Technology Assessment in the US: Reinvigoration and Reinvention

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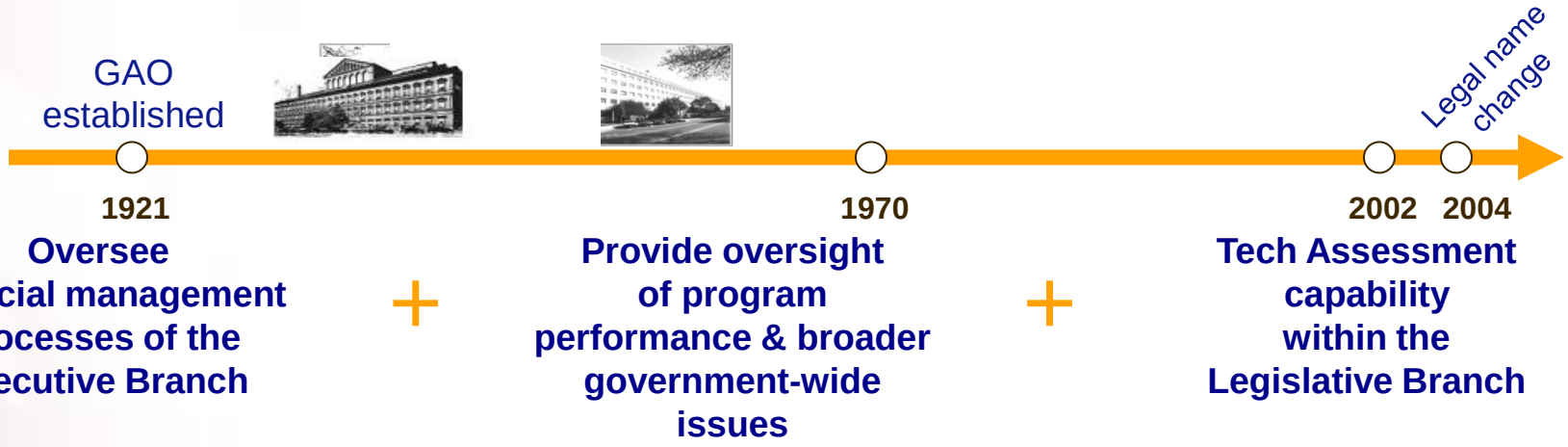
U.S. Federal Government Overview

Evolution of GAO Mission

- At first, the organization's primary function was financial auditing, but over time it evolved to include performance auditing, program evaluations, policy analyses, and technology assessments



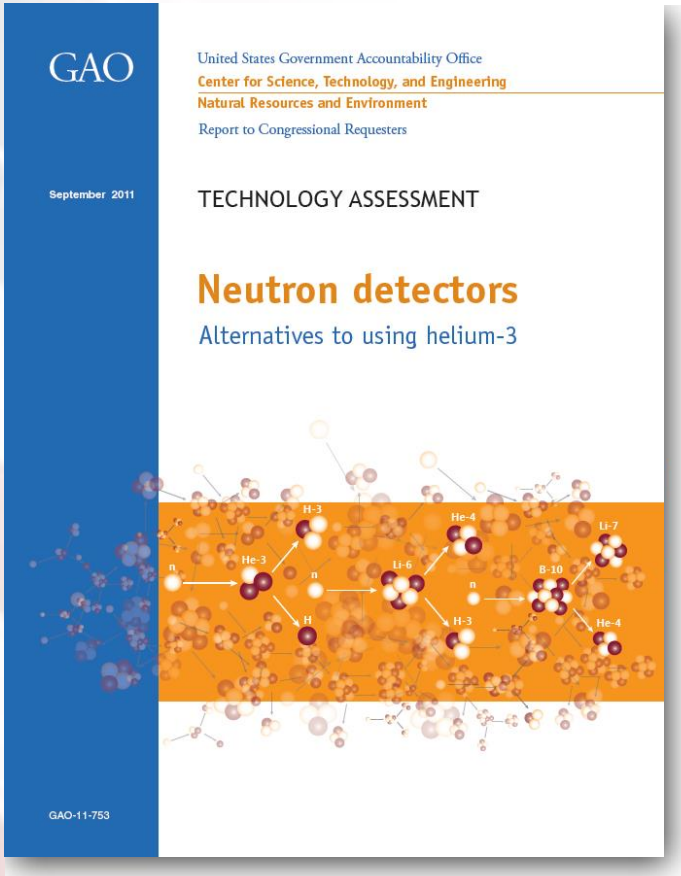
- As GAO's mission evolved, so did the expertise of its staff (from auditors to accountants, to a wide range of experts in STEM)
- GAO's legal name became the Government Accountability Office (2004)
- *cf.*, http://www.gao.gov/multimedia/video/gao_s_90th_anniversary

