

## UMF Science Building Dedication

### Introduction

The dedication of this facility is a very important event...  
not just for the UM-F campus...but for our state.  
Let me explain...

### The view from Michigan..."the Rust Belt"...

While people generally look at the midwest as a relic  
of America's industrial past, let me suggest that in  
many ways, it can also be viewed as America's  
future.

For it is in the industrial midwest...in Michigan...

fhc□ we hc**Error!**

a brave, new world of intense economic  
competition...

Familiar Ills which dominate the headlines

The budget deficit

The trade deficit

Displaced workers

Original Industries

The bad news for Michigan is obvious...

Industries of great economic k

portance to our

nation such as steel and automobiles have  
fallen victim to intense competition from abroad...

Plants have closed...our cities are filled with chronically  
unemployed...

In Michigan we no longer worry about nuclear war and  
and the bomb because we believe that

"The odds are greater that America will be bought up by the  
Japanese than blown up by the Russians..."

What is happening?

The world economy is now in control

However, it is misleading to blame all our ills on  
international competitiveness alone!

Something else is happening...

### The Challenge of Change

Traditional industry economy is shifting to a new  
knowledge-based economy, just as our industrial  
economy evolved from an agrarian society at the  
turn of the century.

A transition is occurring in which..

Intellectual capital has replaced  
financial and physical capital as key to economic development

In all developed countries, "knowledge" workers have already  
become the center of gravity of the labor force.

As Erich Bloch, Director of the National Science Foundation  
puts it, we have entered a new age, an "Age of  
Knowledge in a Global Economy"

And in this age, the major force behind economic  
change is technology, itself.

### Clouds on the Horizon

Maintaining America's competitive edge requires attention

< - **to our traditional strength -- people and research -- and**  
a strong offensive strategy based on these resources.

**Taxes, trade, and general policies!** **influence economic**  
competitiveness. But in the long run, `strong base of

`head < - science □

d engineering research and education is more important.

WARNING SIGN 1: We are seriously underinvesting in R&D and

**Education**

For over two decades, US investment in civilian R&D has dropped while that of our competitor nations has risen rapidly. US investment in civilian R&D as a percent of GNP is now less than that of any other developed nation (and only 60% that of Japan and West Germany...)

head 3 + Note: While midwestern states such as Michigan and Ohio have undertaken many important new initiatives, we

head 4 - still lag considerably behind areas such as California

and New England in our investment in knowledge-based resources such as education. We've come a long ways in the past few years, but we still have one hell of a long ways to go.

#### WARNING SIGN 2: The S&E Pipeline Problem

Today, an unprecedented explosion of knowledge marks the onset of a new era. Since people are the source of new knowledge, we will rely increasingly on a well-educated and trained workforce to maintain our competitive position in the world and our standard of living at home.

Previous economic transformations were closely associated with major public investment in infrastructure such as railroads, canals, electric networks, and highways. In the coming economic transition, an equivalent infrastructure will be an educated population.

But things are going to get MUCH rougher: NSF Study

##### 1. Demand for S&E likely to go up

Population is growing

S&E share of workforce is growing

Industry is becoming more scientific

Most experts predict growth in S&E jobs

##### 2. Supply will probably fall off dramatically simply due to demographics...

Traditional source of S&E college students is declining

25%-30% falloff in HS graduates by 1992

Assuming that same fraction (4.8%) choose to enter S&E, and assuming constant demand (very conservative), drop will be from 197,000 (83) to 152,000 in 1996; there will be a cumulative shortfall of 930,000 by 2010!

To put it another way, fraction of students choosing S&E majors will have to increase by 40% to maintain even present level of graduates.

##### 3. Trends in Intended Majors:

But this situation may become even worse:

Over period from 1966 to 1987, proportion of students who intended to major in physical sciences has dropped from 3% to 1.3%; in mathematics, the decline was from 4% to less than 1%.

Recent trends in engineering also show softening.

