

Long-Term Thinking in Government About S&T and Human Well-Being With a Focus on the Obama Administration

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**Remarks for
Big Hook**

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Underpinnings of thinking about this under Obama

- He was more interested in and informed about ST&I* and their role in the nation's future than any other modern president.
 - Where did he get it? Genachowski; voracious reading with a good BS filter; dinner "salons" with top scientists, engineers, & innovators.
 - He thought about time frames far beyond 4 and 8 years.
- His interest and enthusiasm were reflected in...
 - My interactions with him before he appointed me
 - Care & quality in other Presidential S&T appointments
 - Empowerment of OSTP in structure and access; clarity with senior staff and Cabinet about his respect for the S&T "facts"
 - Attention to the thinking of scientists, engineers, & innovators both inside and outside his administration
 - Willingness to invest in ST&I initiatives around the best ideas
 - His use of the presidential podium & WH events to promote ST&I

* ST&I = Science, Technology, and Innovation

ST&I-related challenges of interest to Obama

- Challenges with which he was fully engaged before taking office
 - ST&I to advance the economy (infotech, biotech, nanotech, energytech, advanced manufacturing)
 - ST&I in biomedicine, IT, and the interaction of these domains to reduce the burdens of disease
 - Measures to reduce the salience of nuclear weapons in foreign affairs
 - Measures to protect the productivity & ecological integrity of the oceans
 - Lifting the Nation's game in STEM education & S&T workforce training
 - ST&I to fully understand & address the energy-climate challenge

ST&I-related challenges of interest to Obama (continued)

- Challenges in which he became much more engaged in office
 - Cybersecurity
 - Artificial organs
 - Precision medicine
 - Big data and privacy
 - Human space exploration
 - The management of epidemics
 - Reducing risks from asteroid impacts
 - Strategic computing / quantum computing
 - Artificial intelligence & the future of employment
 - The adaptation component of climate-change strategy
 - Space weather, EMP, and the resilience of the electricity grid
 - The science & technology of Arctic challenges & opportunities

ST&I-related challenges of interest to Obama (continued)

- In every listed case in both categories (which are partial lists), Obama's interests were reflected in...
 - Requests to the Office of Science and Technology Policy, the National Science and Technology Council, the President's Council of Advisors on Science and Technology (PCAST), and other White House councils for assessments and recommendations, and/or...
 - Creation of new interagency task forces and councils to address the challenges (e.g., National Ocean Council, Council on Climate-Change Preparedness & Resilience, Arctic Executive Steering Committee, Task Force on Advanced Manufacturing, Quadrennial Energy Review)
 - Significant new Administration initiatives based on the recommendations developed in these efforts

PCAST studies under Obama

- The science and technology of 2009-H1N1 influenza
- Reengineering the influenza vaccine production enterprise
- Assessment of the National Nanotechnology Initiative (4 reports)
- STEM education & workforce training (4 reports)
- Accelerating the pace of change in energy technologies
- Realizing the full potential of health IT to improve healthcare
- Networking and Information Technology R&D (4 reports)
- Advanced manufacturing (3 reports)
- Sustaining biodiversity and other environmental capital
- Managing government-owned spectrum for economic growth
- Accelerating drug development and approval
- The future of the US S&T enterprise
- Near-term options for addressing climate change
- Agricultural preparedness and related R&D

PCAST studies under Obama (continued)

- Combating antibiotic resistance
- Bolstering cybersecurity (1 unclassified & 1 classified report)
- Systems engineering for healthcare
- Technological aspects of big data and privacy
- Hearing technologies
- Independence, technology, & connection in old age
- Technology and the future of cities
- Private-sector adaptation to climate change
- Forensic science in the criminal courts (1 report + addendum)
- Protecting the Nation against biological attack
- S&T to ensure the safety of the Nation's drinking water
- Ensuring long-term U.S. leadership in semiconductors

The unclassified reports are archived at
<https://obamawhitehouse.archives.gov/administration/eop/ostp/pcast/docsreports>

A partial list of Obama Administration ST&I initiatives

INNOVATION FOR THE ECONOMY

- American Innovation Strategy
- Startup America
- Materials Genome Initiative
- Data.gov
- Challenge.gov
- Advanced Mfg Partnership / Nat'l Network for Mfg Innovation

STEM EDUCATION

- Educate to Innovate
- STEM Master Teacher Corps
- 100kin10
- STEM Inclusion Initiative
- Computer Science for All

INFOTECH / COMPUTING

- ConnectED
- Big Data Initiative
- Nat'l Strategic Computing Initiative

BIOMEDICINE & HEALTH

- Neuroscience / BRAIN Initiative
- Combating Antimicrobial Resistance
- Precision Medicine Initiative (PMI)
- Cancer Moonshot

