Science, Technology & Innovation For National Security

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OSTP involvement in National Security S&T

- Overall “topline” for national security S&T
- Funding in particular technical areas of national importance, synergies between national security and civilian interests
- Health of defense S&T enterprise
  - Personnel/STEM workforce
  - Labs
  - Access to non-traditional contractors

Importance of national security R&D: a "civilian" perspective (1)

- Track record of supporting innovation that has had a huge impact on our economy and global competitiveness
  - Internet and many other IT advances
  - Integrated circuits (Minuteman missile /Navy 100 percent of 1962 market)
  - GPS
  - Computer science and materials science as disciplines
  - Robotics
  - Your favorite success story here
- Critical role in key disciplines, especially engineering

Importance of national security R&D: a “civilian” perspective (2)

- Ability to support research across TRLs, serve as “early adopter,”
- Diverse set of urgent, complex, challenging and important problems, patriotism as powerful motivator
- Willingness to make larger investments (hard to change the world on $100K/year grants)
- Strong program manager model (important complement to the NSF/NIH model)
- Enduring bipartisan support for national security mission

From perspective of 2030 – what are plausible game-changers (1)?

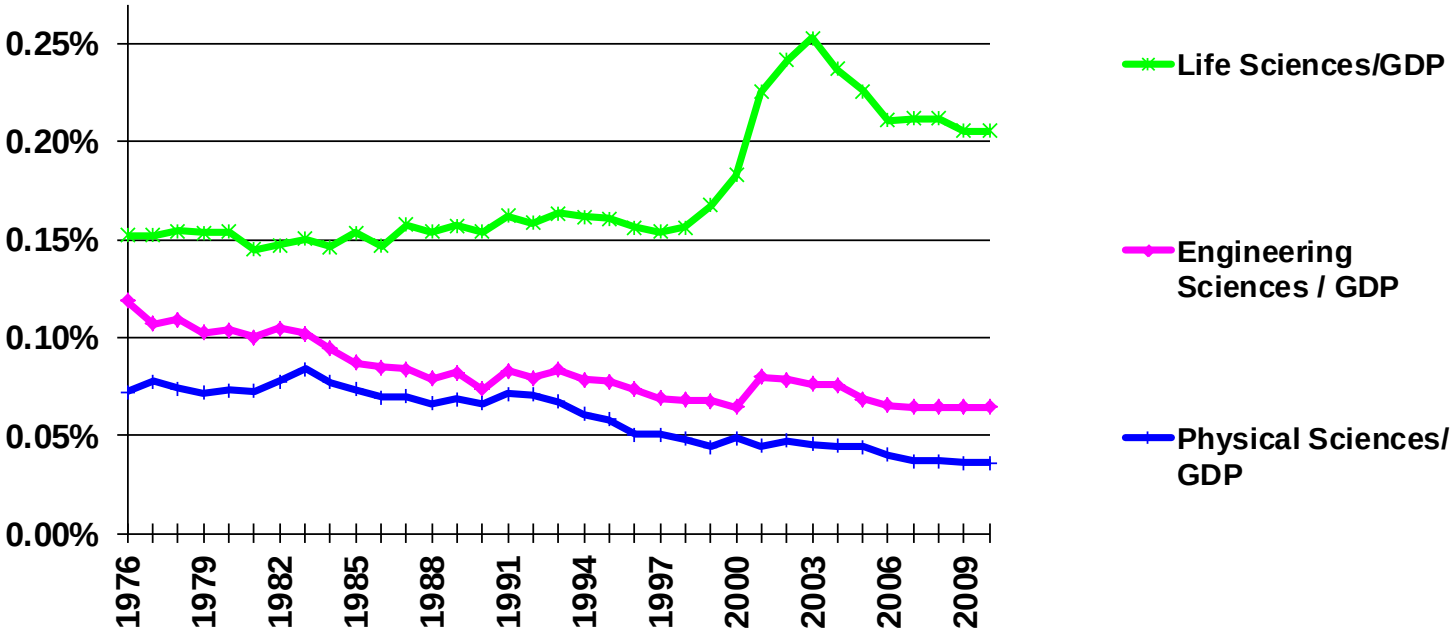
- Autonomous systems – dramatically reduce US casualties
- Flexible biodefense in response to unknown pathogens
- Biology as technology
- Advanced manufacturing (e.g. rapid, cost-effective low-volume production)
- Advanced training technologies (repeatable methodology for 2+ sigma improvement)
- Decision superiority
- US leadership in “converging” technologies
- Advances in systems engineering, coping with complexity

From perspective of 2030 – what are plausible game-changers (2)?

- Materials by design
- Next revolution in computing (e.g. quantum, novel architectures inspired by “reverse engineering” the brain)
- “Applied” social and behavioral sciences
- Your idea here

Trends in Federal Research by Discipline, FY 1976-2010

obligations for research / Gross Domestic Product



From "Sustaining US Global Leadership – Priorities for Sustaining 21st Century Defense"

- "In adjusting our strategy and attendant force size, the Department will make every effort to maintain an adequate industrial base and our investment in science and technology."

