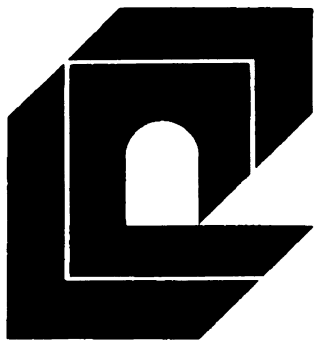


COLLEGE OF ENGINEERING
THE UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN

STATE OF THE UM COLLEGE OF ENGINERING

J. J. Duderstadt

October 10, 1985

State of the College

- Original Goals (1981)
- Progress to date (1985)
- Goals for 1985-1990

MAJOR OBJECTIVE

To be the best -- to rise to a position of leadership among engineering institutions.

GENERAL GOALS

1. To achieve excellence in education, scholarship, and research.

2. To establish an environment within the College that stimulates, rewards and demands excellence, creativity, and innovation.

3. To seek and obtain the resources necessary to support such an environment.

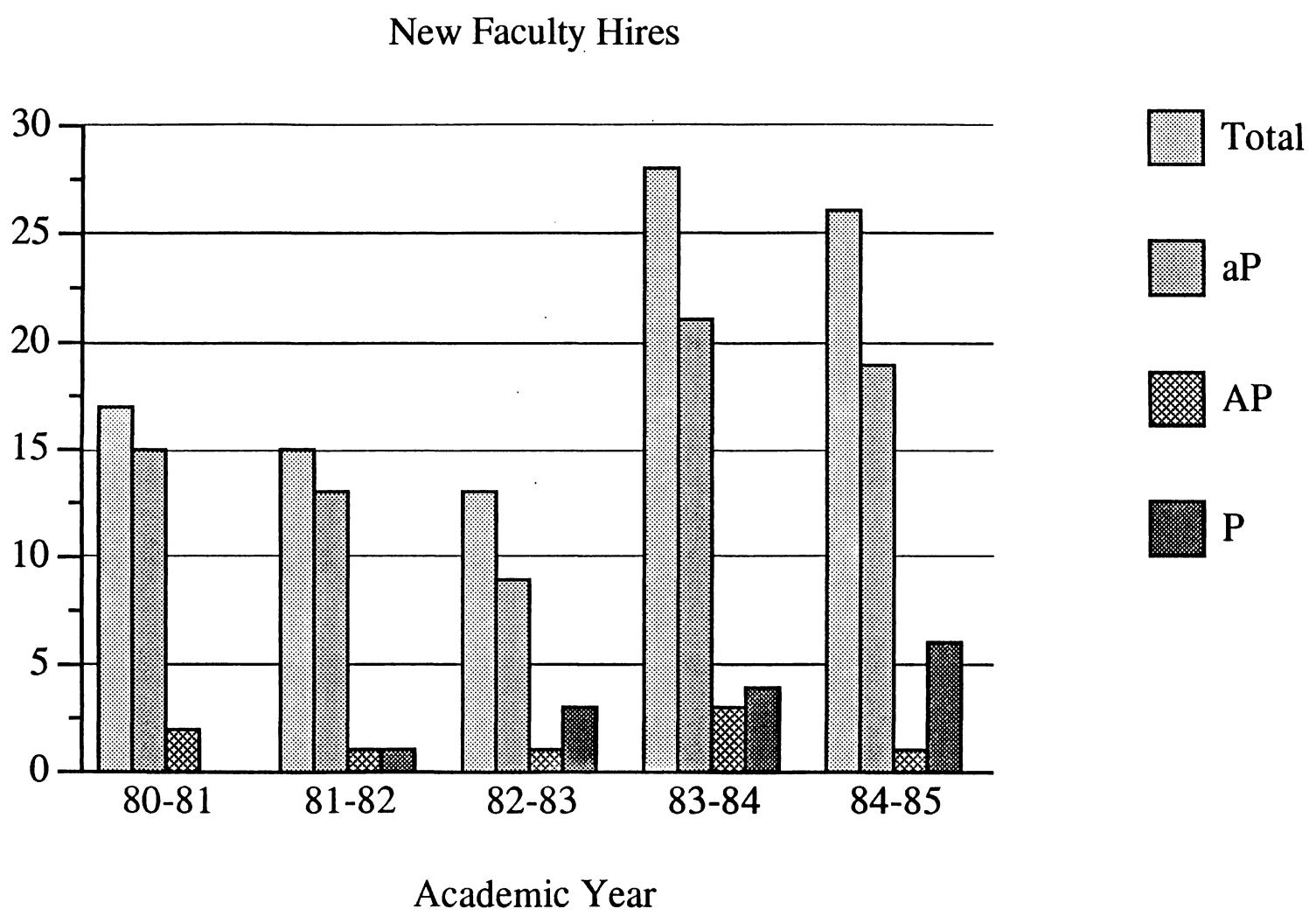
SPECIFIC GOALS FOR 1981-85

1. To implement policies concerning hiring, promotion, tenure, and salary that strongly emphasize excellence and achievement.
2. To increase both the quality and quantity of research in the College.
3. To shift instructional focus to upperclass - graduate level education.
4. To enlarge PhD programs (and production) of the College.
5. To complete move of the College to the North Campus.
6. To rebuild College's equipment inventories and support staff.
7. To strengthen College's relationship with industry.
8. To establish an aggressive private fund-raising program.
9. To develop a continuing long range planning activity.
10. To develop fair and effective policies for resource allocation.

SPECIFIC GOALS FOR 1981-85

- Begin rebuilding faculty of College
- Completion of North Campus Move
- Restore General Fund support
- Rebuild laboratory equipment inventory
- Build state-of-the-art computing environment
- Build adequate technical support staff
- Incentives for excellence and achievement
- Fair and effective policies for resource allocation
- External relations (industry, state, federal, government)

Faculty Recruiting


New Faculty Hires
30
25
20
15
10
5
0
80-81
81-82
82-83
83-84
84-85
Academic Year
Total
aP
AP
P

FACULTY RECRUITING ACTIVITY

Basic Capacity:

- 20 to 30 positions each year
- no constraint on level (aP, AP, P, P*)
- 9 month salary range: $37 K to $88 K
  (12 month: $45 K to $105 K)

Four Year Status:

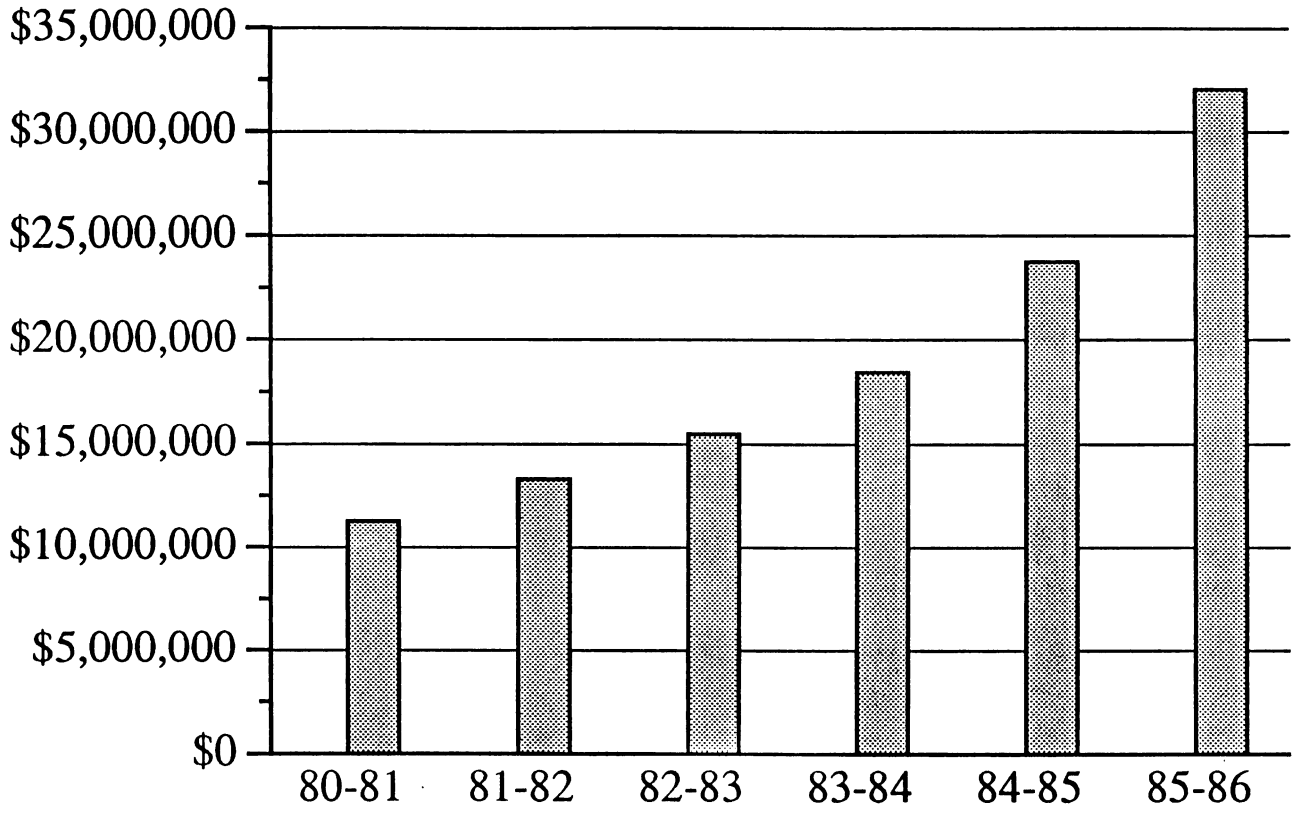
64 assistant professors
10 associate professors
14 professors
88 total

Physical Facilities

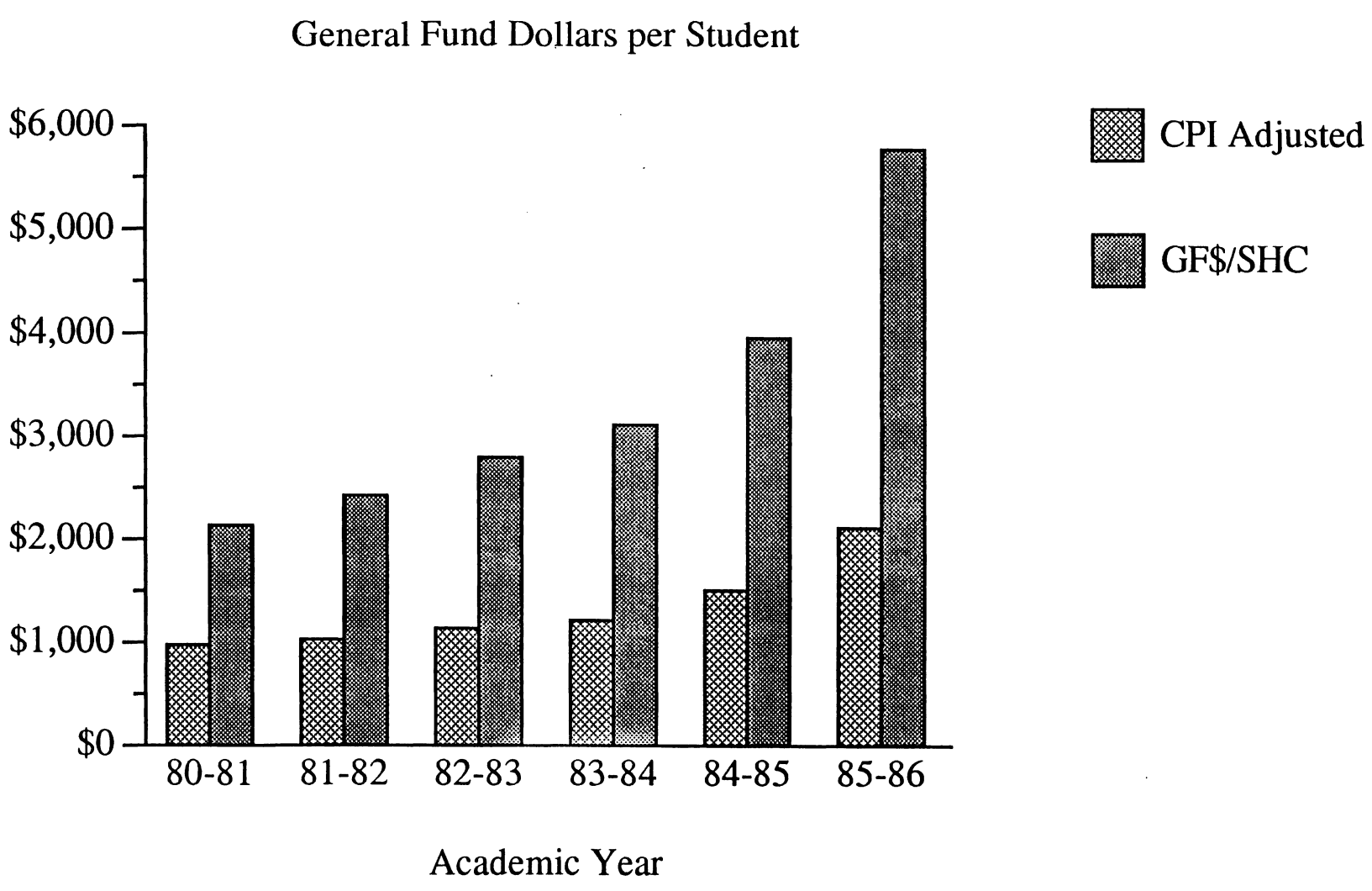
(the North Campus Move)

Restoration of General Fund Support

General Fund Allocation



Fiscal Year


General Fund Dollars per Student
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
80-81
81-82
82-83
83-84
84-85
85-86
Academic Year
CPI Adjusted
GF$/SHC

General Fund Budget Restoration

Status prior to FY1985-86

	Target	Growth	Remaining
Staffing	$5.0 M	$1.1 M	$4.0 M
Research	$3.0 M	$2.5 M	$0.5 M *
Equipment	$3.5 M	$1.0 M	$2.5 M
Totals	$11.5 M	$4.6 M	$7.0 M

