This 1974 annual report of Southern Methodist University (SMU) deals with intentions for 1975-1980 and presents a statistical report and evaluation of trends. Section I, intentions for 1975-80, covers achieving excellence, superior programs, physical plant expansion, minority student program, increasing baccalaureate degrees, an educational venture fund, and a model for minimal doctoral program of high quality. Section II, a statistical report, reviews freshman engineering cooperative program, graduate engineering enrollment, the TAGER television system, graduate degree production, and semester credit hour production. (MJM)
SMU Institute of Technology 1974 Annual Report
The previous Annual Reports of the Institute of Technology have been addressed to a variety of topics in educational administration and management. Each Report attempted to present a systematic, quantitative approach to some specific problem of importance in the management of higher education in science and engineering. Specifically, the following topics have been addressed:

1. The characteristics of the top engineering schools -- 1969 Report
2. The measurement of academic quality and the indices of excellence -- 1970 Report
3. The quantitative evaluation of faculty performance and the specification of standards of productivity and excellence -- 1971 Report
4. The characteristics of the college-age population dynamics and the American economy as determinants in educational program planning -- 1972 Report

This, the 1974 Annual Report, attempts to draw these five elements together by presenting a five-year plan for the SMU Institute of Technology for 1975-1980. It is designed to serve as a specific application and example of the general principles covered in earlier Reports.

In common with all other Reports, the 1974 Report closes with a quantitative summary and interpretive analysis of significant factors which occurred during the 1973-74 academic year. Thus, the first part is a look ahead to the future and the second part is a reflective view of the past.
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Section I INTENTIONS FOR 1975-1980

As explained in the 1973 Report, the first step in long-range planning involves the establishment of well-defined organizational goals. There is often confusion between the meanings attached to goals and objectives. Here they are used to denote two different classes of intentions defined as follows:

(1) A goal is an axiological intention whose attainment is a matter of subjective judgment. They are always expressed as
   To (action word) (object) (qualitative modifier)
(2) An objective is an intention whose degree of achievement can be determined by comparison with specific objective measures, often within specified time frames. They are measurable intentions which are always expressed as
   To (action word) (object) (quantitative modifier)

With this understanding of terms, and with overall University intentions provided by the Administration, the intentions for the Institute of Technology were developed. This involved a three-step process. First, a meeting of the Institute administration - Dean, Associate Dean, Assistant Dean for Undergraduate Programs, and Department Heads - was arranged for the purposes of goal setting. After several hours of discussion, a group of commonly understood intentions was developed. As a second step, these were then referred back to the individual departments for review, criticism and addition. All responses received were factored into the original statements. In the third step, the revised intentions were structured into hierarchical form and again were submitted to the faculty for their reaction. Once again, all responses were factored into the statements and into the hierarchical structure. It is worth noting that faculty response and comment in this process can be described most charitably as minimal. For whatever reason, the faculty was essentially passive as far as goal setting was concerned.

The outcome of this process was a group of 14 intentions that are summarized as follows:

1975-1980

Statement of Intentions (Goals and Objectives)

1) By established measures of performance to stand among the top ten schools of engineering in the nation.
2) To provide educational programs in support of the service sector of the regional economy.
3) To provide support for the science, engineering and technology intensive industries of North Texas and other regions.
4) To assure the existence and availability of excellence in other academic departments of the University which complement and support the Institute of Technology curriculum.
5) To offer superior programs to superior students in Civil, Electrical, Mechanical and Systems Engineering and in Computer Science and Operations Research.
6) To develop and complete a set of innovative and excellent undergraduate laboratories.
7) To double baccalaureate degree output to 150 degrees per year.
8) To maintain Master's degree output in the range from 125 to 200 per year.
9) To award at least 25 doctorates per year, with 10 or more being the Doctor of Engineering which aims at engineering practice.
10) To secure public recognition of Institute accomplishments - on the campus, in the local North Texas area, and nationally.
11) To initiate an "open University" pre-engineering program.
12) To dramatically improve the opportunities for women and minorities as students and faculty within the Institute of Technology.
13) To achieve an increasing degree of interaction and support with and from governmental agencies.
14) To construct a major laboratory facility of 40,000 square feet.
To achieve an increasing degree of interaction and support with and from governmental agencies.

To construct a major laboratory facility of 40,000 square feet. The hierarchical arrangement of these intentions is shown in Fig. 1.

The sections that follow cover the general strategies that are being implemented to assure the achievement of these intentions.

Intention 1 — Achieving Excellence

Excellence in engineering and science education programs can be measured. This subject was reviewed at length in the 1970 Annual Report and the review was based upon a landmark publication by the National Science Board entitled "Graduation Education -- Parameters for a Public Policy." This document identifies a number of correlates of quality. These were derived by examining those "best" schools identified in the Carter Report and then determining if there were any correlations between perceived quality and various measurable factors. These were identified as the correlates of quality. The authors of the report made it clear that the more correlates of quality demonstrated by a school, the greater its likelihood of being identified with the "best," that the correlates were synergistic. It was also noted that the mere achievement of these performance standards was no guarantee of excellence, but that it was hard to imagine that any school described by such characteristics would not possess a high degree of excellence.

The six most important of these correlates of quality are identified in Table 1. The seventh one, as noted in the 1970 Report, is a measure of minimum faculty productivity in the classroom requisite to quality instruction and minimal exposure of all faculty to students. These factors are all ratios of eight different indices which are readily determined for any school. Their average values for the three-year period 1970-1973 for the Institute of Technology are given in Table 2. The corresponding correlates of quality for SMU, compared to those which characterize the "best" schools, are compiled in Table 3. It is worth noting that SMU performance in all cases except one, equals or exceeds that associated with excellence. The one case in which its performance is somewhat below the standard is a byproduct of the large TV graduate program which is the result of strategies supporting Intentions 2, 3 and 8.

### TABLE 1

<table>
<thead>
<tr>
<th>Factor</th>
<th>Formula</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Number of doctorates produced per year</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>(2) Face values of research per year</td>
<td>$35,000</td>
<td></td>
</tr>
<tr>
<td>Number of full-time faculty</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>(3) Doctoral degrees per year</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Number of FTE graduate students</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>(4) Bachelor's degrees per year</td>
<td>$35,000</td>
<td></td>
</tr>
<tr>
<td>Number of full-time faculty</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>(5) Doctoral degree per year</td>
<td>4.24</td>
<td></td>
</tr>
<tr>
<td>B.S. degrees per year</td>
<td>0.16</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 2

<table>
<thead>
<tr>
<th>SMU Performance Indices</th>
<th>1970-1973 3-year average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td></td>
</tr>
<tr>
<td>Doctoral degrees per year</td>
<td>32</td>
</tr>
<tr>
<td>Master's degrees per year</td>
<td>167</td>
</tr>
<tr>
<td>Bachelor's degrees per year</td>
<td>78</td>
</tr>
<tr>
<td>Student Credit Hours (SCH)</td>
<td>12,393</td>
</tr>
<tr>
<td>Number of full-time faculty</td>
<td>45</td>
</tr>
<tr>
<td>Research in force (face value)</td>
<td>$1,716,628</td>
</tr>
<tr>
<td>FTE graduate students (SCH/9)</td>
<td>334</td>
</tr>
<tr>
<td>FTE faculty</td>
<td>50</td>
</tr>
</tbody>
</table>

### TABLE 3

<table>
<thead>
<tr>
<th>SMU Performance</th>
<th>1970-1973 3-year average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td></td>
</tr>
<tr>
<td>Top 10 Model</td>
<td></td>
</tr>
<tr>
<td>Doctorates per year</td>
<td>25</td>
</tr>
<tr>
<td>Research (face value)</td>
<td>$35,000</td>
</tr>
<tr>
<td>full-time faculty</td>
<td>$38,147</td>
</tr>
<tr>
<td>Doctorates/year/full-time faculty</td>
<td>0.43</td>
</tr>
<tr>
<td>Doctorates/year/FTL graduate student</td>
<td>0.1</td>
</tr>
<tr>
<td>Doctorates/year/B.S. degree/year</td>
<td>0.2</td>
</tr>
<tr>
<td>FTE graduate students/FTE faculty</td>
<td>4.24</td>
</tr>
<tr>
<td>SCH/FTE faculty</td>
<td>250</td>
</tr>
<tr>
<td>Also note the number of degrees/faculty</td>
<td>6.16</td>
</tr>
</tbody>
</table>

**FIGURE 2**

**Average for 47 Substitute Faculty**

<table>
<thead>
<tr>
<th>Name of Rater</th>
<th>Name of Person Rated</th>
<th>Date</th>
</tr>
</thead>
</table>

