# “Trends in Federal Funding of University Research"

**Kickoff Talk**
**EECS Department Retreat**
**University of California, Irvine**
**September 19, 2005**

**Dr. Larry Smarr**
**Director, California Institute for Telecommunications and Information Technology**
**Harry E. Gruber Professor,**
**Dept. of Computer Science and Engineering**
**Jacobs School of Engineering, UCSD**

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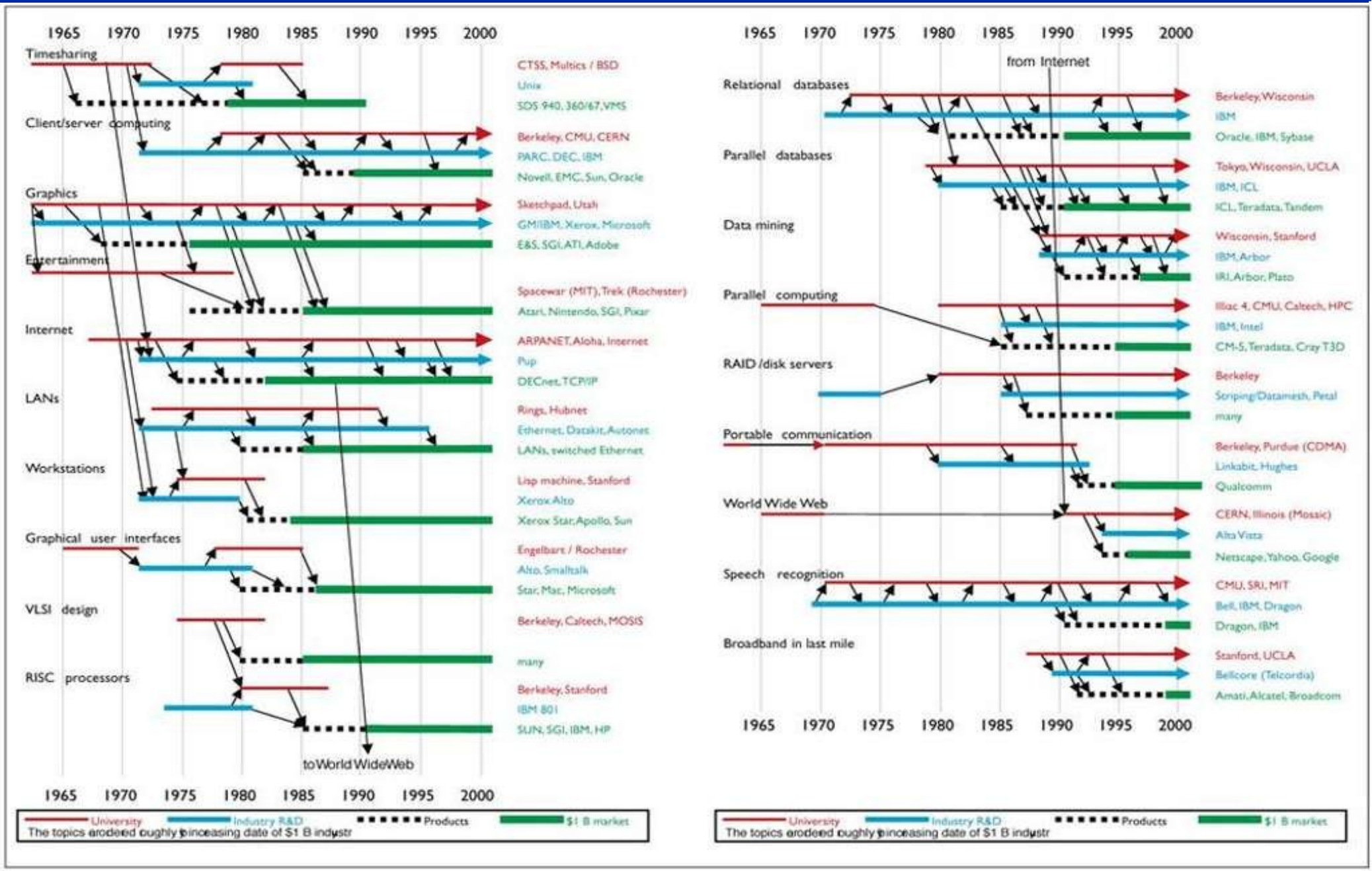
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# Calit2 Has a New Project to Study Research Funding Trends Supporting University Research and Education

- **We Collect Trend Data from Major Studies**
  - Scientific and Engineering Societies: AAAS, CRA,
  - Government Agencies: CBO, GAO, NSF Science Indicators
  - Academy Complex: NRC, NAS, NAE, IOM
- **Commentary from the Community**
  - Science Editorials, Op-Ed Pieces
  - Other Presentations By Community Leaders
- **We Use to Frame Future Problems and Opportunities**
- **Special Thanks to:**
  - Ed Lazowska, chair CS Dept. UWash, co-chair PITAC
  - Stefan Savage, Prof. CSE, UCSD
  - Phil Smith and Forest Baskett, co-chairs Calit2 Advisory Board
  - Jerry Sheehan, Govt. Relations, Calit2@UCSD
  - Albert Yee, Ramesh Rao, Ron Graham, Stephanie Sides--Directors of Calit2

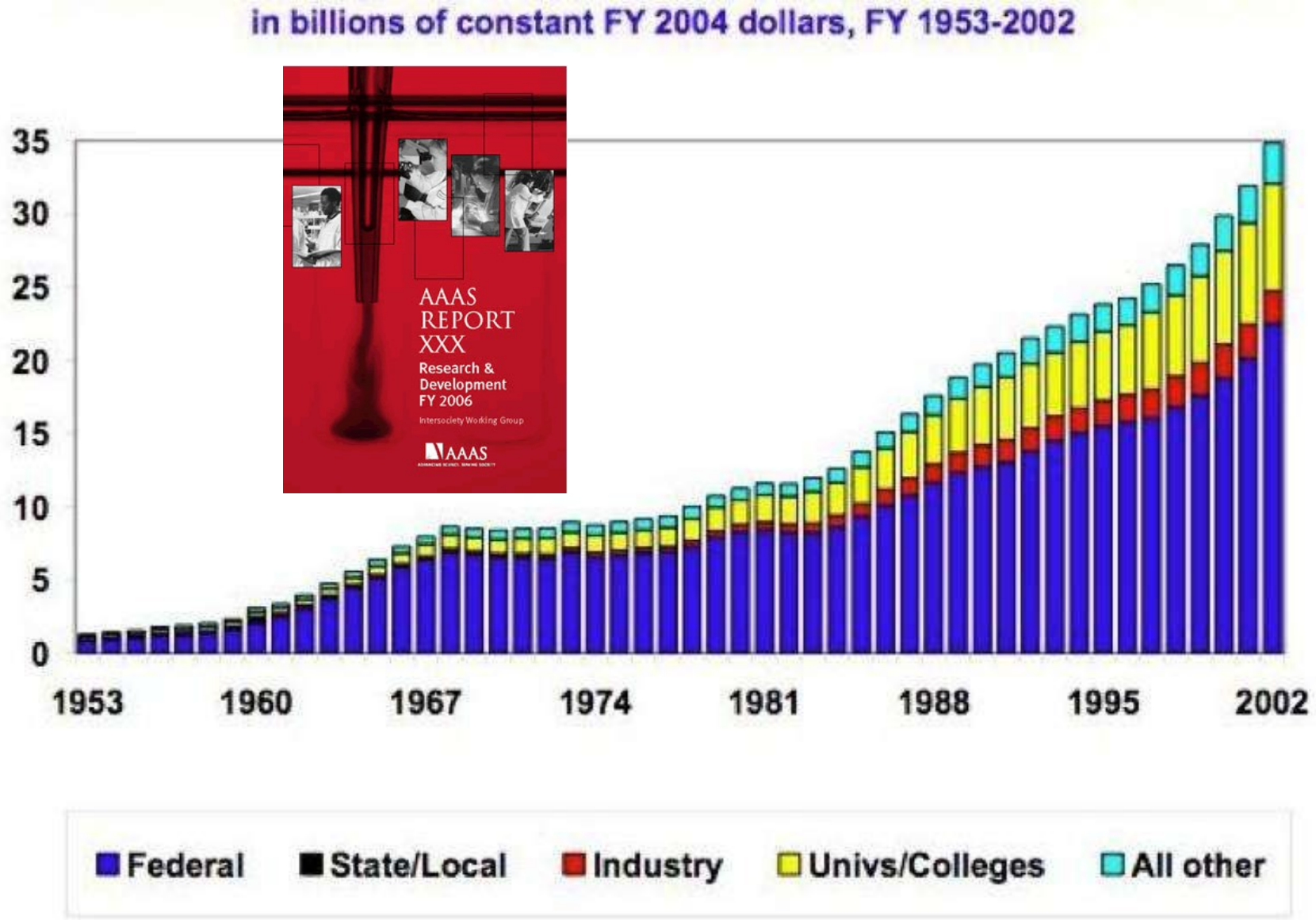
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# Federal Funding to Universities Has Been Essential to the Creation of the IT and Telecom Industries




Source: From [6], reprinted with permission from the National Academy of Sciences, courtesy of the National Academies Press, Washington D.C. ©2003.

# Federal Funding is By Far the Largest Source of R&D Funding at Colleges & Universities




Source: National Science Foundation, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 2002, 2004. (See Table B-1). Constant-dollar conversions based on OMB's GDP deflators.