Why Is Technology Assessment Important in GAO's Work for Congress?

- Provides the thorough and balanced analysis of significant primary, indirect, and delayed interactions of a technological innovation with society, the environment, and the economy and the present and foreseen consequences and impacts of those interactions

- Makes complex science & technology issues more accessible by analyzing the values and trade-offs of various technologies and presenting them in a public policy context that can be applied directly into the Congressional process (*e.g.*, agenda setting, educating and communicating, prioritizing and aggregating, and/or developing policy proposals)

GAO-11-753: Neutron Detectors: Alternatives to Using Helium-3 (9/29/2011)



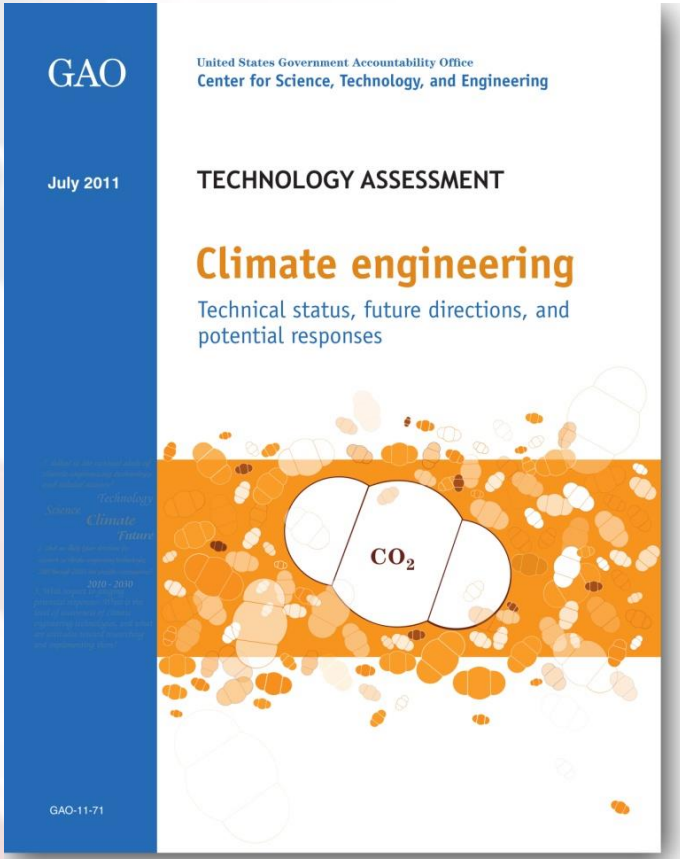
RESULTS

- Science facilities and federal agencies see three promising alternative neutron detector technologies: boron-10 lined proportional detectors, boron trifluoride gas proportional detectors, and lithium-6 scintillators, each with a TRL ranging from 5 to 7.
- A boron-10 lined proportional detector may be available for domestic radiation portal monitor deployments in early fiscal year 2012.
- Federal agencies are funding more than 30 research and development projects that may result in additional alternative neutron detector technologies.