### PERSONAL QUALITIES

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Fairly Adequate</th>
<th>Superior</th>
<th>Outstanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Must be told; no personal initiative.</td>
<td>Needs close, frequent supervision.</td>
<td>Requires average supervision.</td>
<td>Independent; successful.</td>
</tr>
<tr>
<td>2 Motivation to achieve and speak, without regard to effectiveness.</td>
<td>Could do much better than he does. Low effort.</td>
<td>Satisfactory; average effort.</td>
<td>Hardworking; above average.</td>
</tr>
<tr>
<td>3 Responsibility</td>
<td>Unreliable, or prefers lack of responsibility.</td>
<td>Trustworthy, reliable, consistent.</td>
<td>Fairly reliable, always does job at any cost.</td>
</tr>
<tr>
<td>4 Personal Relations</td>
<td>Lacks interest in dealing with others.</td>
<td>Maintains good relations; understands and is returned to others.</td>
<td>Occasionally holds national meetings and presents at least one paper/year.</td>
</tr>
<tr>
<td>5 Professional Activities</td>
<td>Inadequate: does not participate locally or nationally.</td>
<td>Actively participates: frequently a local effective; active atten.</td>
<td>Occasionally invites others: active attendance; work on national committees.</td>
</tr>
<tr>
<td>6 University Service</td>
<td>Avoids service on committee or assistance in student activities, etc.</td>
<td>Occasionally serves on committee, works objectively, but not enthusiastically; accepts some administrative counsel.</td>
<td>Accepts duties: actively counts; on committees in local and national.</td>
</tr>
</tbody>
</table>

### RESEARCH PRODUCTION

<table>
<thead>
<tr>
<th>Research Production</th>
<th>Fairly Adequate</th>
<th>Superior</th>
<th>Outstanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Submits few proposals; usually sends below 100/year.</td>
<td>Submits proposals, usually sends 100/year.</td>
<td>Submits many proposals, with frequent citations, around 200/year.</td>
<td></td>
</tr>
<tr>
<td>3 PhD Productivity</td>
<td>No Ph.D. students enrolled.</td>
<td>Occasional Ph.D. produced of any quality.</td>
<td>Produces 1 or more Ph.D.'s per year.</td>
</tr>
</tbody>
</table>

### TEACHING

<table>
<thead>
<tr>
<th>Teaching</th>
<th>Fairly Adequate</th>
<th>Superior</th>
<th>Outstanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Student Inspiration</td>
<td>Unusual effort to gain student interest.</td>
<td>Highly effective: good teacher.</td>
<td>Unusually effective: good teacher.</td>
</tr>
<tr>
<td>2 Teaching Effectiveness</td>
<td>Good teacher, enthusiastic, well prepared, well organized.</td>
<td>Good teacher, production, well prepared, organization.</td>
<td>Outstanding: teacher, enthusiastic, well organized, well prepared.</td>
</tr>
<tr>
<td>3 Teaching Production</td>
<td>Below 200 S/A.</td>
<td>Approximately 200 S/A.</td>
<td>Over 400 S/A.</td>
</tr>
</tbody>
</table>

### EDUCA TIONAL INNOVATION

<table>
<thead>
<tr>
<th>Educational Innovation</th>
<th>Fairly Adequate</th>
<th>Superior</th>
<th>Outstanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Adequacy of P/Rd. Student Supervision</td>
<td>Students receive little or no direction, contact with advisor infrequent/ineffective.</td>
<td>Students well prepared and progress rapidly in dissertation defense, well counseled.</td>
<td>Students well prepared and progress rapidly in dissertation.</td>
</tr>
</tbody>
</table>

**SUB-TOTAL PERSONAL JOB POINTS:** 71.5

**SUB-TOTAL TEACHING JOB POINTS:** 58.01

**SUB-TOTAL RESEARCH JOB POINTS:** 43.65

**SUB-TOTAL JOB POINTS:** 193.22

**FIGURE 3**

Table showing the average performance of 47 substitute faculty members.
Intention 5 — Superior Programs

According to Intention 5, the Institute of Technology will offer superior programs to superior students in Civil, Electrical, Mechanical and Systems Engineering and in Computer Science and Operations Research. There are two degree paths through the Institute of Technology — one in Engineering and one in Applied Science. These paths lead to the following degrees:

**Engineering:** (Civil, Electrical, Mechanical, Systems)
- The B.S.X.E. — The baccalaureate — basically four years
- The M.S.X.E. — The Master’s — one year past the baccalaureate
- The Engineer — One year past the Master’s
- The Doctorate — Either the Ph.D. or the Doctor of Engineering — basically three years past the baccalaureate

**Applied Science:** (Computer Science and Operations Research)
- The B.A.S. — Bachelor of Applied Science — four years
- The M.A.S. — Master of Applied Science
- The Ph.D.

Degrees in Applied Science at the M.A.S. and Ph.D. levels, with major concentrations in the previously listed engineering areas, may be sought by students with baccalaureate degrees in the hard sciences and mathematics.

It should be noted that an effort has been made to identify the principal mainstreams of local industry interest and national academic interest, and to do those few things well. For example, no effort is made to cover Chemical, Sanitary or Metallurgical Engineering. The limited resources available must be concentrated into a few areas to produce what F. E. Terman, former Provost of Stanford University, identifies as “steeples of excellence.”

The basic plan at SMU is described in detail in that part of this Report entitled “A Model for a Minimal Doctoral Program of High Quality.”

Just as it is necessary to select a few major departments to avoid spreading resources too thin, it correspondingly necessary to select only certain specific academic areas within each major department. Tables 4 through 8, which follow, indicate the areas that are, or are not, covered in the SMU program. As used here, the term covered means that graduate level research is underway. Obviously, it is necessary to be able to teach, principally at the undergraduate level, in all areas and this capability does exist at SMU. But excellence at any level in a given subject requires coverage in the research sense. Minimal coverage has been achieved at SMU.

It is clear from this tabulation that the maximum strength exists in Electrical Engineering. The recent losses of key people must be replaced by senior people if departmental strength and productivity are to be sustained. The most important deficiency in this department is in the area of switched telecommunication systems. The highest priority must be attached to the acquisition of a senior man who can provide leadership and a rallying point for others. Although there are no such programs now in American engineering schools, every school will be trying to start one by 1980. Thus, this is a place where the Institute can provide national leadership and greatly enhance its already good reputation.

A similar situation exists in Mechanical Engineering. In this case the area of nondestructive testing is a “hot” technical area, but absent from the nation’s campuses. The establishment of a major program in this area can be achieved at SMU, with a relatively small capital outlay. Like telecommunications in electrical engineering, it is an area of rapidly increasing importance in mechanical engineering and in industry, both locally and nationally. Its development at SMU could catapult the Mechanical Engineering Department into a position of national eminence and leadership while simultaneously complementing existing strengths.

**TABLE 4**

**Principal Academic Areas**

**Civil Engineering**

**Areas Covered at SMU (Research underway)**
- Solid Mechanics
- Civil Engineering Structures
- Soil Mechanics
- Water Resources
- Environmental Science and Engineering

**Areas Not Covered at SMU (Courses are taught; no research)**
- Graphics and Surveying
- Transportation and Traffic
- Hydraulics (except in the Fluid Sciences area)
- Urban and City Planning
- Construction

Coverage in Environmental Science and Engineering and in Soil Mechanics is only marginal.

**TABLE 5**

**Principal Academic Areas**

**Electrical Engineering**

**Areas Covered at SMU (Research underway)**
- Electronic Devices
- Information Technology
- Systems Science and Technology
- Networks and Circuits
- Biomedical Engineering
- Quantum Electronics and Electromagnetics
- Societal and Public Systems
- Electronic Materials

**Areas Not Covered at SMU (Courses are taught; no research)**
- Energy Technology — Although much of this is covered in Mechanical Engineering in the Thermal Sciences.
- Computer Engineering — Although much is found in Computer Sciences Program

**Telecommunications**
TABLE 6

Principal Academic Areas

Mechanical Engineering

Areas Covered at SMU (Research underway)
- Solid Mechanics
- Thermal and Fluid Sciences and Engineering
- Mechanical Design of Materials
- Environmental Science and Engineering
- Acoustics
- Gas Dynamics

Areas Not Covered at SMU (Courses are taught; no research)
- Controls
- Materials and Manufacturing Processes
- Lubrication
- Tool Engineering
- Petroleum Technology
- Reliability and Quality Control: nondestructive testing

Coverage in Environmental Sciences and Engineering is only marginal.

