

What is ASTRA?



What Resources are Available to Promote Science in the U.S.?

*Presentation by Robert S. Boege, Executive Director
Alliance for Science & Technology Research in America*

**Prepared for the National User Facility Organization (NUFO) Annual Meeting
SLAC National Accelerator Laboratory
Menlo Park, CA**

June 28, 2011



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What is ASTRA?

The Alliance for Science & Technology Research in America

1. **Core mission: increasing federal funding for fundamental research in the physical sciences and engineering, and educating policy makers and general public on linkage between R&D investments and overall health of the economy (jobs, standard of living, national security) through facts-based advocacy. ASTRA has had many partners in this accomplishment.**
2. **ASTRA's 130-plus members and 48,000 "friends" create a nationwide (and global) community of S&T professionals committed to increasing physical science & engineering budgets. Policy research support is key need. Limited resources mean use of technology platforms, virtual organizational structure. ASTRA has 9 dedicated professionals on part-time basis, cadre of volunteers like NUFO.**
3. **ASTRA has succeeded in making the case, developing data, enabling larger communities of S&T professionals and membership organizations to succeed. ASTRA created original strategy for linking federal S&T funding w. workforce, competitiveness, innovation, national defense in 2000. ASTRA enables many smaller groups and individuals to participate in policy discussions through its Web and other Technology Platforms.**
4. **Advocacy materials and programs form basis for recent legislative breakthroughs and disappointments, including ongoing FY 2012 Budget battle, successful reauthorization of the *America COMPETES Act of 2007*, the American Competitiveness Initiative and annual battle over appropriations bills for targeted science agencies like NSF, NIST, & DOE Office of Science, others.**
5. **ASTRA creates new networks, identifies emerging issues, harnesses synergies of broader communities of interest. Provides data for Congressional testimony, Executive Branch research on competitiveness, data mining.**
6. **Key gaps in innovation metrics now involve small business, venture capital and entrepreneurial sectors & commercialization barriers to better understand "Innovation Vital Signs™."**

ASTRA's Board 2011



ASTRA's Board of Directors
as of July, 2011

ASTRA's Board of Directors 2011-2012



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ASTRA Member Organizations 6/11



ACT, Inc.
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American Association for the Advancement of Science (AAAS)
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American Chemical Society
American Dental Association
American Institute of Chemical Engineers
American Institute of Physics
American Mathematical Society
American National Standards Institute (ANSI)
American Physical Society (APS)
American Society for Engineering Education (ASEE)
Applied Materials
Arctic Region Superconducting Center
Association of American Universities
Athena Alliance
AVS—The Science & Technology Society
Battelle
Business Higher Education Forum
California State University System
CASC—The Coalition for Academic Scientific Computing
Center for Strategic & International Studies
Center for Accelerating Innovation
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General Atomics
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Hewlett-Packard
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IEEE-USA
Information Technology & Innovation Foundation (ITIF)
Innovate + Educate
Integrated Manufacturing Technology Initiative
Intel
IPC—Association Interconnecting Electronics Industries
Kent State University
Luna Innovations
Materials Research Society
My College Options™
NanoBusiness Alliance
National Association of Manufacturers
National Council for Women and Information Technology (NCWIT)
National Center for Women and IT (NCWIT)
National Center for Manufacturing Sciences (NCMS)