* Indexed at 15% of total sponsored research volume

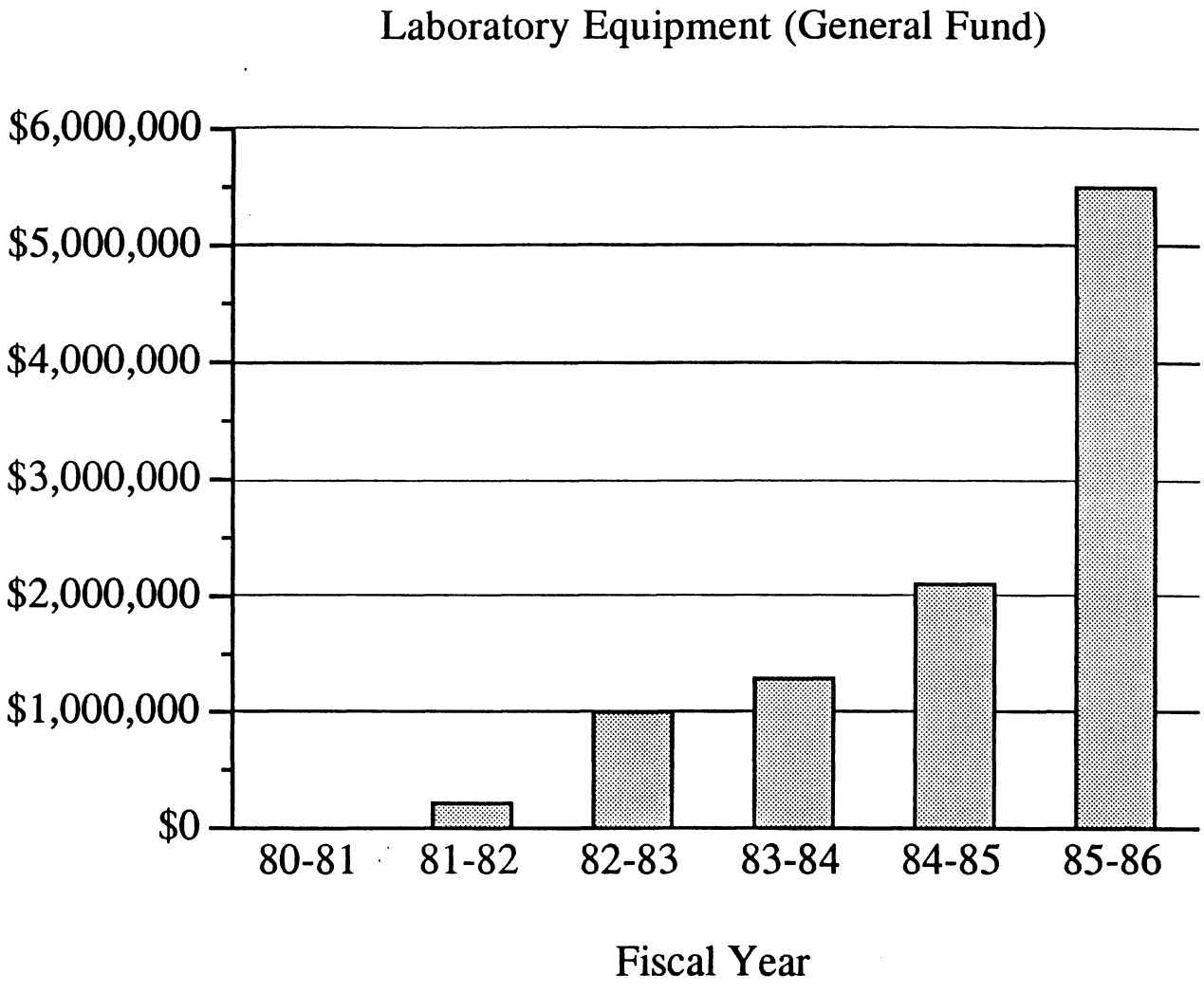
General Fund Budget Restoration

Status with $8.5 M REEDF

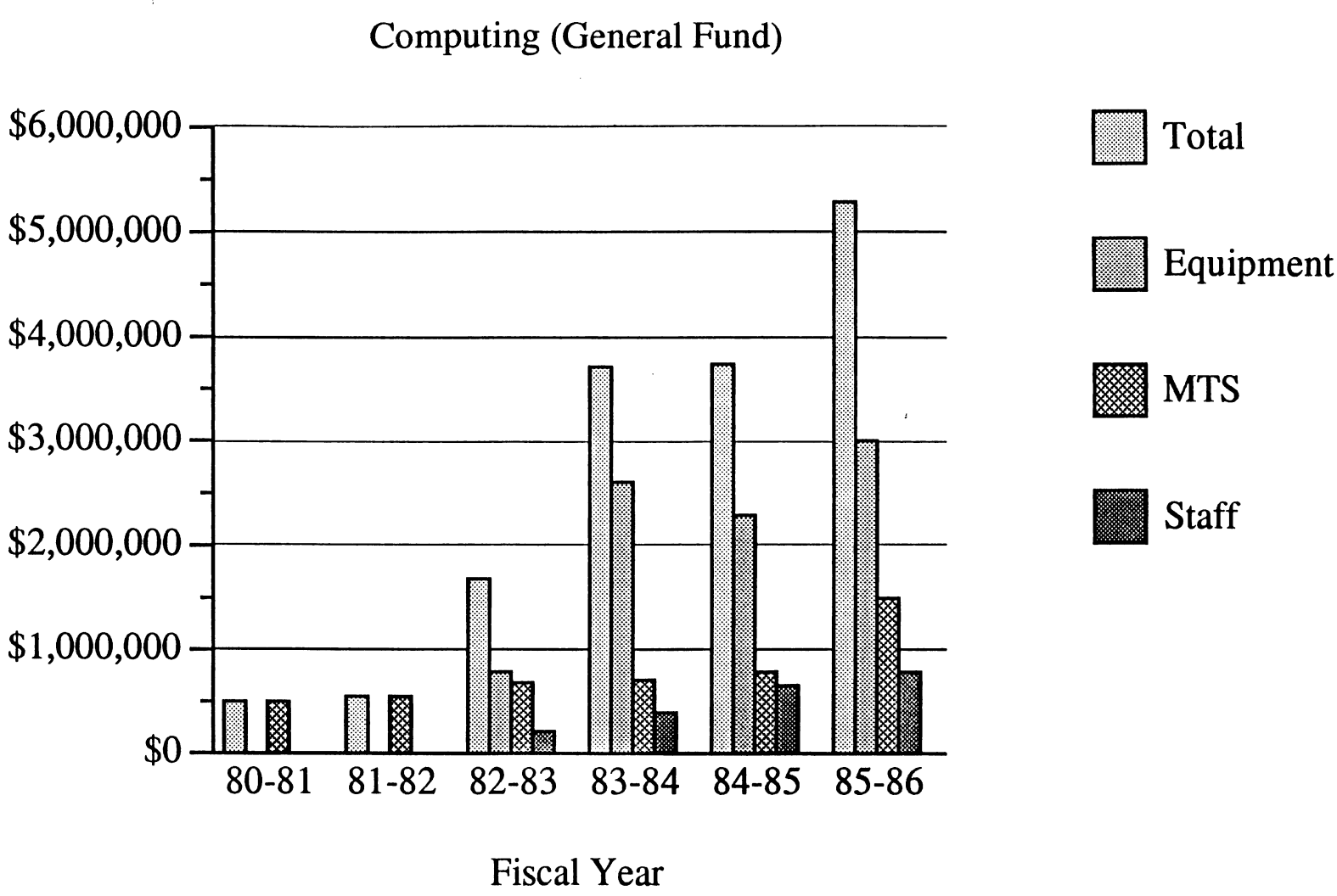
	Target	Growth	FY85-86
Staffing	$5.0 M	$1.1 M	$5.0 M
Research	$3.0 M	$2.5 M	$0.5 M *
Equipment	$3.5 M	$1.0 M	$3.5 M
Totals	$11.5 M	$4.6 M	$9.0 M

* Indexed at 15% of total sponsored research volume

Laboratory Equipment


Laboratory Equipment (General Fund)
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
80-81
81-82
82-83
83-84
84-85
85-86
Fiscal Year

Computing Environment


Computing (General Fund)
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
80-81
81-82
82-83
83-84
84-85
85-86
Fiscal Year
Total
Equipment
MTS
Staff

Support Staff

Longer Range Challenges

1. Maintaining pace and quality of faculty hiring effort.
2. Improving both the quality (and quantity) of engineering graduate students.
3. Responding to needs of disciplines requiring massive experimental facilities.
4. Some final "polishing" on North Campus complex.
5. "Modernizing" the undergraduate engineering degree program.
6. Responding to intellectual changes in engineering and applied science.

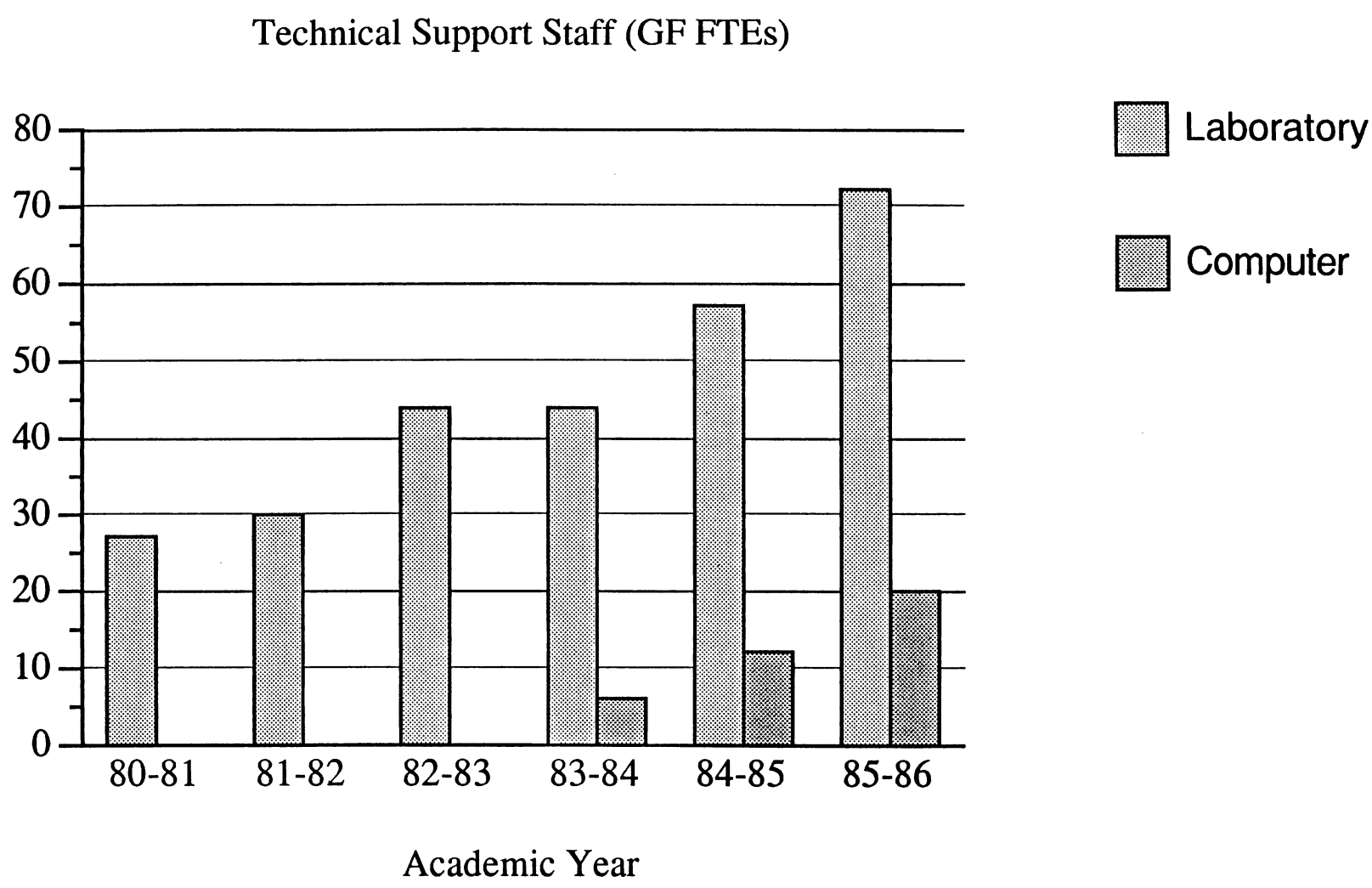
Physical Facilities

Near Term (1985-86):

GGBL-Dow parking lot
Dow Instructional Center
Engineering Building I
Space Physics Addition

Longer Term (1985-87):

Engineering Library (private fund-raising)
GGBL-Dow Connector
Aerospace/Nuclear Laboratories
North Campus Commerical Center
North Campus landscaping
Research Projects Laboratory

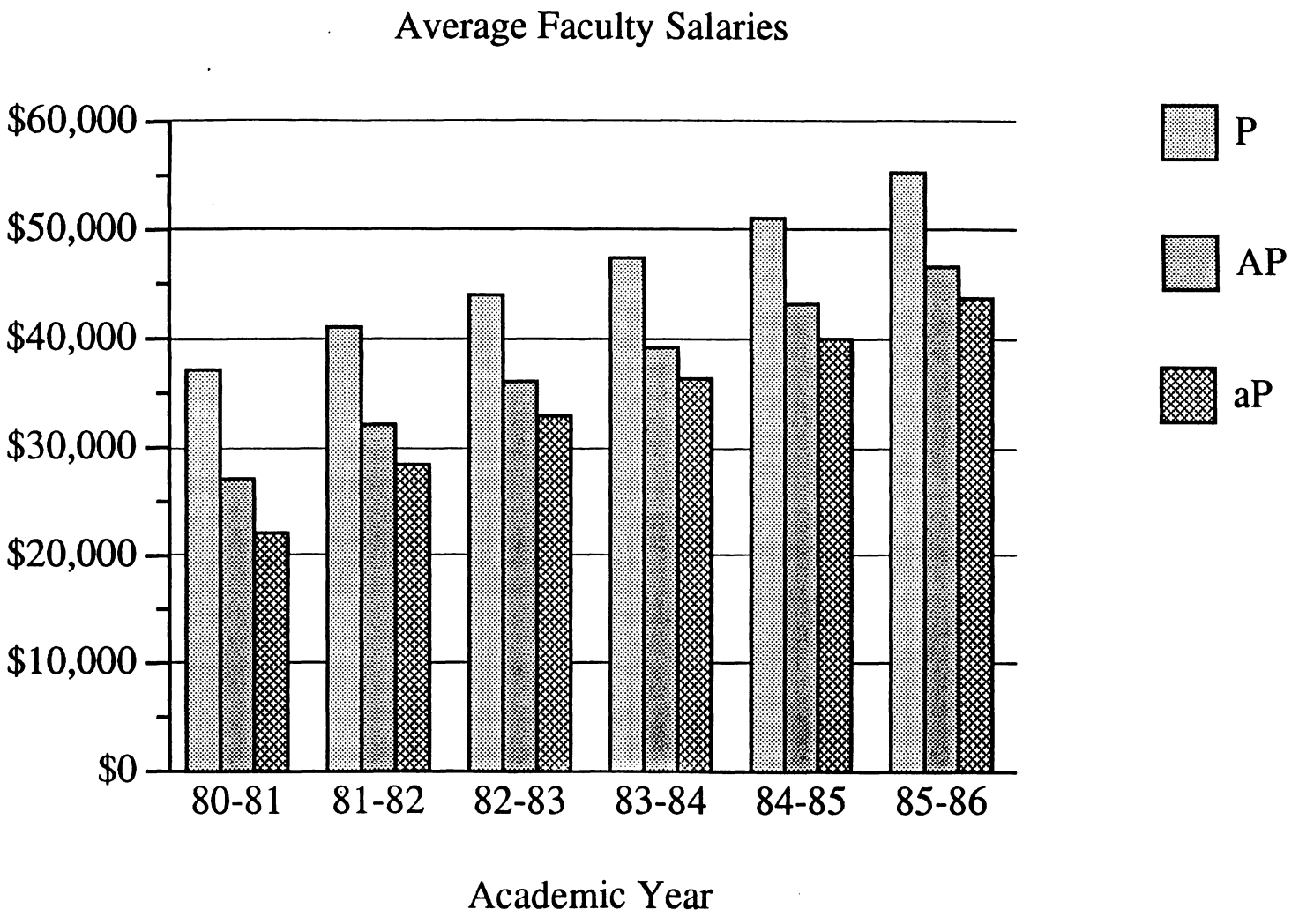

Technical Support Staff (GF FTEs)
80
70
60
50
40
30
20
10
0
80-81
81-82
82-83
83-84
84-85
85-86
Academic Year
Laboratory
Computer

