

# Innovation and the Navy

Thomas Kalil

Deputy Director for Policy

White House Office of Science and Technology Policy

2010 Naval Science and Technology Partnership Conference  
9 November 2010



# S&T as Presidential Priority

“Reaffirming America’s role as the global engine of scientific discovery and technological innovation has never been more critical. ...Our renewed commitment to science and technology ... will help us protect our citizens and advance U.S. national security priorities.”



–National Security Strategy, May 2010



# President Obama's Innovation Strategy

## Innovation for Sustainable Growth and Quality Jobs

### Catalyze Breakthroughs for National Priorities

- Unleash a clean energy revolution
- Support advanced vehicle technology
- Drive breakthroughs in health IT
- Address the “grand challenges” of the 21<sup>st</sup> century

### Promote Competitive Markets that Spur Productive Entrepreneurship

- Promote American exports
- Support open capital markets that allocate resources to the most promising ideas
- Encourage high-growth and innovation-based entrepreneurship
- Improve public sector innovation and support community innovation

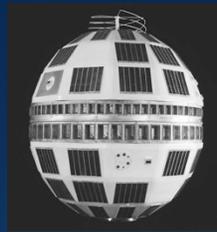
### Invest in the Building Blocks of American Innovation

- Restore American leadership in fundamental research
- Educate the next generation with 21<sup>st</sup> century knowledge and skills while creating a world-class workforce
- Build a leading physical infrastructure
- Develop an advanced information technology ecosystem



# Investing in the Future: DOD S&T

A Track Record of Success....



40s	50s	60s	70s	80s	90s	00s
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New Challenges and Threats for the Future....



# New Ideas for Defense

**2010 CNR Challenge**

Next Generation Technologies  
for Today's Warfighter

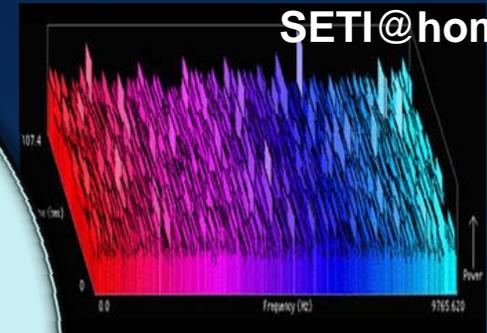


**OPEN INNOVATION**

**PRIZES**

**CROWDSOURCING**

**SBIR/STTR**



# Training the Next Generation : “Educate to Innovate”

Public-Private Campaign to Spur STEM; \$500M already raised

## Some Key Partnerships

- National Lab Day
- SMTI and NMSI Teacher Initiative
- STEM Game Design Competition
- Private Sector Leaders
- Annual White House Science Fair

“Through these efforts, we're going to expand the scope and scale of science and math education all across America.”



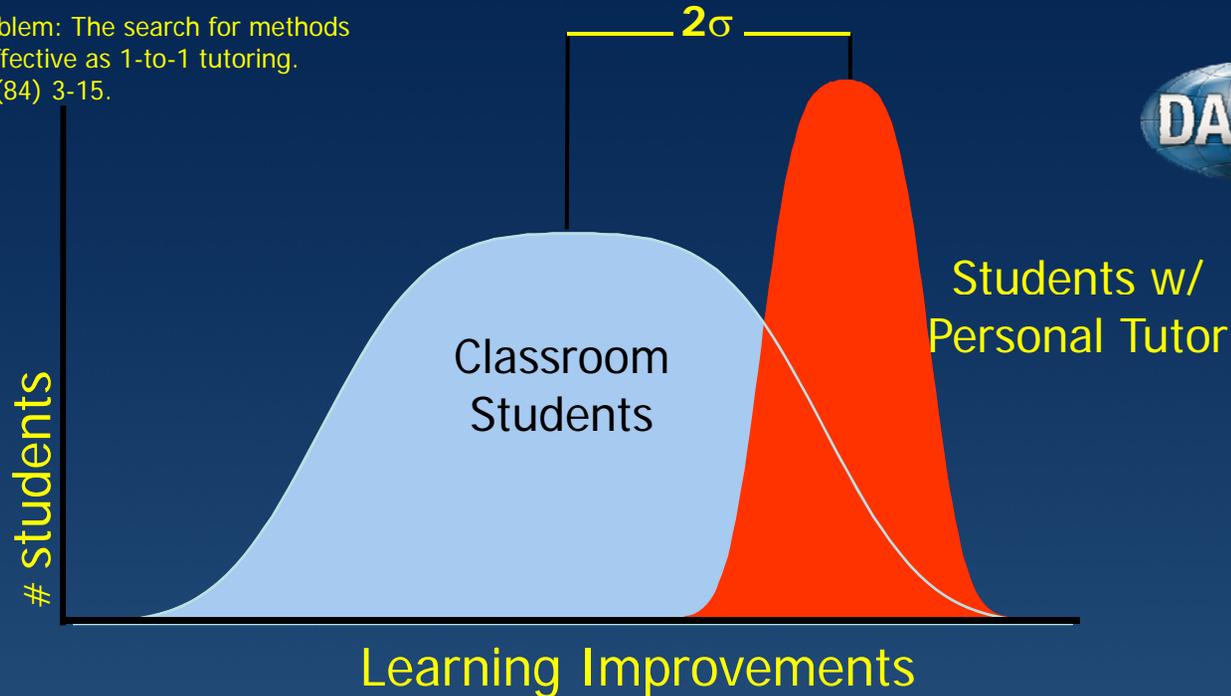
—President Barack Obama, November 3<sup>rd</sup>, 2009



