Science & America's National Security

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Introduction

Scientific innovation bolsters American national security.

Through science, the United States has developed technology and practices that have led to a stronger military and to economic growth.

The American military depends upon scientific advancements to keep it modern and adaptive. In turn, the Department of Defense has funded and driven a large portion of American scientific innovation.

Recent data indicates that the United States is losing its position as a global leader in scientific innovation. This decline correlates with America's drop in global competitiveness rankings.

The American research and development supply chain has become too complex and convoluted, putting it at risk.

As the U.S. moves into a new era, the role that science plays in contributing to American competitiveness and national security must be examined.

Science and the Department of Defense

- The U.S. Department of Defense is at the forefront of pursuing and developing scientific advancements that benefit national security.

- Using science and technology to maintain a military advantage over America's enemies has been a central tenet of American national defense since the founding of the Republic. This tenet's inclusion in National Security Acts since 1947 emphasizes its importance.[1]

- The Department of Defense spent $74,871,000,000 (amounting to a little more than 10%) of its recorded 2011 budget total on "Research, Development, Test, and Evaluation" (RDT&E).[2]

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- The Committee on Appropriations' June, 2012 Department of Defense Appropriations Bill for 2013, recommended that $69,984,145,000 be budgeted for RDT&E.[3]

- The U.S. Navy is working to reduce its reliance upon fossil fuels. Its actions in the last few years, leading to the "Great Green Fleet", have made it a leader in developing and utilizing renewable energy to power America's military.[4]

- The Department of Defense has made cyber security one of its main concerns and is working with scientists and specialists to research and develop new methods to strengthen America's cyber security.[5]

- Although unmanned aerial vehicles were developed for military purposes, they are now being redesigned for a variety of other purposes; such as topography, emergency response, and agricultural use.[6]

## National Security and Historic Scientific Innovations

Throughout America's history, science has worked with the Department of Defense to protect national security and to produce scientific innovations that have changed the world.

- **US Steel**

    - After the invention of the Bessemer converter, the world powers began producing steel in massive quantities.

    - In the 1880's, the U.S. Navy chose to use American steel to build its ships. At that time, the Navy could have purchased steel from Britain or Germany for roughly one third the price of American steel.

    - The Navy's decision to back American producers laid the foundation for a globally dominant steel industry that would build America's infrastructure and win two world wars.[7]

- **Aviation**

    - In 1907, the military announced an advertisement for bids to build an airplane; however, the narrow specifications made it so that the Wrights were the only possible bidder. In 1909 the army bought the world's first military airplane from the Wright Brothers. For most of WWII, the United States acted as a large manufacturer and developer of airplane engines and parts for the Allied Forces. Post-Pearl Harbor, this manufacturing was scaled up as the U.S. joined the war.[8]

- American advancements in aeronautics during WWII were spurred on by the rise of defense contractors, including: Boeing, Lockheed Aircraft Corp., Glen L. Martin Company, Bell Aircraft Co., and Douglas Aircraft Company.[9]

- These advancements would later be used to propel the burgeoning American commercial aviation industry during the late 1950's.[10]

- **Nuclear Power**

  - In the 1930's, the scientists in the United States were at the forefront of a host of advancements towards harnessing nuclear power.

  - After Pearl Harbor, the United States government refocused its efforts upon building an atomic bomb. Through government funding and the collaboration of the most important scientists from around the world, the Manhattan Project was able to successfully test the first atomic device on July 16th, 1945.[11]

  o When World War II ended, the U.S. Government used the Manhattan Project's research to work towards the development of civil nuclear energy, and in 1946 Congress created the Atomic Energy Commission (AEC).[12]

  - In the 1950's the Navy took the lead on the development of nuclear energy for submarine propulsion, leading to the creation of the light water reactors that powered the *Nautilus* and succeeding generations of submarines. This basic reactor design was then adapted for civilian nuclear power.[13]
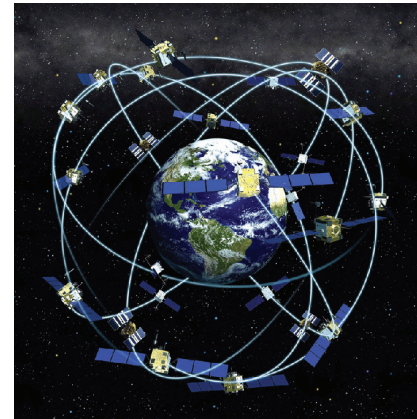
- **GPS**

  - Created entirely for military purposes, the Global Positioning System greatly surpassed previous navigation systems and was the backbone for modernizing the global air traffic system.