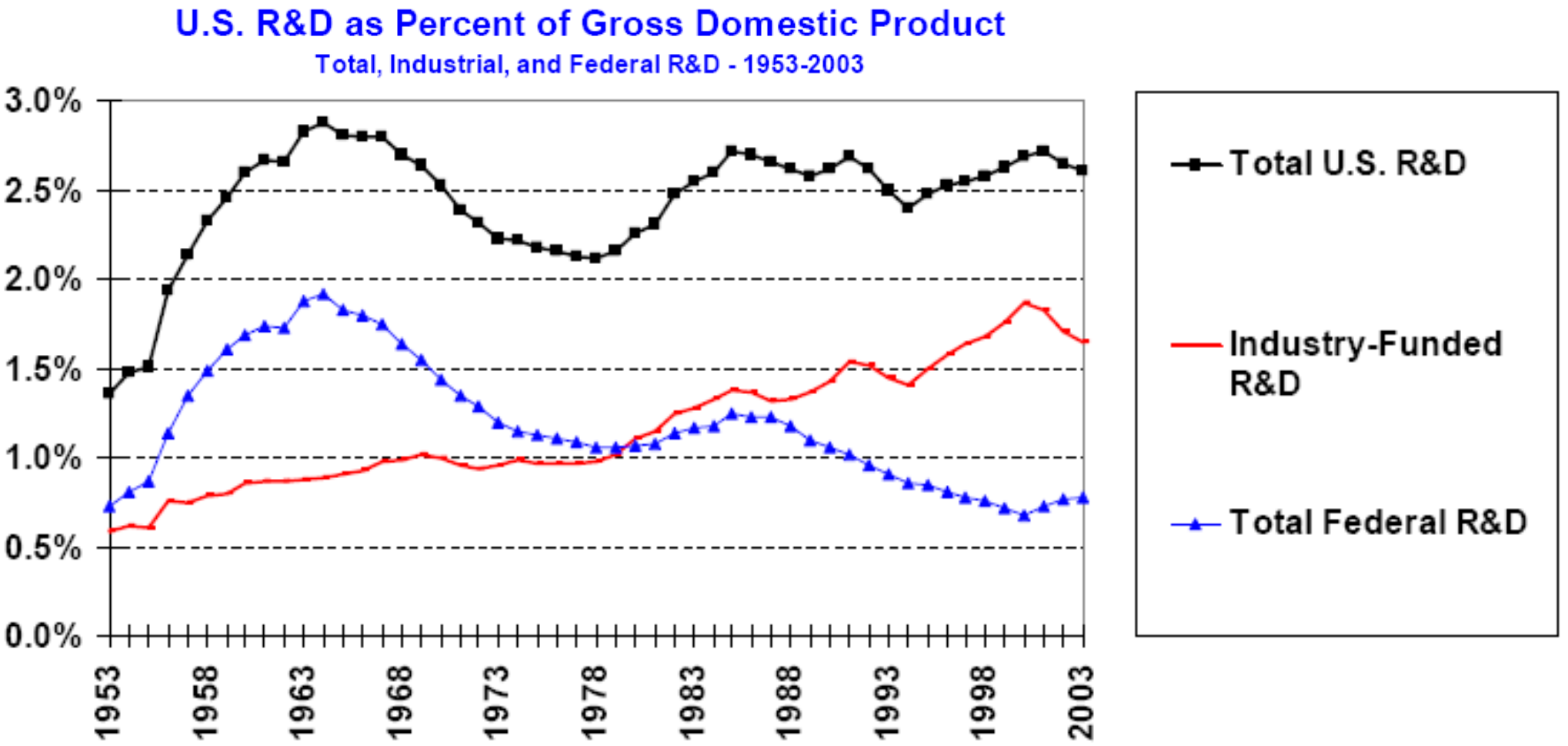
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# While Total US R&D Has Oscillated Around 2.5% of GDP for Fifty Years, Industry Has Risen While Fed Has Fallen



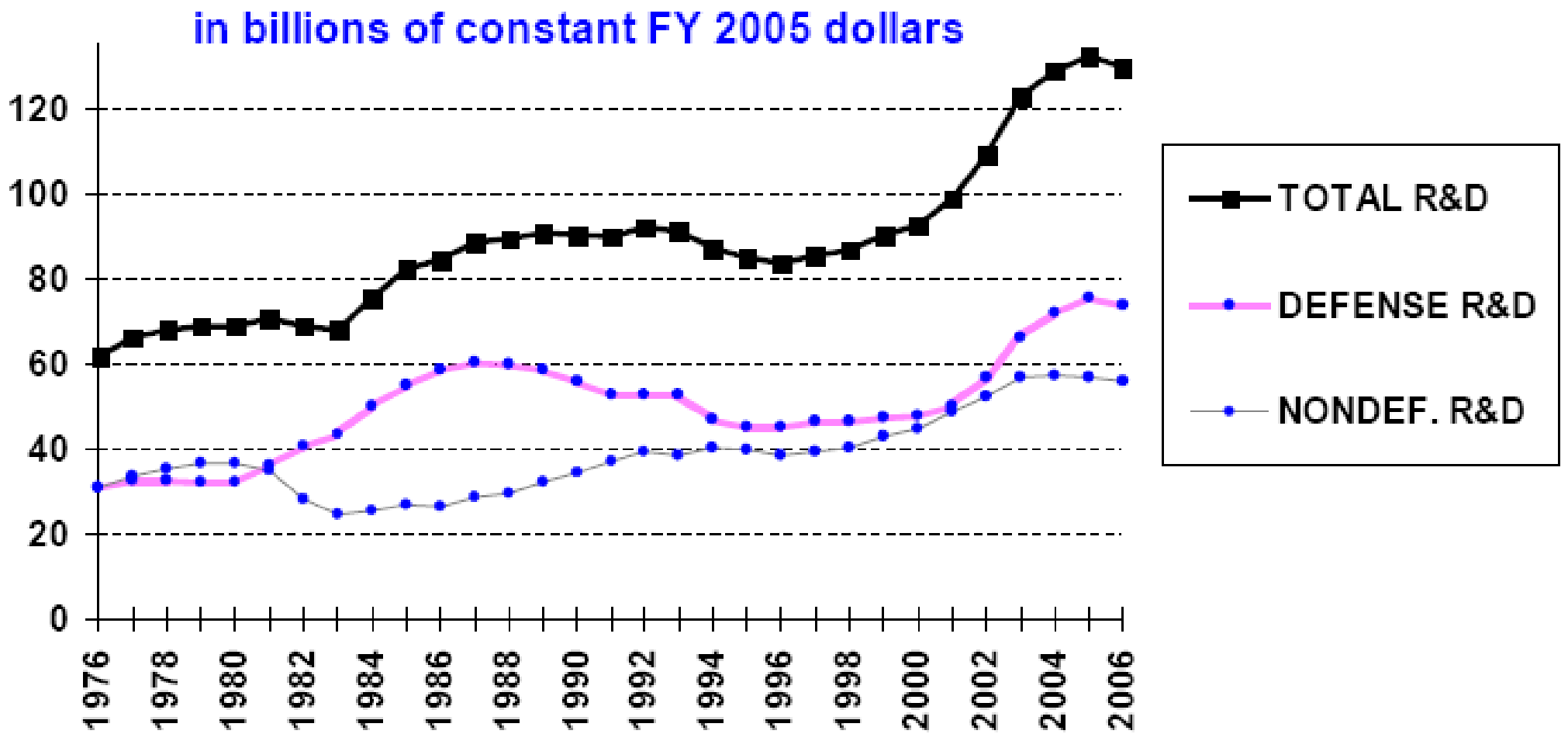

Source: NSF, Division of Science Resources Statistics. 2002 and 2003 data are preliminary. R&D funded by other sources (universities, nonprofits, etc.) included in Total U.S. R&D. Includes defense and nondefense R&D.

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# The Majority of US Federal R&D is Military

