Issues Concerning Political Misuse of Science

Henry Kelly, President
Federation of American Scientists

Shaping Science and Technology for National Security:
Can Policymaking Ride the Tidal Wave of Technological Change?
NSF
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Themes

• Honest, unbiased science and technology policy advice is a necessity not a luxury
• The system is badly broken (it’s probably done best by DoD but even they don’t get a free pass)
• The excuse that “they’ve always done it” is a slippery slope.
• Apolitical advice is an oxymoron: but we can’t afford to take the steps needed to improve the system and confidence in the system
Why It Matters:

• Complex threats to national and homeland security (proliferation of dangerous technology) can only be countered by technological superiority:

• It is impossible to imagine a world with a population of 9 billion people living in peace and prosperity and a sustainable environment without dramatically new technology

• The US can only be the preferred place to invest and the place to hire the best workers if we maintain technological leadership and leadership in meeting exploding demands for lifelong education.

• Gains in health and reduced morbidity depend on technology
Ground Rules:

• Analysis is not a substitute for values
• Don’t confuse the problem of: (a) not having solid analysis on which to base decisions and (b) having decisionmakers ignore the analysis.
• Uncertainty must be explained and the risks clearly understood. It is not an excuse for inaction
• Technical leadership demands a rough and tumble marketplace for ideas, with multiple opportunities for getting ideas and getting reviews and criticism.
Federal S&T Advice

• Congress:
  – GAO, CBO, CRS (OTA the late lamented)
  – Hearings
  – Staff rolodex
  – Google

• Administration
  – OSTP (PCAST)
  – Advisory Panels

• The National Academies

• The press, NGOs, interest groups
Trying to Separate Analysis and Politics: Some Tough Examples

• National security technology: are we getting our priorities right?
• Biological research: will we be fast enough to react to new opportunities and threats?
• Energy and the environment: will the dead hand of the past drag us down?
Focusing on Security Priorities

• What are the greatest threats to US security now and in the foreseeable future?
• What capabilities are most important for security our interests?
• How do these translate into research and development priorities
• Are we willing to look beyond Cold War debates and be honest with ourselves?
Weapons in Space

• Potential for major ideological battle:
  – We must prevail in all battle spaces
  – We must expand areas free of weapons

• Some answerable issues: Would US security interests be enhanced or hurt by putting active weapons in space?
  – Cost-effectiveness (e.g. re-launch vs active defense)
  – Debris issues
  – Impact on reliability of critical communications/intelligence
  – Impact on critical civilian infrastructure
Demand for New Nuclear Weapons

• Potential for major ideological battle:
  – We can’t give in to pacifist demands vs
  – Nuclear weapons are inherently evil

• Some answerable issues: Would US security interests be enhanced or hurt by putting a program to develop new nuclear weapons?
  – Impact on proliferation goals
  – Would bunker-busting nuclear weapons provide anything of tactical value?
Personnel Performance & Training

Tactical Decision Making Under Stress

40% improvement in situation awareness
• 25% improvement in communication skills
• 35% improvement in teamwork skills
• 40% improvement in tactical decision making
• 50% fewer shipboard instructors required
• 90% less exercise setup time
• 40% less time to master skills
New Frontiers in Biology

• This is not at all like physics and engineering
• Nearly everything is dual use
• No security tradition, culture of publishing everything
• Huge room for misunderstanding
Stem Cells: The Rhetoric

Stem cell research:

– is like human cloning/ starts a slippery slope toward cloning (confusing germ-line and somatic cells)
– will increase abortion rates (confusion over origin of the stem cells)

Stem cells can soon be produced from adult tissue obviating embryonic tissue

(misinformation about the difficulty of achieving this, embryonic research essential for progress)
Stem Cells

August 9, 2001 Policy: Only an approved set of pre-existing stem cell colonies could be used by anyone receiving Federal research funds.

60 August 9 announcement
78 Revised administration count
   -7 Determined to be duplicates
   -17 Failed to grow or withdrawn
   -31 Held at foreign labs unwilling to ship to U.S. researchers
   -8 Not available to researchers today, but may be in the future

__________________________________________________________________________

15 Stem cell colonies actually available to researchers today

BUT none can be used for human therapy because ALL are contaminated by being cultured with mouse cell lines.
Dual Use in Biology

Essentially all the equipment and materials needed to develop dangerous biological agents have legitimate uses in a wide range of scientific research and economic activity.