TABLE 7

Principal Academic Areas

Computer Science

Areas Covered at SMU (Research underway)
- Computer Systems Software
- Digital Hardware
- Mathematics of Computation

Areas Not Covered at SMU (Courses are taught; no research)
- Management Data Processing
- Artificial Intelligence
- Simulation — Some coverage in Electrical Engineering
- Analog Computers — Well covered in Electrical Engineering as are Hybrid Computers

TABLE 8

Principal Academic Areas

Operations Research

Areas Covered at SMU (Research underway)
- Deterministic Models
- Stochastic Models
- Information Systems

Areas Not Covered at SMU (Courses are taught; no research)
- Decision Processes (Game Theory, Networks, etc.)
- Applications — specifically in such areas as:
  - Health Care
  - Production Control and Scheduling
  - Reliability
  - Transportation Systems

The Systems Engineering Program offered at SMU is one of the first three Systems Engineering Programs to be accredited by the Engineers Council for Professional Development. Although the program resides adminis-
Figure 3
"Existing" and "Proposed" Facilities

Assuming that this space was available to the Institute, the best plan might be to identify the Caruth Engineering Building and Laboratory Buildings 1, 2 and 3 as the physical plant for the Electrical Engineering Department, including Biomedical Engineering. All administrative and other activities should be moved out of the Caruth Building, and into the Fincher Building, with the exception of the four TV studios. The Caruth Engineering Building would then be used for the TV classrooms, graduate student study spaces, faculty offices, and principally for undergraduate laboratories. Laboratory Buildings 1, 2 and 3 would be converted to heavy duty research laboratories, primarily in the Electronic Sciences and Biomedical Engineering. The third floor of the Science Information Center would be vacated.

The new Laboratory Building No. 4 could be designated as the Civil and Mechanical Engineering Building and all activities which had previously been housed in Caruth and in Laboratory Buildings 1 and 3 could be moved into that facility. This is only one possible plan for the use of Laboratory Buildings 1, 2, 3 and 4. Closer analysis may suggest alternative assignments.

The Department of Computer Science and Operations Research would remain in the Bradfield Computing Laboratory. All facilities and personnel not associated with that activity could be moved into Fincher. Furthermore, the department will require some space in Fincher because it is already overcrowded.

This would place all of the non-televison classrooms, conference rooms, administrative offices, reading rooms for students and so on in the Fincher Building. It would be many, many years before the Institute could fully occupy all of this space so that a large proportion of it would be available for general University use. This would make a major increment in office and classroom space available to the University as a whole because most of it is now fully utilized by the School of Business Administration.
It would appear that the foregoing physical plant development could be accomplished with five decision packages at the following approximate costs:

<table>
<thead>
<tr>
<th>Package Number</th>
<th>Package Name</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package No. 1</td>
<td>Laboratory Building 4</td>
<td>$860,000</td>
</tr>
<tr>
<td>Package No. 2</td>
<td>Refurbish Lab Buildings 1, 2 and 3</td>
<td>25,000</td>
</tr>
<tr>
<td>Package No. 3</td>
<td>Move Electronic Sciences out of SIC-3</td>
<td>50,000</td>
</tr>
<tr>
<td>Package No. 4</td>
<td>Refurbish Fincher Building</td>
<td>50,000</td>
</tr>
<tr>
<td>Package No. 5</td>
<td>Refurbish Caruth Building</td>
<td>50,000</td>
</tr>
</tbody>
</table>

All these estimates may be in error to some degree, but in any event, it is clear that the entire project could be accomplished for less than about one or $1.2 million. Considering the overall magnitude of the project, that is a tremendous bargain by any test.

**Intention 12 — Minority Student Program**

In the National Conference on the Recruitment of Minority Students that was held in Washington in 1973, the following key points emerged as important factors in the recruitment and retention of minority students in predominantly white schools:

1. They need tuition assistance in nearly all cases.
2. In many instances, they come from desperately poor families, whose expectation is that the potential student will work and earn money to contribute to the family expenses. His removal from this enterprise by full-time attendance in school can work hardships upon his family. Consequently, it is imperative that, while he is a full-time student, he be provided with some sort of spending money.
3. The program must move to precisely the same levels as programs for white students. The minority communities believe that a double standard would be a rip-off that they would not accept.
4. Assuming that student performances and attitudes are accepted, the companies must be willing to guarantee a job at the end to establish credibility for the program. Too many inducements and promises have been made in the past which have not been kept and credibility of the Establishment is not high.

With these considerations in mind, the following general elements have been incorporated into the SMU Plan:

1. During the student's first year at SMU, the company would agree to pay full tuition to allow him to go to school full time and would additionally provide him with some sort of stipend or spending money and to contribute to family support.
2. The company would agree to provide the student with a co-op job for the remainder of his time at SMU with tuition assistance depending on need.
3. These efforts would be coordinated with any tuition equalization scholarship programs operated by either the State or Federal Government; the purpose of this last provision being to minimize the overall cost to the sponsoring company.
4. SMU would endeavor to recruit the students, but would welcome nominations from the companies themselves, either from their work force or from children of their employees.

5. The program is aimed at all minority groups, Negro, Spanish surname and American Indian.

Assuming that a minority student does not receive any financial aid from any source other than his or her sponsoring firm, the cost of sponsoring a student is estimated to be $11,000 in total. This cost figure is based on the following assumptions:

1. The student will be able to complete the freshman engineering curriculum in two semesters, i.e., he or she will not require remedial work or will not need a summer term to yield a lighter-than-normal load in the regular term.
2. The sponsoring firm will pay for all of the student's expenses for the freshman year, then only for tuition after this. This is based on the premise that a student will co-op with the firm after his freshman year, and thus, be able to pay for all expenses other than tuition through his co-op earnings.
3. SMU tuition and fees will not increase beyond $2,450 per year. If it does increase, costs will rise accordingly.

The costs for a student's freshman year will be:

- **Tuition**: $2,200
- **Room and Board**: 1,200
- **Fees**: 250
- **Books and Supplies**: 150
- **Spending Money for $50/mo.**: 450

**Total**: $4,350

After the freshman year, it is assumed that the student will co-op with his sponsoring firm, and will receive a normal co-op salary. The sponsoring firm will pay the tuition for the student during each school term, and this will total approximately $6,750 (based on 1974-75 charges).

There are a number of other sources for financial aid, including:

1. Texas Equilization Grants which are provided by the State of Texas for Texas students who wish to attend private universities in Texas. The value of these grants is up to $600 for each academic year.
2. Basic Educational Opportunity Grants (BEOG's) which are provided by the Federal Government for freshman students who show a rather high degree of financial need. The value of these may be from $500 to $800.
3. Supplemental EOG's which provide additional funds for students with greater need than is called for in the BEOG program.
4. Other scholarships which are administered by SMU's Financial Aid Office.

It is anticipated that most of the students who will be selected for the Minority Student Program will be able to receive one or more of these forms of financial assistance. The cost to the sponsoring firm will be reduced accordingly, but to an extent that cannot be predicted in advance.

The program has been well received and a number of companies represented on the Board of Directors of the SMU Foundation for Science and Engineering have agreed to sponsor minority students.
Intention 7 - Increasing Baccalaureate Degrees

By late 1972, it was increasingly evident that a critical shortage of engineering baccalaureates would occur by 1975. This was recognized by Texas Instruments Incorporated and a cooperative effort with SMU was undertaken to assure TI's long-range manpower needs. Fortunately, this matched the SMU desire to increase the size of its baccalaureate programs.

Accordingly, the SMU-Texas Instruments Engineering Development Program was established in the Spring of 1973 to provide for the education, on a part-time basis, of 75 TI employees through the Bachelor's degree in engineering. As initially conceived, the participants were to be employed full time by TI, but would be released during the morning hours from 8:00 to 12:00, five days a week, to attend classes on the SMU campus. It should be noted that SMU has three closed-circuit TV channels into Texas Instruments and could provide much of the instruction by TV; however, TI management insisted that all instruction be on campus so that the students could be exposed to the greatest extent possible to an education in a campus environment removed from the conventional in-plant training atmosphere.

The 75 students were to be about equally divided among three areas of interest to TI - Manufacturing Engineering (first identified under Industrial Engineering and later under Systems Engineering), Electrical Engineering, and Mechanical Engineering. The initial selection of students was made from applicants who had completed about two years of college work including mathematics through integral calculus.