National Research Center for College & University Admissions (NRCCUA)
National Science Teachers Association
National Semiconductor Corporation
National Venture Capital Association
NEC Research Institute
New Economy Strategies
New Mexico Optics Industry Association
NJIT—New Jersey Institute of Technology
Northern Illinois University
ONAMI—Oregon Nanoscience & Microtechnologies Institute
Optical Society of America (OSA)
Optoelectronics Industry Development Association (ODA)
Orbital Research, Inc.
Pacific Northwest National Laboratory
Purdue University
Rensselaer Polytechnic Institute
Rockwell Collins
Rohm & Haas
RSB & Associates, Inc.
SAE International
Sandia National Laboratories
Semiconductor Equipment & Materials International (SEMI)
Semiconductor Industry Association (SIA)
Small Business Technology Council (SBTC)
Semiconductor Research Corporation (SRC)
Southeastern Universities Research Association (SUFA)
SPIE—The International Society for Optical Engineering
STEM Ed Coalition
Stanford University
TechVision 21
Texas Instruments
Texas State University, San Marcos
Texas Tech University
The Minerals, Metals and Materials Society (TMS)
The Science Coalition
University Corporation for Atmospheric Research (UCAR)
University of Alaska, Fairbanks
University of Arkansas, Fayetteville
University of Arkansas, Little Rock
University of California, Los Angeles
University of California, Office of the President
University of California, Santa Barbara
University of Central Florida
University of Connecticut
University of Florida
University of Illinois, Chicago
University of Illinois, Springfield
University of Illinois, Urbana-Champaign
University of Massachusetts
University of Maryland
University of Missouri
University of New Mexico
University of North Texas
University of Oklahoma
University of South Carolina
University of Virginia
US Car
U.S. Institute of Peace
Washington State Economic Development Commission
Worcester Polytechnic Institute
WTEC

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Making a Case — And Vetting the Data Correctly!

ASTRA has mobilized thousands of ordinary people (48,000 “friends” as of 6/11) at the grassroots level, as well as key leadership individuals in science & engineering organizations, industry, and academe.

ASTRA creates many data products which are carefully vetted by expert volunteers, graphically appealing, and focused upon putting a “human face” on the complex relationships science funding creates with job creation, competitiveness, innovation, STEM education and national security.

Policy research is needed in many areas.



Facts-based Advocacy Materials 6/11

ASTRA develops facts-based advocacy materials for use by other organizations.

Visit our Web Sites at: www.usinnovation.org and www.aboutastra.org
 ASTRA provides education, research and connectivity to a virtual global community of 48,000 innovation policymakers — it distributes more than 420,000 downloads of specialized research per year, conducts Briefings and coordinates Washington, D.C.-focused visitation programs on Capitol Hill and within the Administration.



Experts: "Technological Progress" is the Primary Driver of Economic Growth.

Author (Year)	Time Period	% of Economic Growth Due to:		
		Capital	Labor	Tech. Progress
Abramovitz (1956)	1869-1953	22	33	48
Kendrick (1961)	1909-1949	21	24	51
Denison (1962)	1889-1953	21	34	44
Denison (1967)	1909-1929	26	16	33
Kuznets (1971)	1929-1957	15	19	58
Jorgenson (1972)	1950-1962	25	19	47
Kendrick (1973)	1950-1962	25	19	56
Denison (1979)	1929-1957	8	14	78
Denison (1985)	1889-1929	34	32	34
Jorgenson (1987)	1950-1962	40	8	51
	1948-1966	21	24	56
	1929-1976	15	26	50
	1929-1982	19	26	46
	1948-1979	12	20	69

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Facts-based Advocacy Materials 6/11

ASTRA's State R&D Sheets and its State STEM Ed Report Cards, along with its *Innovation Vital Signs* graphics have resulted in more than 415,000 downloads of information per year by science policy advocates, economists, governmental institutions, academe, and many other individuals.

These materials have in turn enabled thousands of ordinary people (48,000 "friends" as of 6/11) at the grassroots level, as well as key leadership organizations in science & engineering voluntary organizations, industry, and academe.

California R&D 2011
 Science & Engineering R&D Fuels U.S. Economic Growth & New Jobs

More than fifty years of experience shows that a strong federal commitment to scientific research is key to building a better America. **Discovery and innovation are proven fuels for economic growth and job creation.** And the elements for achieving energy security and sustainable global leadership in science. We must reduce the deficit and begin to live within our means. We must be smart about how we go about it. **Federal support for science will spur economic growth and restore a firm fiscal foundation for our nation.**

A National Science Foundation (NSF) study found that of the science papers cited in industry patents were funded by taxpayers through the federal government, especially university research operations.¹

California received \$13,009 billion in federal R&D grants and contracts investment in FY 2010, with approximately 14,001 transactions taking place.² Information and charts on this page demonstrate the importance of federal investment in R&D to California's economy, and its future in the global marketplace.