  - Beginning in 1973, GPS was designed and realized by the U.S. Department of Defense and American military contractors.[14] It became fully operational in 1994 and has inspired many other civil and military technological innovations, while also generating over 100,000 jobs in a multi-billion dollar industry.[15]

- **The Internet**

  - In 1957 the U.S. Department of Defense (DOD) formed a small agency called ARPA (Advanced Research Projects Agency) to work on R&D for military science and technology. A few years later, ARPA became the main sponsor for MIT's research on sharing information using small, phone-linked networks. They hoped to discover a way to maintain command and control after a nuclear attack.[16]

- In 1966, ARPANET was unveiled and in 1969 the DOD commissioned ARPANET for network research. Within two years, ARPANET had a total of 15 connected schools and institutions and in 1973 it went global when the College of London and Norway's Royal Radar Establishment joined the network.[17]

- The next three decades would see a host of American advancements that would build upon ARPANET to create the internet that the world uses today.
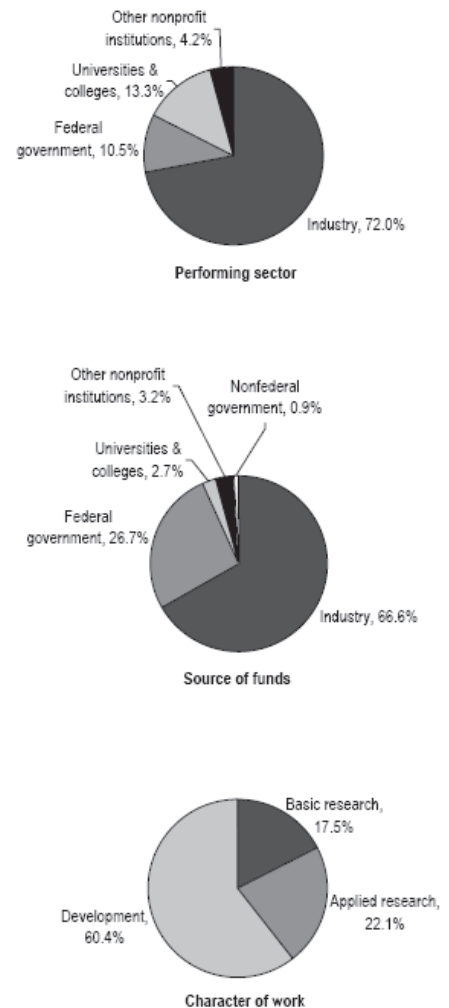
U.S. is Losing its Position as a Global Leader in Scientific Innovation

- The United States dropped two places from 5th to 7th in the World Economic Forum's 2012-2013 "Global Competitiveness Report".[18] In this same report the U.S. also placed sixth in the innovation pillar, which measured each country's capacity for innovation, quality of research institutions, and R&D spending.[19]

- The U.S. ranks 9th in terms of R&D spending as a percentage of GDP (both public and private), behind countries like Japan, Korea, Sweden and Denmark.[20]

- In 2010, the Department of Energy spent $2.27 billion on applied R&D, which by comparison, is less than the government spends on tax benefits for employee parking ($3.1 billion).[21]

- The U.S. ranks 27th among developed nations in the proportion of college students receiving undergraduate degrees in science and engineering.[22]

- According to a 2011 Research!America poll, 77% of Americans agree that the U.S. losing its competitive edge in science, technology, and innovation.[23]

Science and America's Economic Security

- Scientific innovation allows American companies to remain competitive in the international market while also spurring economic growth.

