S&T Research Funding In A Rule-Changing World

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Research under fire: In the war on terror, academic freedom could wind up as collateral damage

By Barry Bergman, Public Affairs

The University of California's credo, "Fiat lux" ("Let there be light"), celebrates the power of knowledge. Federal officials, however, mindful that power is a double-edged sword, seem intent on imposing an alternate, post-9/11 credo on those who conduct university research: Let there be licenses.

In an age when data can be dangerous, the Bush administration is clearly concerned with keeping classified information out of the hands of America's enemies, terrorist networks to hostile regimes. But university officials warn of a dimly grasped threat from the U.S. government itself, having less to do with legitimate security worries than with a needless clampdown on academic freedom — including moves to bar non-citizens, and even foreign-born U.S. citizens, from participating in an ever-expanding list of university research.

Beyond funding levels, fundamental shift in how S&T R&D is done in the US!

January 27, 2005: UC Berkeley News: Berkeleyan, Barry Bergman, "Research under fire: In the war on terror, academic freedom could wind up as collateral damage."


April 10, 2005: Washington Post, Rick Weiss, "Our Incredible Shrinking Curiosity"


April 15, 2005: New York Times, Tom Friedman, "Bush Disarms, Unilaterally"

April 17, 2005: San Jose Mercury News, Editorial, "Quiet change in priorities poses dire threat"

April 17, 2005: Seattle Post-Intelligencer, Editorial, "Investing in Research: A lose-lose deal"

April 20, 2005: Roll Call, Norman J. Ornstein, "Bad Policy Choices Are Worrisome for U.S. Economy's Future"

April 25, 2005: Roll Call, Morton M. Kondracke, "Congress Must Increase Bush's Science Budget" (paid subscription req'd) -- coverage of the article on CRA's Computing Research Policy Blog

April 2005: Communications of the ACM, David Patterson, "President's Letter: The State of Funding for New Initiatives in Computer Science and Engineering"

May 6, 2005: Science, Edward Lazowska and David Patterson, "An Endless Frontier Postponed" -- Coverage of the article on CRA's Computing Research Policy Blog

May 6, 2005: Los Angeles Times, Editorial, "The Imagination Drain"

May 11, 2005: Business Week, Matthew Fordhal, "Scientists complain about Pentagon cuts"


August 2005: Communications of the ACM, Sanjeev Arora, Bernard Chazelle, "The Thrill is Gone?" (pdf)
The Known World

• Federal Agencies:
  – Highly decentralized with individual subcommittees that have funding oversight over individual agencies
  – National Science Foundation
  – NIH, DOE, NASA, DoD, USDA, etc.
    • About $68B out of which about $5B is general R&D (6.1)
      – Singapore is $2.4B (2004)

• States
  – Economy-driven initiatives

• Industry Research Laboratories

• Industry and Industry-Participated Consortia
  – Competitive pressures in pre-competitive landscapes
• Co-founded American Appliance Company in 1922
  – First product was a gaseous rectifier, Raytheon, for RX power supplies
• Professor, EE @MIT 1923-32
  – Differential Analyzer
  – Claude Shannon
  – “As We May Think”: Memex, a microfilm-based mechanized memory device
• Dean of Engineering, MIT‘32-38
• President, Carnegie Institute of Washington 1939
• Pushed for National Defense Research Committee in 1940
  – Managed to meet President Roosevelt on 12 June 1940 and convinced him to build NDRC
• Turned into Office of Scientific Research and Development (OSRD)
  – supervising work of 6000 scientists involved in the war effort…
Origins of the “Research University”

11/17/1944, President Roosevelt asked V Bush:

(1) What can be done … to make known to the world as soon as possible the contributions which have been made during our war effort to scientific knowledge?

(2) … what can be done now to organize a program for continuing in the future the work which has been done in medicine and related sciences?

(3) What can the Government do now and in the future to aid research activities by public and private organizations?

(4) Can an effective program be proposed for discovering and developing scientific talent in American youth so that the continuing future of scientific research in this country may be assured on a level comparable to what has been done during the war?
“Science: The Endless Frontier”

• submitted to President Truman 3/1945
  – Formed the basis of “University, Industry, Government” compact on research and education
  – One of the most persuasively written policy document in the nation’s history
    • “Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress.”
    • Led to the emergence of “Research University”
NSF established 1950

• Three policy pillars
  – Federal support of basic scientific research
  – Role of research universities
  – Federal support of education of young people in science and engineering

• “Research University”
  – “The publicly and privately supported colleges, universities, and research institutes are the centers of basic research. They are the wellsprings of knowledge and understanding.”