- "To that end, the Department will both encourage a culture of change and be prudent with its "seed corn," balancing reductions necessitated by resource pressures with the imperative to sustain key streams of innovation that may provide significant long-term payoffs."

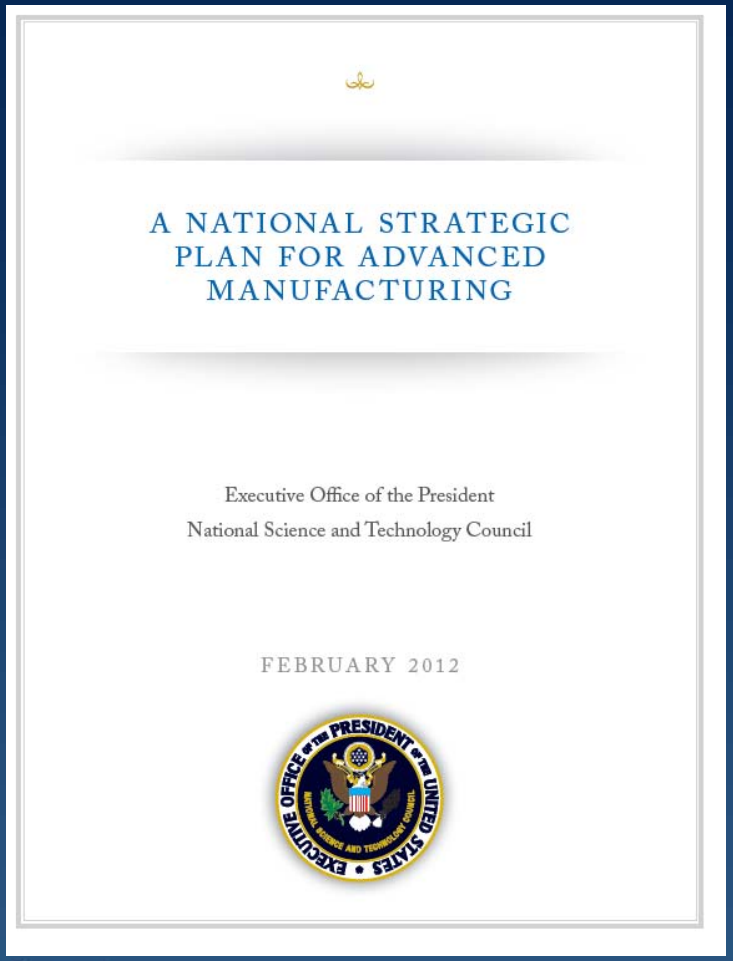
January 5, 2012

White House R&D Initiatives

- Advanced Manufacturing
- Energy
- Robotics
- Materials Genome
- BioEconomy
- Big Data
- STEM Education
- Grand Challenges
- Prizes
- Innovative Contracting

Strategic Plan for Advanced Manufacturing (AM)

- Accelerate investment in AM technology, especially by small and medium-sized enterprises
- Create and support national and regional public-private, government-industry-academic partnership
- Expand the number of workers with skills in demand and make the education and training system more responsive
- Optimize the federal government's AM investment by taking a portfolio perspective
- Increase total U.S. public and private investments in AM R&D.



National Network for Manufacturing Innovation

$1 billion FY13 proposal:

"institutes of manufacturing excellence where some of our most advanced engineering schools and our most innovative manufacturers collaborate on new ideas, new technology, new methods, new processes."

$45 million FY12 pilot – multi-agency pilot on additive manufacturing

President Obama at Rolls-Royce Crosspointe, Petersburg, VA, March 9, 2012

Promise of Additive Manufacturing

"… in our lifetime, at least 50% of the engine will be made by additive manufacturing."

—Robert McEwan, General Manager, Airfoils and Manufacturing Technologies, GE Aviation, 2011

Source: David Abbott, GE Aviation

Image courtesy of GE Aviation

WOHLERS ASSOCIATES

Energy Security

"Unleash us from the tether of fuel."

Gen. James Mattis, USMC

Public-Private partnerships to develop and procure alternative

BLUEPRINT FOR A SECURE ENERGY FUTURE

March 30, 2011

THEMES

- **Develop and Secure America's Energy Supplies**
- **Provide Consumers With Choices to Reduce Costs & Save Energy**
- **Innovate our Way to a Clean Energy Future**

National Robotics Initiative (NRI)

The realization of co-robots acting in direct support of individuals and groups…manufacturing, exploration, discovery, agriculture, security, …..

THEMES

- Fundamental research
- Controls and dynamical systems
- Computational models of human cognition
- Application-inspired topics
- Micro- and nano-robotics, neuro-robotics, humanoid robotics, & networked multi-robot team
- Understanding of the long term social, behavioral and economic implications of co-robots across all areas of human activity
- Use of co-robots for STEM learning

Materials Genome Initiative

Goal: Decrease the time-to-market by 50 %

To help businesses discover, develop, and deploy new materials twice as fast, we're launching what we call the Materials Genome Initiative. The invention of silicon circuits and lithium ion batteries made computers and iPods and iPads possible, but it took years to get those technologies from the drawing board to the market place. We can do it faster.