Federal R&D Expenditures as Percentage of GDP Compared to Strategic Competitors 1996 - 2007

Year	Japan	South Korea	United States	EU	China
1996	~3.2	~2.8	~2.2	~1.8	~0.8
1997	~3.2	~2.8	~2.2	~1.8	~0.8
1998	~3.2	~2.8	~2.2	~1.8	~0.8
1999	~3.2	~2.8	~2.2	~1.8	~0.8
2000	~3.2	~2.8	~2.2	~1.8	~0.8
2001	~3.2	~2.8	~2.2	~1.8	~0.8
2002	~3.2	~2.8	~2.2	~1.8	~0.8
2003	~3.2	~2.8	~2.2	~1.8	~0.8
2004	~3.2	~2.8	~2.2	~1.8	~0.8
2005	~3.2	~2.8	~2.2	~1.8	~0.8
2006	~3.2	~2.8	~2.2	~1.8	~0.8
2007	~3.2	~2.8	~2.2	~1.8	~0.8

Fueling California's 21st Century Workforce: Federal R&D Expenditures at California Universities & Colleges FY 2008

California's colleges and universities received \$7.026 billion in federal R&D spending in FY 2008, making it 1st in the nation.

Key Reports and On-line Resources

- The Science-Engineering-Technology Working Group (SETWG) sponsors the annual Congressional Vets Day Program. See www.aboutastra.org/vets
- Science & Engineering Indicators 2010, published by the National Science Foundation, provides a broad base of quantitative information on the U.S. and international science and engineering enterprise. It is created biennially by the National Science Foundation's Division of Science Resources Statistics (SRS). See www.nsf.gov/statistics/indicators/

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How California Ranks 2011

Category	California	Total U.S.
3.4.5	309,050,816	8.35%
Bureau estimates)	1.18%	
2006/2007	11.45%	
	\$127	
	\$2	
	\$7.43	
	2.62%	
	NA	
	239	
	149	
	280	
	47	
	16	
	1	

STEMconnector
 New Mexico's K-12 STEM Ed Report Card 2011
 Jobs & Economic Prosperity Through STEM Education

Support for STEM Education Enables New Mexico's Workforce to Compete in a Global Marketplace: Advances in science and engineering are essential for ensuring America's economic growth, job creation, quality of life, and our national security.

During the next decade, U.S. demand for scientists and engineers is expected to increase at four times the rate for all other occupations.¹ But today's high school students overall are not performing well in math and science, and fewer of them are pursuing degrees in technical fields.

The U.S. Department of Labor predicts that jobs requiring science, engineering, and technical training will increase 34% between 2008 and 2018.²

The Science & Engineering (S&E) Workforce has grown at an average annual growth rate of about 6.2% since 1950, nearly 4 times the annual overall labor force growth rate of 1.6%. It totaled about 5.7 million workers in 2007.³

About 174,000 S&E Doctoral Degrees were awarded worldwide in 2006, of which about 30,000 — or 17% — were in the U.S. More than half of the S&E doctorates awarded in the U.S. went to non-U.S. citizens in 2006. For comparison purposes, China has probably surpassed the U.S. in doctoral degree production since 2006 according to the National Science Foundation and the European Union produced more than 52,000 S&E Doctoral Degrees in 2006.⁴

The 2009 Programme for International Student Assessment (PISA) results ranked the U.S. 23rd in science with a score of 502, well below Shanghai, China (575), Finland (554), Hong Kong, Singapore (542), Japan (539), Korea (538), and New Zealand (532), and just one point above the average score on this subject in 2006. In math, the U.S. fared even worse, ranking 32nd on the PISA test with a score of 487, 10 points below the average score (497) of the 65 participating countries.