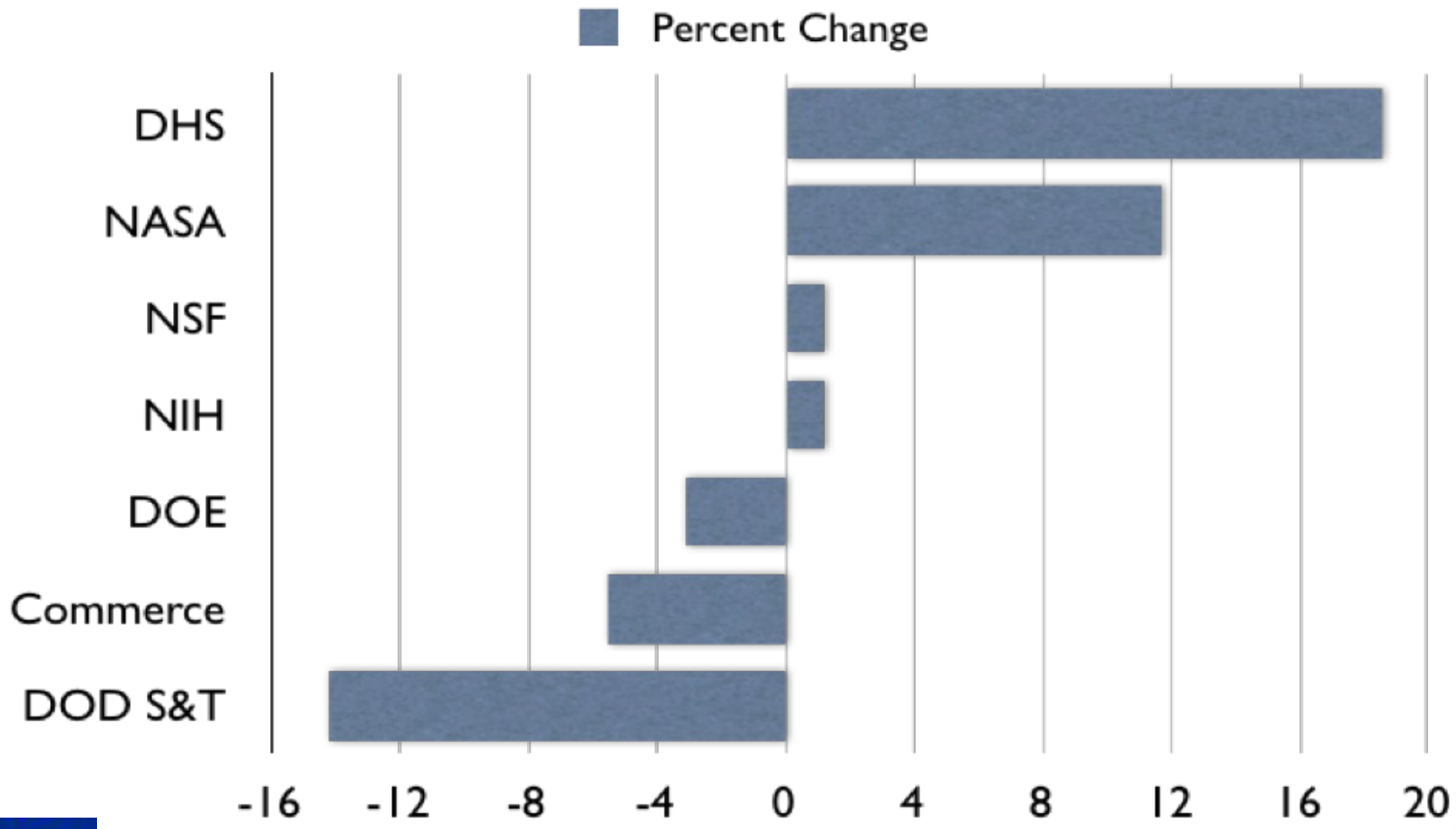



Source: AAAS analyses of R&D in *AAAS Reports VIII-XXX*. FY 2006 figures are President's request. R&D includes conduct of R&D and R&D facilities.
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# DOD Will Greatly Reduce Its Science and Technology Funding

## FY 2006 R&D Request

Percent Change from FY 2005
(basic + applied)

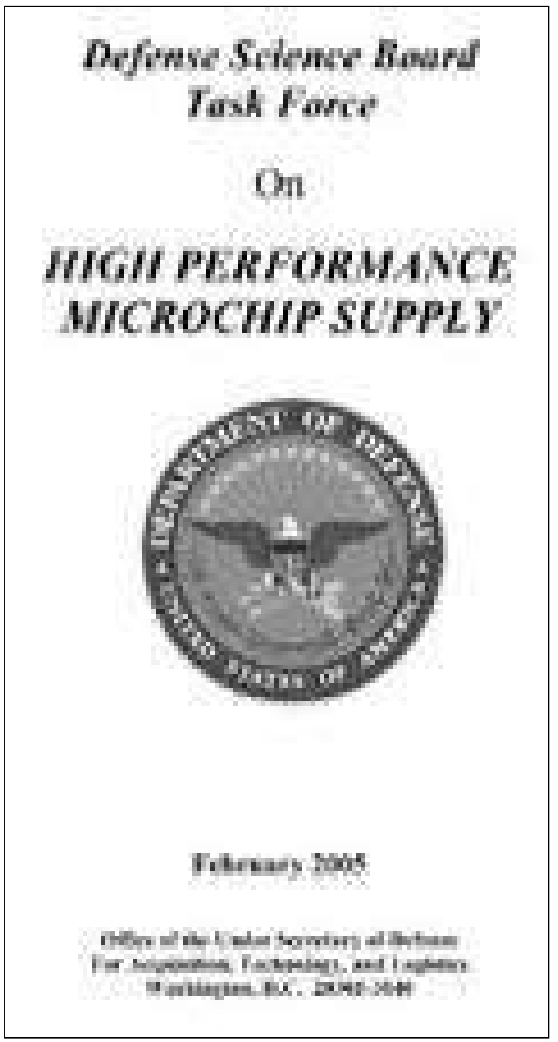



Source: *AAAS Preliminary Analysis of R&D in the FY 2006 Budget*, February 2005

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# DOD Has Pulled Back From Funding Research on High Performance Embedded Processors

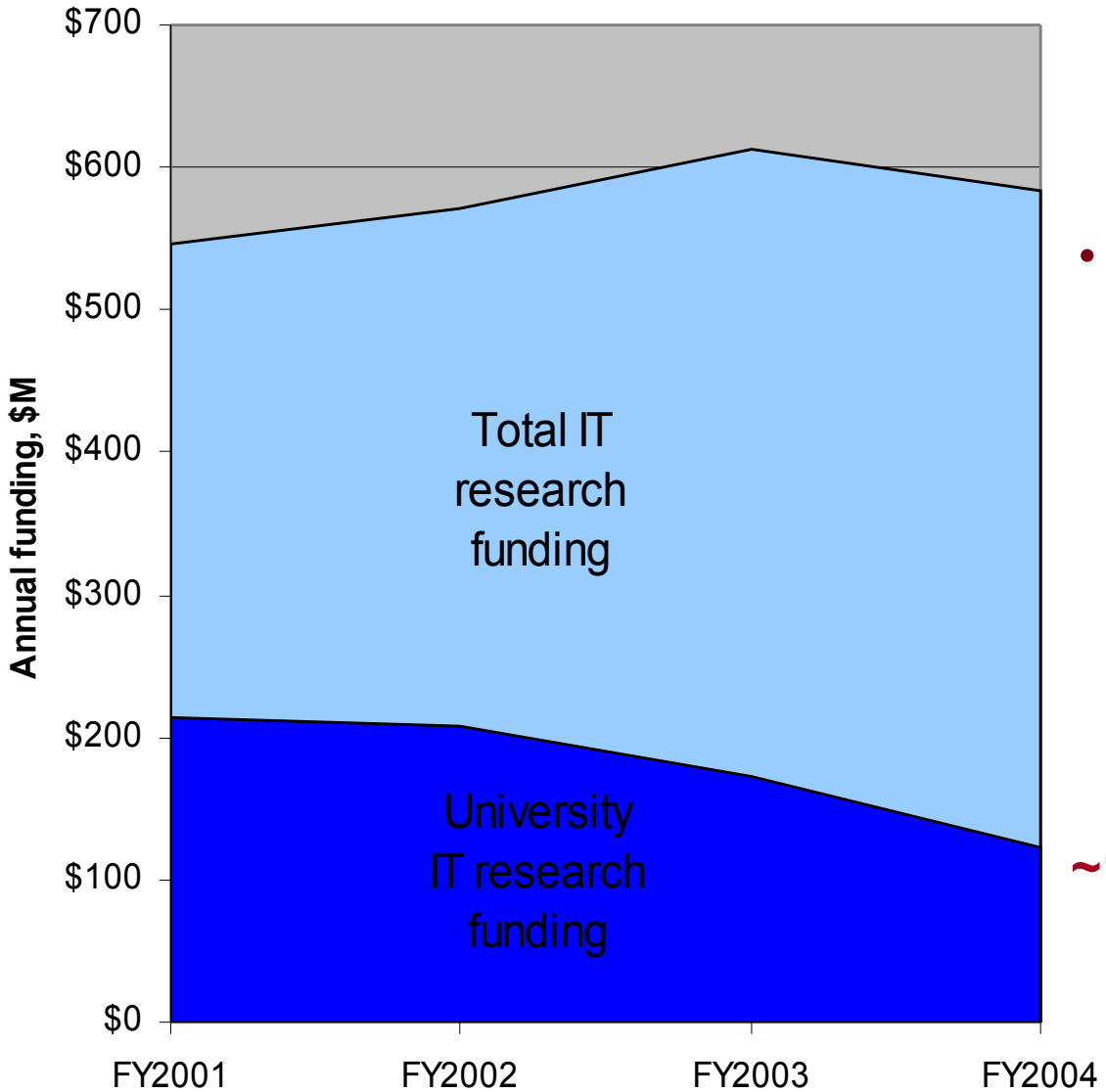
Historically, the rapid rate of growth in U.S. microchip capability resulted from a robust national portfolio of long-term research that incorporated both incremental and revolutionary components. Industry excelled in evolutionary technology developments that resulted in reduced costs, higher quality and reliability and vastly improved performance. DOD now is no longer perceived as being seriously involved in – or even taking steps to ensure that others are conducting – research to enable the embedded processing proficiency on which its strategic advantage depends. This withdrawal has created a vacuum where no part of the U.S. government is able to industry and the nation as a whole, is that no effective leadership structure has been substituted. Instead, research in these fields is managed through a hodge-podge of programs spawning numerous government agencies. The President's budget includes "cross-cuts" of the government's Nanotechnology (the NNI) and IT (the NITRD) research investments, each of which is stitched together by committees representing the participating agencies. However, there is no unified source of leadership that can mount revolutionary programs, let alone ensure that the DOD's future requirements for programmable microchips will be met.