The program was to begin in the Fall 1973. It was recognized that refresher type courses would be required during the Summer 1973 for the students who had not been enrolled in formal credit-type courses for a number of years. Accordingly, three noncredit courses were offered during the Summer 1973:

- SS 1301 Calculus Review - Part I
- SS 1302 Calculus Review - Part II
- IC 1305 Fundamentals of Electrical Engineering

Except for the calculus review the refresher courses were fairly conventional in lecture sessions. In the calculus review courses, however, lectures were supplemented with video tapes, study guides, and lecture notes (these materials available as Calculus Revisited Parts I, II, III, were purchased from the Center for Advanced Engineering Study at M.I.T.).

Enrolled for the refresher courses during the Summer 1973 were 19 electrical, 13 industrial, and 9 mechanicals. Upon the completion of Calculus Review - Part I, three students had withdrawn from the program and it was clear that almost half of the remaining students needed additional review on the material of Part I. Accordingly, the math class was divided into two groups - one group of 17 students entered a more detailed review of Part I to prepare them to take SMU's third calculus course in a three-course sequence. The other group of 21 students continued with Calculus Review - Part II.

In the Fall of 1973 the program was brought up to full strength with 76 students enrolled. The distribution of these students and changes that occurred during the Fall semester are as follows:

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>With-</th>
<th>Grad-</th>
<th>Enroll-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 1973</td>
<td></td>
<td></td>
<td>Spring 1974</td>
</tr>
<tr>
<td>Fall 1973</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td>35</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Industrial</td>
<td>17</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Mechanical</td>
<td>24</td>
<td>1</td>
<td>23</td>
</tr>
</tbody>
</table>

One year is a relatively short sample time to establish conclusions on what is actually a rather bold experiment in engineering education; however, it is clearly a successful program and is to be expanded by Texas Instruments to have in school continuously for the next several years 100 engineering students at the junior and senior levels. In many respects the educational backgrounds and motivations of these students resemble those of the better World War II Veterans and make this group a welcome addition to the campus.

THE NEED FOR AN EDUCATIONAL VENTURE FUND

It is necessary that an Educational Venture Fund be established by the SMU Foundation for Science and Engineering, and operated by the Foundation in support of the Institute of Technology.

It should be the purpose of this Fund to allow strategic investment of resources to promote future growth of the Institute of Technology, growth in quality or in size or in effectiveness. The Fund would invest in projects which aim to increase Institute revenues from tuition, research and annual giving; alternatively, other projects could aim to reduce expenditures.

In part, the Educational Venture Fund should resemble an endowment fund. That is, one part of the Fund should be permanent and its corpus should not be invaded. Instead, only earnings from this permanent part of the Fund should be invested in proposed educational ventures.

Other parts of the Fund need not be permanent. A particular donor might desire to fund a particular project over a certain specified time frame and provide the funds for that. Other projects might involve a one-time expense which a particular donor might wish to support. Thus, the Fund should have both permanent and nonpermanent components.

It is proposed that the Foundation look to this Educational Venture Fund, rather than to a conventional endowment, to secure the future of the Institute of Technology as an innovative school.

It is imperative that the effort to raise money for this Fund does not interfere with fund raising for annual operations. If that occurred, the diversion of support to new activities could collapse the existing program.

Beginning in 1974-75, the budget of the Institute of Technology will be constructed, as described in the 1973 Annual Report, as a series of rank-ordered decision packages. The annual operating budget will fund those decision packages of the highest rank whose cumulative cost does not exceed Institute revenue from tuition, research and annual giving. Those decision packages falling below this cutoff line will form the creative reserve of projects for consideration for funding from the Educational Venture Fund.

All decision packages in the creative reserve will be approved by the President of SMU, or the Provost, prior to submission to the Foundation for consideration.
The list of decision packages submitted will not be rank ordered when it is submitted to the Foundation.

The Executive Committee of the Foundation will rank order the decision packages with each committee member in attendance having a vote for each decision package. The committee will also set the cutoff line, funding those packages above the line. This identifies the expenditure level permitted from the Fund at that time.

These recommendations will then be presented to the entire Board of the Foundation for their consideration and action.

Strategic decision packages already identified for the 1975-80 time frame include the following:

<table>
<thead>
<tr>
<th>Package No.</th>
<th>Package Name</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nondestructive Testing</td>
<td>$90,000</td>
</tr>
<tr>
<td>2</td>
<td>Telecommunications</td>
<td>$25,000</td>
</tr>
<tr>
<td>3</td>
<td>New Laboratory Building</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>4</td>
<td>Minicomputer</td>
<td>$11,000</td>
</tr>
<tr>
<td>5</td>
<td>ME Undergraduate Lab Support</td>
<td>$20,000</td>
</tr>
<tr>
<td>6</td>
<td>Biomedical Student</td>
<td>$12,000</td>
</tr>
<tr>
<td>7</td>
<td>Undergraduate Hydraulics Lab</td>
<td>$30,000</td>
</tr>
<tr>
<td>8</td>
<td>Remodeling of Caruth</td>
<td>$5,000</td>
</tr>
<tr>
<td>9</td>
<td>Remodeling of Lab Bldgs. 1, 2, 3</td>
<td>$12,000</td>
</tr>
<tr>
<td>10</td>
<td>Remodeling of Fincher</td>
<td>$15,000</td>
</tr>
<tr>
<td>11</td>
<td>Move Electronic Sciences</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

A MODEL FOR A MINIMAL DOCTORAL PROGRAM OF HIGH QUALITY

... a minimal doctoral program of high quality (in science and engineering) might contain at least 7 graduate departments (i.e., minimal groups, not formally or informally structured groups, each containing diverse specialties), a total of 49 faculty members (typically of the rank professor or associate professor) and 343 doctoral students.

The foregoing specification is based upon the widely accepted concept that any given academic area requires a "critical mass" of faculty members of outstanding qualification to achieve a state of self-sustaining excellence. In general, in an average sort of way, this number is taken to be seven. Thus, sustained excellence requires approximately seven main areas of seven faculty members, each associated with seven doctoral students.

There is nothing absolutely immutable about the number seven. Stanford had one of the two best Chemical Engineering Departments in the country with a faculty of only four. The number required depends upon the excellence of the faculty -- the higher the faculty quality, the fewer that are needed. But seven is commonly accepted as a good "center" value for "good" people who serve in full-time nonteaching, nonresearch posts. The principal faculty deficiency is in Information Systems and Sciences, notably in Switched Telecommunications, and it is here that new additions should be made.

Graduate Education -- Parameters for Public Policy, National Science Board, National Science Foundation, 1969, Washington, D. C., p. 102.

<table>
<thead>
<tr>
<th>Name</th>
<th>1974-75 Budget Number of Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science</td>
<td>7.5</td>
</tr>
<tr>
<td>Operations Research</td>
<td>5.5</td>
</tr>
<tr>
<td>Electronic Science</td>
<td>8.0</td>
</tr>
<tr>
<td>Information Systems and Science</td>
<td>4.0</td>
</tr>
<tr>
<td>Systems and Control Science</td>
<td>7.0</td>
</tr>
<tr>
<td>Solid Mechanics</td>
<td>7.0</td>
</tr>
<tr>
<td>Thermal-Fluid Sciences</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>47.0</td>
</tr>
</tbody>
</table>

It should also be understood that seven areas is also a minimum. A higher level of excellence requires a broader spectrum of activity. The next area, the eighth, to be added should be in the field of nondestructive testing with a staffing level rising from one to four over a period of about three years.

Total operating costs are determined primarily by the number of faculty involved in a program, and only in a minor way by the number of administrators. Thus, the foregoing concept of the staffing requirements for a minimal program of high quality can be used to construct an approximate cost model.

For example, assume that the faculty consists of 49 faculty members, including the Dean, Associate Dean and Department Heads. Assume that there are three additional full-time administrators not engaged in faculty duties. It is assumed that all 49 faculty members are able and willing to pursue research and direct doctoral students. Because of differing startup and stop dates of research grants and contracts, fluctuations in graduate student enrollment, and changing patterns of funding support, it is assumed that it will never be possible for more than about 80 percent of the faculty to be actively engaged in supported research at the same time. Thus it is assumed that 80 percent of the faculty teach 6 credit hours each term and 3 credit hours in the summer for a total of 15 credit hours per year. The other half of their time is committed to research. As noted above, it is assumed that, even under the most ideal practical conditions, 20 percent of the faculty will not be involved in research or the Ph.D. program. They are assumed to teach 9 credit hours per term, and not at all in the Summer, for an annual average of 18 credit hours. Thus, for the academic year, if \( F \) denotes the number of faculty,

\[
TCH = 0.8 F (12) + 0.2 F (18) = 13.2 F
\]

where \( TCH = \) Teaching Credit Hours

This defines the number of courses that can be offered per year. With 49 faculty members, and assuming all...
courses are 3 credit hours; this yields about 645 credit hours or about 215 courses per year. This should be an entirely adequate menu of courses for a wide range of student interests, but sufficiently limited to avoid undue dissipation of faculty energies.