Interest in STEM Education is Declining and Most Students are not Adequately Prepared to Succeed in College-Level Coursework. America's Preparedness Storm, released by the Educational Testing Service (ETS) studies key forces affecting our country's fate. According to ETS: by 2030 the average levels of literacy and numeracy in the working-age population will have decreased by about 5 percent while inequality will have increased by about 7 percent. See www.ets.org/files/Assets/Assets/PreparedStormETS2007.pdf

ETS cautions:

Put crudely, over the next 25 years or so, as better-educated individuals leave the workforce they will be replaced by those who, on average, have lower levels of education and skill. During the same period, nearly half of the projected job growth will be concentrated in occupations associated with higher education and skill levels.

Tens of millions more of our students and adults will be less able to qualify for higher-paying jobs... they will be competing not only with each other and millions of newly arrived immigrants, but also with equally (or better) skilled workers in lower-wage economies around the world.

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STEM TRENDS
 New Mexico's STEM College Major / Career Interest Trend by Graduation Year

New Mexico's STEM Trend by Student Ethnicity

New Mexico's STEM Trend by Student Gender

Focus on Diversity, Gender & Early Identification and Mentoring of STEM-Interested Students

One solution to the New Mexico's STEM pipeline problem is to take action given known gender and ethnically differences in STEM education. Early identification and mentoring by parents and teachers can encourage early STEM success by students. "Race & Poverty are not Destiny!": Importantly, a recent McKinsey Report finds that the wide variation in performance among schools serving similar students suggests that these gaps can be closed. Race and poverty are not destiny.

STEM TRENDS Research provided by the My College Options College Planning Program, which collects the educational profiles of an estimated 2.5 million students annually across the nation. For more information, please visit www.mycollegeoptions.org/about

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Facts-based Advocacy Materials 6/11

ASTRA has identified innovation metrics and the underlying theories of innovation as a major problem in overall science advocacy. Its “Periodic Table of Innovation Elements” has been widely used throughout the global innovation community to stimulate thought. ASTRA’s Industry Innovation Alliance has created several study maps of the problem, workshops are in planning stages, and interested organizations should contact us.

The **ASTRA Research Task Force** was formed in 2001 out of an effort to better define the innovation debate in the US. Our current **Vice President for Research, Dr. Robin Gaster**, pioneered several projects for ASTRA, including the **ASTRA Innovation Index®** tool for quick Web-based comparison of innovation metrics between states and regions. This tool was developed through funding from the **National Institute of Standards & Technology**.

ASTRA’s **Innovation Vital Signs Project** from 2006-2007 also set the standard for identifying and assessing the importance of innovation input and output metrics. The Innovation metrics derived from this project continue to inform and be used by other organizations involved in similar pursuits. The ASTRA Team is dedicated to finding and developing the innovation metrics that will serve to inform and enable the debate on appropriate policies for ensuring America’s scientific and technological future.

Given the current environment, it is more important than ever for the U.S. to develop its own STEM capabilities to help grow the economy and to maintain the nation’s lead in the technologies that are vital to our collective future.

ASTRA’s annual **State STEM Ed Report Cards** series have received wide support and distribution from leading scientific and engineering organizations and reflect a desire to provide “facts-based” and neutral assessments of state, local and regional progress in STEM education efforts. The State STEM Ed Report Cards are unique in providing rankings and socio-economic context measurements to otherwise bland educational assessments and teacher preparedness data.

Example from ASTRA’s *Pioneering Innovation Vital Signs Project 2006-2007*:

Periodic Table of Innovation Elements														
R&D Expenditures	R&D Capital	Innovation Element Groups (Families)*										Impact	Impact	MacroEcon
Patents	Gross Capital Formation	Inputs		Process		Outputs		Impact				# Innovative Enterprise	Birth Rate New Enterprises	Average Hourly Earnings
Talent	Capital	Macro-Economy		Policy		Infrastructure		Mindset				Impact	Impact	MacroEcon
# Researchers	ICT Investment	S&T Employment		Net Change Enterprises		Gross Private Investment								
Talent	Capital	Networks	Networks	Networks	Management	Prod Dev.	Process	Process	Process	Output	Output	Output	Impact	MacroEcon
No. with Higher Education	Initial Public Offerings	Broadband Penetration	SMEs with Cooperation Arrangements	# Business Incubators	Entrepreneurship	# Approved Patents	# Cooperation Agreements	R&D Used From Overseas	Sales New to Market	# New Products Introduced	New Markets Created	Leading Competitiveness Indicators	Real GDP	Real Interest Rates
Talent	Capital	Networks	Networks	Networks	Management	Prod Dev.	Process	Process	Output	Output	Output	Impact	MacroEcon	
Verbal SAT	Angel Networks	Computer Use per Capita	Internet Alliances	# Internet Domains	Quality of Management	Time & Money to Develop	Early Stage Entrepreneurial Activity	Innovation Expenditure	Sales New to Firm	Output per Sector	Export Sales	High Tech Jobs Gained & Lost	Real GDP per Capita	
Talent	Capital	Networks	Networks	Management	Management	Efficiency	Process	Process	Output	Output	Output	Impact	MacroEcon	
Math SAT	SBIR Funding	Internet Use by Business	Federal Lab CRADAs	Shareholder Value	# of Ideas	Availability of Competent Managers	Research Quality	Enterprises Innovating In-House	Royalty, License Fees	New Companies Created	High Tech Exports	Income per Capita	Inflation Rate	
Talent	Capital	Networks	Networks	Management	Prod Dev.	Efficiency	Process	Process	Output	Output	Output	Impact		
Pop with Life Long Learning	Investment Risk	Broadband Costs	University Spinouts	Customer Satisfaction	Technology Absorption	Cost Reduction	Quality of University Collaboration	Product Launch Speed	Overall Productivity	Value Add of SMEs	Employment 1 in High Tech Sector			
Policy	Policy	Policy	Policy	Policy	Policy	Infrastruc	Infrastruc	Infrastruc	Infrastruc	Mindset	Mindset	Mindset		
Corporate Tax Rate	# New Taxes, Excess, Dues	Time Required to Start Business	Foreign Ownership Restrictions	Rule of Law Governance	IP Rights	Environment Governance	Legal Rights Index	Home Attractability	Public Source of S&T Information	Informed about Policy Issues	Value Place on Creativity			
Policy	Policy	Policy	Policy	Policy	Infrastruc	Infrastruc	Infrastruc	Infrastruc	Mindset	Mindset	Mindset			
Overall Tax Burden	# Procedures to Start Business	Trade Barriers	IP Protection	Judicial Independence	Infrastructure Quality	Openness to Competition	# of New Bids Designed	Youth Interest in Science	Public Interest in S&T	Science Literacy	Wish to Own Business			

*A provisional framework identifying 14 groupings of innovation indicators that collectively interact to create national innovation capacity and performance.

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Congressional Visits Day 2011 — Success!



ASTRA co-chairs the Annual Science-Engineering-Technology Working Group (SETWG), hosts the organization's Web Site, and develops State -oriented fact sheets for the annual event, as well as coordinating its Annual Exhibit of science & engineering exhibitors.



Latest ASTRA Petition Campaign 6/24/11 “Stand Up for Science Funding”

**JOBS, ECONOMIC GROWTH, NATIONAL SECURITY,
OUR STANDARD OF LIVING & OUR KIDS' FUTURE ...**

We, The Undersigned, Petition Congress to Support

*Predictable & Sustained Funding
for Scientific & Engineering Research & Development
(R&D) and STEM* Education Funding
for America's Future*

We, the undersigned, petition Congress to support a strong federal commitment to science and engineering research & development (R&D) funding as well as a commitment to Science, Technology, Engineering and Mathematics (STEM) education. As our nation grapples with reducing our federal deficit and living within our means, we ask Congress to remember that **Discovery and Innovation are proven fuels for economic growth and job creation.** www.usinnovation.org/sites/default/files/ASTRAtechnologyFuelsGrowth6222011.pdf.