# Education Dominance

Students learn the most when instruction is from a live one-on-one tutor.

Bloom, B.S.: The 2  $\sigma$  Problem: The search for methods of group instruction as effective as 1-to-1 tutoring. Educational Research 13(84) 3-15.

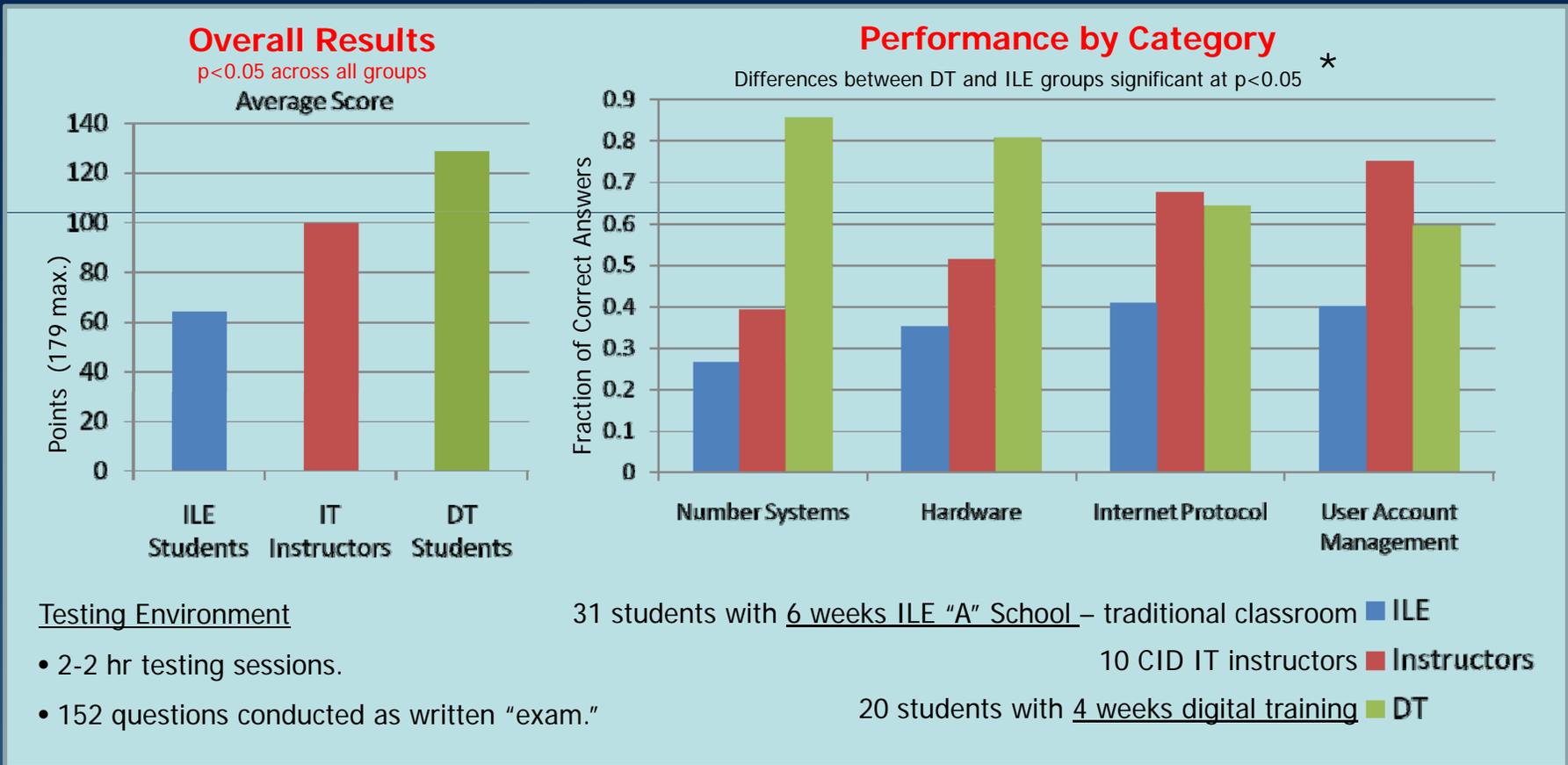


Today's Navy IT-training begins with "A" School classroom training and continues with reliance on additional cycles of classroom ("C-School") and on-the-job training.



# Education Dominance: Digital Tutor

Students trained on the Digital Tutor spent 1/3 less time in the classroom and outperformed traditionally trained ILE students on every aspect of the General Knowledge IT exam\*.



# Robotics



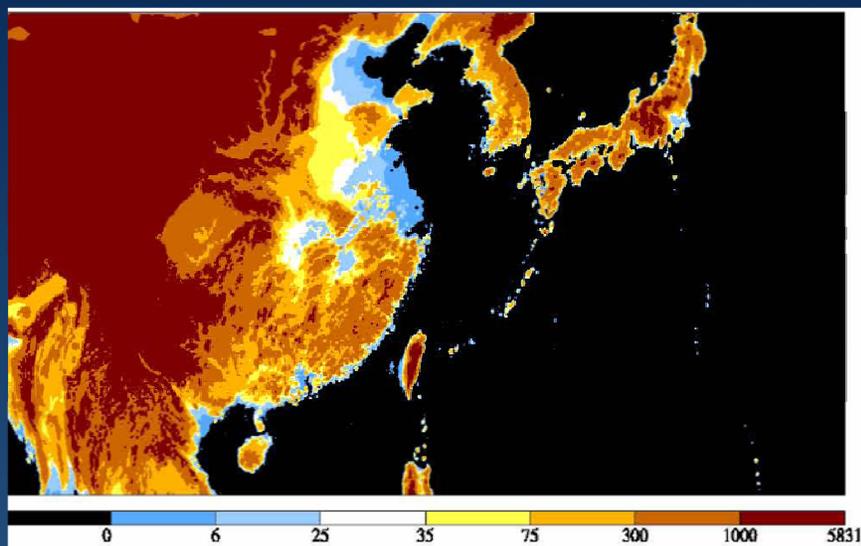
Robots as “co-workers, co-protectors, and co-inhabitants”



# Climate Change

What if there was complete melting of Greenland's glaciers? (6.55 meter sea rise)

## CHINA



## UNITED STATES



# Energy Security

*“Unleash us from the tether of fuel.”*

Gen. James Mattis, USMC



Air Transport Association

**Public-Private  
partnerships to  
develop and  
procure  
alternative  
aviation fuels**



# Materials Genome to Manufacturing

Predict, screen, optimize, and apply materials at an unparalleled scale and rate