• Microbes may be manipulated to make them more dangerous and easier to use—i.e. resistant to antibiotics, or more virulent.
• Dangerous viruses may be artificially created with common molecular biological techniques.
• Novel drug delivery devises can be made to deliver bioweapons—i.e. aerosols, and gene therapy.
Mousepox Example

**Scientific Goal:** Use the mouse pox virus to immunize mice against a protein on their eggs, rendering them infertile, and subsequently controlling the mouse population.

**Experimental Technique:** Insert a mouse egg protein into the mouse pox virus triggering an immune response against the virus and mouse eggs.

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**Mouse egg gene**

**IL-4 gene**

**Mouse Pox Virus**

**Mice infected with the engineered mouse pox virus**

**IL-4:** Interleukin-4 is a protein involved in immune response. The hypothesis: IL-4 would enhance the immune system response against the mouse egg protein.
**Poliovirus Example**

Experiment: Synthesize Poliovirus from scratch with small bits of mail ordered DNA designed from sequence downloaded off the internet.

Lab-created Poliovirus:
- Killed mice
- Almost indistinguishable from the original
Open Issues:

- Did the researchers do an adequate job considering the unintended and potentially deleterious consequences of their research?
- Should the research have been published?
- When/how do scientists learn about biosecurity and the security implications of their research?
- Should there be oversight of biological research, and by whom?
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Stem cells can soon be produced from adult tissue obviating embryonic tissue

(misinformation about the difficulty of achieving this, embryonic research essential for progress)
Stem Cells

August 9, 2001 Policy: Only an approved set of pre-existing stem cell colonies could be used by anyone receiving Federal research funds. Claims that 60 lines are available (later revised to 78)

Revisions

- 7 Determined to be duplicates
- 17 Failed to grow or withdrawn
- 31 Held at foreign labs unwilling to ship to U.S. researchers
- 8 Not available to researchers today, but may be in the future

15 Stem cell colonies actually available to researchers today*

* none can be used for human therapy because ALL are contaminated by being cultured with mouse cell lines.
Environmental and Resource Issues

• May be the most contentious issue of the 21st century, key to security, economic development, regional tension, relative prosperity of nations

• Paralyzed by ancient feuds and tribal warfare

• Technology is the only way out
Why Care about Climate Change?

- 2-4°C warmer than now by 2100. Mid-continent warming will be 2-3x greater
- Sea level will be 20-100 cm higher than today (best estimate 50 cm).
- Unpleasant surprises
- Impacts:
  - Productivity of farms, forests, & fisheries
  - Geography of disease
  - Livability of cities in summer
  - Damages from storms, floods, wildfires
  - Property losses from sea-level rise
  - Distribution & abundance of species

Source: IPCC, John Holdren, 2004
Carbon Dioxide Concentrations

Ice Core Data

Mauna Loa (Hawaii)

parts per million

1860 1880 1900 1920 1940 1960 1980 2000
Open Issues

• Does uncertainty demand inaction?
• How do we understand the risks of action vs. inaction?
• If Kyoto is deeply flawed what are better options?
• The real debate should be over finding solutions that advance productivity and the environment.
Energy Supply Options: Problems Everywhere

Fossil:
- Lots of it but at what cost ($ and environmental)

Nuclear:
- Safety and waste disposal manageable, let the market manage the economics
- Fuel cycle security issues a major problem

Hydrogen:
- Not a supply option but an energy carrier/storage option

Renewables:
- How much at what price
Energy and the Economy

- Advances in biotechnology, nanotechnology and information technology can lead to huge gains in productivity (including productivity of use of energy)
- Underinvestment in R&D (particularly in older industries that tend to be the most energy intensive)
- Policy paradox: the best solution (raise the price and let the market do it) is a political dead end. All “second best” solutions are more complex and involve federal investments and intervention in the marketplace (politically difficult but possibly not impossible)
Next Generation Manufacturing

On-demand assembly of complex objects

• Assembly of complex materials starting with widely available, and/or renewable materials

• biodegradable waste
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Federal Advisory Committees

- About 1000 Committees (down from 5000 in 1972)
- >50,000 people serve on them
- 1500 FTEs of staff time to support
- Cost $281M/year
- Freedom of Information Act (1966) and Federal Advisory Committee Act (1972) established uniform procedures
Federal Advisory Committees:

Criticism:

“What's unusual about the current epidemic is not that the Bush administration examines candidates for compatibility with its "values." It's how deep the practice cuts; in particular, the way it now invades areas once immune to this kind of manipulation.”