The major items of expense can be estimated in a similar way and expressed in terms of the number of faculty $F$ and administrators $A$. This is illustrated for 14 major items of direct cost in the first column of Table 10. The second column gives the actual funds budgeted in each category in 1974-75 for the Institute of Technology. The last column then gives the predicted expenses for minimal excellence assuming 49 faculty and three administrators. It is apparent that the Institute is not yet up to the minimum expense levels necessary for sustained excellence. The differences arise primarily in the categories of faculty salaries and graduate student support. Faculty salaries are below the model because current staffing is two positions below the model and some present faculty are not capable of original research and do not qualify for the higher average salary indicated by the model. Their inability to acquire outside research support accounts for the difference in the actual funding level for graduate students and that specified by the model. It is interesting to note that total operating costs can be computed from these tables very simply as follows:

$$47,135 \times F + 19,075 \times A = \text{Total Direct Expense}$$

It is obvious that a very good horseback guess comes out at $50,000 per faculty member.

In return for this level of expenditure, faculty performance should equal or exceed the levels given in Table 11. Indeed, expense levels should advance to model levels only as faculty productivity reaches and exceeds the levels given in the Table. Achievement of these performance levels requires a substantial increase in enrollment without an increase in faculty. Additionally, a higher proportion of the faculty must secure outside research support at higher funding levels.

### Table 10

<table>
<thead>
<tr>
<th>Unit Costs</th>
<th>1974-75 Budget</th>
<th>Total Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Total faculty salary $F \times 25,000</td>
<td>$1,068,840</td>
<td>$1,225,000</td>
</tr>
<tr>
<td>(2) Secretarial support $0.3 (F + A) \times 6,200</td>
<td>90,695</td>
<td>96,720</td>
</tr>
<tr>
<td>(3) Fringe benefits $0.12 F \times 25,000</td>
<td>107,410</td>
<td>147,000</td>
</tr>
<tr>
<td>(4) Travel $650 (F + A)</td>
<td>32,300</td>
<td>33,800</td>
</tr>
<tr>
<td>(5) Supplies $1,000 F</td>
<td>42,530</td>
<td>49,000</td>
</tr>
<tr>
<td>(6) Telephone (connection + LD) $520 (F + A)</td>
<td>26,500</td>
<td>27,040</td>
</tr>
<tr>
<td>(7) Equipment $1,000 F</td>
<td>20,700</td>
<td>49,000</td>
</tr>
<tr>
<td>(8) Technician Support $400 F</td>
<td>16,546</td>
<td>19,600</td>
</tr>
<tr>
<td>(9) Typewriters and Maintenance $150 \times .3 (F + A)</td>
<td>1,840</td>
<td>1,840</td>
</tr>
<tr>
<td>(10) Contingent reserve $400 F</td>
<td>0</td>
<td>19,600</td>
</tr>
<tr>
<td>(11) Graduate assistants $1.6 \times F \times 5,500</td>
<td>301,768</td>
<td>454,720</td>
</tr>
<tr>
<td>(12) TV Operations $1.1 \times F \times 2 \times 900</td>
<td>92,250</td>
<td>97,020</td>
</tr>
<tr>
<td>(13) Scholarships $2,000 F</td>
<td>98,000</td>
<td>98,000</td>
</tr>
<tr>
<td>(14) Administrators $A \times 16,000</td>
<td>47,700</td>
<td>48,000</td>
</tr>
</tbody>
</table>

**TOTAL** $1,947,089 $2,366,340

### Table 11

<table>
<thead>
<tr>
<th>The Performance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Ph.D. degree output - 25 + per year</td>
</tr>
<tr>
<td>(2) B.S. degree output = 125 + per year</td>
</tr>
<tr>
<td>(3) M.S. degree output = 125-200 per year</td>
</tr>
<tr>
<td>(4) Research grants/faculty member ( \geq $25,000/\text{year} )</td>
</tr>
<tr>
<td>(5) SCH/faculty member/year ( \geq 350 )</td>
</tr>
<tr>
<td>(6) Graduate student credit hours/faculty ( \geq 70 )</td>
</tr>
</tbody>
</table>
Section II Statistical Report and Evaluation of Trends

Freshman Engineering Enrollment

Early in 1973, projections of education trends were reported in the Fall 1972 SMU News, suggesting that student enrollment in engineering would increase nationally from previous years. However, after recent trends were released for the fall term, it appeared that the level of enrollment in the fall was down slightly from the 1972 level. The College of Engineering had anticipated a small decrease in the number of students enrolling in the fall of 1972. The decrease was not significant and the fall enrollment trend for the fall of 1972 was not unexpected.

The percentage of freshman enrollment at Southern Methodist University and the national engineering enrollment has increased in 1973 and is likely to increase further. This is particularly true since the total number of freshman entering SMU will probably decline, paralleling the national trend of fewer entrants in all-year college programs. The decrease in any substantial increase in freshman enrollment at the Institute of Technology are not likely for the Fall of 1973. For those reasons, it is expected to expect some increase in 1973 and 1974. The quality of SMU's freshman enrollment and the curriculum are as measured by entrance test scores shown in Figure 5.

Undergraduate Engineering Enrollment

Figure 5 shows a steady increase in engineering student enrollment at SMU and across the country since 1965. More engineering students are entering the engineering undergraduate engineering and in particular for 1974-75. One of the most important reasons for this increase is that current students in the curriculum declare that number of freshman engineering students, and not just in recent years, but with some trend toward a new equilibrium in engineering programs since 1970.

The increase in engineering enrollment at SMU and across the country since 1965 was a result of a number of factors. One was that the attention on the need to increase opportunities. This appeared to produce an increase in interest and enrollment at the freshman level programs. The second, and probably just as important factor, was the introduction of the noted undergraduate program with Texas Instruments, the SMU TI Institute. Under this new program, which was introduced in the summer of 1972, students were enrolled in the fall semester. The students are employed by Texas Instruments and are required to participate in a newly scheduled curriculum, which includes work on the SMU campus. The curriculum is designed such that it can be completed with limited academic year enrollment at the Institute of Technology during the Fall and Spring semesters.

Another important reason for increasing the number of students in engineering at SMU may be the increasing emphasis on the national level towards more emphasis on science and engineering education. The administration of the Institute of Technology for the fall of 1973 is the result of an increase in student enrollment in engineering, with the steady increases in the number of students entering the college.

Full-Time Enrollments

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>60,000</td>
</tr>
<tr>
<td>1969</td>
<td>65,000</td>
</tr>
<tr>
<td>1970</td>
<td>70,000</td>
</tr>
<tr>
<td>1971</td>
<td>75,000</td>
</tr>
<tr>
<td>1972</td>
<td>80,000</td>
</tr>
<tr>
<td>1973</td>
<td>85,000</td>
</tr>
</tbody>
</table>

Full-Time Enrollments

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>60,000</td>
</tr>
<tr>
<td>1969</td>
<td>65,000</td>
</tr>
<tr>
<td>1970</td>
<td>70,000</td>
</tr>
<tr>
<td>1971</td>
<td>75,000</td>
</tr>
<tr>
<td>1972</td>
<td>80,000</td>
</tr>
<tr>
<td>1973</td>
<td>85,000</td>
</tr>
</tbody>
</table>

Source: SMU Institute of Technology

Freshman Engineering Student Characteristics

<table>
<thead>
<tr>
<th>Year</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>Verbal</th>
<th>Math</th>
<th>Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967</td>
<td>79</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>551</td>
<td>642</td>
<td>1193</td>
</tr>
<tr>
<td>1968</td>
<td>81</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>551</td>
<td>654</td>
<td>1205</td>
</tr>
<tr>
<td>1969</td>
<td>82</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>556</td>
<td>652</td>
<td>1208</td>
</tr>
<tr>
<td>1970</td>
<td>85</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>568</td>
<td>647</td>
<td>1215</td>
</tr>
<tr>
<td>1971</td>
<td>89</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>568</td>
<td>697</td>
<td>1265</td>
</tr>
<tr>
<td>1972</td>
<td>97</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>568</td>
<td>690</td>
<td>1268</td>
</tr>
<tr>
<td>1973</td>
<td>83</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>575</td>
<td>627</td>
<td>1202</td>
</tr>
</tbody>
</table>
The Undergraduate Engineering Co-Operative Program

The Undergraduate Engineering Co-Operative Program (Co-op) was introduced in 1925. The program is designed to provide students with practical experience through alternating periods of study and work in industry. Participating students spend half of each academic year working in a cooperating industry. By the end of their senior year, students have completed a minimum of three cooperative terms. Industries and employers look for the program's full-time enrollment.