IMPACT

- Requesters utilized report as technology scorecard for multi-agency R&D efforts
- Complementary report to GAO-11-472 – Managing Critical Isotopes: Weaknesses in DOE's Management of Helium-3 Delayed the Federal Response to a Critical Supply Shortage

GAO-11-71: Climate Engineering – Technical Status, Future Directions, and Potential Responses (7/28/2011)



RESULTS

- Emerging technologies, which include carbon dioxide removal (CDR) and solar radiation management (SRM) are not now viable options – may be difficult to develop because of current gaps in climate data, models
- Future directions—expert views advocate conducting research immediately see urgency or express "insurance" view while opponents cite major risks or say not needed; advocates emphasize risk management in future research and envision a future federal effort with specific features
- Potential responses – public not currently familiar with climate engineering yet are open to research but concerned about safety

IMPACT

- Requester held multiple hearings on this topic, this report contributed to ongoing follow on discussions
- Complementary report to GAO-10-903

Ranking Member of House Committee on Natural Resources Requests Technology Assessment of *Water Conservation Technologies* (October 2012)

3 Major Areas of Examination

(1) Technologies available or being researched to reduce fresh water consumption and employ alternative water sources in thermoelectric power plants

(2) Technologies either available or being researched to reduce fresh water consumption and prevent or address water contamination in drilling and mining activities, such as commercial oil and shale-gas development and uranium mining

(3) Locations in the United States facing water scarcity problems that would benefit most from available and developing technologies

Ongoing TA Activities

Codification of the quality assurance framework for TAs

Assessment of policy, scientific/technical, and foresight community response to recent report and innovations

Development of metrics for impact, *e.g.*, attention to distinctions such as conceptual and instrumental use

Consideration of TA model for examining other complex issues

GAO is Developing a Designing Technology Assessment Guide

- GAO analysts require diverse methodologies to develop sound and timely answers to the questions the Congress asks.
- The guide will address the logic and design of technology assessments.
- The guide will introduce key issues in reviewing and designing technology assessments to best meet decision-makers' needs while accounting for the constraints GAO analysts face.
- The guide will provide an audit tool for GAO analysts and others examining and conducting technology assessments.

Designing Technology Assessment Guide Objectives

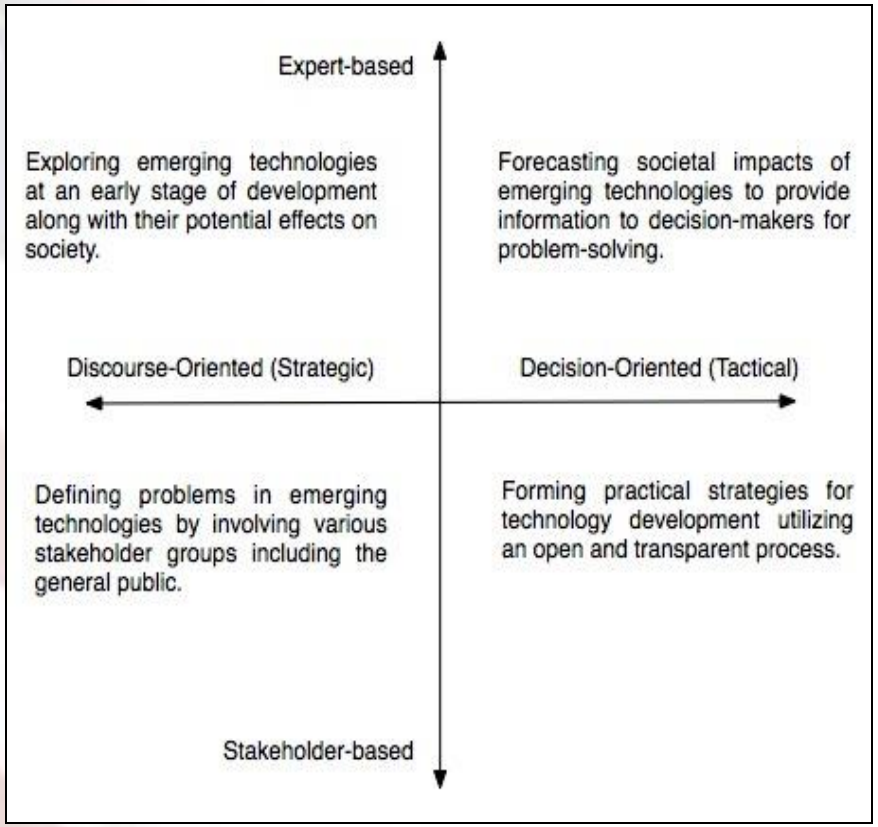
The GAO guide will focus on:

- What is a technology assessment?
- What are the key steps of a technology assessment design?
- What factors should be considered in selecting an appropriate technology assessment design?
- What are different methods for conducting a technology assessment?
- What are the strengths and weaknesses of different methods?