- Between 1998 and 2007, R&D accounted for roughly 6.3% of average annual growth in real GDP (GDP adjusted for in-

FIGURE 1. Share of U.S. R&D expenditures, by character of work, source of funds, and performing sector: 2007 (estimated)

Performing sector

Other nonprofit institutions, 4.2%
Universities & colleges, 13.3%
Federal government, 10.5%
Industry, 72.0%

Source of funds

Other nonprofit institutions, 3.2%
Nonfederal government, 0.9%
Universities & colleges, 2.7%
Federal government, 26.7%
Industry, 66.6%

Character of work

Basic research, 17.5%
Applied research, 22.1%
Development, 60.4%

NOTES: U.S. R&D expenditures totaled an estimated $368.1 billion in 2007. Federal R&D performers include federal agencies and federally funded research and development centers.

SOURCE: National Science Foundation, Division of Science Resources Statistics, National Patterns of R&D Resources (annual series).

flation) and 6.6% between 2002 and 2007.[24]

- Total R&D spending (both public and private) is today about 2.85% of GDP.[25]

- Science and basic research are necessary to properly harness America's resources and capital.

The Greatest Future Threats to the United States Will Require Scientific Solutions

- **Energy Security:**

  - The United States will need to provide better access to modern energy for U.S. citizens and the 1.5 billion people around the world who live without regular energy.

  - It also needs to develop new sources of clean energy and more efficient methods of extracting and consuming fossil fuels.

- **Climate Change:**

  - America needs to reduce its greenhouse gases to avoid the worst effects of climate change; such as: rising water, droughts, famine, and natural disasters.[26]

- **Growing Population:**

  - The population of the United States is expected to grow by 93 million as soon as 2050.[27]

  - To deal with this population growth, America must increase its agricultural productivity, reduce the stresses upon on its water resources, and create more jobs.

- **Health Concerns:**

  - America needs to continue to address biological outbreaks and pandemics, like the Avian Flu, which require constant scientific and medical innovation.

- **Next-Generation Weapons:**

  - America's future will require an advanced and modern military that can deal with both conventional and non-state actor threats.

  - The Department of Defense must continue to support R&D in order to remain innovative and prepared.

  - Proper investment in next-generation weapons and weapon systems will be crucial to maintaining America's military strength in the future.

Conclusions

- America's national security is intricately linked to scientific innovation.

- Scientific advancements have bolstered the United States' capacity to successfully engage in war and, in return, the military has played a critical role in driving innovation.

- The Department of Defense has a long history of scientific pioneering, which has helped create business opportunities for American companies and improve the well being of U.S. citizens.

- In the future, the largest threats to America's national security will require scientific solutions.

- For this reason and many more, the United States needs to reassess its current R&D policies, to properly plan and foster future innovation, and to reinvest in science and science education.

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For More Info:

ASP's American Competitiveness Page

Science and National Security Forum

Science and National Security (Brigadier General John Adams USA (Ret.)

ASP's Research and Development Fact Sheet

CIA and Science

Endnotes

1.   National Security Act of 1947, Public Law 253, 80th Congress, 1st Session (1947)

2.   Historical Tables (Figure 3.2). (2012). Retrieved September 27, 2012, from Office of Management and Budget: http://www.whitehouse.gov/omb/budget/Historicals/

3.   Department of Defense Appropriations Bill, 2013, 112-493, 112th Congress, 2d Session (2012).

4.   Energy. (2012, September 28). Retrieved from U.S. Navy Energy, Environment and Climate Change: http://greenfleet.dodlive.mil/energy/

5.   (2011). Department of Defense Strategy for Operating in Cyberspace. Department of Defense.