• Currently about $5.65B
  – $4.22B for research, $841M EHR, $174 Maj Equip
    • CISE and ENG at about $600M each
Overall Federal R&D Budget FY 2006
$132 billion
+$733 million over FY 05, a 0.6% increase

NITRD component of budget
$2.155 billion
-$101M below FY 05, a 4.5% decrease

Source: AAAS Reports 1 through XXX, based on OMB and agency R&D budget data. Includes conduct of R&D and R&D facilities. Constant dollar conversions based on OMB’s GDP deflators from the FY 2006 budget.
CISE@NSF provides 86% of Federal Obligations for Basic CS Research

- 3X increase in submissions over 5 years
- Pathetic funding rates:
  - ~5% ; ~6% requested $$
  - Theory 05: 11% $70K/yr
  - CCF 04: 5%
  - Cybertrust 04: 8%
  - IDM 04: 3%, FY05: 0%
  - IIS 04: 5%
  - CNS 04: 10-15%
DARPA: Mission Oriented
DARPA

- FY 2005: $2.97B
  - $1.3B is basic research, $1.6B is applied research
    - Materials and Electronics is about $0.5B

- FY 2006: $3.08B => $2.8B
  - $1.4B basic, $1.5B applied
    - All computing related money to Cognitive Computing ($200M)
      - Latest: $55M cut from $114M
    - Electronics at $241M
      - Network centric warfare is a growth component.
DARPA Support for IT Research

~125M for FY05

43% reduction in 5 years.

DARPA response to SASC, 4/2005
State Participation

• Goes long back: 19th century
  – land grant universities that focused on agriculture and technology
• Feds took dramatic lead during WWII
• IT boom enabled states to get back into the action
  – Even as feds withdrew to 0.9% of GDP from 1.5% in 1965
The Consortia

• “A loose long-term alliance between competitors in a given industry”
  – Modestly budgeted than company alliances
  – Often non-profit (or marginally so)

• Enabled by the National Cooperative Research Act 1984
  – Quite a bit of international dynamics: Japanese TRA, EU
  – But variations in tax-payer support (Japan: 53%, US: 17%)

• Some ‘successful’ models
  – Well-defined pre-competitive technology developments (SEMATECH)
  – Centers that form consortia for solving well-defined technical problems (IMEC)
  – Endowed Institutes and University Centers
    • (Cal Institutes for Science and Innovation: CITRIS, CalIT2, CNSI, QBIC; Albany NanoTech; Texas Tech Initiative)

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SEMATECH

• 1986: US share of semi market was project to reach 20% by 1993
  – DSB and SIA contributed to the overall noise against the Japanese
• 14 companies accounting for 80% of US semi industry banded together
  – Strange bedfellows bounded by a common threat
  – Goal: “To provide the US Semi industry the capability of achieving world-leadership manufacturing position by the mid 1990s.”
  – $100M/year from US, 1% of sales ($1M-$15M)
    • $200M/year operating budget
• By 1993, US Semi overtook Japan
  – by 1996: US: 44%, Japan: 36%
  – Execution, Central research facility key to its success.
A Rule-Changing World: Shifting priorities of a nation at war

• Goals of technology policy are changing
  – Pre 9/11:
    • We need technology advantage for a superior military
    • Collateral commercial developments are a good thing
  – Post 9/11:
    • We have technology advantage. We need deployment.
    • A deepening paranoia of the foreigners among our midst

• Partly driven by “neocon” dislike for centrally organized anything
  – A (minority) thought that never really bought the endless frontier.
    • Cf: @Cato & Hoover;
      • Donald Kennedy on “Riding through the Endless Frontier –Right past the students”

• Partly by a palpable political sense that science is getting in the way of policy (and ethics)
  – Not really laughable concerns. Cf: Bill Joy
Annual Degrees and Job Openings in Broad S&E Fields


Percentage of freshmen interested in CS

Difficult getting attention of students

Asian PhD’s Are Staying Home
Closing Thoughts

• What is the role of “unsolicited” research?
  – Agencies routinely engage in divining future
  – Picking up technology winners by committee or worse
    • Plenty of humbling experiences in predicting technology winners: General Magic, Telecosm, MCC, FGCP

• Shrinking co-investments are altering the R&D ecosystem
  – While small in magnitude, federal R&D leadership is the catalyst for the much larger R&D engine to keep going
    • Example: CISE/NMS $3-5M; SRC at $40M
      – versus $900M (WW) ITRS related spending

• What are the good models to effectively advocate S&T policy?
FUD?

1984

2005
Star sickness
Celebrities speaking out about their afflictions can raise awareness and money.

By Mark Ebner and Lisa Derrick
Nov. 29, 1999

Celebrity is a fleeting thing, fragile and impermanent. And health, like elusive fame, can vanish in an instant, leaving the subject weakened and bereft. Stardom and illness have united in banquet halls and the halls of Congress to raise money for and awareness of everything from Alzheimer's to osteoporosis. Disease-stricken celebrities have put a familiar face on infirmities that otherwise hovered below the high-profile funding radar.
Until recently, for instance, Parkinson's disease was just a shaky blip in the National Institutes of Health's budget, despite the more than 1 million victims of the neurological illness. In 1998, the NIH research funding for Parkinson's was $41 million (or $41 per person afflicted), …