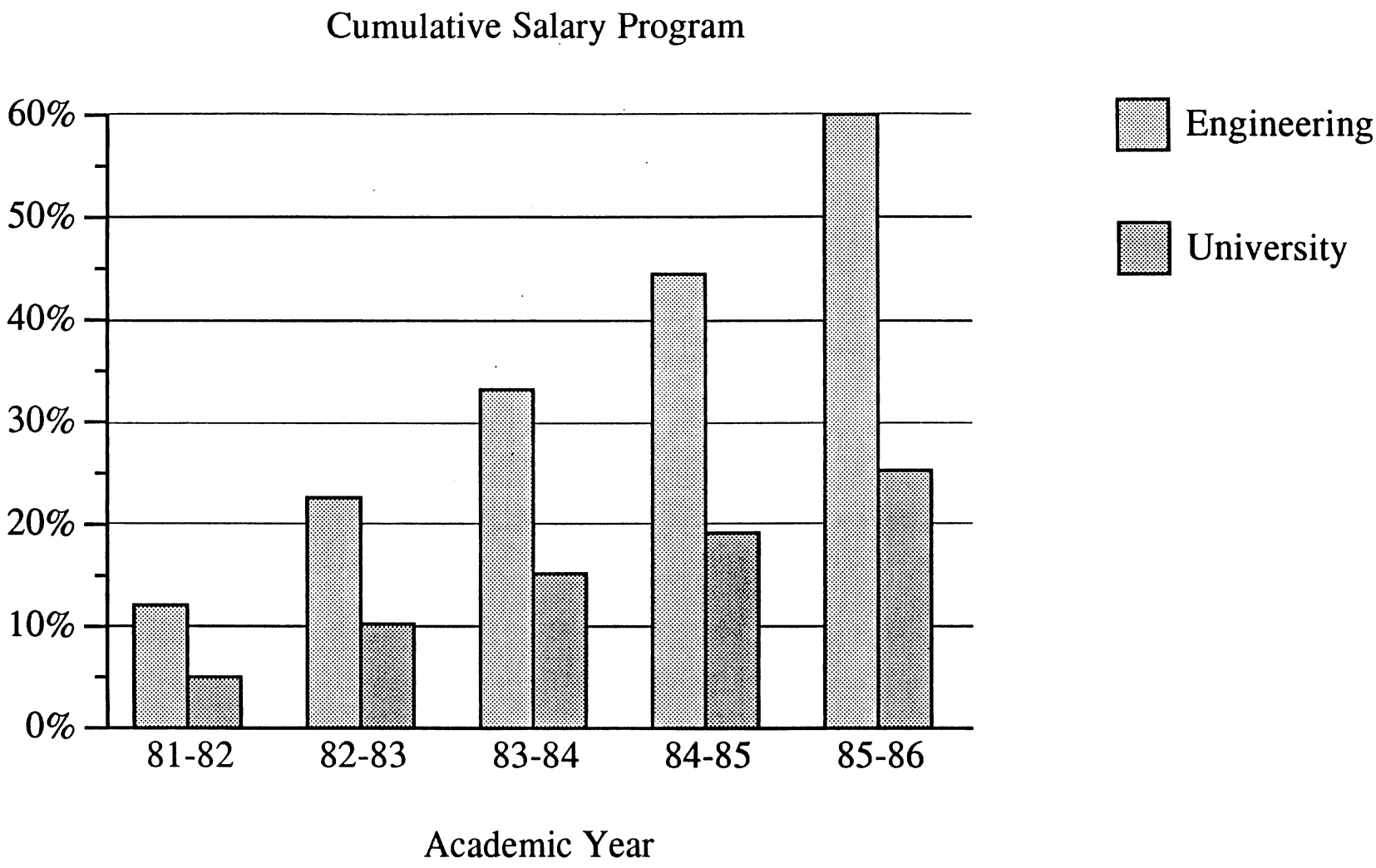
Incentives for Excellence

- Hiring, promotion, tenure policies
- Salary policies
- Discretionary resources

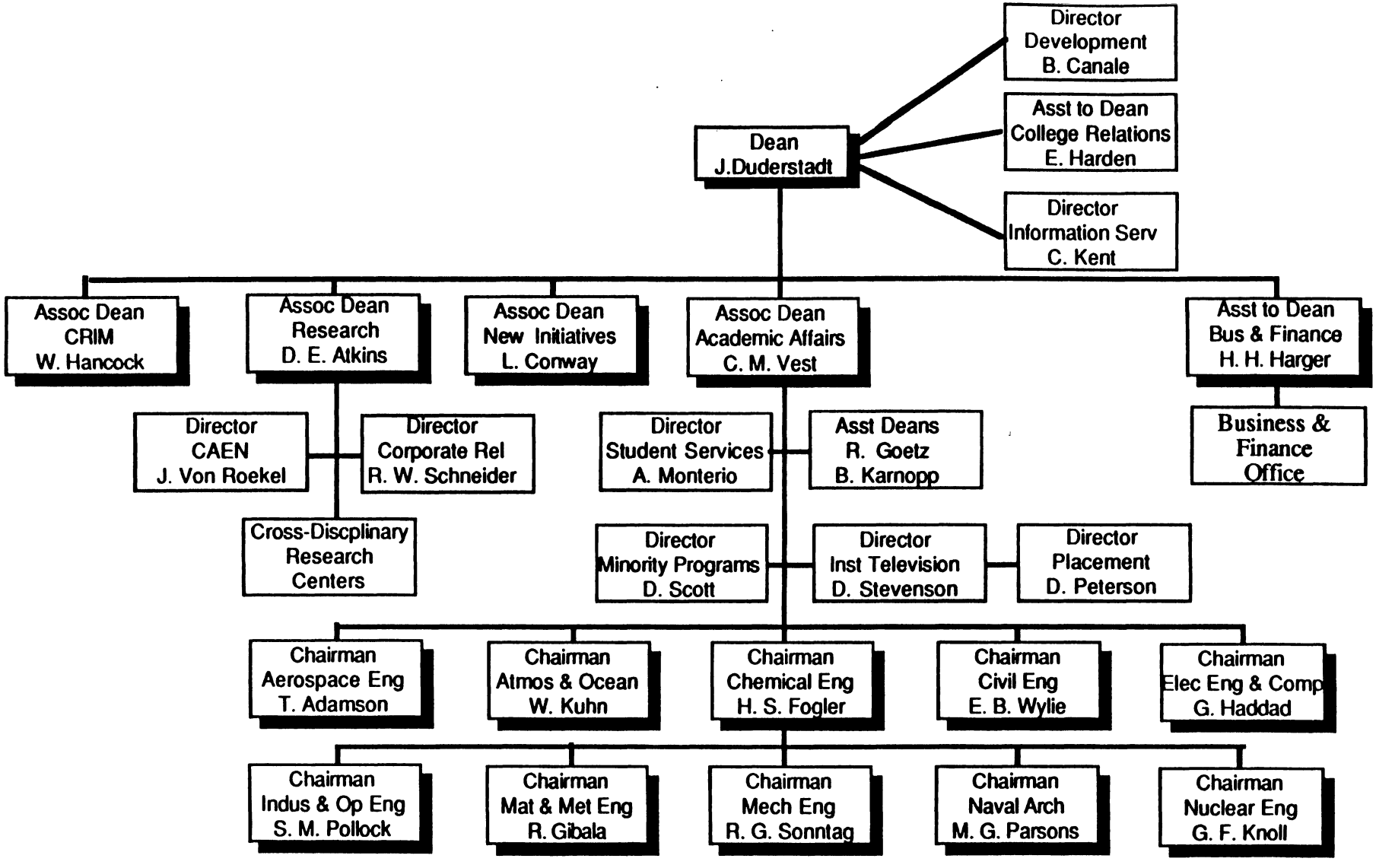
INCENTIVES FOR ACHIEVEMENT

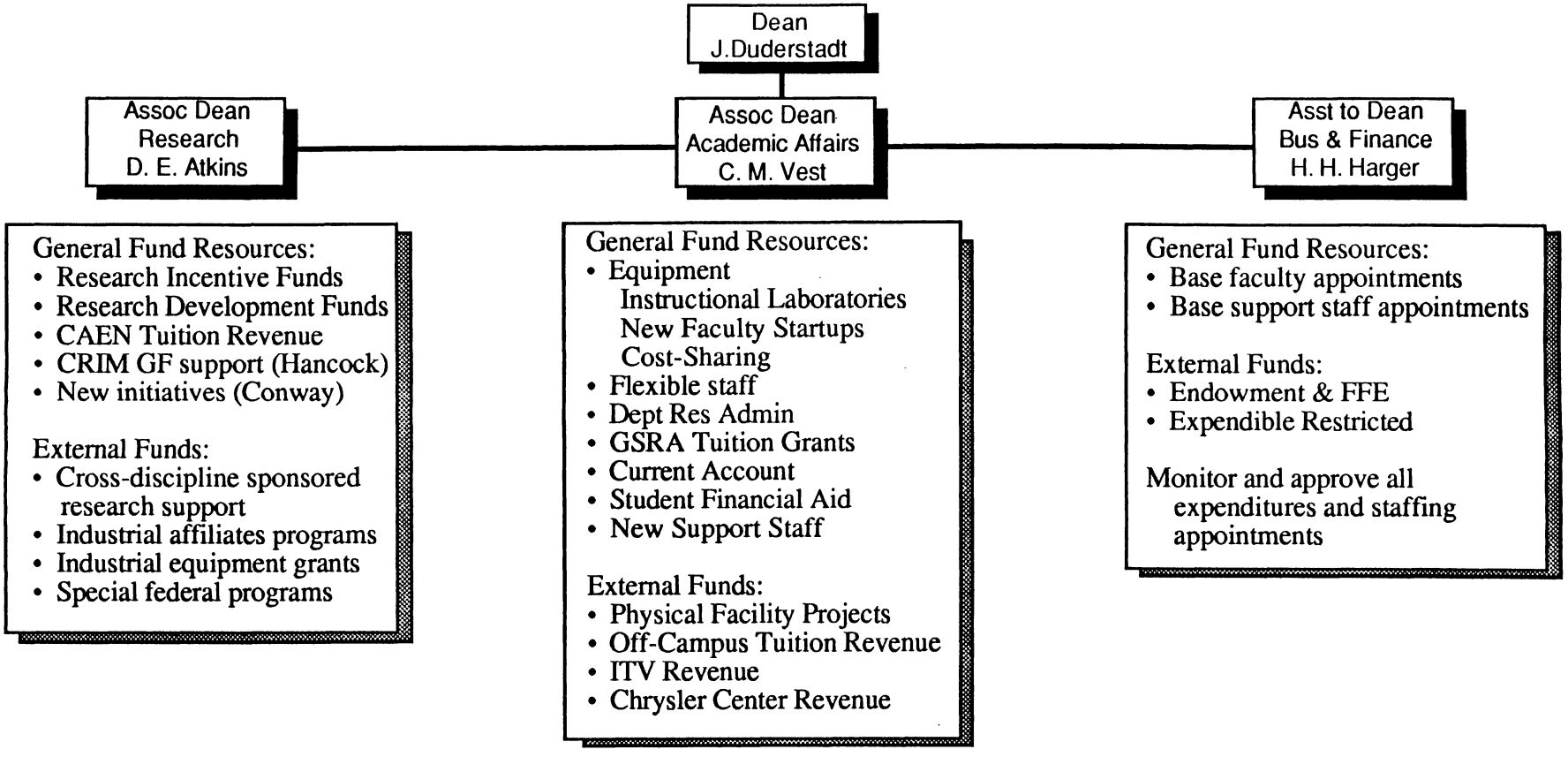
- Rigorous promotion and tenure criteria
- Strong merit-only salary program
- Research incentive program
- Decentralized discretionary resources
- Zero-base budgeting strategies


Average Faculty Salaries
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
80-81
81-82
82-83
83-84
84-85
85-86
Academic Year
P
AP
aP


Cumulative Salary Program
60%
50%
40%
30%
20%
10%
0%
81-82
82-83
83-84
84-85
85-86
Academic Year
Engineering
University

Resource Allocation


Director
Development
B. Canale
Asst to Dean
College Relations
E. Harden
Director
Information Serv
C. Kent
Dean
J.Duderstadt
Assoc Dean
CRIM
W. Hancock
Assoc Dean
Research
D. E. Atkins
Assoc Dean
New Initiatives
L. Conway
Assoc Dean
Academic Affairs
C. M. Vest
Asst to Dean
Bus & Finance
H. H. Harger
Director
CAEN
J. Von Roekel
Director
Corporate Rel
R. W. Schneider
Director
Student Services
A. Monterio
Asst Deans
R. Goetz
B. Karnopp
Business &
Finance
Office
Cross-Discplinary
Research
Centers
Director
Minority Programs
D. Scott
Director
Inst Television
D. Stevenson
Director
Placement
D. Peterson
Chairman
Aerospace Eng
T. Adamson
Chairman
Atmos & Ocean
W. Kuhn
Chairman
Chemical Eng
H. S. Fogler
Chairman
Civil Eng
E. B. Wylie
Chairman
Elec Eng & Comp
G. Haddad
Chairman
Indus & Op Eng
S. M. Pollock
Chairman
Mat & Met Eng
R. Gibala
Chairman
Mech Eng
R. G. Sonntag
Chairman
Naval Arch
M. G. Parsons
Chairman
Nuclear Eng
G. F. Knoll