6.   Neild, B. (2012, July 12). Not just for military use, drones turn civilian. Retrieved from CNN: http://www.cnn.com/2012/07/12/world/europe/civilian-drones-farnborough/index.html

7.   Economic Development into the 1880's. Retrieved from Macrohistory and World Report: http://www.fsmitha.com/h3/h46-am5.htm

8.   Military Use of the Airplane. Retrieved from The Wright Brothers: http://airandspace.si.edu/wrightbrothers/age/1910/military.cfm

9.   History, The War Years: 1939-1945. Retrieved from Boeing: http://www.boeing.com/history/narrative/n026dou.html

10. Attack Aircraft Development in Late WWII. (2008, December 31). Retrieved from National Museum of the U.S. Air Force: http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=3165

11. Outline History of Nuclear Energy. (2010, June). Retrieved from World Nuclear Association: http://www.world-nuclear.org/info/inf54.html

12. U.S. Department of Energy. The History of Nuclear Energy. Washington, District of Columbia, United States. p. 8

13. Ibid p. 13

14. Stanford University. (2004, February 18). GPS Inventor inducted into hall of fame. Retrieved from Stanford Report: http://news.stanford.edu/news/2004/february18/parkinson-218.html

15. Global Positioning Systems History. Retrieved from National Park Service: http://www.nps.gov/gis/gps/history.html

16. Birth of the Internet, ARPANET General Overview. Retrieved from Explore the Internet: http://smithsonian.yahoo.com/arpanet2.html

17. Internet History. Retrieved from Computer History Museum: http://www.computerhistory.org/internet_history/

18. Schwab, K. (2012). The Global Competitiveness Report 2012-2013. Geneva: World Economic Forum.

19. Ibid

20. Grueber, M. (2011, December 16). 2012 Global R&D Funding Forecast: R&D Spending Growth Continues While Globalization Accelerates. Retrieved from R&D: http://www.rdmag.com/Featured-Articles/2011/12/2012-Global-RD-Funding-Forecast-RD-Spending-Growth-Continues-While-Globalization-Accelerates/

21. Augustine, N. (2011, September 2). The Research and Development Gap. Retrieved from The Hill: http://thehill.com/blogs/congress-blog/technology/179367-the-research-and-development-gap

22. STEM Education in Washington State: The Facts of the Matter. (2011). Rising Above the Gathering Storm: STEM Education in Washington State (pp. 1-30). Seattle: Washington State Academy of Sciences.

23. (2012). America Speaks! Alexandria: Research!America.

24. (2012). Research and Development as a National Priority. Washington, D.C.: American Security Project. Retrieved from American Security Project: http://americansecurityproject.org/wp-content/uploads/2012/01/Ref-0043-RD-fact-Sheet-Jan-2012.pdf

25. Grueber, M. (2011, December 16). 2012 Global R&D Funding Forecast: R&D Spending Growth Continues While Globalization Accelerates. Retrieved from R&D: http://www.rdmag.com/Featured-Articles/2011/12/2012-Global-RD-Funding-Forecast-RD-Spending-Growth-Continues-While-Globalization-Accelerates/

26. Climate, Energy, and Security. (2012, September 28). Retrieved from American Security Project: http://americansecurityproject.org/issues/climate-energy-and-security/climate-change/consequences/

27. Friedman, H. S. (2012, 1 31). 10 Countries With the Largest Projected Population Growth: American Exceptionalism. Retrieved from The Huffington Post: http://www.huffingtonpost.com/howard-steven-friedman/population-growth-worldwide_b_1245202.html

Building a New American Arsenal

The American Security Project (ASP) is a nonpartisan initiative to educate the American public about the changing nature of national security in the 21st century.

Gone are the days when a nation's strength could be measured by bombers and battleships. Security in this new era requires a New American Arsenal harnessing all of America's strengths: the force of our diplomacy; the might of our military; the vigor of our economy; and the power of our ideals.

We believe that America must lead other nations in the pursuit of our common goals and shared security. We must confront international challenges with all the tools at our disposal. We must address emerging problems before they become security crises. And to do this, we must forge a new bipartisan consensus at home.

ASP brings together prominent American leaders, current and former members of Congress, retired military officers, and former government officials. Staff direct research on a broad range of issues and engages and empowers the American public by taking its findings directly to them.

We live in a time when the threats to our security are as complex and diverse as terrorism, the spread of weapons of mass destruction, climate change, failed and failing states, disease, and pandemics. The same-old solutions and partisan bickering won't do. America needs an honest dialogue about security that is as robust as it is realistic.

ASP exists to promote that dialogue, to forge consensus, and to spur constructive action so that America meets the challenges to its security while seizing the opportunities the new century offers.

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