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# DARPA's Support In University IT Funding Has Been Greatly Reduced




- **University Participation is Dramatically Decreasing**
  - **Classification of Programs**
  - **Shortened Research Horizon**
  - **12-month Go/No-Go Evaluations**

**~125M for FY05**
**a 43% reduction in 5 years!**

**Source: Ed Lazowska, Co-Chair PITAC**

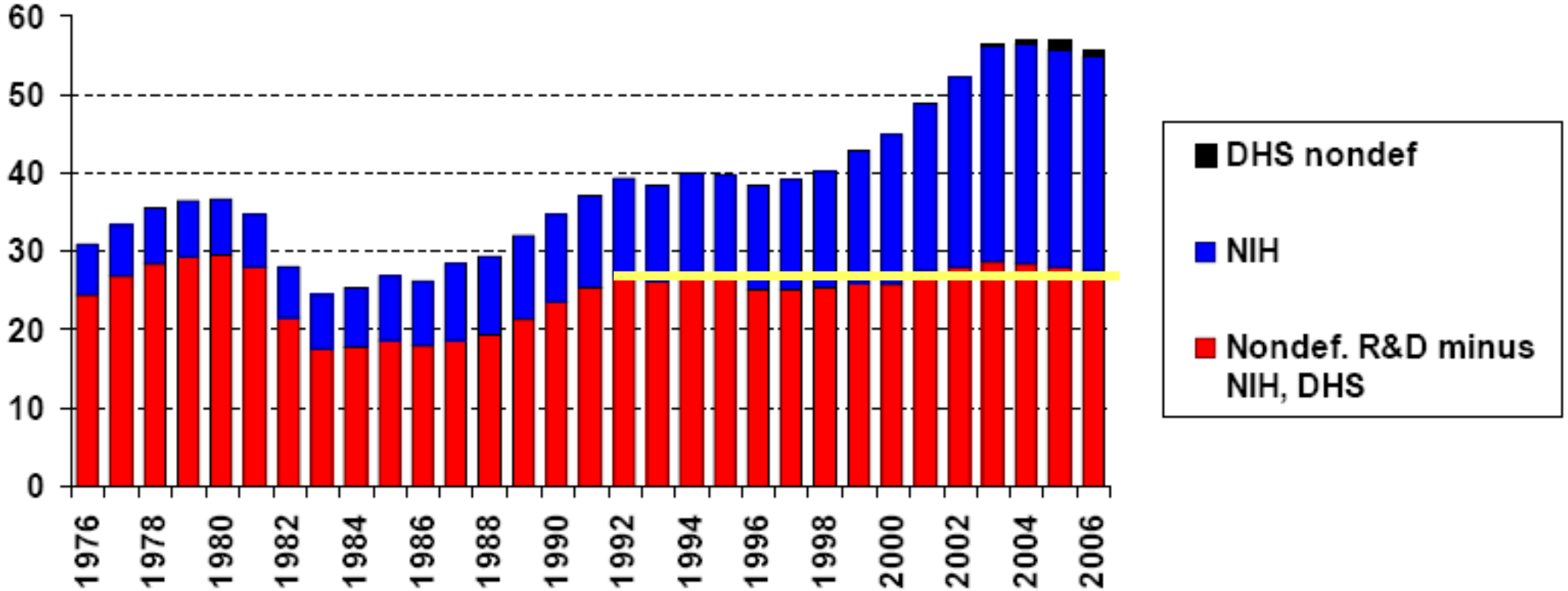
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# Non-Defense Federal R&DFunding Has Been Flat for 15 Years Except for NIH

in billions of constant FY 2005 dollars




Source: AAAS analyses of R&D in *AAAS Reports VIII-XXX*. FY 2006 figures are President's request. R&D includes conduct of R&D and R&D facilities.
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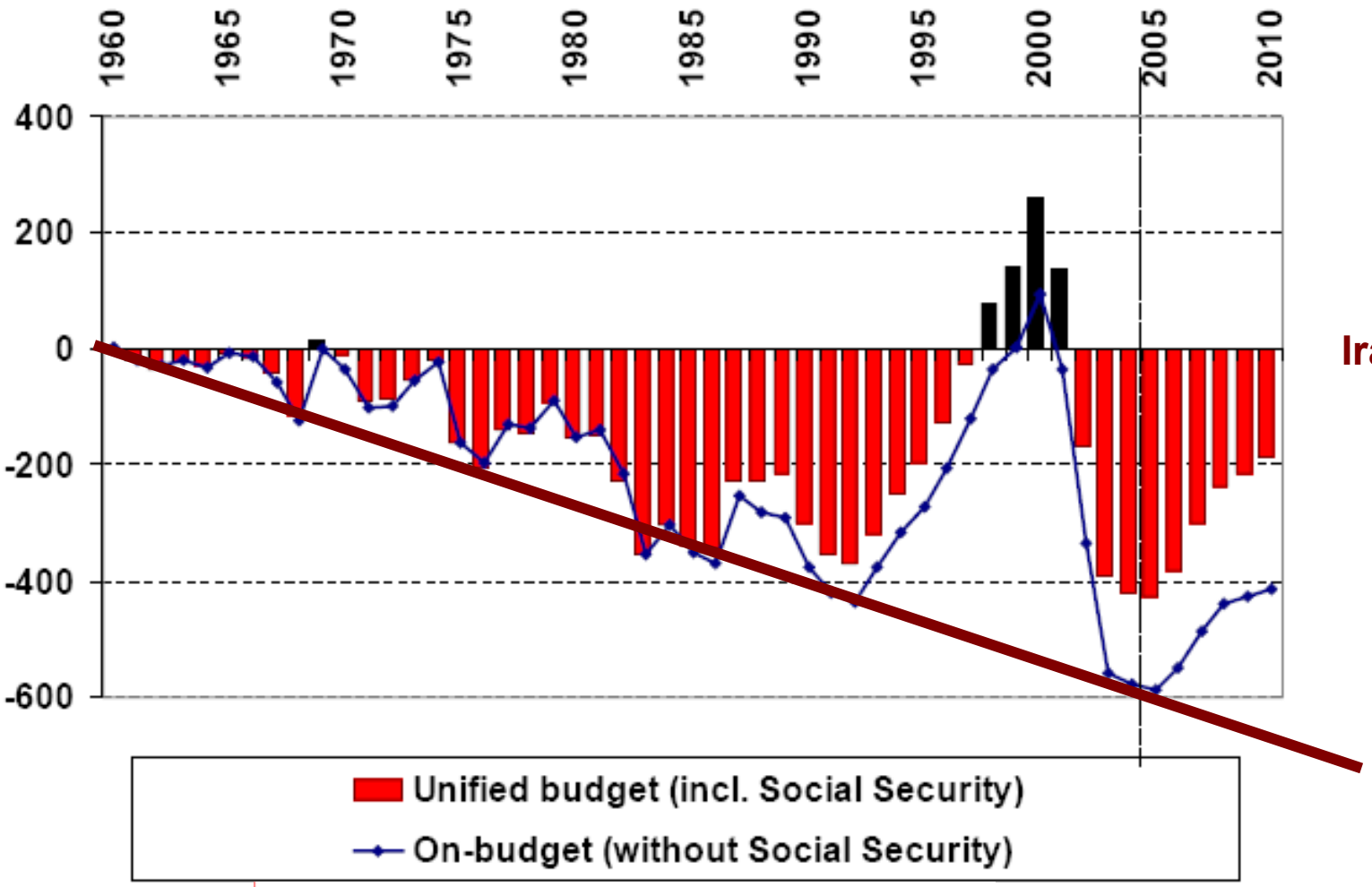
# Major Multi Agency R & D Initiatives Funding Will Decline in FY06

- National Nanotechnology Initiative -2.8% ($1.1B)
- Networking and Information Technology R & D -4.5% ($2.2B)
- Climate Change Science Program -1.4% ($1.9B)

# The Federal Budget Deficit Over Fifty Years -- The Squeeze on Discretionary Funding Will Increase

## Federal Budget Deficit (or Surplus), FY 1960-2010

in billions of CONSTANT FY 2005 dollars




**Note This**
**Does NOT Include:**
**Iraq/Afghan Supplement,**
**Disaster Relief,**
**or Tax Cut Extensions**

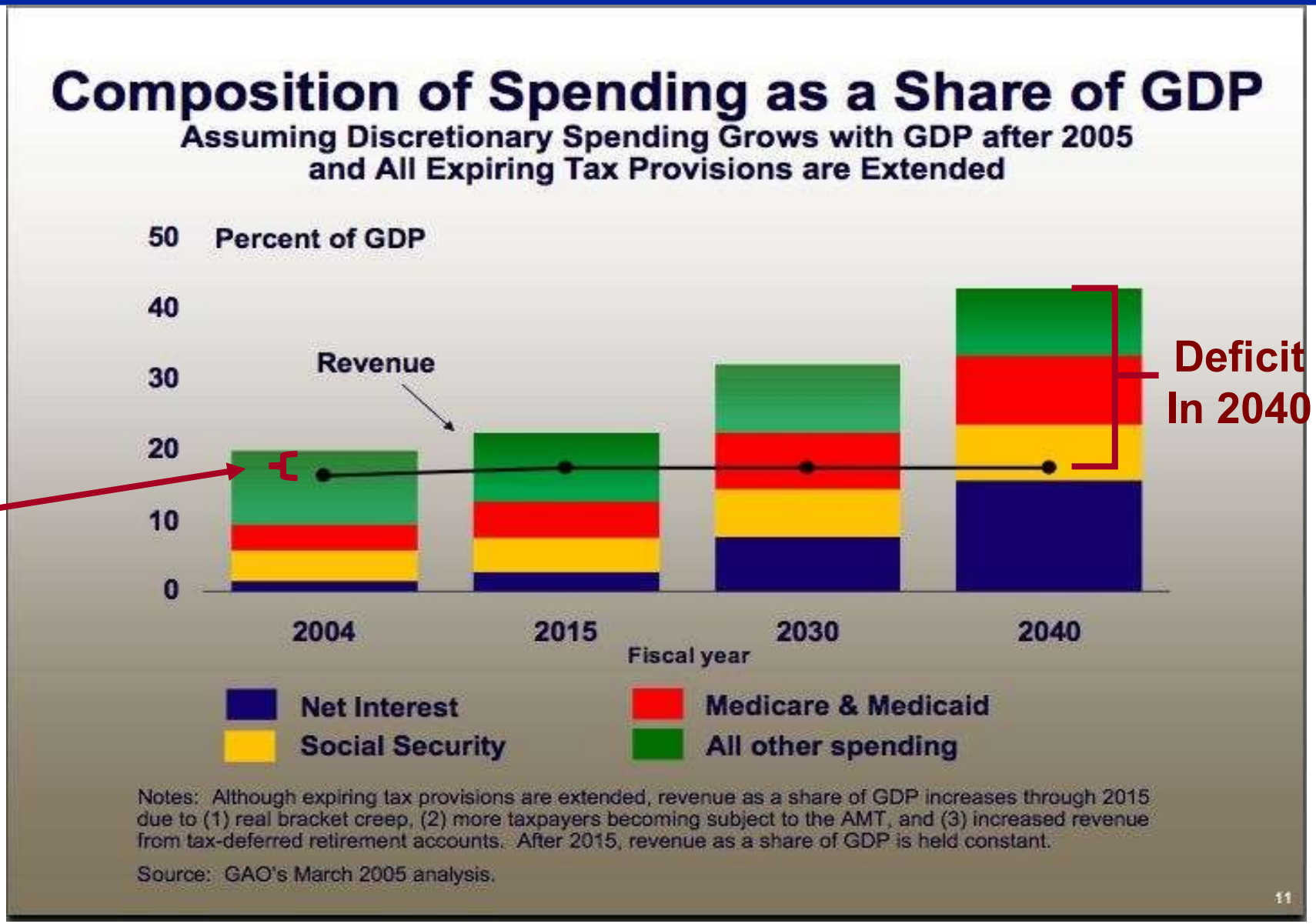
Data in fiscal years. Source: *Budget of the United States Government, FY 2006.* FY 2005 data are estimates. FY 2006-2010 data are budget projections. FY 2006 - 2010 figures exclude Iraq occupation costs, extensions of expring tax cuts, and Social Security reform.