NAT'L SECURITY

- Cybersecurity Initiative
- Space Weather Strategy

ENERGY & ENVIRONMENT

- New fuel-economy/CO₂ standards
- ARPA-E, Energy Innovation Hubs
- Social cost of carbon
- Climate Action Plan & COP21
- Mission Innovation
- National Ocean Policy
- Arctic Initiative / AESC
- Pollinator Initiative
- Valuation of ecosystem services

For details and more initiatives see <https://obamawhitehouse.archives.gov/the-press-office/2016/06/21/impact-report-100-examples-president-obamas-leadership-science>

Cross-cutting themes in ST&I under Obama

- A high proportion of these issues entailed playing a long game, in which most of the fruits of the efforts would only materialize well after the Administration had left office (in some cases decades after).
- In many of the issues, the degree of uncertainty about how S&T will evolve and how society will react is so high that the appropriate strategy involves investments that hedge bets and lay groundwork for being able to respond appropriately when the situation becomes clearer.
- Both of these considerations favor increased investments in basic research.
- The complexity of the challenges for which ST&I are germane and the diversity of capabilities required to succeed favor proceeding via collaboration across government, industry, & academia.

Where we fell short on ST&I issues

- Goal to raise sum of public + private R&D to 3% of GDP was not met.
 - In round numbers, this would have entailed raising gov't R&D to 1% of GDP and incentivizing industry to reach 2%.
 - After big boost in Federal R&D in American Recovery & Reinvestment Act (early 2009) and more modest increase in 2010, budget caps prevented further growth.
 - It took almost 7 years of trying to get Congress to make the Research & Experimentation Tax Credit for the private sector larger, simpler, and permanent.
 - At the end of the Administration, we were at 0.75% of GDP for Federal R&D and 2.05% of GDP for non-Federal R&D.

Where we fell short (continued)

- A nationwide price on carbon emissions was not achieved.
 - A “cap-and-trade” bill passed the house in 2010 but never got a vote in the Senate—health care debate got in the way.
 - Republican control of Congress after the 2010 midterms made any form of carbon price a dead letter.
 - Modeling showed Obama 2025 target of 26-28% below 2005 by 2025 could have been 32-33% with a moderate carbon tax.
- Shifts in nuclear-weapon policy were modest
 - The broad vision Obama articulated in Prague in 2009—devaluing the currency of nuclear weapons worldwide—foundered for a number of reasons.
 - The Iran nuclear agreement was the biggest success, but matters went downhill with Russia and North Korea.
- We left off our agenda the role of population growth in compounding the global challenges ST&I must meet.

Looking ahead: White House Frontiers Conference

Pittsburgh, PA • October 2016

Looking ahead 50 years at...

Personal Frontiers: Advancing precision medicine, neuroscience, health-care innovation; combating antibiotic resistance

Local Frontiers: Building smart, inclusive communities using, e.g., open data, internet of things, transportation innovation; improving criminal justice

National Frontiers: Harnessing broadband, data science, machine learning, automation, robotics in ways that benefit all Americans; advanced manufacturing

Global Frontiers: Accelerating the clean-energy revolution and developing advanced climate-change information, tools, services, and collaborations; enhancing ocean resilience

Interplanetary Frontiers: Advancing space exploration; harnessing the small-satellite revolution; ameliorating asteroid risks and other space hazards



https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/ostp_exit_memo_final.pdf

Looking ahead: ST&I in government under Trump

- He has appointed fact-averse ideologues to some key posts (Pruitt, Zinke, Mulvaney, DeVos) but not all (Mattis, Collins, Cordova, Droegemeier).
- He personally has no knowledge of / interest in S&T, in analysis more generally, or in long-range thinking (except judges!)
- He has rescinded as many of Obama's climate & clean-energy initiatives as he can without Congress.
- OSTP's main substantive focuses to date have been drones, self-driving cars, AI, and cybersecurity.
- There is as yet no PCAST...and little action in NSTC.
- ST&I will advance despite less help from the gov't, but more slowly and more unevenly;

Looking ahead: What ST&I developments will have most affected human well-being by 2068?

UPSIDE BIGGER THAN DOWNSIDE

- Transformative energy-supply and energy-efficiency technologies
- Precision medicine, artificial organs, neuroscience
- Quantum computing → synthetic chemistry

DOWNSIDE BIGGER THAN UPSIDE

- Engineered pathogens & engineered defenses against them
- Ubiquitous surveillance technologies
- Miniature drones

TOSS-UPS

- Social media
- The internet of things
- Cyber attack / cyber defense

Your lists?

Looking ahead: A closing thought

Arguably the biggest pitfall in thinking about the future of the intersection of ST&I with human well-being—aside from advances in S&T we cannot even imagine—is underrating the diversity and perversity of the ways human frailties can screw things up.