Key Steps in Designing a Technology Assessment

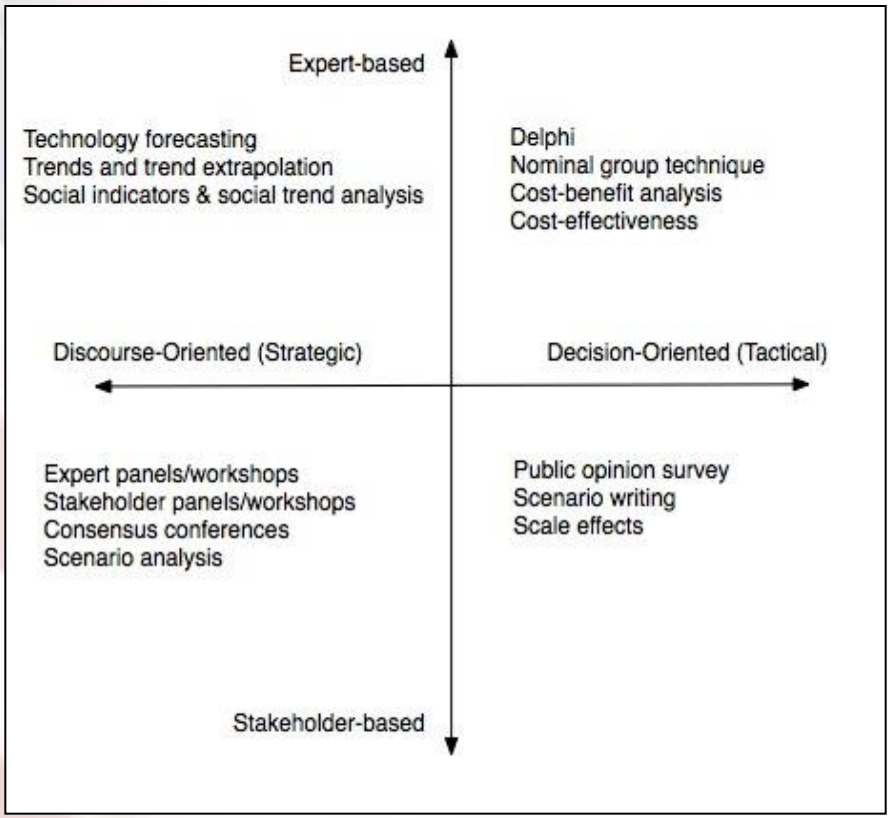
- A GAO technology assessment is tailored to answer specific questions about implications of technological development and change.
- Clarify and agree upon an understanding of the technology to be assessed.
- Develop relevant and useful technology assessment questions.
- Identify the data sources, collection procedures, and scientific, technological and other expertise that will be required to credibly address the questions.
- Select appropriate methods, techniques, and tools to address the questions.
- Develop plans to analyze the data in ways that allow valid conclusions to be drawn from the technology assessment questions.

Defining the TA scope



- Different TA organizations, such as PACITA and EPTA members, the Innovation and Institutionalization of Technology Assessment (I2TA) project in Japan, utilize different TA approaches.
- Two TA approaches: Expert-based and Stakeholder-based
- Since GAO focuses on providing information to decision-makers, its approach is tailored as appropriate to the TA objectives.

Framing TA Methods



- Different methods (or techniques) can be used within the TA. TA methods depend on the TA approach and questions that are the focus of the study.
- As an example, for a technology at the early stage of development, a method that could be utilized is **technology forecasting**. Questions of interest could include: Is the technology likely to being utilized by the target recipients as it was intended? What is the range of plausible alternatives for the future development of the technology, and which alternatives are most and least likely?
- As another example, if the technology is stable and mature, then a method that could be utilized is **cost-effectiveness analysis**. Questions of interest would include: How does the technology compare with other potential alternatives?