We must begin to reduce the federal budget deficit AND... we must be smart about how we go about it. **Federal support for science & engineering will spur economic growth and help restore a firm fiscal foundation for our nation.** More than fifty years of experience shows that a strong federal commitment to scientific research is the key to building a better America. R&D and STEM Education funding creates jobs, improves our quality of life, and insures a stronger America — they are vital elements for achieving energy security and sustaining America's global leadership in science and the 21st Century Economy. See www.usinnovation.org/index.php?q=state-sheets to see how science & engineering R&D and STEM education funding benefits each State and Congressional District in America.

We, the Board of Directors of ASTRA, The Alliance for Science & Technology Research in America — as well as many other undersigned individuals and organizations — represent companies, organizations, and institutions of higher education and research that directly include approximately 3.5 million American workers, scientists, engineers, students, teachers, small business owners, entrepreneurs, researchers, technicians, and millions of additional Americans at all levels, ages, and walks of life.

We are nonpartisan and determined to help America grow its way out of our current fiscal crisis — the smart way!

* STEM = Science, Technology, Engineering & Mathematics

ADD YOUR OWN NAME — and Please send us your own photo (optional) when you sign the Petition! For details, click through to:
www.aboutastra.org/petition/sign_petition.asp?sign=Sign+Petition

See Photos, Names & Affiliations of Petition Signers (Provisional List) on Next Page ...



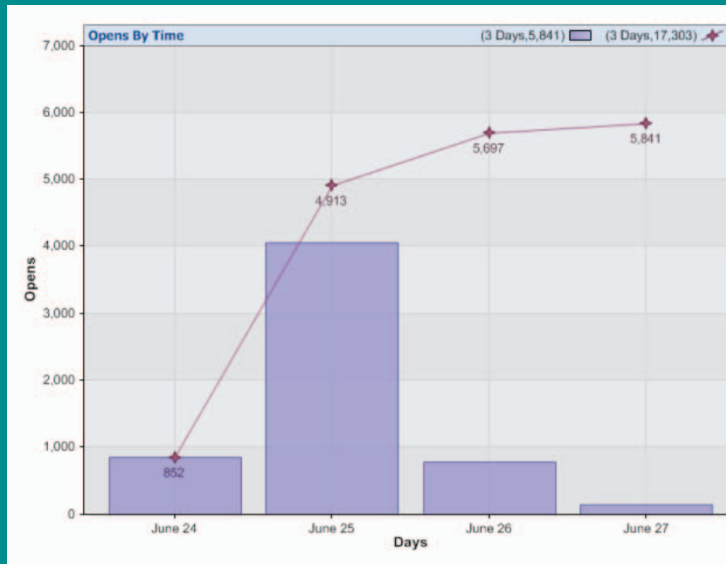
Provisional List
The Board of Directors of ASTRA, The Alliance for Science & Technology Research in America and the undersigned ...

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ADD YOUR OWN NAME — and Please send us your own photo (optional) when you sign the Petition! For details, click through to:
www.aboutastra.org/petition/sign_petition.asp?sign=Sign+Petition