The Undergraduate Engineering Co-Operative Program offers students the opportunity to work in industry for a year and return to the classroom. The program is designed to prepare students for careers in engineering and related fields. Participants spend one year working in industry and one year in academic study. This cycle is repeated for subsequent years.

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The Undergraduate Engineering Co-Operative Program offers students the opportunity to work in industry for a year and return to the classroom. The program is designed to prepare students for careers in engineering and related fields. Participants spend one year working in industry and one year in academic study. This cycle is repeated for subsequent years.
Graduate Engineering Enrollment

Figure 8 compares the changes in full- and part-time graduate engineering enrollments from 1968 to 1972 for all schools offering graduate engineering programs. Graduate engineering enrollments for the Institute of Technology are shown using the total full-time equivalent. The changes in enrollment levels for graduate engineering at SMU tend to follow the pattern of the changes recorded for part-time enrollments at all schools. This similarity in the pattern of change in enrollment levels is a reflection of the fact that the graduate student body at SMU includes substantial numbers of students who are employed full-time in industry and take graduate engineering courses via the TAGER Television Network.

The increase in part-time graduate enrollment shown for all schools offering engineering programs, which occurred in 1973, appears to reflect the recent upturn in employment opportunities for engineers. However, the pool of potential graduate engineering students has fallen off since 1969 because of the shrinking undergraduate engineering population. The head-count figure of graduate students enrolled in all engineering schools is down 1.1% in 1973 from the previous year. Similarly, the head count for graduate engineers at SMU is down 1.8% from the 1972 level. See Figure 9.

The flight from engineering which has occurred at the undergraduate level since 1969, removed some of the best students who would have been the most likely candidates for graduate work had they not switched to other fields of study. Thus, not only did the falloff in the production of Bachelor's degrees reduce the number

The TAGER Television System

Most of the graduate courses offered by the Institute of Technology are presented via the TAGER Television Network. The general TV enrollment patterns at the various receiving locations appear in Figure 10.

Figure 11 reveals the general TV enrollment pattern in the various departments and academic centers of the Institute and includes a comparison of off-campus and on-campus enrollments. The impact of recent "new hires" of engineering by the TAGER industrial affiliates is clearly shown in the increase in enrollments recorded for the Spring semester 1974.
### FIGURE 10

**Geographical Distribution of TV Enrollments**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic Richfield</td>
<td>3</td>
<td>1</td>
<td></td>
<td>1</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>E-Systems — Garland</td>
<td>12</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td>General Dynamics</td>
<td>10</td>
<td>28</td>
<td>19</td>
<td>7</td>
<td>25</td>
<td>24</td>
</tr>
<tr>
<td>LTV — Grand Prairie</td>
<td>8</td>
<td>19</td>
<td>11</td>
<td>4</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Mobil</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texas Instruments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dallas</td>
<td>53</td>
<td>210</td>
<td>174</td>
<td>74</td>
<td>219</td>
<td>229</td>
</tr>
<tr>
<td>Texas Instruments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sherman</td>
<td>1</td>
<td>3</td>
<td></td>
<td>5</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>SMU-On-Campus</td>
<td>65</td>
<td>367</td>
<td>331</td>
<td>201</td>
<td>286</td>
<td>321</td>
</tr>
<tr>
<td>Southwestern</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical School</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texas Christian</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Univ. of Dallas</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Univ. of Texas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at Dallas</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>137</td>
<td>657</td>
<td>564</td>
<td>291</td>
<td>564</td>
<td>606</td>
</tr>
</tbody>
</table>

### FIGURE 11

**Graduate TV Enrollments By Centers (1972-1973) By Departments (1973-1974)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>off campus</td>
<td>on campus</td>
<td>total</td>
<td>off campus</td>
<td>on campus</td>
<td>total</td>
</tr>
<tr>
<td>Computer Science/Operations Research</td>
<td>22</td>
<td>46</td>
<td>68</td>
<td>85</td>
<td>196</td>
<td>281</td>
</tr>
<tr>
<td>Electronic Sciences</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>61</td>
<td>43</td>
<td>104</td>
</tr>
<tr>
<td>Information/Control</td>
<td>40</td>
<td>114</td>
<td>151</td>
<td>97</td>
<td>91</td>
<td>188</td>
</tr>
<tr>
<td>Solid Mechanics</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>17</td>
<td>18</td>
<td>35</td>
</tr>
<tr>
<td>Thermal/Fluid Sciences</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>19</td>
<td>20</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>65</td>
<td>137</td>
<td>279</td>
<td>368</td>
<td>647</td>
</tr>
</tbody>
</table>

*8 Courses 34 Courses 38 Courses*
FIGURE 12
TV Enrollment

<table>
<thead>
<tr>
<th>Term</th>
<th>Summer</th>
<th>Fall</th>
<th>Spring</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972-73</td>
<td>291</td>
<td>661</td>
<td>564</td>
<td>+154</td>
</tr>
<tr>
<td>1973-74</td>
<td>137</td>
<td>564</td>
<td>606</td>
<td>+97</td>
</tr>
</tbody>
</table>

FIGURE 13
Master's Degrees in Engineering

<table>
<thead>
<tr>
<th>Term</th>
<th>Full</th>
<th>Spring</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972-73</td>
<td>389</td>
<td>654</td>
<td>1043</td>
</tr>
<tr>
<td>1973-74</td>
<td>317</td>
<td>564</td>
<td>881</td>
</tr>
</tbody>
</table>

School Year Ending in May

Master's Degree Awarded

Semester Credit Hour Production

18
FIGURE 14
Doctoral Degrees in Engineering

![Graph showing Doctorates Awarded over the years from 1968-69 to 1972-73]

FIGURE 15
Semester Credit Hours Production

<table>
<thead>
<tr>
<th>Term</th>
<th>Term</th>
<th>Total SCH's</th>
<th>Undergrad SCH's</th>
<th>Graduate On Campus</th>
<th>SCH's</th>
<th>Total SCH's</th>
<th>Grad. Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>1972</td>
<td>1,160</td>
<td>302</td>
<td>450</td>
<td>408</td>
<td>658</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>1972</td>
<td>5,121</td>
<td>2,192</td>
<td>2,155</td>
<td>774</td>
<td>2,929</td>
<td></td>
</tr>
<tr>
<td>Interterm</td>
<td>1973</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>1973</td>
<td>4,485</td>
<td>1,793</td>
<td>2,033</td>
<td>699</td>
<td>2,702</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>10,782</td>
<td>4,287</td>
<td>4,814</td>
<td>1,681</td>
<td>6,495</td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>1973</td>
<td>1,344</td>
<td>491</td>
<td>613</td>
<td>240</td>
<td>853</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>1973</td>
<td>5,183</td>
<td>2,600</td>
<td>1,821</td>
<td>782</td>
<td>2,583</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>1974</td>
<td>4,901</td>
<td>2,303</td>
<td>1,743</td>
<td>655</td>
<td>2,588</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>11,428</td>
<td>5,394</td>
<td>4,177</td>
<td>1,857</td>
<td>6,034</td>
<td></td>
</tr>
</tbody>
</table>

OFFICE OF THE DEAN

<table>
<thead>
<tr>
<th>Item</th>
<th>1972 73</th>
<th>1973 74</th>
<th>Projected 1974 75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. Adm.</td>
<td>$249,621</td>
<td>$275,540</td>
<td>$321,916</td>
</tr>
<tr>
<td>Comm. Media</td>
<td>42,662</td>
<td>51,937</td>
<td>41,887</td>
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<tr>
<td>Foundation</td>
<td>110,241</td>
<td>36,834</td>
<td>34,240</td>
</tr>
<tr>
<td>Machine Shop</td>
<td>12,358</td>
<td>11,476</td>
<td>12,366</td>
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<tr>
<td>Computer Sci./Opr. Res.</td>
<td>276,434</td>
<td>297,861</td>
<td>381,939</td>
</tr>
<tr>
<td>Electronics Sciences (1)</td>
<td>207,399</td>
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<td></td>
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<tr>
<td>Info. &amp; Control Sciences (1)</td>
<td>237,201</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Eng. Dept. (1)</td>
<td></td>
<td>491,300</td>
<td>527,728</td>
</tr>
<tr>
<td>Solid Mechanics (2)</td>
<td>153,645</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal &amp; Fluid Sciences (2)</td>
<td>164,846</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil &amp; Mech. Eng. Dept. (2)</td>
<td>296,382</td>
<td></td>
<td>374,511</td>
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<tr>
<td>Academic Computing Lab.</td>
<td></td>
<td>196,550</td>
<td>228,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$1,454,797</td>
<td>$1,658,588</td>
<td>$1,922,587</td>
</tr>
</tbody>
</table>

(1) and (2) Formation of Departments.
*Non-Federal Funds.