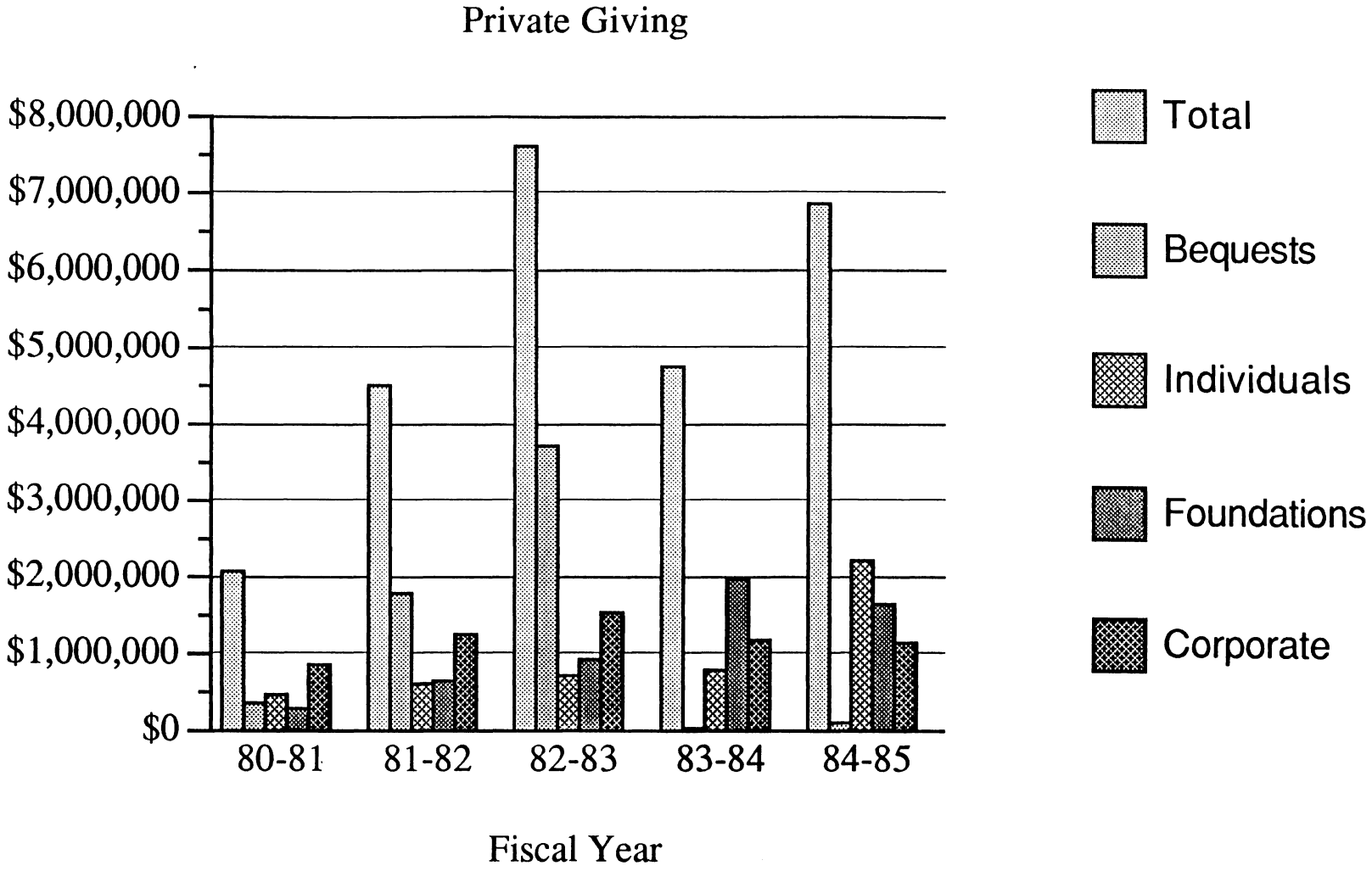


College Administration
Resource Control Responsibilities

External Relations

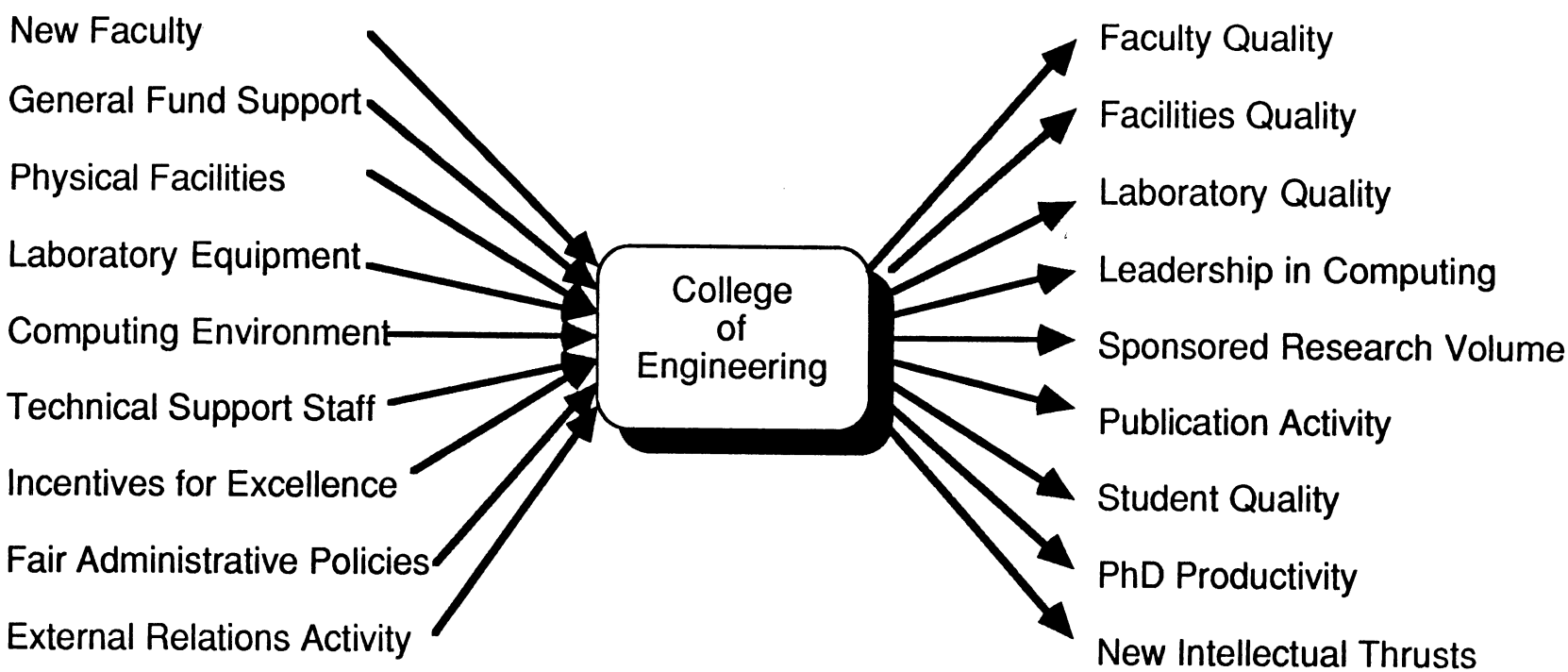
- Industry
- Federal government
- State government
- Alumni
- and, of course,

The University!!!


Private Giving
$8,000,000
$7,000,000
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
80-81
81-82
82-83
83-84
84-85
Fiscal Year
Total
Bequests
Individuals
Foundations
Corporate

Status of College of Engineering Capital Campaign

Donor	Facilities	Endowment	Pending Request
General Motors	$2,000,000		
Detroit Edison	220,000		
Dow Corning		350,000	
Mobil	50,000		
Steelcase	200,000		
Michigan Bell	125,000		
Individuals	275,000		
Individuals		$7,230,000	
Allied-Bendix			$250,000
Ameritech			350,000
Chrysler			2,000,000
Eaton			500,000
Ford			2,000,000
General Dynamics			500,000
Gould			500,000
Lockheed			500,000
Rockwell			500,000
TRW			350,000
Whirlpool			250,000
Totals	***$2,870,000***	***$7,580,000***	***$7,700,000***
Goals	***$12,000,000***	***$20,000,000***	



Inputs
(Quantity)

Outputs
(Quality)

Measures of College Progress -- 1981-85

- Faculty recruiting success
- Physical facilities status
- Laboratory equipment inventory
- Computing environment (CAEN)
- Sponsored research volume
- PhD production
- New intellectual thrusts

Faculty Quality

FACULTY RECRUITING ACTIVITY
1984-85

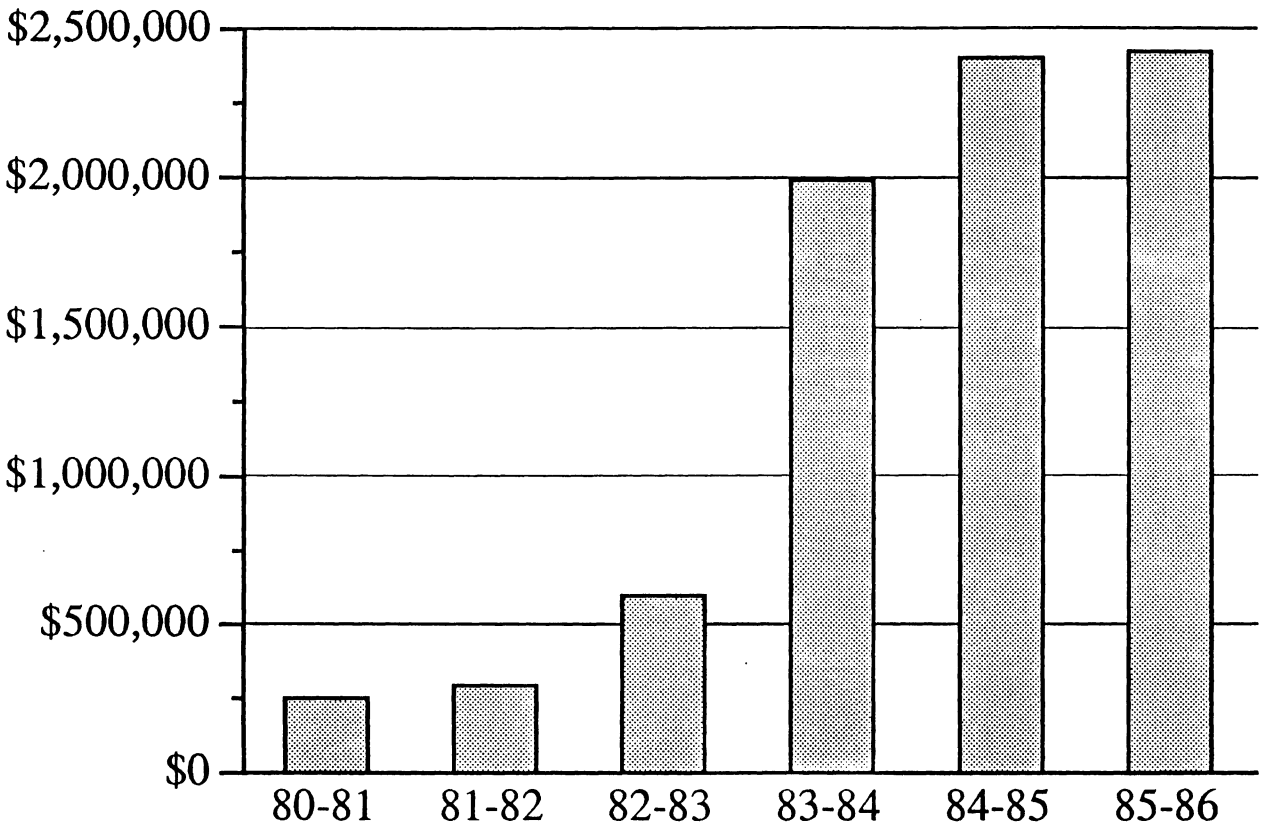
Assistant Professors	20
Associate Professors	4
Full Professors	8
Total	32

NOTE: Success rate: *85%* (38 offers, 32 acceptances)

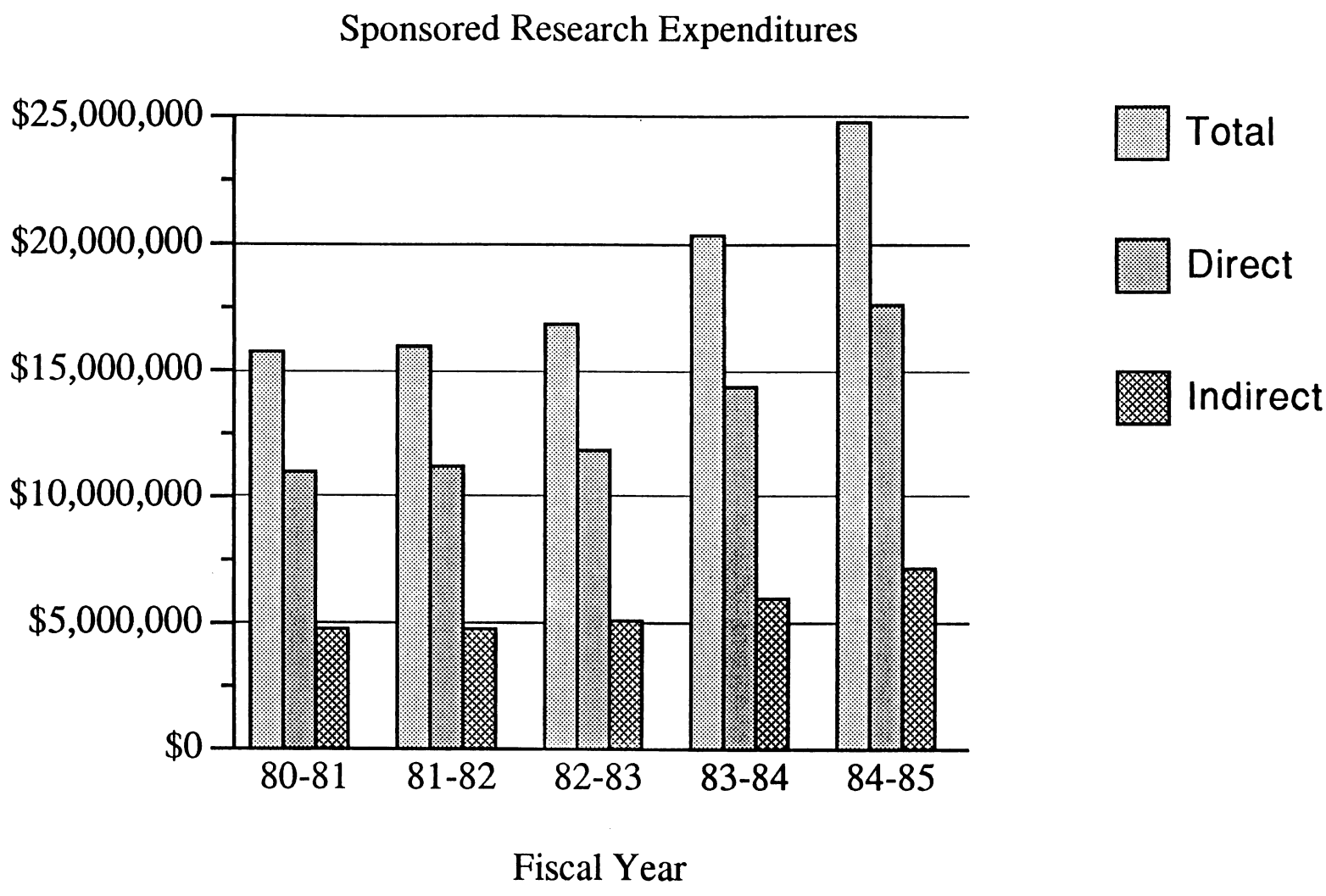
Facilities, Laboratory, Computing Quality