Applications to most engineering schools are down by 10-20% this year. (USC <0%)

Interest in computer science is always waning. Drop from 4% in 1983 to below 2% in 1987.

Note: dramatic increase in proportion of freshmen interested in business majors--now up to 25% (and rising rapidly)

Furthermore, the dropout rate is extraordinary...

From 8th grade through PhD, the half-life of students in the mathematics curriculum is one year!

That is, if we begin with 32 million students in junior high school, we lose 50% each year until only a few hundred attain the PhD.

##### 4. Composition of college age population is also changing...

In 1966 44% of college freshmen were women; today 52%.

By 2020 30% will be composed of Blacks and Hispanics...

students who have not traditionally chosen S&E careers.

Indeed, by the turn of the century, over 50% of K-12 students

will be Black or Hispanic.

Less than 15% of new people entering the labor force of the 1990s will be white males.

The fastest growing pool of youths has the lowest participation rate in college and the highest dropout rate in high schools -- not to mention the least likelihood to study science and math.

NOTE: We must make special efforts to expand participation by these groups...not just because that is good social policy, but because we cannot afford to waste their talents!

Conclusions:

i) If we couple demographics with student preferences, we have got a timebomb on our hands...

iii) We must act rapidly...

First to plug up the leaks in the pipeline...

Then, over the longer term, to adapt the education system in American to a changing population

WARNING SIGN 3: Technological Illiteracy

□ + **We really haven't appreciated impact of technology.**

Today we are witnessing an unprecedented explosion of knowledge.

Technology doubles every 5 years in some fields!

Graduates are obsolete by the time they graduate!

Technological change is a permanent feature of our environment

Examples of just the past few months:

i) hole in the ozone layer over Antarctica

ii) new supernova in the heavens

iii) new high temperature superconductor

iv) a new theory suggesting that all matter is composed of infinitesimal "superstrings" rather than point particles

**Yet, at the same time public ignorance is extraordinary!**

A recent NSF survey indicated that only 18% of those asked said they knew how a telephone works -- and

head 5 - only half of these gave the right answer. head 4 + Yet

more than half of those surveyed indicated they head 5 - believe we were being visited by aliens from outer

space!

head 3 + And yet, our education system has not responded..`

Note: it is bad enough that...

10% of Americans are illiterate

25% now fail to complete high school

Scientific Literacy of J-12 Teaching Force

Only 30% have read college chemistry

Only 20% have had college physics

Less than 50% have had calculus or computers

head 4 + International Association for Evaluation of Educational Achievement (IEA)

Grades 4, 8, and 12

US was 8th of 17 for 4th graders

US was 14th of 17 for 8th graders

US was 11-13 of 17 for 12th graders

Bottom 25% of US students were scoring at chance level, indicating that they were scientifically illiterate

(Top scores were Japan, Korea, Hungary

"For a technologically advanced country, it would appear that a reexamination of how science is presented and studied is required...in the United States."

More than half of all our high school graduates have not had even one year of science.

Face it, gang:

The tragedy is not simply our poor showing relative to other nations. Head 5 + Science, mathematics, and computer literacy will increasingly become a requirement for almost all employment.

We are condemning an entire generation to a lifelong estrangement from the very technology that will inevitably govern their lives.

**WARNING SIGN 4: America's Work Force is Becoming Obsolete**

The education of the Michigan workforce is inadequate to the demands of the next century.

Michigan is undergoing dramatic change in industry...

Away from low-skill, blue-collar workers

Unskilled labor will lose relevance in a world dominated by microelectronics, computers, and automation.

The factory of the future will have NO low skill workers

Statistical quality control and just-in-time inventory systems require production workers with mathematical abilities that are far beyond the present level.

An example: Expert systems

The "expert system" craftsman...

Serious concern:

Key input, however, is quality of the workforce.

Our principal competitors are simply producing workers better capable of absorbing modern production skills. The lack of these skills is preventing us from achieving the productivity gains that we should be getting.