First-Principles Bond Energy Calculations

Crystal Orientation Data

Tomography

EBSD

3-D Quantitative Data

$\beta$ -21S, 947 grains

Developed automated computing environment coupled to databases

User Query

We have the possibility of computing the properties of all known inorganic materials ... and many "unknown" materials ...

Developing the ability to screen compounds per

High throughput computing environment

AgCd AgMg AgMo CdMo MoPd  
 MoRh MoRu MoTc AgNb CdNb  
 NbPd NbMo NbRh NbRu NbTc  
 AgPd PdCd AgRh CdRh PdRh  
 AgRu CdRu RuPd RhRu AlSc  
 AgTc CdTc TcPd RhTc RuTc  
 AgTi CdTi MoTi TiPd RhTi  
 RuTi TcTi TiZr AgY CdY  
 MoY NbY PdY RhY RuY  
 TcY YZr AgZr CdZr MoZr  
 Zr ZrPd RhZr RuZr TcZr

Phase field modeling of dislocation accumulation

New Understanding

Periodic Table of the Elements

IA																	0		
1	H																	He	
2	Li	Be											B	C	N	O	F	Ne	
3	Na	Mg			Al	Si	P	S	Cl	Ar									
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	+Ac	Rf	Ha	Sg	Ns	Hs	Mt	110	111	112	113						
* Lanthanide Series			Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu			
+ Actinide Series			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr			