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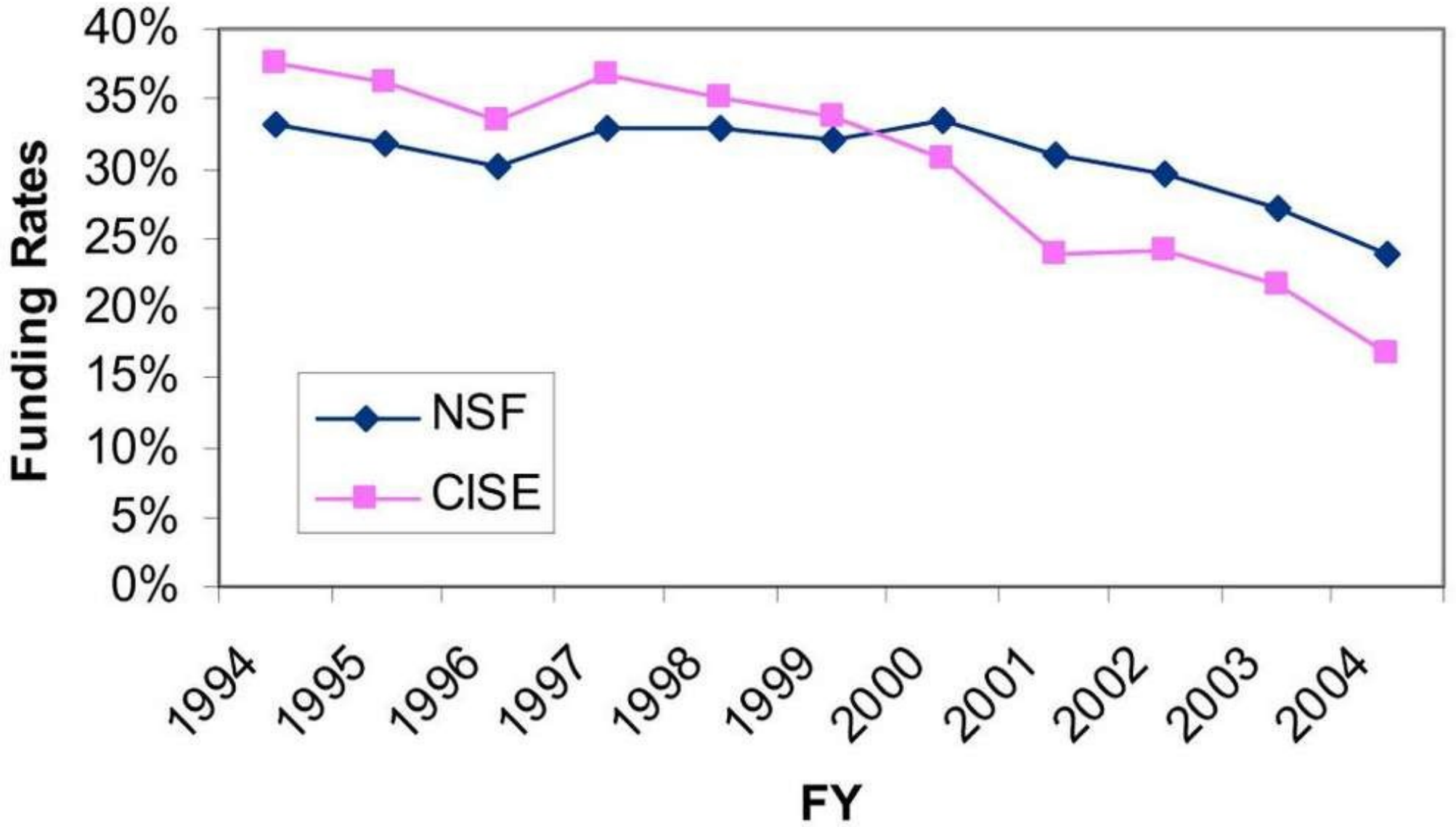
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# If Tax Cuts are Extended, the Deficit Is Predicted to Grow Enormously




**Essentially Federal Revenues Will Go to Cover Interest on Debt**

# NSF and CISE Grant Funding Success Rates-- Getting More Difficult to Win a Grant



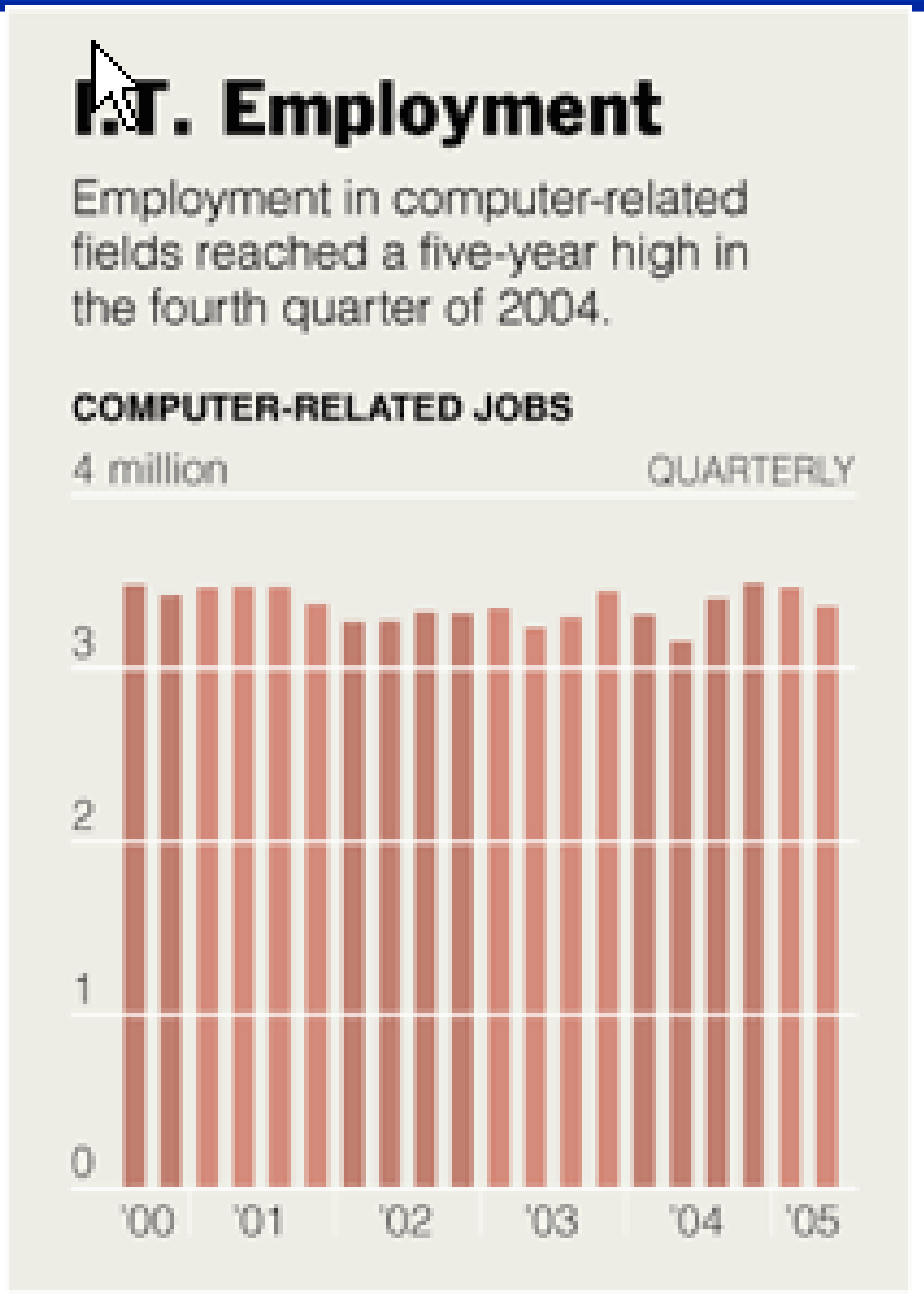

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Source: CRA

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# However, IT Employment Has Recovered to Pre-Bubble Levels in US