Revenue/Expense Summary

<table>
<thead>
<tr>
<th>Item</th>
<th>1972 73</th>
<th>1973 74</th>
<th>1974 75</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REVENUE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tuition Income</strong></td>
<td>$673,774</td>
<td>$769,043</td>
<td>$832,227</td>
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<tr>
<td>Fringe Benefits</td>
<td>30,979</td>
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<td></td>
</tr>
<tr>
<td>Univ. College Counsel</td>
<td>11,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV Surcharge</td>
<td>69,050</td>
<td>76,442</td>
<td>88,360</td>
</tr>
<tr>
<td>Research Overhead</td>
<td>37,296</td>
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<td></td>
</tr>
<tr>
<td>SMU Found. Sci./Eng.</td>
<td>633,158</td>
<td>621,282</td>
<td>650,000</td>
</tr>
<tr>
<td>SMU Computer Allocation</td>
<td>186,950</td>
<td>228,000</td>
<td></td>
</tr>
<tr>
<td>TOTAL REVENUE</td>
<td>$1,454,797</td>
<td>$1,683,715</td>
<td>$1,922,587</td>
</tr>
<tr>
<td><strong>EXPENSES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL REVENUE</strong></td>
<td>$1,454,797</td>
<td>$1,683,715</td>
<td>$1,922,587</td>
</tr>
<tr>
<td>Difference</td>
<td>(- 25,449)</td>
<td>(- 24,000)</td>
<td></td>
</tr>
</tbody>
</table>

*Non-Federal Funds.
Appendix I  Resident Administration and Faculty of the Institute

RESIDENT ADMINISTRATION—As of May 31, 1974
Thomas L. Martin, Jr., Ph.D.
Dean of The Institute of Technology
Leon Cooper, Ph.D.
Associate Dean of The Institute of Technology
Jack W. Harkey, B.S.M.E.
Assistant Dean of The Institute of Technology
George P. Schmaling, B.S.E.E.
Assistant Dean for Industrial Relations
Peter Van't Slot, M.B.A.
Assistant Dean for Institute Development
Finley W. Taturn, Ph.D.
Assistant Dean—Undergraduate Division
James King, C.P.A.
Finance Officer of The Institute of Technology
Robert Dupree
Engineer: TV System
Barbara Babcock
Director of Academic Records

FACULTY—As of May 31, 1974
Department of Computer Science and Operations Research

Resident Faculty
U. Narayan Bhat
Professor and Department Head
Ph.D. (Stat.) University of Western Australia
Leon Cooper
Associate Dean and Professor
Ph.D. (Ch.E.) Washington University
John L. Fike, Jr.
Assistant Professor
Ph.D. (C.S.) Southern Methodist University
Dennis J. Frailey
Associate Professor
Ph.D. (C.S.) Purdue University
Myron Ginsberg
Assistant Professor
Ph.D. (C.S.) University of Iowa
Jeff L. Kennington
Assistant Professor
Ph.D. (I.E.) Georgia Tech
Robert R. Korfhage
Professor
Ph.D. (Math) University of Michigan
Larry J. LeBlanc
Assistant Professor
Ph.D. (O.R.) Northwestern University
David W. Matula
Professor
Ph.D. (Engr. Science (O.R.) University of California, Berkeley
William C. Nylin
Assistant Professor
Ph.D. (C.S.) Purdue University
Robert J. Smith, II
Associate Professor
Ph.D. (C.S.) University of Missouri-Rolla

Visiting Industrial Professors
Charles R. Blackburn, II
Assistant Professor
MBA (O.R.) Tulane University
Mary W. Cooper
Assistant Professor
Ph.D. (O.R.) Washington University
J. Gerry Purdy
Assistant Professor
Ph.D. (C.S. and Exercise Physiology) Stanford University

Department of Electrical Engineering

Resident Faculty
Kenneth L. Ashley
Professor
Jerome K. Butler
Professor
Ph.D. (E.E.) University of Kansas
Shirley S. C. Chu
Associate Professor
Ph.D. (Chem.) University of Pittsburgh
Ting L. Chu
Professor
Ph.D. (Chem.) Washington University
Jon W. Eberle
Associate Professor
Ph.D. (E.E.) Ohio State University
Yumin Fu (deceased)
Associate Professor
Ph.D. (E.E.) University of Illinois
Someshwar C. Gupta
Professor
Ph.D. (E.E.) University of California at Berkeley
Kenneth W. Heizer
Professor
Ph.D. (E.E.) University of Illinois
Lorn L. Howard
Professor
Ph.D. (E.E.) Michigan State University
William F. Leonard
Professor
Ph.D. (E.E.) University of Virginia
Thomas L. Martin, Jr.
Professor
Ph.D. (E.E.) Stanford University
Louis R. Nardizzi
Associate Professor
Ph.D. (E.E.) University of Southern California
Behrouz Peikari
Associate Professor
Ph.D. (E.E.) University of California at Berkeley
Andrew P. Sage
Professor and Department Head
Ph.D. (E.E.) Purdue University
John A. Savage
Professor
M.S. (E.E.) University of Texas
Edmund W. Schedler
Associate Professor
M.S. (E.E.) Oklahoma State University

Mandyam D. Srinath
Professor
Ph.D. (E.E.) University of Illinois

Finley W. Tatum
Professor
Ph.D. (E.E.) Texas A&M University

Chelsea C. White
Assistant Professor
Ph.D. (E.E.) University of Michigan

Adjunct Faculty in the Biomedical Engineering Program

C. Gunnar Blomqvist
Assistant Professor of Internal Medicine
M.D. University of Lund

Ivan E. Danhof
Associate Professor of Physiology
M.D. University of Texas Southwestern Medical School

Javad Fiuza
Associate Professor of Thoracic and Cardiovascular Surgery
M.D. University of Tehran

Charles F. Gregory
Professor of Orthopedic Surgery
M.D. Indiana University School of Medicine

Robert L. Johnson, Jr.
Professor of Internal Medicine
M.D. Northwestern Medical School

Robert M. Lebovitz
Assistant Professor of Physiology
Ph.D. (Neurophysics) University of California

Jere H. Mitchell
Professor of Internal Medicine and Physiology
M.D. University of Texas Southwestern Medical School

Robert W. Noble
Associate Professor of Internal Medicine
M.D. University of Texas Southwestern Medical School

Steven P. Pokes
Associate Professor of Veterinary Medicine
Ph.D. (Veterinary Pathology) Ohio State University

William J. Rea
Assistant Professor of Thoracic and Cardiovascular Surgery
M.D. Ohio State University College of Medicine

William E. Romans
Assistant Professor of Biophysics
M.S. (E.E.) Southern Methodist University

Ernest M. Stokely
Assistant Professor of Biomedical Engineering
M.D. University of Texas Southwestern Medical School

Winfred L. Sugg
Associate Professor of Thoracic and Cardiovascular Surgery
M.D. University of North Carolina School of Medicine

Gordon H. Templeton
Assistant Professor of Physiology
Ph.D. (Biophys.) University of Texas Southwestern Medical School

John C. Vanatta
Professor of Physiology
M.D. Indiana University School of Medicine

Hal T. Weathersby
Professor of Anatomy
Ph.D. (Anatomy) Tulane University

Visiting Industrial Professors

William S. Ewing
Assistant Professor
Ph.D. (E.E.) Southern Methodist University

Alan L. McBride
Assistant Professor
Ph.D. (E.E.) Southern Methodist University

Theo J. Powell
Assistant Professor
Ph.D. (E.E.) University of Illinois

Department of Civil and Mechanical Engineering

Resident Faculty

Charles E. Ballentine
Professor
M.S. (M.E.) MIT

Harold A. Blum
Professor
Ph.D. (Ch.E.) Northwestern University

Jan Cernosek
Associate Professor
Ph.D. (Exper. Mech.) Technical University of Prague

