

Welcome

Don't want to lay responsibilities

that are too heavy on you...but...

Examples...

- i) Ozone layer...
 - ii) CO-2 buildup (Greenhouse effect)
 - iii) Loss of biodiversity...
- Even more serious: scientific illiteracy

Scientific 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 only half of these gave the right answer.

Yet more than half of those surveyed indicated they believed we were being visited by aliens from outer space!

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

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

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

Math: Only 1 out of 100,000 high school students study calculus...and then for only part of a year
Five million Soviet high schools students receive a full two years!

Physics: Few US students will ever take a physics course. In fact, only one out of four American high schools even offer a course in physics!

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:

The tragedy is not simply our poor showing relative to other nations.

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

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. We are now far behind Japan and Germany in

the fraction of GNP invested in R&D.
Almost all growth has gone into military research (70% of federal R&D budget)
Support of basic research has dropped significantly (as has support of research in C&S)

S&E Manpower Shortage

US faces a S&E manpower crisis of unprecedented proportions

0. Indeed, today the United States awards the smallest proportion of university degrees in science and engineering of any industrialized nation!
1. Proportion of graduating seniors who major in science and engineering is smaller today than it was in 1970s (5%). Particularly severe drops in physical sciences and mathematics. (Fallen by 40% over past decade)
2. Per capita production of US engineers lowest among industrialized nations:
US: 72,000 (3%)
Japan: 85,000 (21%)
USSR: 300,000 (35%)
Japan has doubled its technical workforce in past decade...
7 of 1,000 American students receive engineering degrees
40 of 1,000 Japanese -- indeed, Japan with less than half the population is producing far more scientists and engineers!

President of Sony:
"In US you produce 4 lawyers for every engineer.
In Japan, we graduate 4 engineers for every lawyer!"

3. More than 60% of engineering PhDs are now foreign
Indeed, foreign students account for nearly 85% of growth.
It is bad policy to be dependent on an unpredictable resource and not to be able to meet more of our needs with American talent.

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!

Note: Composition of college age population is also changing...

By 2020 30% will be composed of Blacks and hispanics... students who have not traditionally chosen S&E careers.

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.

Indeed, while Blacks and Hispanics account for 20% of total population, they account for less than 2% of scientists and engineers!

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!

The Challenge of Change

The challenge of dramatic economic 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.

The days of low interest rates, limited foreign competition, slow-moving technology, stable markets, and mass production processes that once allowed our industries to thrive in a sheltered environment have long since passed.

This change has gripped the Rust Belt...

A transition is occurring in which..

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

The challenge today is to develop an agenda to achieve and sustain prosperity in a new environment of intense international competition and rapid technological change.

Some examples:

Industrial production is steadily switching away from material and labor intensive products and processes to knowledge intensive processes:

In a car, 40% materials, 25% labor...

In a chip, 1% materials, 10% labor, 70% knowledge!!!

Increasing manufacturing production has come to mean decreasing blue collar employment!

head 5 - In the 1920s, 1 of 3 was a blue-collar worker

today 1 in 6 and dropping fast

probably to about 1 in 10 within a couple of decades...

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

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