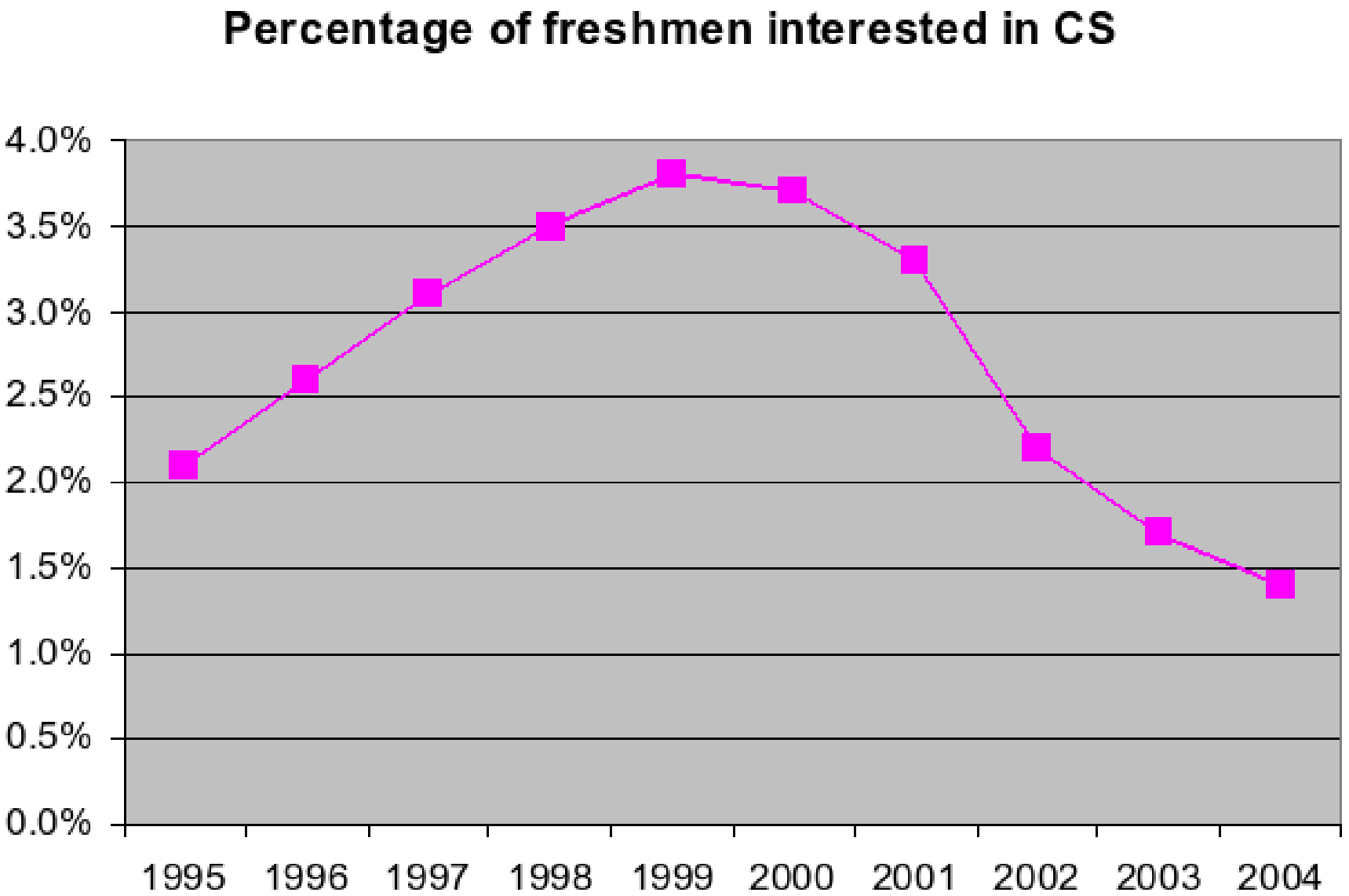
**While Jobs in Categories Like Programming Have Declined Since 2000, According To The Labor Department, the Need for Information Technology Experts Has Not**




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# The Tech Bust Immediately Translated into Declining Undergrad Interest in Computer Science

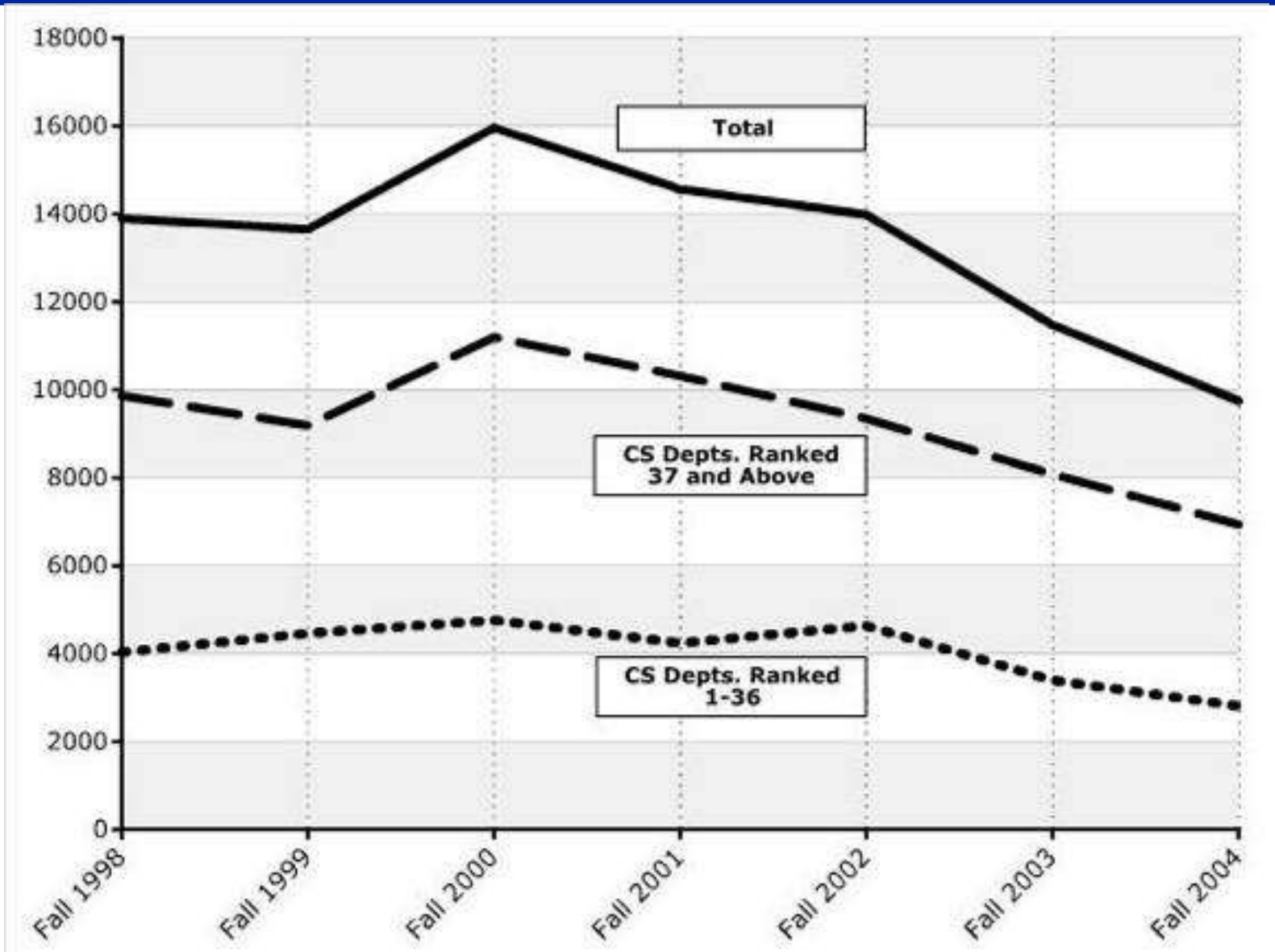



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**Source: CRA**

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# Computer Science Majors Also Peaked with the Tech Bubble