Sampling of TA Methods Utilized by GAO

- Cost-Benefit Analysis (e.g., Using Biometrics for Border Security, GAO-03-174)
- Expert Panel (e.g., Protecting Structures and Improving Communications during Wildland Fires, GAO-05-380)
- Risk Analysis (e.g., Cybersecurity for Critical Infrastructure, GAO-04-321,)
- Scenario Writing (e.g., Securing the Transport of Cargo Containers, GAO-06-68SU)
- Stakeholder Panel (e.g., Explosives Detection Technologies to Protect Passenger Rail, GAO-10-898)
- Technology Forecasting (e.g., Neutron Detectors, GAO-11-753)
- Trends and Trend Extrapolation (e.g., Climate Engineering, GAO-11-71)

GAO Technology Assessment Reports

TECHNOLOGY ASSESSMENT: Using Biometrics for Border Security, GAO-03-174, November 14, 2002

TECHNOLOGY ASSESSMENT: Cybersecurity for Critical Infrastructure Protection, GAO-04-321, May 28, 2004

TECHNOLOGY ASSESSMENT: Protecting Structures and Improving Communications during Wildland Fires, GAO-05-380, April 26, 2005

TECHNOLOGY ASSESSMENT: Securing the Transport of Cargo Containers, GAO-06-68SU, January 14, 2006 [Classification: For Official Use Only]

TECHNOLOGY ASSESSMENT: Explosives Detection Technology to Protect Passenger Rail, GAO-10-898, July 28, 2010

TECHNOLOGY ASSESSMENT: Climate Engineering—Technical Status, Current Perspectives, and Future Prospects, GAO-11-71, July 28, 2011

TECHNOLOGY ASSESSMENT: Neutron Detectors—Alternatives to Using Helium-3, GAO-11-753, September 29, 2011

Contact Information

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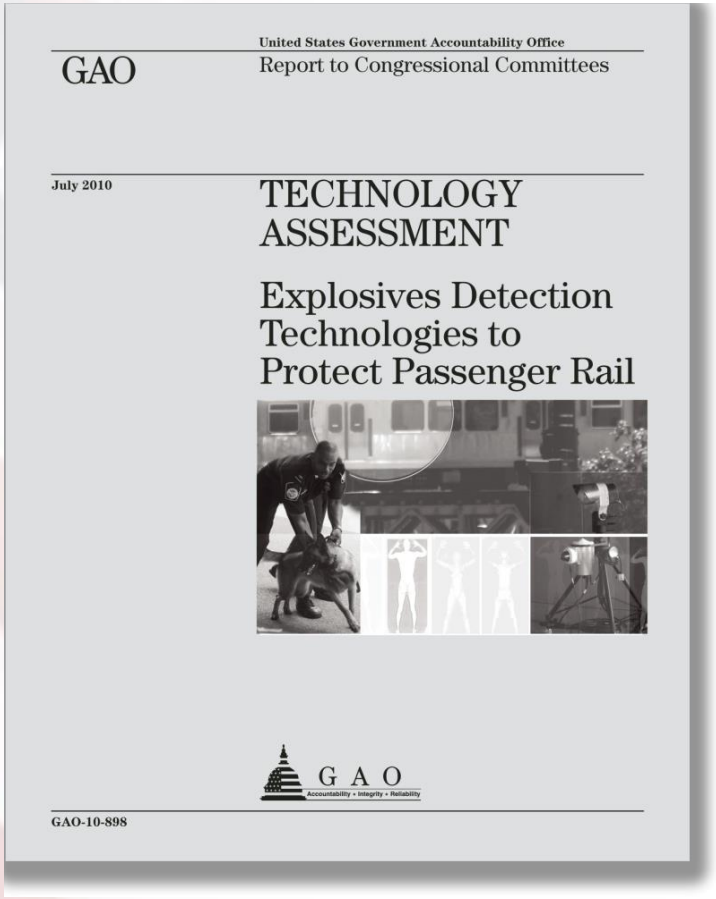
BACKUP

GAO-10-898: Explosives Detection Technologies to Protect Passenger Rail (7/28/2010)



RESULTS

Explosives detection technologies show promise but have potential limitations in the rail environment. Considerations include screening throughput, mobility, and durability, and physical space limitations.