Sponsored Research Activity

Research Environment (General Fund)



Fiscal Year


Sponsored Research Expenditures
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
80-81
81-82
82-83
83-84
84-85
Fiscal Year
Total
Direct
Indirect

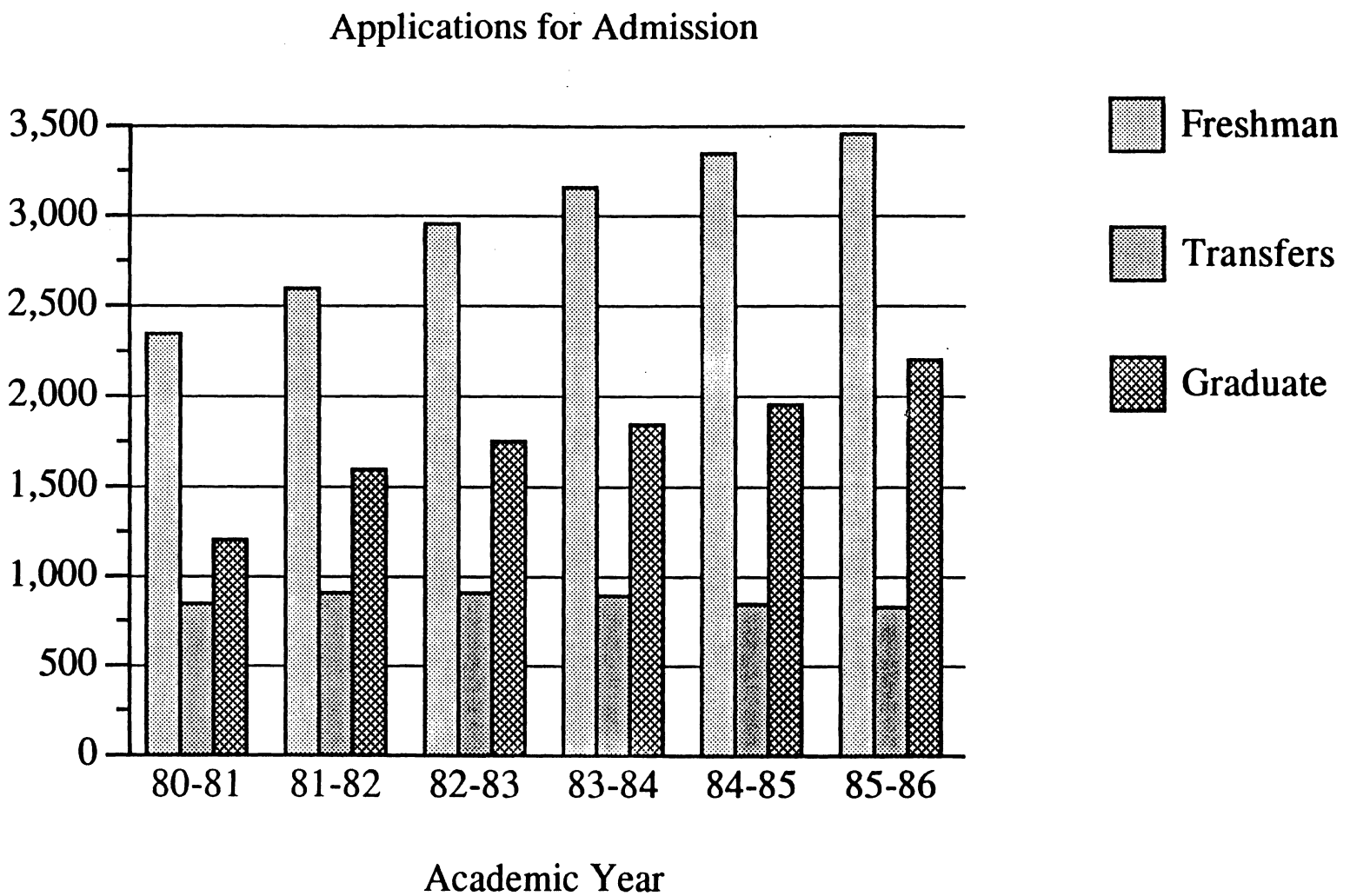
RESEARCH ACTIVITY

College of Engineering Units:

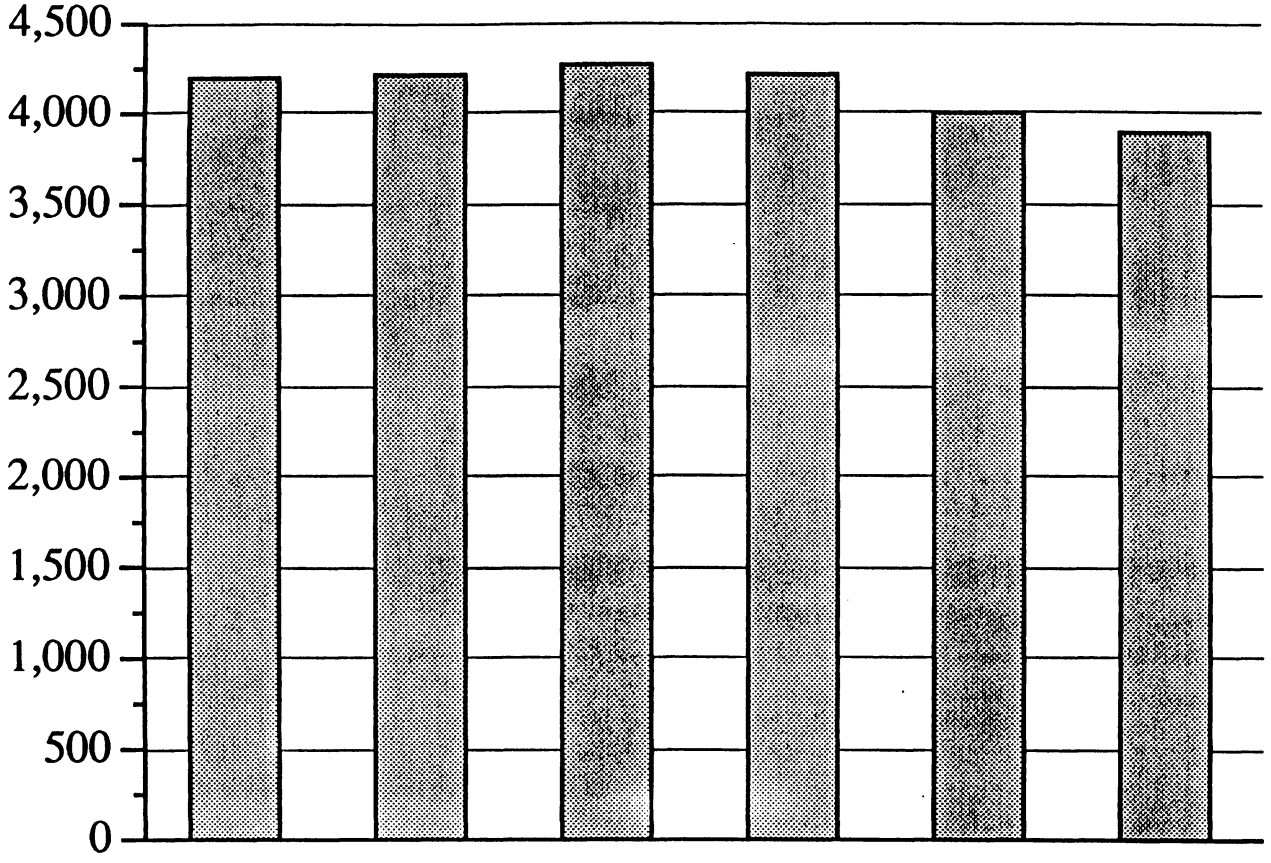
Federal	$22 M/y
Industry	$ 5 M/y
State	$ 9 M/y
Affiliated Units:	$12 M/y
Total	$48 M/y

Publication Activity

Student Quality

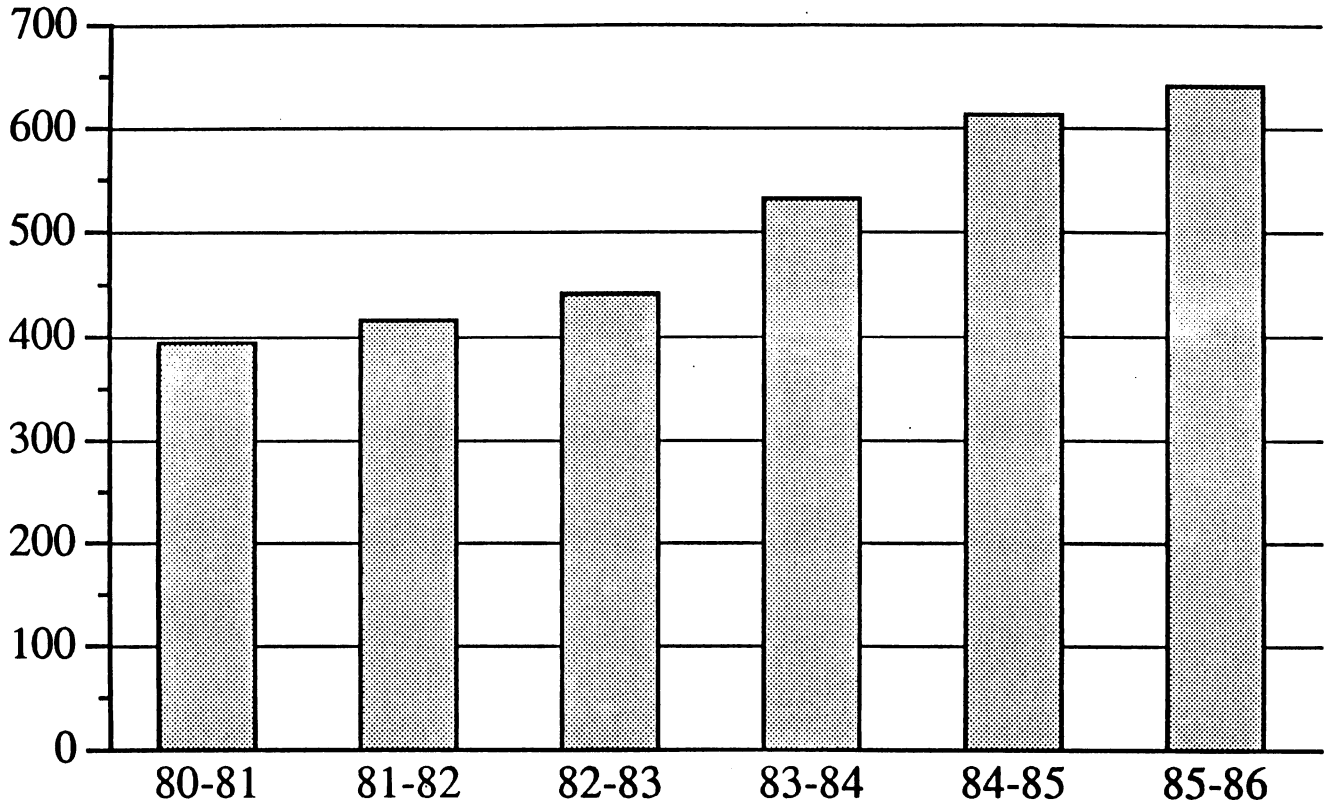

Applications for Admission
3,500
3,000
2,500
2,000
1,500
1,000
500
0
80-81
81-82
82-83
83-84
84-85
85-86
Academic Year
Freshman
Transfers
Graduate

Engineering Undergraduate Enrollment

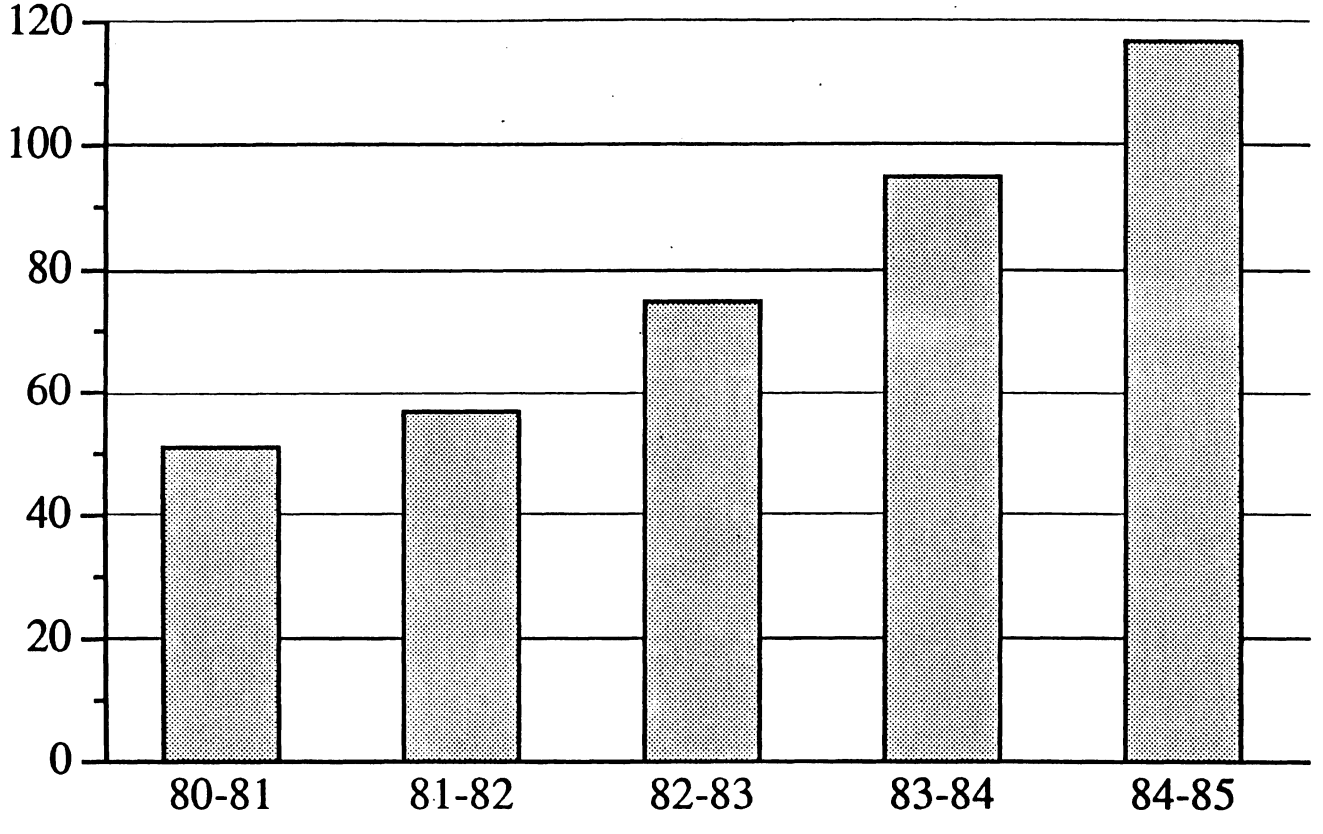


PhD Productivity

PhD Enrollment



PhD Graduates



Academic Year

New Intellectual Thrusts

Goals for the Year Ahead

- Facilities
- Instrumentation
- Budget
- Intellectual goals
- Federal Initiatives
- Fund-raising