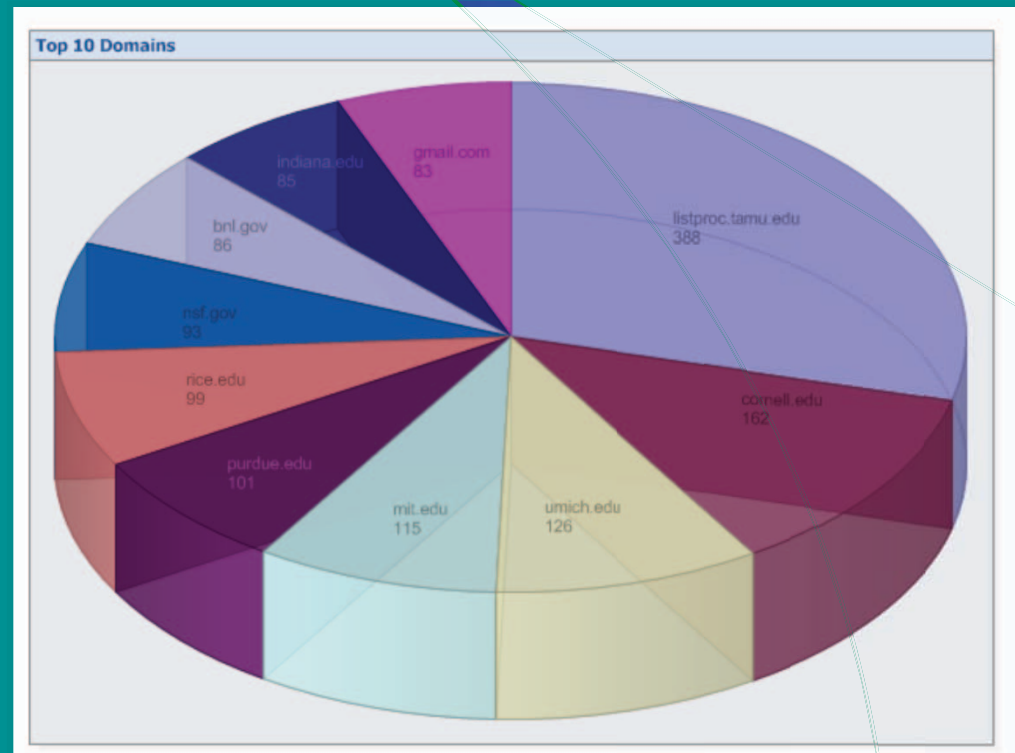
Latest Petition Campaign 6/11 — 48 hrs. results

In first 48 hours — 5,841 “opens,” 450 individuals & Organizations Signed up to and ... 250 photos sent in!



Above: 5,841 “opens,” 450 individuals & Organizations to date, 250 photos received...

Right: Top 48-hr. responding domains at right



ASTRA, its Members & Key Partners in “Moving the Needle” for Innovation Policy and R&D Funding

For the past eleven years, ASTRA has provided strategic support for many organizations’ D.C. public policy efforts. For example, ASTRA created opportunities for H-P’s 2007 Hill Testimony by Dr. Stan Williams and 2009 testimony for its University Relations VP Wayne Johnson and Dow Chemical’s VP for External Relations Dr. Susan Butts. ASTRA paves the way for Agency scheduling, Hill Visits, Briefing invitations, and opportunities for sponsorships.



From left above: Former House Science & Technology Committee Subcommittee on Technology & Innovation Chairman David Wu (D-OR) and ASTRA Board Members. ASTRA has testified on such issues as R&D funding levels for critical agencies like DOE, NSF & NIST, the effectiveness of the Bayh-Dole Act, and the 10-year Policy framework that is part of the America COMPETES Act, innovation economics and other key issues that affect our future.



ASTRA has made a Difference ...

“Level I” of ASTRA Plan = SUCCESS:

A. Identify proper data, enable capacity within powerful membership organizations, academe & industry to create public dialogue. ASTRA among groups contributing to “doubling” of budgets for key physical science & engineering agencies. Positioning for Administration, Congress ongoing. ASTRA-created Task Forces effective.

B. Perform research and data mining to determine links between science funding and desired outputs for society — lay basis for innovation economics theoretical development (2010)

C. Create proper messaging and unify diverse communities of interest, esp. bringing industry to table.

D. Foster nationwide networks and collaborations for science advocacy (key potential area for additional funding).

What's Next?

- Election 2010 Results in Systemic Funding Challenges
- Fiscal Crisis & 2012 campaigns accelerating (!)
- Perception that science & engineering communities “were taken care of” (!) in terms of America COMPETES Reauthorization, Stimulus, etc. = Nightmare ...
- Expectations Game Beginning
- Innovation Policy Needs Deeper Research, Metrics
- Scientific Research budgets are in perpetual jeopardy of being cut as entitlement spending overwhelms government’s capacity to pay for discretionary items
- 2012 Federal Budget puts Science & Engineering R&D in Dire Straits, “Smart Way to Growth” is one message.
- Focus on 2012 Presidential Election has Begun