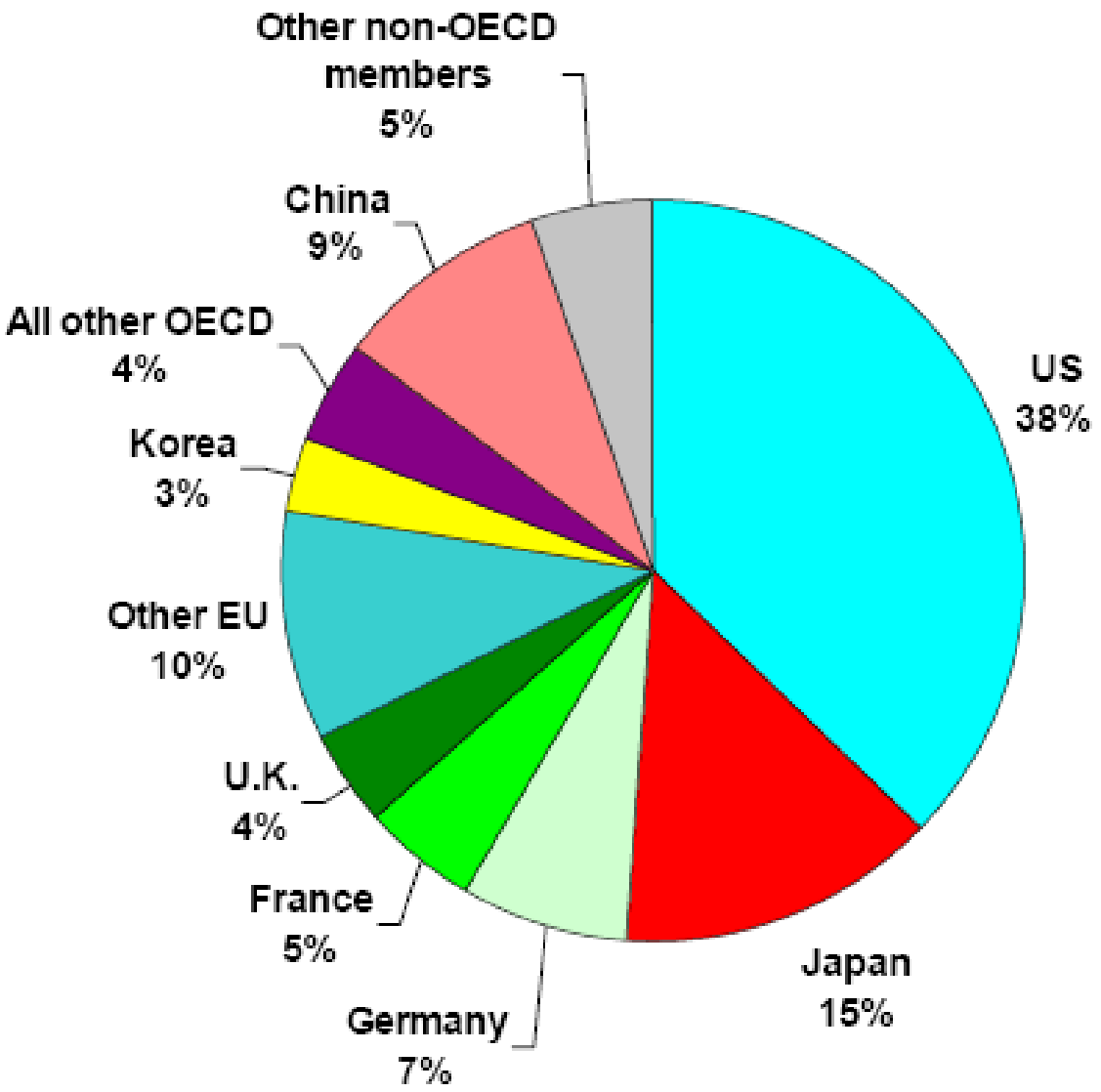



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**Source: CRA**

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# Innovation is Increasingly Global
# The US Share of Total World R&D is Less Than 40%




**Total World* R&D = U.S. $764 billion****

* World = OECD members plus Argentina, China, Romania, Israel, Russia, Singapore, Slovenia, Taiwan

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Source: OECD, Main Science and Technology Indicators, 2004.
2003 data or latest year available.
* *- calculated using purchasing power parities.
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# How Can We Prepare for a More Challenging Federal Grant Regime?

- **Focus on Radical Advances in EECS**
  - "There isn't the buzz and excitement about computer science that there should be. We're on the threshold of extraordinary advances in computing that will affect not only the sciences but also how we work and our culture. We need to get the brightest people working on those opportunities."—Bill Gates, 2005

- **Interdisciplinary Hires Within the Department**
  - On campuses today, the newest technologists have to become renaissance geeks. They have to understand computing, but they also typically need deep knowledge of some other field, from biology to business, Wall Street to Hollywood. –Steve Lohr, NYTimes August 23, 2005

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# We Are Living Through A Fundamental Global Change—How Can We Glimpse the Future?

**[The Internet] has created a [global] platform where intellectual work, intellectual capital, could be delivered from anywhere.**
**It could be disaggregated, delivered, distributed, produced, and put back together again…**

**The playing field is being leveled."**

**Nandan Nilekani, CEO Infosys (Bangalore, India)**

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# Calit2 is Establishing Global Research and Education Partnerships

Maxine Brown, Tom DeFanti, Co-Chairs

# iGrid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY

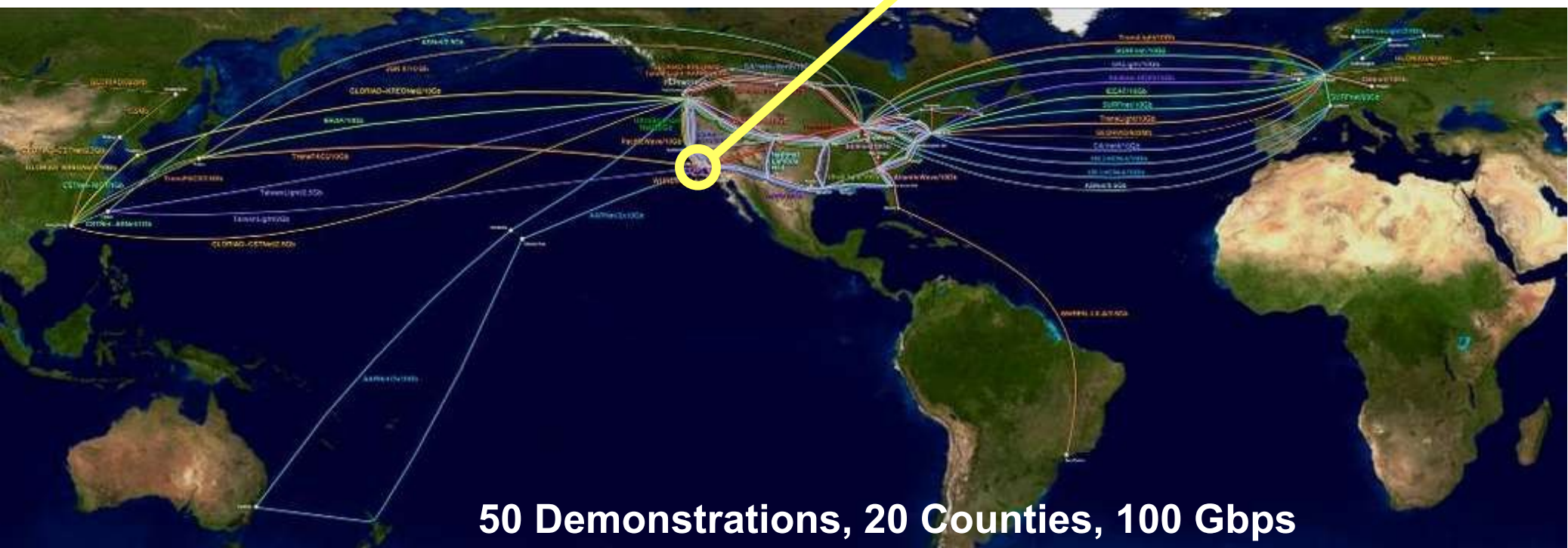
www.igrid2005.org



**September 26-30, 2005**

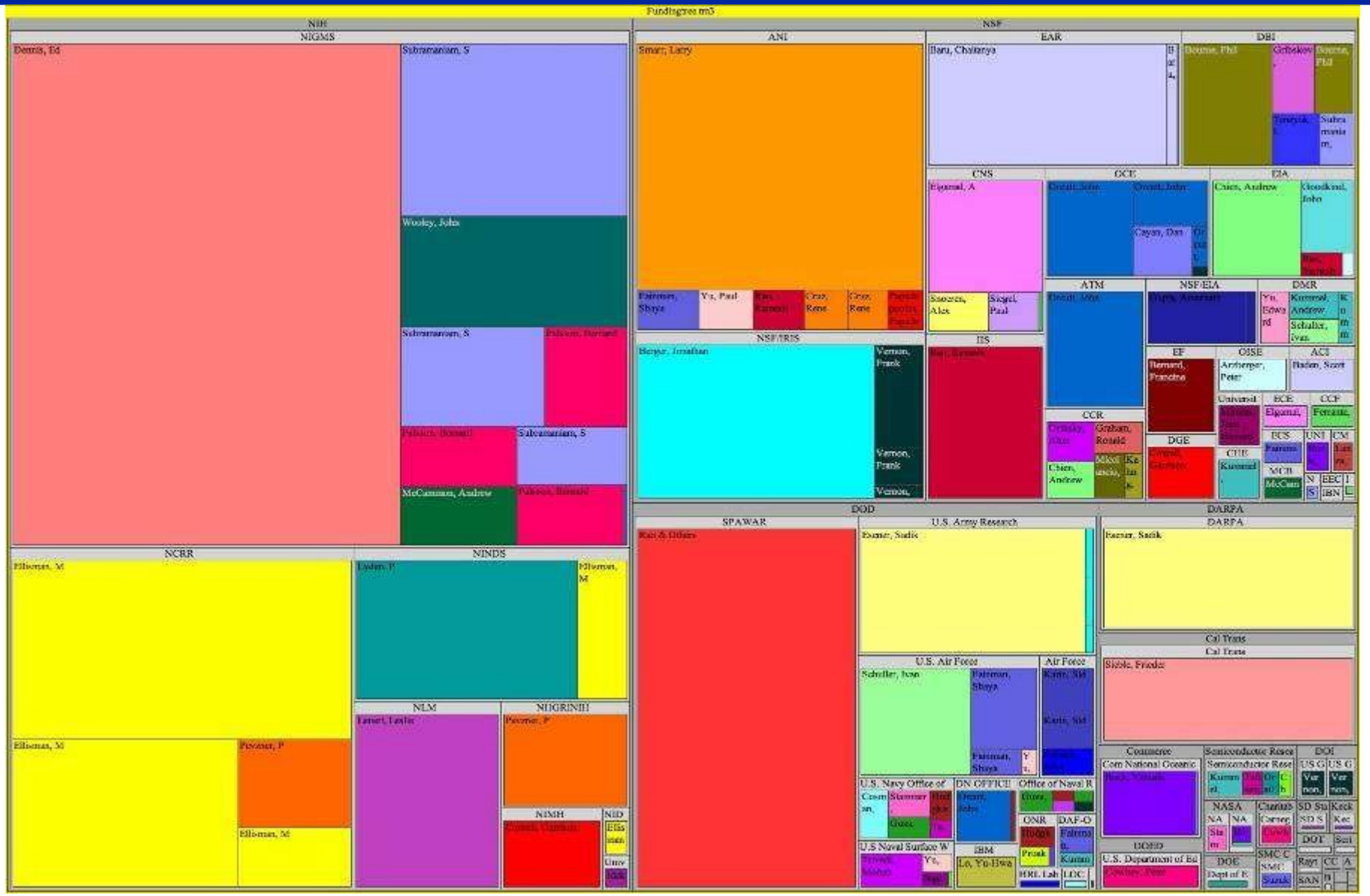
**Calit2 @ University of California, San Diego**