Michael A. Collins
Associate Professor
Ph.D. (C.E.) MIT

LeVan Griffis
Professor
Ph.D. (C.E.) California Institute of Technology

Jack P. Holman
Professor and Department Head
Ph.D. (M.E.) Oklahoma State University

Robert M. Jones
Associate Professor
Ph.D. (Appl. Mech.) University of Illinois

W. Scott McDonald, Jr.
Associate Professor
Ph.D. (E.M.) University of Kansas

Bijan Mohraz
Associate Professor
Ph.D. (E.M.) University of Illinois

Roger L. Simpson
Associate Professor
Ph.D. (M.E.) Stanford University

Cecil H. Smith
Associate Professor
Ph.D. (C.E.) University of Texas

Henry W. Stoll
Assistant Professor
Ph.D. (M.E.) University of Illinois
Hal Watson, Jr.
Associate Professor
Ph.D. (E.M.) University of Texas

Edmund E. Weynand
Professor
Sc.D. (M.E.) MIT

Marion W. Wilcox
Professor
Sc.D. (Engr. Sci.) University of Notre Dame

W. Gerald Wyatt
Associate Professor
Ph.D. (M.E.) University of Minnesota

**Visiting Industrial Professors**

Richard P. Bywaters
Assistant Professor
Ph.D. (M.E.) Southern Methodist University

Kondliattiir S. Ratagopalan
Assistant Professor
Ph.D. (C.E.) University of Texas

Wayne L. Sanders
Assistant Professor
MSME Lamar State College
Appendix II  Events Affecting the Faculty

New Appointments
Dr. Henry W. Stoll, Assistant Professor of CEME, received his Ph.D. degree from the University of Illinois. He specializes in Mechanical Design and joins the faculty of the Department of EC ME as Professor, September 1, 1974.
Dr. Chelsea C. White received his Ph.D. from the University of Michigan. He joins the faculty of the Department of Electrical Engineering as Assistant Professor on September 1, 1974.
Dr. David W. Matula joins the faculty of the Department of Computer Science and Operations Research as Department Head on August 15, 1974. Dr. Matula received his Ph.D. from the University of California at Berkeley.

Promotions
Effective Fall Semester 1974:
Jerome K. Butler, to Professor
Dennis J. Frailey, to Associate Professor
Robert Jones, Associate Professor, given tenure
William F. Leonard, to Professor
Behrouz Peikari, Associate Professor, given tenure
Robert J. Smith II, to Associate Professor

Changes and Leaves
On August 15, 1974, Dr. U. Narayan Bhat resigned as the Head of the Department of Computer Science and Operations Research. He will continue to serve as Professor in the Department.
Dr. Kenneth L. Ashley will serve as Acting Department Head of the Department of Electrical Engineering as of September 1, 1974. He will continue on as a Professor in the Department.

Resignations
Dr. Alan Wheeler, Associate Professor of Computer Science and Operations Research for the four-year period from September, 1971 to May, 1974, resignation effective May 31, 1974.
Dr. William N. Carr, Professor of Electrical Engineering, completed his terminal leave of absence, resignation effective June 30, 1974, and is now General Manager of Zentron Equipment Corporation.
Dr. Thomas P. Hughes, Professor of History, resignation effective June 1, 1973, has accepted the position of Professor in the Department of History and Sociology of Science at the University of Pennsylvania.
Dr. Andrew F. Sage, Professor and Head of the Department of Electrical Engineering for the seven and one-half year period from April, 1967, to August, 1974, resignation effective August 31, 1974, has accepted the Lawrence R. Quarles Chair and an Associate Deanship at the University of Virginia.
Dr. Charles R. Vail has resigned his post as Vice President of the University and Professor in the Department of Electrical Engineering, resignation effective June 30, 1973, and is now Associate Dean of the College of Engineering at Georgia Institute of Technology.

Textbook Publications
LEON COOPER, Ph.D. (Washington University)
Professor and Associate Dean of the Institute of Technology
Methods and Applications of Linear Programming, with D. I. Steinberg, W. B. Saunders and Company, May, 1974.

JACK P. HOLMAN, Ph.D. (Oklahoma State University)
Professor and Department Head

ROBERT R. KORFHAGE, Ph.D. (University of Michigan)
Professor
### Appendix III  
**Active Grants/Contracts in Force During Fiscal Year 1973-74**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Principal Investigator</th>
<th>Amount</th>
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<tr>
<td>83160</td>
<td>&quot;Amplitude Departures in the Active Region of GaAs Lasers&quot;</td>
<td>K. L. Ashley</td>
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<td>8567</td>
<td>&quot;A Methodology for the Analysis of Multi Arrival Queueing Systems&quot;</td>
<td>U. N. Bhat</td>
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<td>Duration: September 1, 1973 to December 31, 1974</td>
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<td>8545</td>
<td>&quot;Analysis of Some Queueing Systems&quot;</td>
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<td>8681</td>
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<td>Duration: July 1, 1974 to June 30, 1974</td>
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<td>8701</td>
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<td>8868</td>
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<td>&quot;Optical Field Distributions and Mode Selection Properties of GaAs (AlGa) as Lasers&quot;</td>
<td>J. K. Butler</td>
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<td>&quot;Photoelastic Analysis of Helicopter Structures&quot;</td>
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<td>&quot;Investigation of Inter Laminar Stresses in Fiber Reinforced Composites&quot;</td>
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<td>Number</td>
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<td>&quot;Optimal Operating Policy for Metropolitan Multiple Water Supply Reservoir System&quot;</td>
<td>M. Collins</td>
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<td>J. L. Fike</td>
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<td>&quot;Undergraduate Research Participation&quot;</td>
<td>D. J. Frailey</td>
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<td>&quot;A Study of Storage Allocation Methods for Simple Data Structures&quot;</td>
<td>D. J. Frailey</td>
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<td>&quot;Development of a Computer Code for Solution of Ordinary Differential Equations&quot;</td>
<td>M. Ginsberg</td>
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<td>S. C. Gupta</td>
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<td>&quot;Air Pollution Control Fluidized Bed Reactor&quot;</td>
<td>J. P. Holman</td>
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<td>&quot;Experimental and Analytical Studies of Jet Blowing Cooling Techniques&quot;</td>
<td>J. P. Holman</td>
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<td>Development of an Efficient Technique for Equilibrium Traffic Assignment of Urban Networks</td>
<td>L. J. LeBlanc</td>
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<td>Characterization and Optimization of Infrared Detectors</td>
<td>W. F. Leonard</td>
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<td>Vacuum Deposition and Characterization of III-V Antimonide Alloys</td>
<td>W. F. Leonard</td>
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<td>Thermoelectric Power of Noble Metals</td>
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<td>Demonstration Project in the Application of Instructional Technology to the Undergraduate Engineering Laboratory</td>
<td>W. F. Leonard</td>
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<td>Photoelastic Model for the Evaluation of Axisymmetric Composite Structures</td>
<td>W. S. McDonald</td>
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<td>Cooperative College School Science Programs</td>
<td>L. Nardizzi</td>
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<td>Instructional Scientific Equipment Program</td>
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<td>Engineering Analysis of the Cardiovascular System</td>
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<td>Modeling, Simulation, and Analysis of the Cardiovascular System</td>
<td>L. Nardizzi</td>
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<td>Study of an Automatic Reorganization System for Modular Programs</td>
<td>W. C. Nylin, Jr.</td>
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<td>Development of a Continuation Concept of a Speech Dashboard Based on Adaptive Estimation Techniques</td>
<td>A. P. Sage</td>
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<td>System Identification in Large-Scale Systems</td>
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<td>A Hierarchical Approach in Large-Scale Systems</td>
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<td>Making Laser Anemometer Measurements in a Separating Boundary Laser Produced by an Adverse Pressure Gradient</td>
<td>R. L. Simpson</td>
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<td>&quot;Hot Film Anemometer Measurements of Concentration in Turbulent Flow&quot;</td>
<td>R. L. Simpson, W. G. Wyatt</td>
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<td>R. J. Smith</td>
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<td>&quot;Analysis and Synthesis of Diagnosis and Design Techniques for Digital Systems Requiring High Maintainability/Reliability&quot;</td>
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<td>&quot;R &amp; D of Gray Valve Generator&quot;</td>
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<td>TOTAL</td>
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McDermott, Estate of Eugene
Meaders, L. B.
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Sage, Dr. and Mrs. Andrew P.
Scruggs, Mr. and Mrs. William L.
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Wisenbaker, J. D.