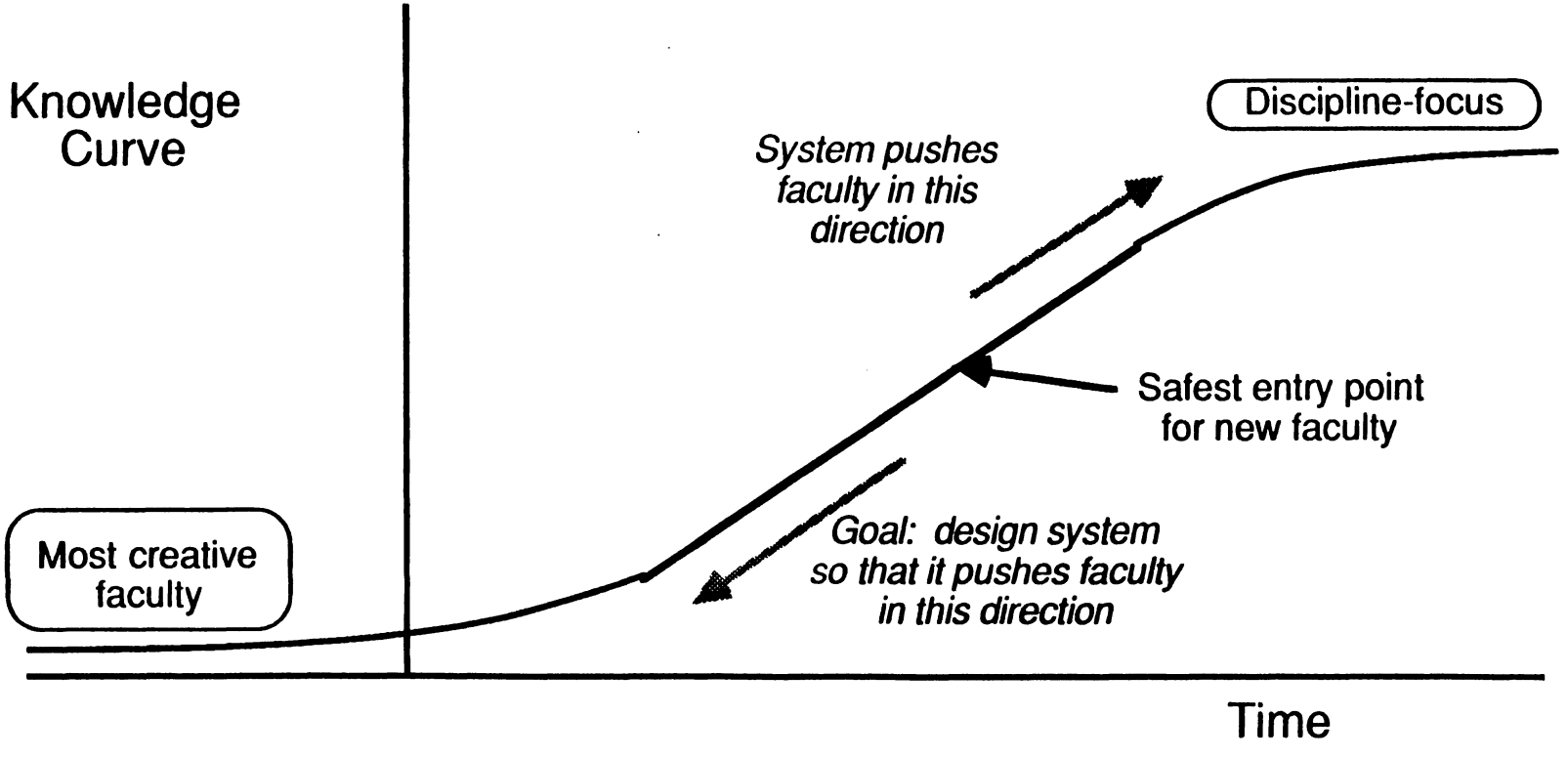
Intellectual Challenges

- Diffusing boundaries between engineering and science
- Obsolescence of traditional engineering disciplines
- Applied Sciences --> Subsystems --> Total Systems Integration
- Pushing College back on the "exponential" part of the knowledge curve
- Accommodating and stimulating innovation and creativity
- Experiment, theory, computation & simulation

Challenges

Macroscopic: Traditional discipline focus
"Deification of departments"

Microscopic: "Working on the exponential part of the knowledge curve..."


Knowledge Curve
Discipline-focus
System pushes faculty in this direction
Safest entry point for new faculty
Goal: design system so that it pushes faculty in this direction
Most creative faculty
Time

Response to Intellectual Challenges

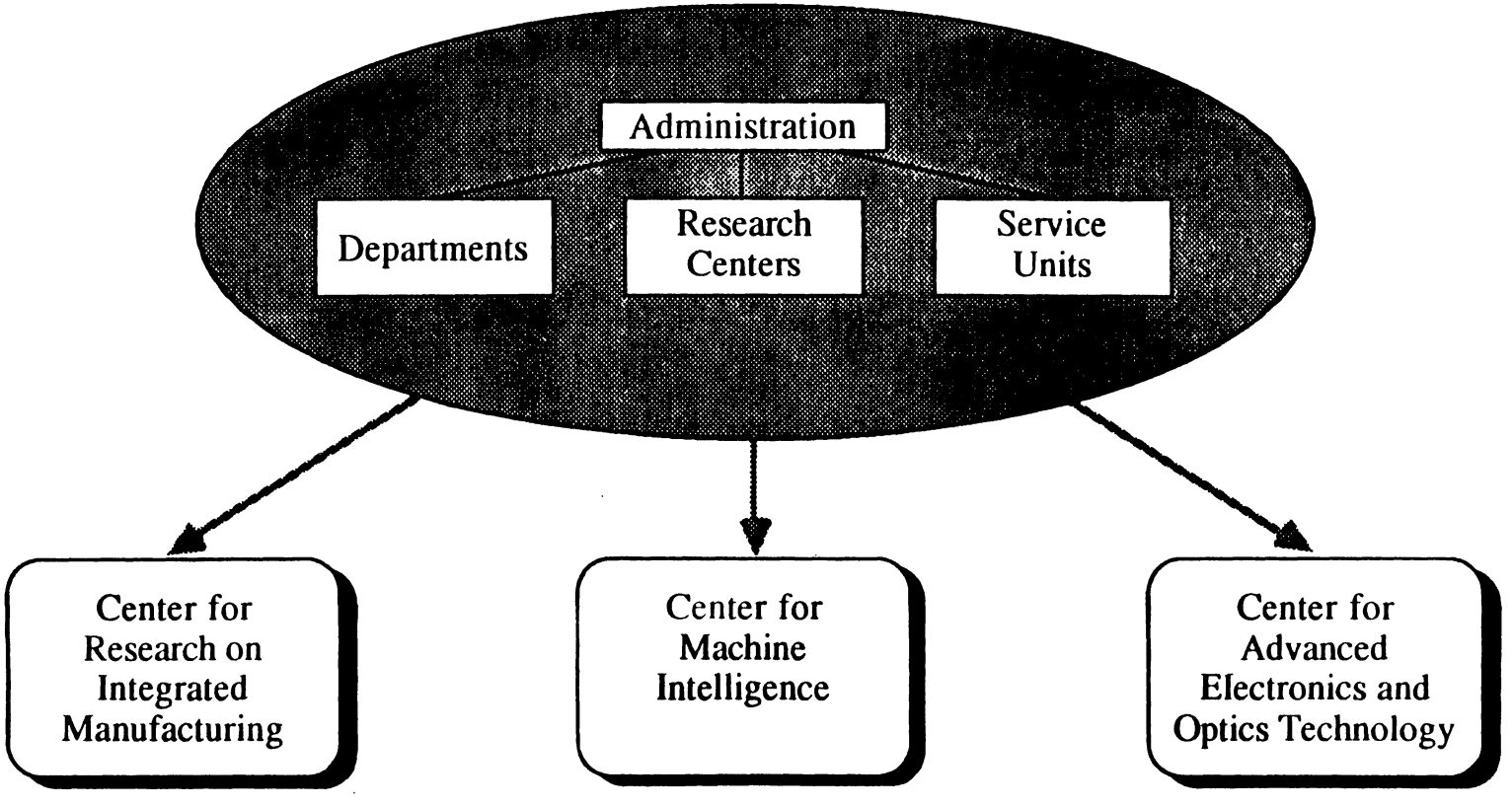
Response to Microscopic Challenges:

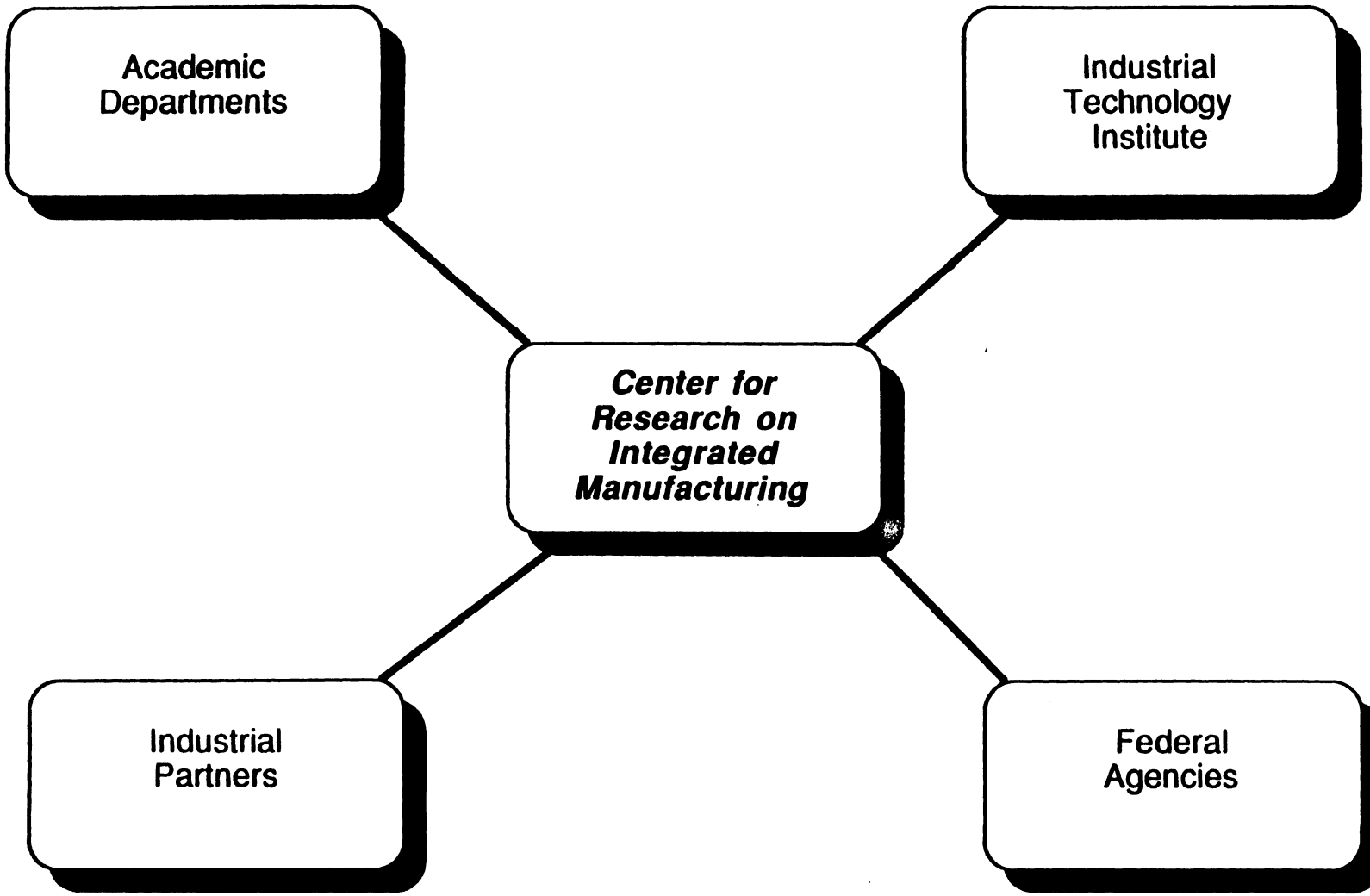
1. Promotion-tenure evaluation policies
2. "Deans' Department"

Response to Macroscopic Challenges:

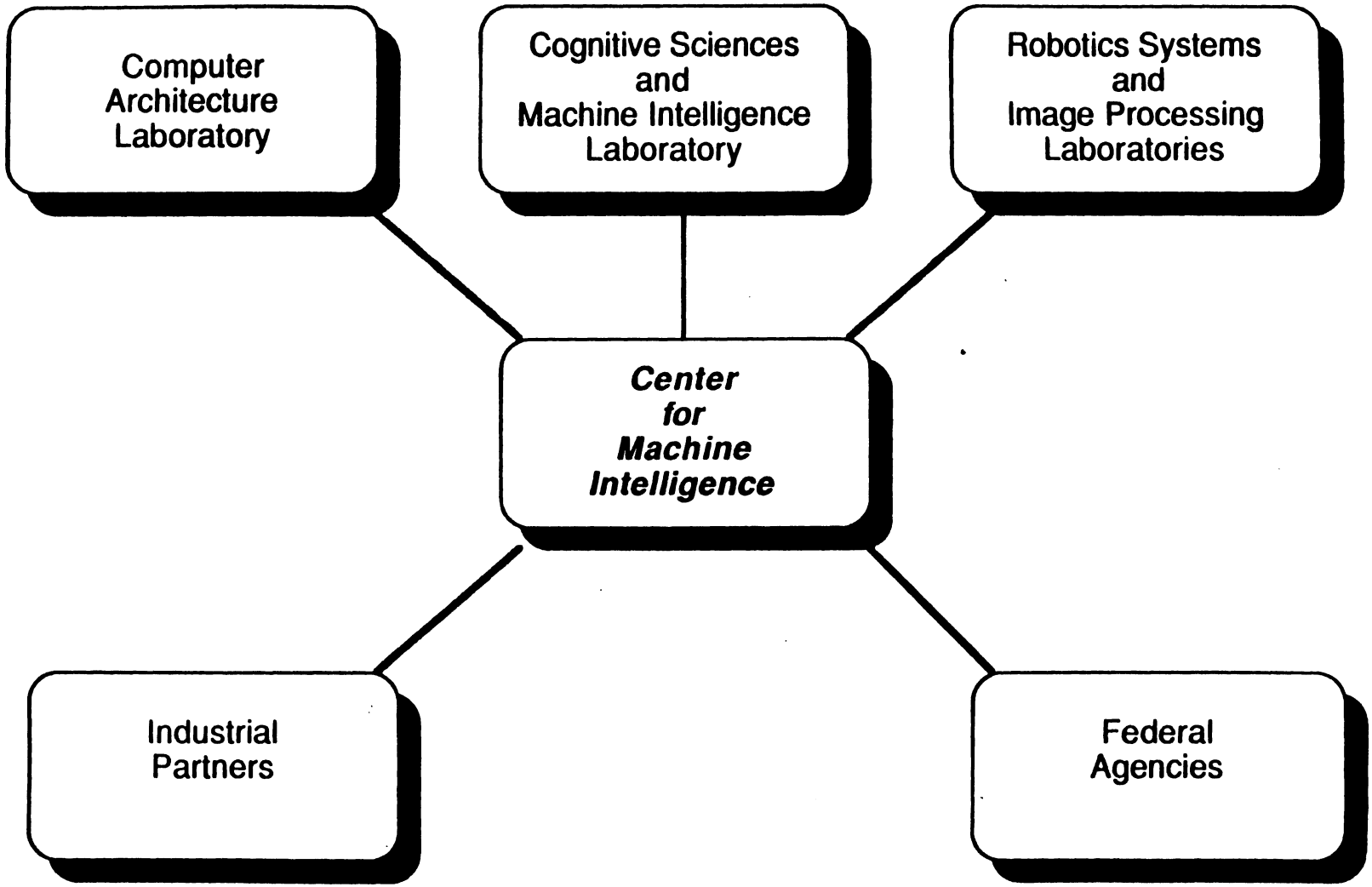
1. Cross-discipline faculty recruiting teams
2. Cross-discipline research centers ("matrix management")