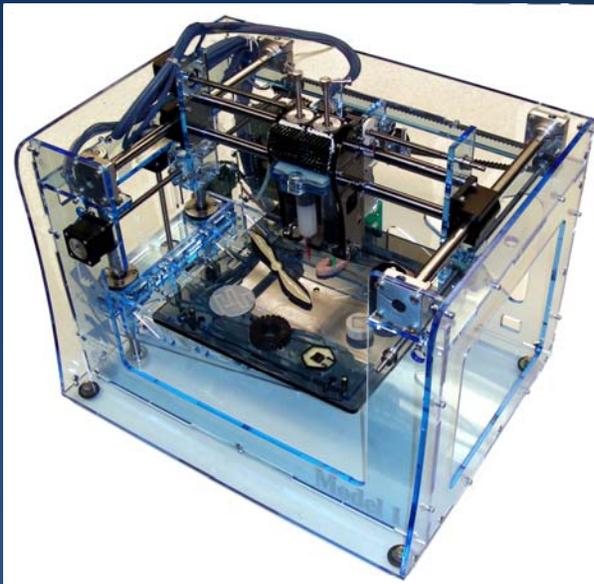
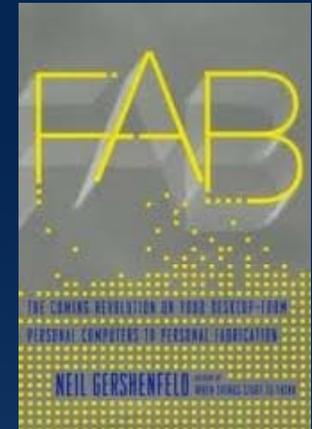
# Manufacturing in the 21<sup>st</sup> Century

*“if any particular manufacture was necessary, indeed, for the defense of the society it might not always be prudent to depend upon our neighbors for the supply.”*

- Adam Smith, *Wealth of Nations*, 1804



Tata Nanos being built at Tata Motors' plant for the Tata Nano at Sanand, Gujarat, inaugurated on June 2, 2010.



**FY03-FY05 DOD Mantech**

**\$705 M  
DOD  
Investment**



**Estimated  
\$6.3 B  
Savings**

Report to Congress on Implementation of DoD ManTech Projects, 2008



# Support for the Navy Labs

“The Government should maintain a great research laboratory.... In this could be developed...all the technique of military and naval progression without any vast expense” – Thomas Edison, 1915

NRL Nanoscience Research Laboratory



Research Funding  
Flexible Hiring  
Infrastructure  
Partnerships

IEEE Spectrum  
Patent Power Scorecard

GOVERNMENT AGENCIES										
RANK	COMPANY/ORGANIZATION, COUNTRY	2009 U.S. PATENTS	PIPELINE GROWTH INDEX	PIPELINE IMPACT	SELF-CITATIONS 15%/	ADJUSTED PIPELINE IMPACT	PIPELINE GENERALITY	PIPELINE ORIGINALITY	PIPELINE POWER	ADJUSTED PIPELINE POWER
1	U.S. Navy, U.S.	222	1.01	0.10	15.1%	0.80	0.72	2.18	256	256
2	U.S. Department of Health and Human Services, U.S.	111	0.94	0.79	11.6%	0.79	1.13	1.37	128	128
3	Japan Science and Technology Agency, Japan	104	0.72	0.66	5.2%	0.66	0.75	2.00	111	111
4	Ministry of Economy Trade and Industry, Japan	104	1.24	0.56	7.3%	0.56	0.83	2.18	97	97
5	Centre National de Recherche Scientifique, France	75	0.45	0.45	28.9%	0.45	0.51	2.27	75	75
6	U.S. Department of Energy, U.S.									
7	U.S. Army, U.S.									
8	National Aeronautics and Space Administration, U.S.									
9	Commissariat à l'Energie Atomique, France									
10	U.S. Air Force, U.S.									
11	U.S. Department of Agriculture, U.S.									
12	Agency for Science, Technology and Research, Singapore									
13	Ministry of Defense, United Kingdom									
14	Council of Scientific and Industrial Research, India									
15	National Research Council of Canada, Canada									
16	Israel Ministry of Defense, Israel									

US Navy – Top ranked in IEEE Spectrum 2010 Patent Power Rankings – Government Agencies



*"The Navy has both a tradition and a future--and we look with pride and confidence in both directions."*

**Admiral George Anderson**, former Chief of Naval Operations