**California Institute for Telecommunications and Information Technology**



**50 Demonstrations, 20 Counties, 100 Gbps**

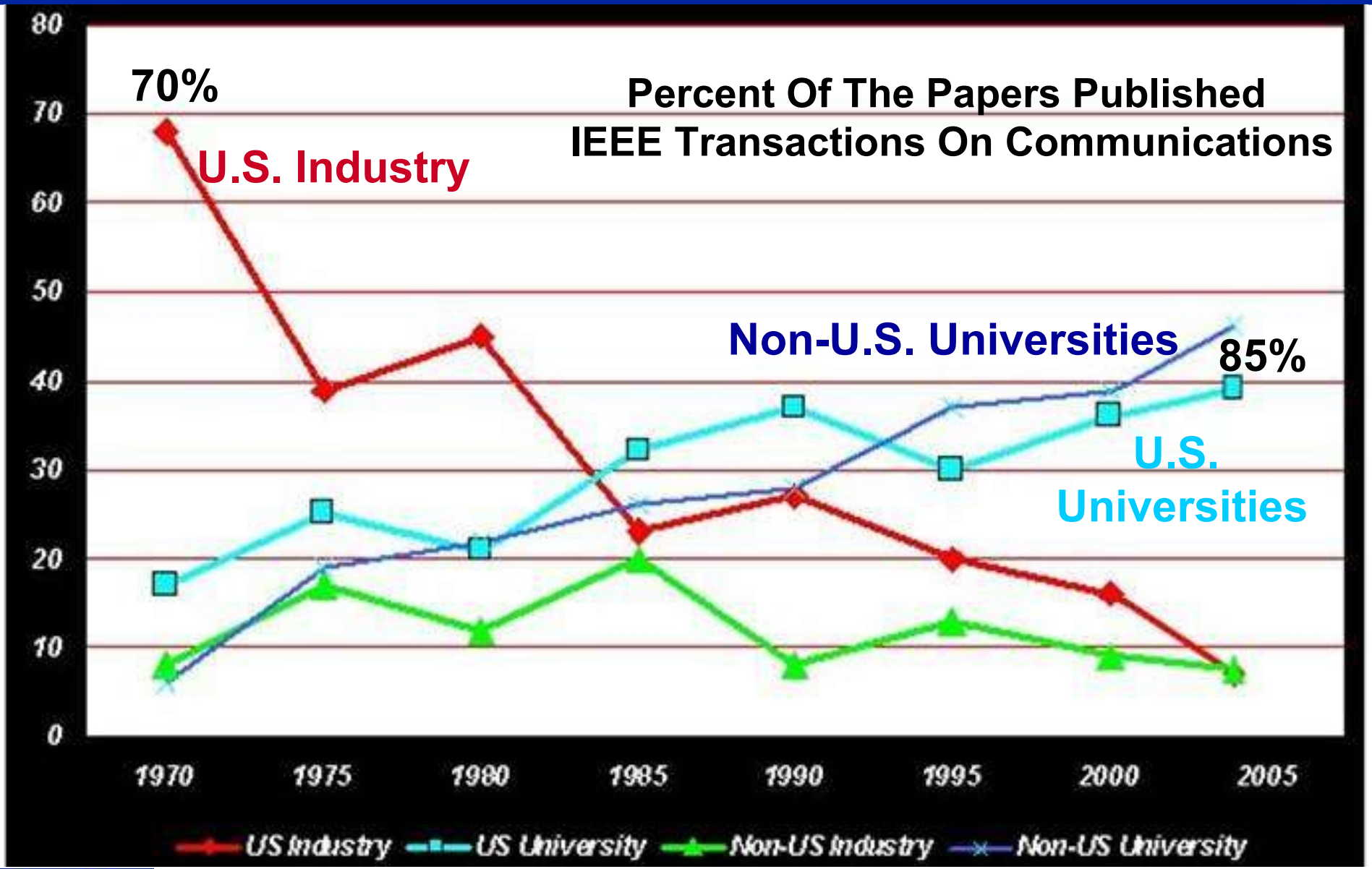
# Calit2 Is Tracking Federal Funding Opportunities, Serving in DC, Forming Teams, and Helping Write Grants




**Interactive Visualization of Calit2@UCSD Reported Federal Grants**

**Source: Jerry Sheehan, Calit2@UCSD**

# Where is Telecommunications Research Performed? A Historic Shift




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Source: Bob Lucky, Telcordia/SAIC

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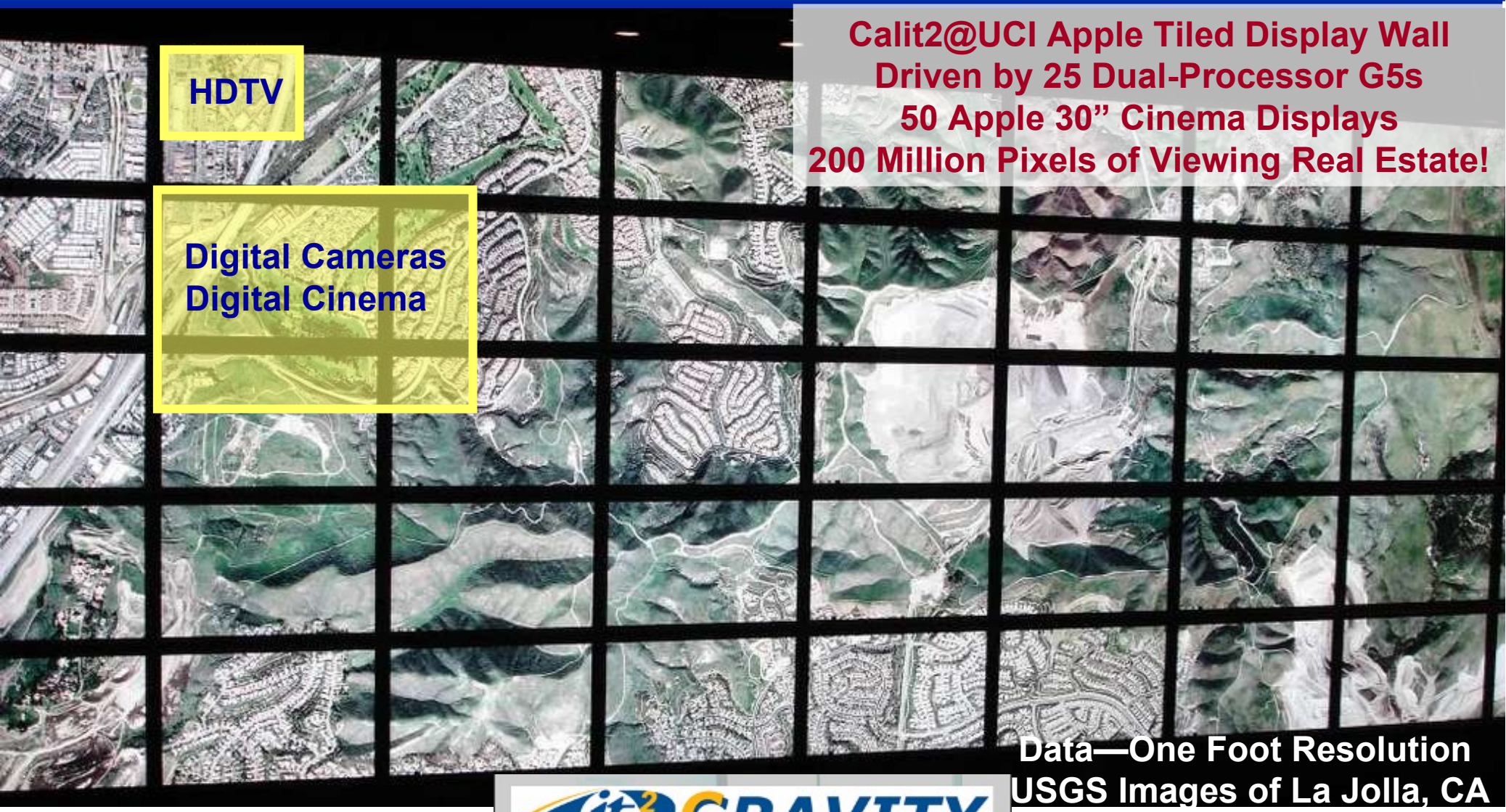
# Calit2 Proactively Seeks & Manages Relationships With Multiple Industrial Partners Teaming with Academic Researchers

- Funding Faculty Research Projects
- Supporting Graduate/Undergraduate Fellows
- Providing Access to Leading Edge Equipment
- Startups Integrated in "Living Labs"
- Joining on Federal Grants
- Co-Sponsoring Workshops/Conferences
- Hosting Seminars or Lectures
- Endowing Chaired Professorships

**Calit2@UCI Recently Hired**
**Debbie Nielsen (nielsen@rgs.uci.edu)**
**as Industrial Partner Liason**

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# Calit2 Helps Faculty Create New Laboratories and Shared Information Infrastructure




it² Center of GRAVITY
Center of Graphics, Visualization and Imaging Technology

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Source: Falko Kuester, Calit2@UCI
NSF Infrastructure Grant

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