose, then efforts need to be focused upon phasing the program out—especially in view of the high cost of the program relative to other training efforts.

The Nuclear Weapon Intern Program is currently undergoing a major revamping to improve its effectiveness. The reduction from a 2-year to a 1-year program should help reduce the cost of the overall program and/or enable more candidates to participate.

The new effort with Division 2000 seems to be using the same format as the Materials Science Program. Courses focused upon Division 2000's training needs[14] appear broad and should benefit many employees at the Labs if the courses are offered outside of Division 2000.

[14] *Michelle Fromm-Lewis, private communication (2002)*

**Overall Observations
About Training at SNL**

- **University Programs**
  - **At historical (1985- 2001) average of about 50 graduates per year**
  - **Major growth in the University Programs came from granting additional Bachelor and Masters degrees.**
    - **SNL should be able to hire at these degree levels.**
    - **The early Technology Development Program was discontinued, because we could hire new employees at the Masters level.**
  - **Some growth due to hiring practices.**
- **Advertising**
  - **Although a lot of training advertising exists at SNL, the advertising may not be as effective as desired.**
    - **Loss of course catalogs and Weekly Bulletin announcements.**
- **Trades Training**
  - **Only locally available in Division 14000.**
    - **Loose trainees to other Divisions.**

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Some overall observations about training at SNL are made here.

The University Programs seem healthy, operating at about the historical average of 50 graduates per year and expecting to grow due to some recent recruiting into the program. The cost per full-time employee in the program is about $100,000 per year. Students are now required to pay back the time in the program with service time or repay the cost of the training if they leave SNL sooner than the requisite amount of service time is met. It was noted that major growth in the University Programs during the time when no selection committee was in place was in non-technical Masters and Bachelors degrees. This opportunity is a nice benefit to offer employees. However, SNL should be able to hire at these degree levels; we note that the early Technology Development Program was discontinued because SNL could hire new employees at the Masters level.

A lot of advertising for training programs exists, but it may not be as effective as desired. The only trades training available today is sponsored by Division 14000, which has the Advanced Manufacturing Technologies Trades Program and participates in Next Generation Economy and Advanced Technology Academy Programs[14]. We have been informed[15] that many trainees are lost to other positions across SNL, therefore it is possible that such training is more necessary than originally believed.

[14] *Phillip Gallegos and Carla Forrest, TRADE proposal-AMTTP, (May 23, 2002)*
[15] *Jane Poppenger, private communication, (January 2002)*

Final Observations of Education and Training

- **The basic changes to the education and Training program may be in attitude and focus.**
- **There is no longer a general attitude that education and training is important and valued by SNL management.**
- **The focus of the education and training program appear to be tactical versus strategic.**
  - **"Tactical" training, i.e. near-term need (~$14M)**
    - **NWIP, IT/CS, University Programs, Organization Specific**
    - **Covers ~100 people**
      - **Except Org. Spec. ($0.53M)**
  - **Mandatory/Required Training (~$13M)**
    - **Compliance, ES&H**
    - **Covers everyone at SNL for 8 hours**
  - **"Strategic" training, i.e. career broadening (~$5M)**
    - **Technical, Leadership, SBS, TAP**

Note: Numbers are from data presently available to us, and may vary slightly from EOFY02 actual results.

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There seems to have been a fundamental change in SNLs' attitude about education and training. Anecdotal evidence seems to support the position that education and training is not as important at SNL as it use to be. Floran[1] found in his 1999 study that individuals did not feel that SNL's management encouraged or valued education and training.