Major Thrusts of UM Engineering

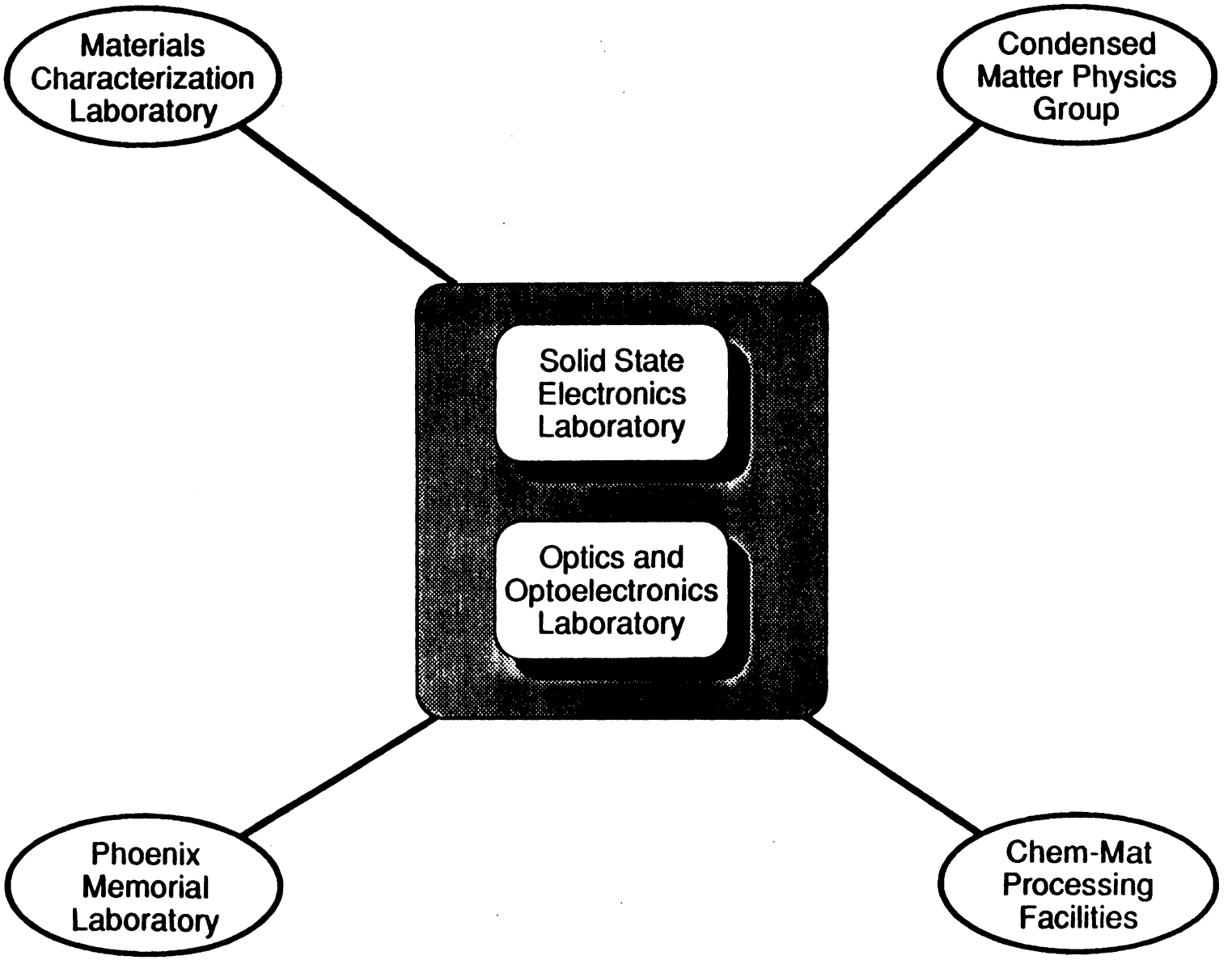




Center for Research on Integrated Manufacturing

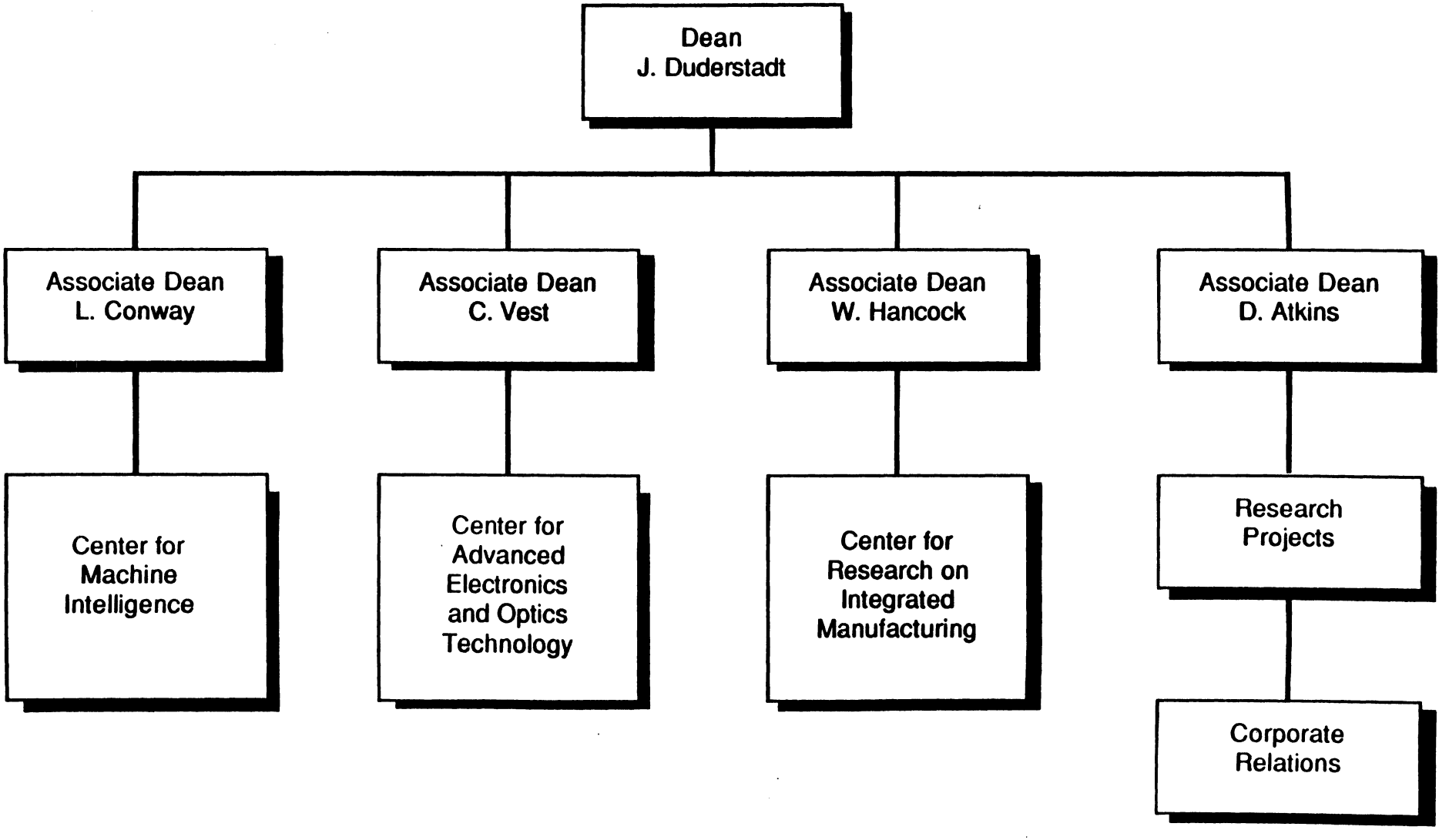


Center for Machine Intelligence



Center for Advanced Electronic and Optics Technology

UM Engineering Center Management Structure

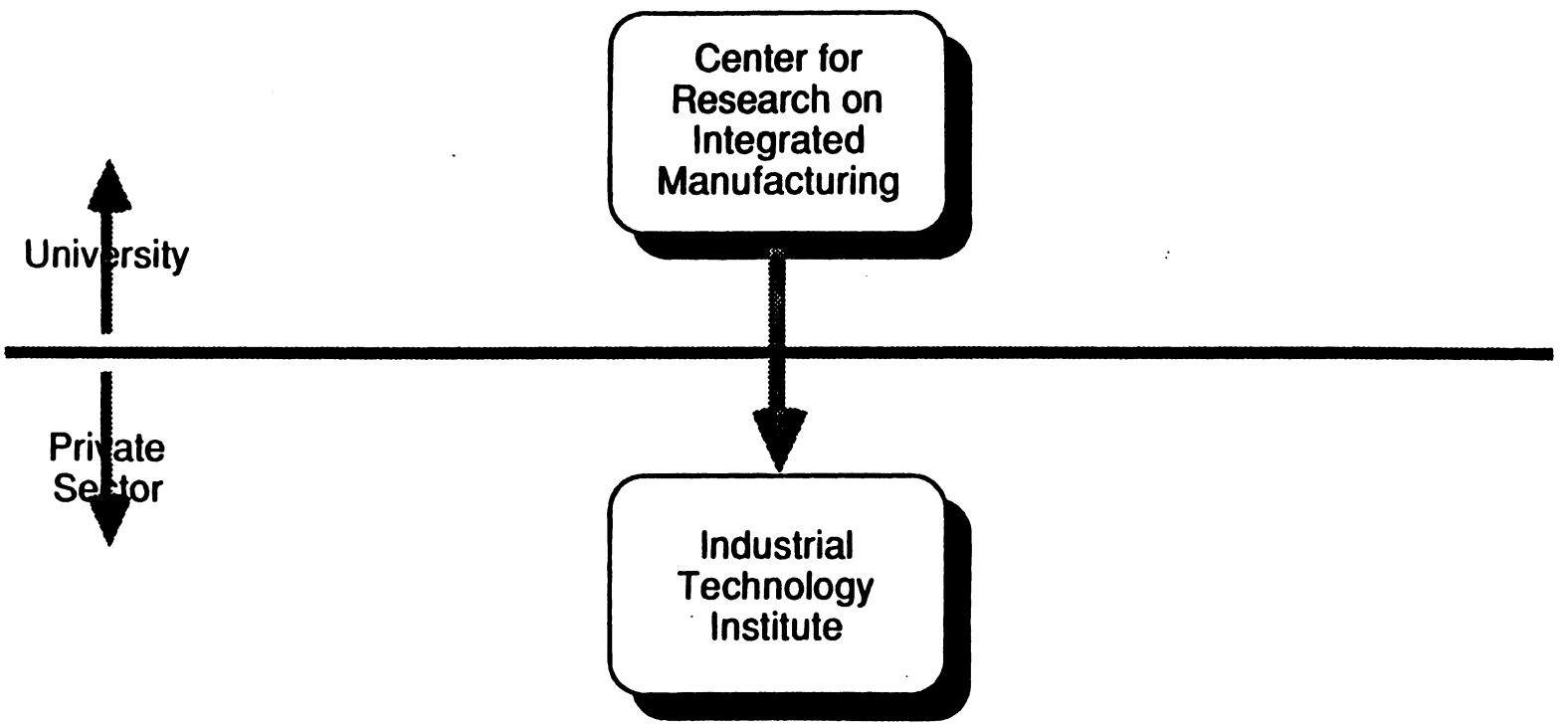


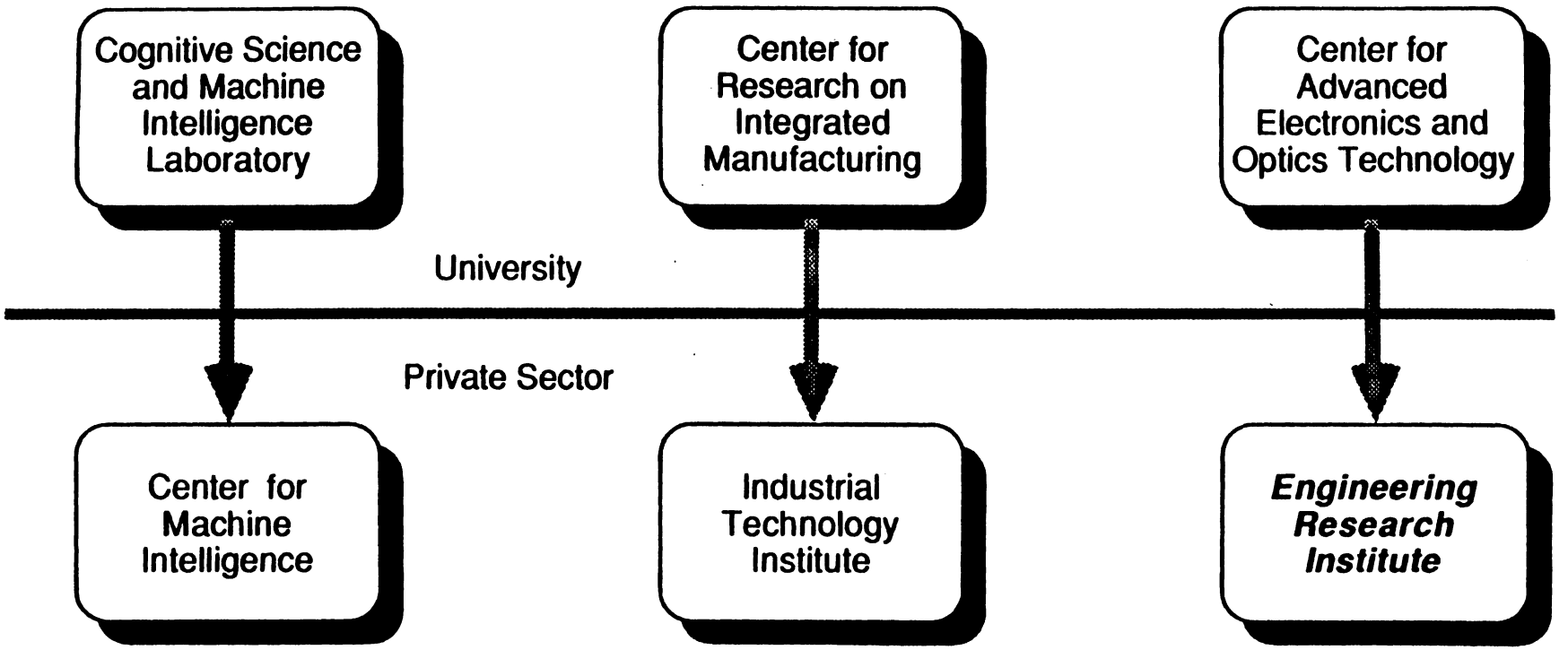
Michigan Research Excellence and Economic Development Fund

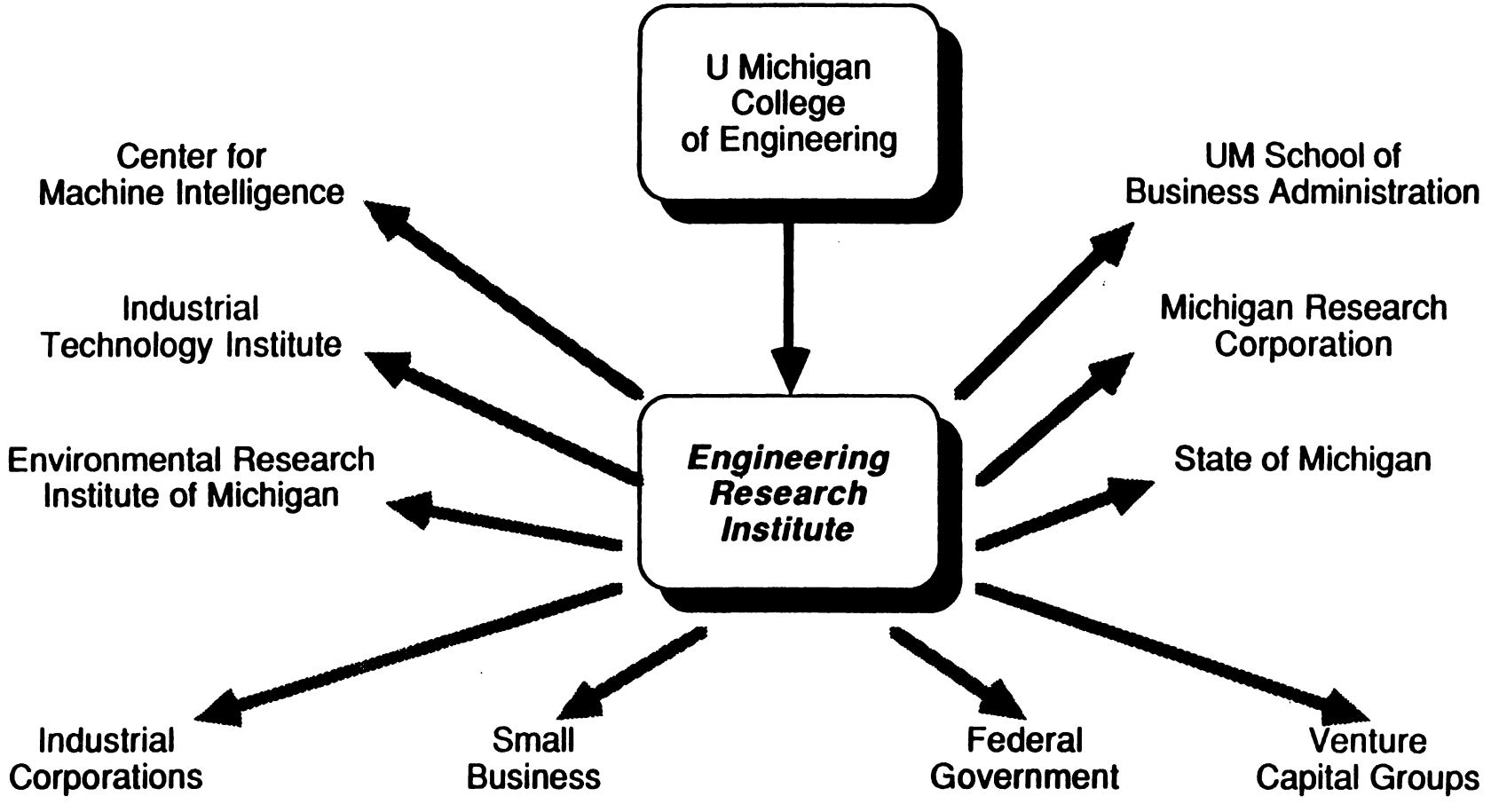
Center for Research on Integrated Manufacturing	$3,225,000/year
Center for Machine Intelligence	$1,775,000/year
Center for Advanced Electronics & Optics Technology	$3,960,000/year
Total	$9,960,000/year

Research Center Funding Goals

	State	Industry	Federal	Total
Integrated Manufacturing	$3.2 M/y	5.1	7.0	15.0
Machine Intelligence	$1.8 M/y	1.2	3.5	6.5
Electronics and Optics	$3.7 M/y	4.5	9.0	17.5


Center for Research on Integrated Manufacturing
University
Private Sector
Industrial Technology Institute


Cognitive Science and Machine Intelligence Laboratory
Center for Research on Integrated Manufacturing
Center for Advanced Electronics and Optics Technology
University
Private Sector
Center for Machine Intelligence
Industrial Technology Institute
Engineering Research Institute



Engineering Research Institute

Opportunities

OPPORTUNITIES

The UM College of Engineering has been identified as a key factor in the economic future of the Great Lakes area by the University, the State of Michigan, and the nation.

OPPORTUNITIES

- Base instructional budget has increased from $11.5 M to $33 M over 4 years
- Competitive salary structure (decoupled from rest of University)
- New faculty capacity (20 to 30 positions per year)
- New physical plant:
  - $12 M Dow Building
  - $30 M EE&CS Laboratory
  - $15 M renovation program
  - $12 M Capital Campaign
- Major growth in equipment and support staff
- Entrepreneurial environment

KEY FACTOR

The University has provided the College of Engineering with an unusual degree of autonomy and flexiblity in financial management, resource generation, personnel policies, and the administration of academic and research programs.

Philosophy and Strategy

Philosophy 1: The UM College of Engineering is a "people-dependent" institution.

The key to its achievement of excellence lies with people, with their abilities and their commitments.

Hence our fundamental goal must be to attract and retain the best people, provide them with the environment necessary to achieve excellence, and then get the hell out of their way...

Philosophy 2: Our future will be determined by our ability to focus resources to build peaks of excellence.

We must emphasize the quality rather than the breadth or capacity of our programs.

We must identify those areas in which we have the tradition, the opportunity, or the mission to become the best -- and then focus resources to build and strengthen these areas.

Major Accomplishments of UM Engineering (1981-1985)

Key Accomplishment

The College of Engineering was reestablished as a top priority both of the University of Michigan and the State of Michigan.

Quality

Faculty Recruitment:

A major renewal of the College faculty occurred, with the hiring of mo5e than 90 new faculty (corresponding to almost 30% of the faculty). The College has been successful in attracting an extraordinary group of new faculty members at all ranks.

Student Quality:

Student quality rose still further to the point at which the average student entering the College now ranks in the 98th percentile of high school graduates. This is all the more impressive in view of the fact that the College among the national leadersin the total number of degrees awarded (almost 1,900 per year, including Computer Science).

Environment for Excellence:

The College has been successful in establishing an intense, entrepreneurial environment in which initiative, achievement, and the quest for excellence dominate. Hiring, promotion, tenure, and salary policies have been modified to reflect this emphasis on achievement.

Faculty and Student Morale:

Faculty and student morale seem very high. We are beginning to achieve the level of intensity -- the "go for it" attitude, the unwillingness to settle for anything less that the best -- necessary to compete with our leading peers (MIT, Stanford, UC-Berkeley).

Environment

Completion of the North Campus Move:

The opening of Engineering Building I next spring will complete the move of the College to the North Campus. Over the past several years, the University and College have managed a complex sequence of construction, renovation, and space trade projects totalling $70 million and involving the relocation of 7 academic departments, 250 faculty, and 5,000 students.

Computer-Aided Engineering Network:

UM Engineering has managed to build what is generally regarded as the leading computing environment in engineering education. This is serving as a model for many institutions across the nation (including other components of the UofM).

Laboratory Equipment and Support:

The College has begun to make a major dent in the staggering laboratory equipment needs of its instructional and research programs (although we are still a long ways from where we need to be). We have also tripled technical support staff for laboratory activities.

Administration:

- A first-rate team of associate deans has been assembled.
- The administration has been structured to emphasis responsiveness.
- Equitable resource allocation policies (zero-base budgeting)

Ongoing program review and reallocation:

Review of all academic departments; discontinuance of 1 department, 4 academic programs, and 2 administrative units; achievement of equitable degree of General Fund support for all departments and programs

General Resources:

With the successful implementation of the Research Excellence Fund, the College will have managed to restore the base General Fund support of its programs lost during the 1970s. The "Engineering Gap" will have been eliminated.

Research

- Research Incentive Program
- Sponsored research increase from $16 M/y to $28 M/y
- Major increase in PhD enrollments
- Center for Research in Integrated Manufacturing
- Industrial Technology Institute
- Computing Research laboratory
- Computer Aided Engineering Network
- Department of Electrical Engineering and Computer Science
- Center for Advanced Electronics and Optics Technology
- Renovation of Ship Hydrodynamics Laboratory (Towing Tank)
- Civil Engineering Structures Laboratory
- Electron Microscopy and Surface Sciences Laboratory
- Advanced Computer Architecture Laboratory (NCUBE)
- Biomechanics Laboratory (Al Schultz)
- SPRL Expansion (HRDI)
- Nuclear Accelerator Laboratory
- Directed Energy Beam Laboratory
- MEAM CAD Facility
- Harris H-800 Facility
- Center for Machine Intelligence
- Applied Physics Program
- Materials Processing Research Laboratory
- Center for Scientific Computation (under development)
- Industrial Research Partnership program
- Michigan Research Excellence Fund

Instruction

- Student Computing Environment (CAEN)
- Freshman Computer Instruction Laboratories (Eng 103)
- Engineering Instruction Center (Dow)
- VLSI Design Laboratory
- Integrated Design and Rapid Prototyping Laboratory
- UM Videotape Instruction Program
- Co-operative Engineering Education Program
- Engineering Graduation Exercises

Development, State, Federal, and Alumni Relations

- National Advisory Committee
- Strong relationships established with Governor's team
  ("MIT of Midwest" strategy)
- Strengthening federal relationships
- Engineering Alumni Society

Challenges in the Years Ahead

1. "Liberalization" of the Engineering Undergraduate Degree Program

2. Responding to intellectual changes in engineering and applied science
   - Diffusing boundaries between engineering and science
   - Obsolescence of traditional engineering disciplines
     (importance of cross-disciplinary activities)
   - Applied Sciences --> Subsystems --> Total Systems Integration
     (new intellectual taxonomy of engineering)
   - Accommodating and stimulating innovation and creativity
   - Pushing the College back on the "exponential" part of the knowledge curve
   - Experiment, Theory, Computation & Simulation

3. Faculty

   - Rebuilding senior leadership in key departments
     (EECS, MEAM, Chem Eng, Civil)
   - Staffing "hot" areas
     (software engineering, manufacturing systems, computational science)

4. Physical Facilities

   - North Campus Engineering Library
   - Engineering Research Project Laboratory
   - North Campus Commercial Center
   - Aerospace Laboratories
   - Expansion of Nuclear Laboratories
   - GGBL-Dow Connector (MME/Chem Eng Labs)
   - Landscaping of North Campus complex

5. Rebuilding strength of physical sciences at Michigan

   - Applied Physics Program
   - Center for Scientific Computation
   - Applied Mathematics Program
   - Relationships with Chemistry
   - Applied "biosciences" programs (biotech, bioengineering, etc.)

6. Massive Experimental Facilities

   - Funding acquisition and maintenance costs
   - Staffing and management

7. Administration

- Transition from "takeoff and climbing" to "cruising altitude"
- Budget
  Indexing budget component to 15% of research activity
  - Elimination of "Engineering Gap"
  - Differential tuition
  - Completion of transition to cost-revenue control center
- Completion of "MIT of Midwest" Strategy