It is bad enough to face the prospect of a significant fraction of our labor force becoming permanently unemployable because of an inadequate education. Do we want to condemn their children...OUR children...to a similar fate? Can we afford it?

### **The State of Michigan Response**

What has been the response of Michigan to the challenge of change -- to the Age of Knowledge in a Global Economy...

The Michigan Strategy

Blessed with public leaders that recognized the challenge...

had the vision to develop a forward-looking strategy to respond... and the courage and skills to implement this strategy...

Economic prosperity lies not in tearing down our old industrial base for a different kind of economy, but in helping that base make the changes necessary to compete in a new economic environment.

The goal: Michigan must become America's factory of the future... its source of emerging industrial technology...

Our ability to innovate will become our principal economic advantage... innovation will be the energy that drives change

### **Development of Unique State-University Partnership**

Universities committed themselves to:

Strategically realigning activities into key thrust areas

had 5 - of major importance to State...

Attracting leading scientists, engineers, and professionals to staff these programs...

Developing new mechanisms for technology transfer...

State government committed itself to:

Establishing higher education in general and the state's research universities as a high priority

Providing seed resources to sustain key thrust areas

Developing novel institutions to act as catalysts in these activities

**State Actions:**

Vision and courage of leaders in public and private sector  
 Recognized the importance of technology to Michigan's future...  
 Also, were willing to make the investments today necessary  
 for Michigan's prosperity tomorrow...

**Michigan is on the move!**

State has taken strong first steps to rebuild capacity of its research  
 universities to provide the knowledge-based resources so necessary  
 to our long term well-being and prosperity.

Indeed, Michigan is rapidly becoming a model for the nation of the  
 advent of an exciting new competitive age.

The state has assembled its tremendous assets and its people  
 into a winning team involving state government, Michigan's  
 colleges and universities, business, labor, and industry.

**BUT, Michigan's efforts have just begun...**

We still have far to go to counteract the crippling deterioration of public  
 support experienced in the 1970s and 1980s.

1. While Michigan ranks 5th in tax revenue, we rank only 32th in  
 appropriations per student and only 37th in percentage of  
 total appropriations allocated to higher education.

Indeed, we have dropped to 32nd in  
 tax revenue for higher ed--7.8%  
 compared to 11.4% for California!

2. SRI Study suggests that we presently are underinvesting by  
 as much as 30% in the knowledge infrastructure necessary  
 to secure our state's future leadership and prosperity.

We are being outspent by 30 - 40%  
 in state support per student...  
 Not simply by prosperous states like  
 California...but by neighbors such as  
 Indiana and Ohio!

3. In fact, the only area where we now lead  
 the nation is in our prison system...  
 We are now investing more in prisons than  
 in higher ed...that is, we spend more money  
 putting people into jail than we do in  
 keeping them out of jail!

Intense international competition, turbulent markets, rapid  
 technological change present new challenges to our future.

To stand still...to fail to make the investments in our research  
 universities so necessary for tomorrow...is to lose the race for  
 future prosperity and well-being of our citizens.

We really have no choice but to forge ahead, to pick up the pace, and  
 to increase these investments in order to secure once again the  
 position of leadership to which our state has long been accustomed.

**Courage...**

The renewed investment in higher education of recent years  
 has taken extraordinary vision, courage, and determination  
 on the part of state government, particularly during a period  
 with many other competing demands and pressures.

However, it also seems clear that in the knowledge-intensive  
 future that our state faces, we really have no choice but to  
 sustain and increase these investments.

In the long run it will be our investments in the most  
 important resources of all, in people and ideas, that  
 will determine the future prosperity and well-being of our  
 state.

As we enter the Age of Knowledge, our ability to sustain the  
 strength of our nation...to achieve the quality of life for  
 our citizens...will be determined by, more than any other  
**educate that most**

precious of resources, our people.

We simply must provide them with the most outstanding education possible to prepare them for the age in which knowledge will hold the key to prosperity and quality of life...