

National Honor Society

Ah, memories...

Congratulations!

**Let me congratulate you on the distinguished record
that has led to this recognition...**

**As I usually say each year to entering freshman at the
University, the good news is that you are probably
part of the academically strongest class in your
schools history...the bad news is that next year's
class will be even better...**

You cannot slow down!

Just out of curiosity's sake:

How many of you are planning on careers in science or engineering?

How many in a profession like medicine or law?

How many undecided?

I'm interested because of another hat I wear...

National Science Board

Education and Human Resources Committee...

Serious concern:

America is losing out in the "brain" race...

Let me explain...

When I graduated from college...

Space race with the Russians...

First to the moon...

Some were even looking beyond...

Rover Project: nuclear rockets for Mars mission

We fully expected to have a base on Mars by this time!

What happened?

America became disenchanted with science and technology...

Maybe the war in Vietnam...

Maybe the concern about the environment...

The best of our students stopped going into science...

Despite the fact that so many of you say you will go on...

only about 3% of you will major in science or engineering!

(Compared to 50% in most other nations...)

But something even more serious happened...

**We seemed to forget for a time about the importance of
quality...of excellence...in what we did.**

Example: When I was Dean, a GM executive...

Claimed that Japanese would never beat us...

We could put a car on the showroom floor...
Only problem was that people don't buy cars by the pound...
They buy junk by the pound!

**At a time when the rest of the world was picking up the pace...
America was sitting back and resting on its laurels...
We stopped demanding the best...in our schools...in our
industry...in our achievements...**

The Challenge of Transition

Important transition:

Agriculture --> Industrial --> Knowledge-based economy
Intellectual capital -- brain-power

Today: strong signs that technology is in vogue again

Economic competitiveness
National Security
The Information Age

EXAMPLE 1: Demand for engineers and scientists

Through good times and bad, mobs of recruiters still
crowd our placement center.

80% of all job interviews at UM for engineers

Starting salaries: \$30 K +

Many offers for each graduate

All national studies indicate shortage of engineers

EXAMPLE 2: Demand for admission to engineering programs

For past decade, student interest has grown steadily

At UM we are forced to limit admissions

EXAMPLE 3: Reawakening of public interest in science

New magazines and TV programs --

"golly-gee-whiz-bang" style of science

Media attention to areas like robotics, computers

NYT article

John Naisbett

Impact of personal computer -- telecommunications

Even the counterculture types of the 60s have now

traded in organic gardening of lettuce for Apples --

rather, Macintoshes!

But, if we look beneath the hype, we see danger signs!!

Clouds on the Horizon

WARNING SIGN 1: America is slipping

No question that US has lost lead in many areas

Industrial productivity and heavy manufacturing

Steel, autos, ...
Energy (particularly nuclear)
Electronics
Also serious signs that lead is slipping rapidly in
Computers
Aerospace

WARNING SIGN 2: S&E Manpower Shortage

US faces a S&E manpower crisis of unprecedented proportions

Some examples:

Per capita production of US engineers lowest among
industrialized nations:
US: 72,000 (3%)
Japan: 85,000 (21%)
USSR: 300,000 (35%)

President of Sony:

"In US you produce 4 lawyers for every engineer.

In Japan, we graduate 4 engineers for every lawyer!"

But things are going to get MUCH rougher:

NSF Study

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

Supply will probably fall off dramatically

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),

there will be a cumulative shortfall of 700,000
by 2010!

WARNING SIGN 3: THE IMPACT OF TECHNOLOGY

We really haven't appreciated impact of technology.

Example:

Technology doubles every 5 years in some fields!

Graduates are obsolete by the time they graduate!

Graduates must factor change into their career objectives.

Change is a permanent feature of our environment

However now employees will have to change areas frequently.

Indeed, on the average, every 3 years.

Continuing education will be an absolute necessity.

Example: IMPACT OF THE COMPUTER

Computer is a "lever" for the mind

Now improves both the productivity and intellectual span

CAD, CAM, CIM, CEP --> CAE

Obvious implications

Integrate ("saturate") curriculum

Take advantage of enhanced productivity

Unleash student's creativity

Not so obvious, but more profound implications

Computer has changed engineering practice

No longer: design-analysis-production-manufacturing...

Now one engineer spans all

Hence we demand a generalist -- not a specialist

Computer has provided powerful analysis tools

Instead, can explore many designs -- let computer do dog work

Reemphasizes creativity over analysis -- science back to art

Right to left side of brain

Example: "Creation station"

WARNING SIGN 4: Technological Illiteracy

Claim: We are rapidly becoming a nation of illiterates ...

in science and technology, no longer able to comprehend or cope with the technology that is governing our lives.

Public's knowledge and understanding of science has not kept pace with technology

Some examples:

How many of you recognize the follow terms

expert systems, polymeric composites,
lattice guage theory, recursive procedures,
CAE, CIP, FMS, CCC,...

Modern tools of professional

CAD, CAM, CAE

Modern workstations

Expert Systems and Knowledge Engineering

Examine education system:

Incredible that students can graduate from high school without a solid education in science & math -- or can complete college without such coursework.

80% of hs graduates --> 1 course in physical science

Another example: K-12 education in physics

In US, one year for a few...

In Europe, teaching of physics as a separate subject begins as early as 6th grade (also in USSR)

Student planning on majoring in physics will have had 6 years -- more than 500 class hours

Non-science major will have had 3 years

Face it, gang:

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

Already see danger signs: misunderstanding of science

Pop or psuedo-science:

astrology, health fads, parapsychology

Nonsense surrounding nuclear power, genetic engineering, hazardous waste disposal, smoking

Possible Responses

Need for a reawakening of interest

Background

National leadership

Slipping behind

Why are we losing leadership

Have our colleges and universities lost the ability to provide the quality of education in science and technology necessary for world leadership? I think not. The enormous number of foreign students attending American universities from those very nations that are passing us in science and technology give evidence to this.

Perhaps it is due to short-sighted government policies. To be sure, the federal government seems to have lost its enthusiasm for the support of science and technology, while this state has certainly lost its capacity to support higher education -- at least at the level that built distinguished universities such as Michigan. But this still doesn't explain the situation.

Key Factor

Rather I would suggest a more fundamental factor. I believe that for the past decade or more the best of our students have bypassed careers in science (or perhaps have been persuaded to bypass these careers) in favor of other professions such as business, law, medicine, and so on.

The simple fact of the matter is that unlike the 1950s when the best of our students chose careers in science and engineering, over the past decade few have done so.

But, whatever the reason, it is certainly true that this nation needs a reawakening of interest in science and engineering among our best students.

Now there is a real challenge for you!

Because if our nation is to get its act together again,
it will be because students like you demand it!

If our schools are ever to improve, it will be because
you simply will demand the best of your teachers!

If we are to regain our scientific leadership, it will
be because many of you make the commitment to seek
the rigorous education required of scientists and
engineers.

Wouldn't it be great if many of you
decided that you simply were not going to stand for
mediocrity! That you were going to go for the
gold...for the best in the achievements of your schools,
your teachers, your friends, your nation!

Ah, well, don't let me lay too much on you!!!