Donald Kennedy, editor of Science

• Bias in selection of members
• Closed meetings
• Incomplete publication of results

Solutions:

• Explicit break between political advisors and external reviewers
• Selection and review by external groups
• Publish and public review of prospective members
• Increased reliance on private foundations?
The President’s Science Advisor and OSTP

• Checkered history
• Role & Powers far from those available to the NSC advisor
• Few professional staff survive changes of administration
Hart-Rudman Recommendations

• Strengthen role of President’s Science Advisor
• More active science and technology advisory panel with a significant professional staff
• Reorganize of the National Laboratories to serve new missions and roles

National Security/21st Century (Hart-Rudman Commission)
Secrecy Policy: What’s at Stake

- Free exchange of information and ideas is an essential element of research – for testing ideas
- Access to information is essential for the democratic process to function
- Information about key defense technologies can gravely compromise security
Secrecy Policy: The Criticism

“The possibility of excessive restrictions on scientific publication, motivated by security concerns, [poses ] clear threats to science today…. Some of the plans being proposed could severely hamper the U.S. research enterprise and decrease national security”

Bruce Alberts, NRC
Guiding Principles

• Is the information otherwise available in public domain? (Or can it be readily deduced from first principles?)

• Is there specific reason to believe the information could be used by terrorists? Are there countervailing considerations that would militate in favor of disclosure, i.e. could it be used for beneficial purposes?

• Is there specific reason to believe the information should be public knowledge to improve public oversight of environmental or other matters?
This works pretty well:

- AEC act, Espionage Act, Intelligence Identities Protection Act, others provide statutory authority
- The Freedom of Information Act (FOIA) public right to access agency records, subject to applicable exemptions.
- Executive Order 12958 Classified National Security Information 1995 amended by Executive Order 13142, 1999
- Interagency Security Classification Appeals Panel (ISCAP).
Sensitive But Unclassified

- ..departments and agencies maintain and control sensitive information related to America's homeland security that might not meet one or more of the standards for classification set forth in Part 1 of Executive Order 12958.

- The need to protect such sensitive information from inappropriate disclosure should be carefully considered, on a case-by-case basis, together with the benefits that result from the open and efficient exchange of scientific, technical, and like information.

DoJ March, 2002
Essential Elements of Information Security

- Clear set of principles guiding protection of information developed by an open process
- Clearly defined and transparent procedures for applying these principles
- A clear appeals process overseen by an organization not under the control of the agency making the original ruling
Congressional Advice: The Criticism

• Can Congress operate effectively as an independent branch of government without an ability to undertake independent S&T analysis? Deterrence?

• Risk that special interest influence grows if independent analytical capabilities wither

• Concern that virtually all Committee Hearings have become little more than PR events
Potential Solutions

- Expanded role for NAS
- Expand experiments at GAO
- Reinvent OTA
- Privately funded analytical groups (e.g. new MacArthur centers, science fellows, etc.)
A Separate Front

• Absence of a clear career path for anyone interested in science and technology policy

• Few universities have programs that can prepare people with the needed technical, policy, and communication skills
Where to Go From Here

- Truth is an illusive and ephemeral beast BUT
- If we lose faith in the process of dispassionate analysis we abandon the field to a collision of special interests
- It’s essential to encourage debate and competing analysis. If we punish critics as disloyal we will pay a heavy price.
- It’s time to talk about structural improvements that would make sense for any administration
- We’ve got to get this right!
FOIA exemptions

1. criteria established by an Executive order to be kept secret in the interest of national defense or foreign policy and (B) are in fact properly classified pursuant to such Executive order;
2. related solely to the internal personnel rules and practices of an agency;
3. specifically exempted from disclosure by statute
4. trade secrets and commercial or financial information
5. [material ] would not be available by law to a party other than an agency in litigation with the agency;
6. personnel and medical files and similar files [constituting an ] invasion of personal privacy;
7. records or information compiled for law enforcement purposes [narrowly defined
8. [material prepared for ] regulation or supervision of financial institutions; or
9. geological and geophysical information ..concerning wells.
Toxic Chemical Information

- **Emergency Planning and Community Right-to-Know Act (EPCRA), 1986** establishes State Emergency Planning Commissions and Local Emergency Planning Committees to help prepare for chemical releases.

- **Clean Air Act Amendments, 1990** requires each facility that has chemicals on-site above specific thresholds to prepare a risk management plan, specify the quantities of chemicals that may be released, potential population exposures, and develop “worst case scenarios”.

- **EPA has four criteria for assessing the sensitivity of our information resources:**
  - **type** (location, volume, acute effects)
  - **specificity** (level of detail provided)
  - **connectivity** (utility for building a scenario)
  - “availability” of information in other public sources