In addition the focus of education and training at Sandia seems to have changed from a strategic view to a more tactical view. We have attempted to categorize the training programs into tactical and strategic. The tactical training is training employees to meet near-term needs. Tactical programs tend to have clear measurable value metrics. Any special university program by its very nature is fulfilling a well-identified near-term need. The NWIP, IT/CS, and Organization Specific programs are categorized as meeting near-term or tactical needs of SNL. The tactical training efforts, except for Organization Specific, which cost $0.53 million in FY99, trains less than 100 people but costs $13.5 million. The Mandatory/Required training, i.e. Compliance and ES&H, also falls in the tactical category and costs about $13 million annually. This amount covers every employee's involvement at SNL. The Tuition Assistance Program is placed into the strategic training category because it pays for employees to take a university course in an area of their choosing and is not required to fill a near-term need. Most of the Technical and many of the Leadership & Management courses are strategic in nature. Strategic training costs about $5 million. The number of individuals covered by this type of training is harder to quantify. However, comparing the Tactical versus Strategic budgets and participants, it is clear the financial support is largely in the Tactical area and benefits fewer individuals than the Strategic category. Is this what is intended?

ADDENDUM

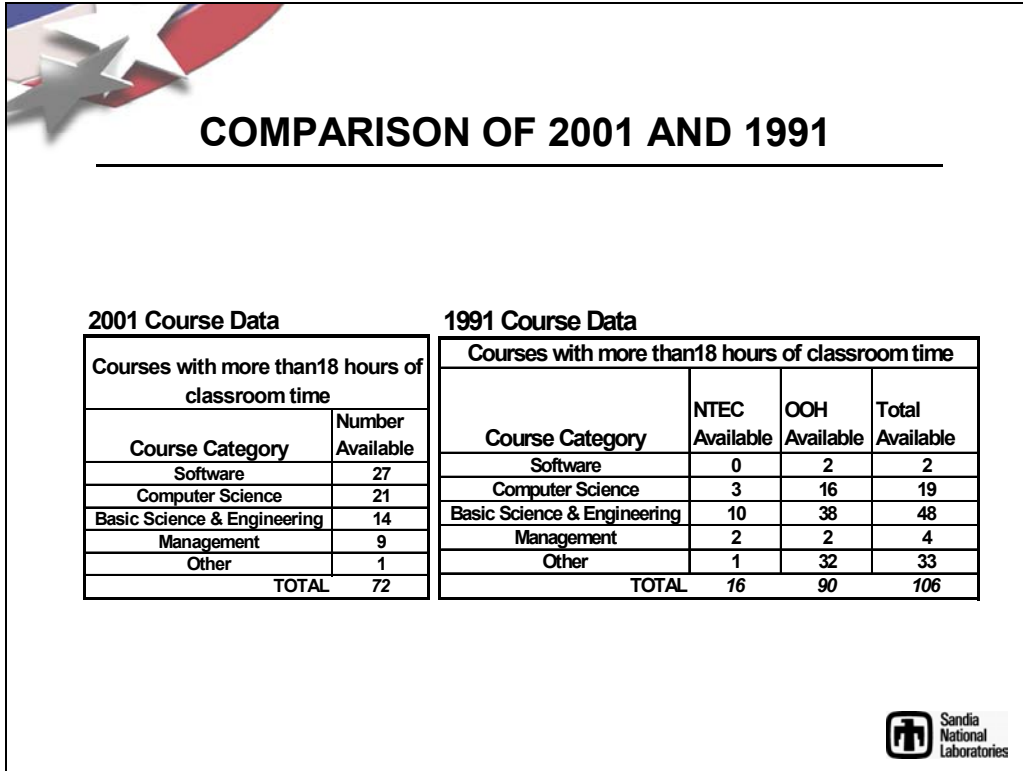| Courses with 18 hours or more of classroom time—FY01			
Course Category	**Number Available**	**Number Provided**	**Number of Completions**
Software	62	6	117
Computer Science	21	19	559
Basic Science & Engineering	14	7	200
Management	10	7	245
Other	3	0	0
TOTAL	*110*	*39*	*1121*
Environmental & Safety	13	4	600

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Addendum

After hearing these study results, the "Gang of Six" proposed developing up to 10 longer-term "classroom-delivered" courses in the basic Science and Engineering area. Based on this specific proposal, it was decided to request an Ad hoc query of the TEDS database to determine the types and number of "classroom-delivered" courses that were currently available.