-President Obama, Carnegie Mellon University, June 2011

Initiatives

- Develop a Materials Innovation Infrastructure
- Achieve National goals in energy, security, and human welfare with advanced materials
- Equipping the next generation materials workforce

Themes

- Incentivizing open paradigms of sharing & access of tools
- Facilitating the development of innovation ecosystems & access to all stakeholders
- Driving innovative techniques across computation, informatics & experimentation
- Catalyzing shift in culture across the entire materials continuum & scaling the movement

BIG DATA

- ***"The future of computing is not just big iron. It's big data."***
- March 29th – agencies announce $200 million in additional investments in R&D related to Big Data
  - NSF and NIH joint solicitation
  - DARPA XDATA program
  - DOD "Data to Decision" initiative
  - Accelerate "data to knowledge to action."

STEM – Every Child a Maker

JOINING FORCES | TAKING ACTION TO SERVE AMERICA'S MILITARY FAMILIES

- FLOTUS Initiative to support veterans and military families

- Education
  - Improving STEM educational opportunities fro military children
  - Retraining of transitioning veterans
  - Training of military spouses
- Employment
  - Federal opportunities for veterans, spouses, and wounded warriors
  - Private sector hiring commitments
- Wellness
  - Enhance veteran access to care
  - Improve awareness and quality of care for veterans health issues

NATIONAL MATH + SCIENCE INITIATIVE

Strategy for American Innovation

"The Federal government should … use high-risk, high-reward policy tools such as prizes and challenges to solve tough problems."

-President Barack Obama

August 5, 2009

Grand Challenges

Department of Energy: Clean Energy Grand Challenges

- **SunShot:** To make solar energy cost competitive with other forms of energy by 2020
- **EV Everywhere:** To make electric vehicles as affordable and convenient to own as gas-powered vehicles by 2020

Private Sector Grand Challenges

- **IBM – Watson**
- **Google – self-driving car**
- **Qualcomm – Tricorder X Prize**

BENEFITS

- Help solve important economic and societal problems
- Serve as a "North Star" for high-impact, multi-disciplinary collaborations and public-private partnerships
- Create the foundation for the industries and jobs of the future
- Capture public imagination and increase support for public policies that foster science, technology and innovation
- Inspire the next generation of scientists, engineers, and entrepreneurs

Incentive Prizes

1. Exemplar (recognition)
2. Point-solution
3. Exposition
4. Participation
5. Network
6. Market stimulation

BENEFITS

- Shine a spotlight on a problem or opportunity
- Pay only for results
- Target an ambitious goal without predicting which team or approach is most likely to succeed
- Reach beyond usual suspects to tap top talent
- Stimulate private sector investment many times greater than the prize purse
- Bring out-of-discipline perspectives to bear
- Inspire risk-taking by offering a level playing field
- Establish clear target metrics and validation protocols

AFRL Vehicle Stopper Challenge

- Requirements
  - $25,000 for design for a system that could safely stop uncooperative fleeing vehicles without harm
  - Solution in 60 days
- Winner
  - Retired 66-year-old mechanical engineer from Lima, Peru

Solution remote electric-powered vehicle
- can accelerate up to 130 mph within 3 sec. to position itself under a fleeing car and automatically trigger a restrained airbag to lift the car and slide it to a stop

High Skills Immigration

- President Barack Obama,, 2012 State of the Union

"… let's at least agree to stop expelling responsible young people who want to staff our labs, start new businesses, defend this country. Send me a law that gives them the chance to earn their citizenship. I will sign it right away."

- Can we access foreign national talent from universities or international partners in national security R&D missions?
- Optional Practical Training (OPT) Extension for expanded list STEM degree programs
- Streamlining immigration for foreign entrepreneurs
- Expand the existing DOD Military Accessions Vital to the National Interest (MAVNI) program to include STEM professions?

Innovative Contracting Mechanisms

"Military advantage in the future will be conferred upon defense establishments that are able to mine the globalized, commercialized technology base the fastest, keeping ahead of competitors who will be able to draw from much of the same base. It is crucial to U.S. military advantage that it be a faster adopter and adapter of technology, since it can no longer hope to be technology's exclusive owner … ***The single most powerful mechanism to make defense a smart buyer of technology is to reduce the artificial barriers that separate defense businesses from commercial businesses."***

- Hon. Ash Carter noted in Keeping the Edge: Managing Defense for the Future

"For decades the U.S. has commanded a decisive lead in the quality of defense-related research and engineering conducted globally and in the military capabilities of the products that flow from this work. However, the advantages, which have enabled American pre-eminence in defense technology, are not a birthright and they must be sustained."

- Hon. Frank Kendall to SASC, 2011

Innovative Contracting Mechanisms

- Expand use of “Other Transactions” – where appropriate
- Administration position on OT reauthorization
- In-Q-Tel model
- Non-Traditional Enterprise Acquisition of Technology (CIA)
- Applied Research Prototypes (NSA)
- Agile procurement (especially for software)
- Other examples?