The table on this chart shows the results of that query. "Classroom-delivered" courses, which were offered in FY01 and were 18 hours or longer in length[*], were categorized as Software, Computer Science, Basic Science and Engineering, Management, and Other and tallied. SNL's security force classroom instruction courses were eliminated from the list. The first column has the number of courses that were available and the second column contains the number of courses that were actually provided. The final column is the total number of course completions per category.

Of the Basic Science and Engineering courses, there was one biology course, one ceramics course, 6 ProE courses, one surety class for managers, one weapons survey course, and 4 explosives technology courses that are Organization Specific training. The majority of all the courses offered were Software or Computer Science courses. This quick analysis shows there is clearly room for additional basic Science and Engineering courses provided in a longer-term "classroom-delivered" venue.

*We originally sought courses that were 30 hours or greater in length—a 16-week course meeting twice a week for an hour would be 32 hours of classroom time; however, so few course offerings exceeded 18 hours that we accepted this as a lower limit.

COMPARISON OF 2001 AND 1991

2001 Course Data

Courses with more than18 hours of classroom time	
Course Category	Number Available
Software	27
Computer Science	21
Basic Science & Engineering	14
Management	9
Other	1
TOTAL	72

1991 Course Data

Courses with more than18 hours of classroom time			
Course Category	NTEC Available	OOH Available	Total Available
Software	0	2	2
Computer Science	3	16	19
Basic Science & Engineering	10	38	48
Management	2	2	4
Other	1	32	33
TOTAL	16	90	106

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After presenting the previous data, we were asked by members of the Education Council to provide some data from the early '80s or '90s for comparison. Unfortunately, we could not get the same data for previous years as we presented for 2001. However, we were able to collect data for 1991 from INTEC and OOH course catalogues. The catalogues only contained data on what courses were offered. There was no data on completions. The tables in this chart are a comparison of available courses, which had more than 18 hours of classroom time in 2001 and 1991.

The number of courses available in 1991 is 106 and 72 in 2001. Not really that different. In 1991, 64 out of the 93 INTEC courses or over 60% were delivered by ITV. The majority of the Basic Science and Engineering (BSE) courses (physics, chemistry, engineering, metallurgy, etc.) were offered thorough ITV. Of the 29 courses offered in the classroom, only 10 were longer than 18 hours. These classroom offerings aren't all that different than 2001. However, an extensive set of BSE courses was offered through ITV. Generally these courses were taught by professors at UNM and NM Tech.

While in 1991 in the OOH program, which includes the self-help program, there were 90 courses with more that 18 hours of classroom time. The majority of the classes were in the BSE area. Classes were offered in basic math, chemistry, electronics, semiconductors, circuit analysis, physics, pulse power, etc. These may be the classes that people are remembering as the "good old days."

Acknowledgments

• Nanette Morton	• Duane Dimos
• Robert Floran	• Bill Cook
• Paul Hlava	• Clyde Layne
• Keith Almquist	• Rosemary Dunnivan
• Curtis Hines	• Dolores Chavez
• Charline Wells	• Eric Ryder
• Belinda Holley	• Sharon Mackel
• Pat Willan	• Trudy Blake
• Patti Cover	• Beth Potts
• Linda Stackpole	• Carla Simeos
• Michelle Fromm-Lewis	• Jerri Dye
• Yvonne Vallejos	• Debbie Dominquez
• Bill Hammetter	• Becky Hunter
• Donna Baros	• Paul Graham
• Marilyn Barr	• Rick Calvert
• Helga Judd	• Donna Filip
• Carl Skinrood	• Michelle Barela
• Doug Nordquist	• Shiela Nelson
• Diana Suina	• Bruce Hendrickson
• Bill Richard	• Carla Forrest
• Phil Gallegos	• Dominique Wilson
• Jane Poppenger	• Duane Garrison
• Roberta Jaramillo	

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Acknowledgments

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