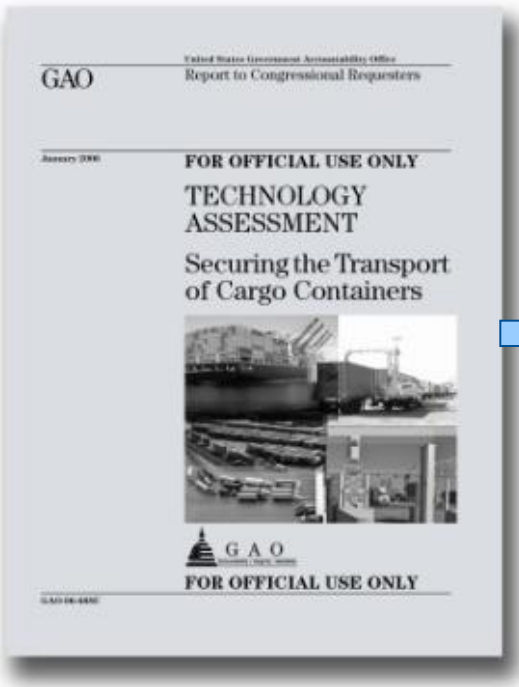
Federal agencies and rail operators are likely to be confronted with cost, potential privacy and legal implications of using these technologies.

IMPACT

Support to recent testimony concerning TSA risk management of passenger rail systems

Informing debate on nature and extent of passenger rail security

GAO-06-68SU: Securing the Transport of Cargo Containers (1/14/06)



Reference: GAO-10-887

RESULTS

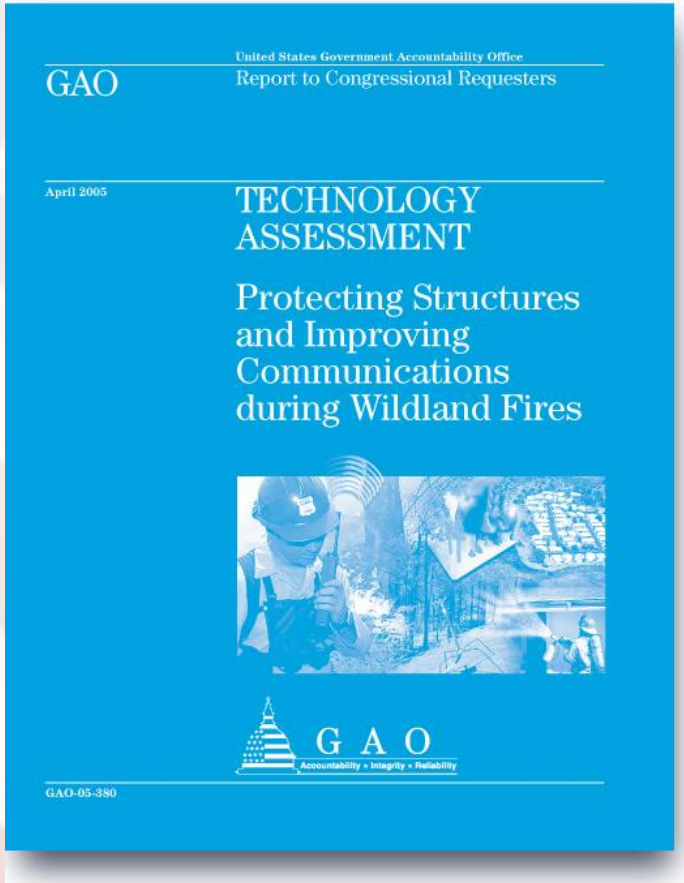
CBP study demonstrated that existing container seals provided inadequate security against physical intrusions. For example, seals installed on container doors can be bypassed by simply removing an entire container door

Thus, CBP desired a technology with the ability to detect door openings and eventually detect and report intrusions on all six sides of a container

IMPACT

Law now requires DHS standards and procedures for securing cargo and monitoring security while in transit

GAO-05-380: Protecting Structures and Improving Communications During Wildland Fires (4/26/05)



RESULTS

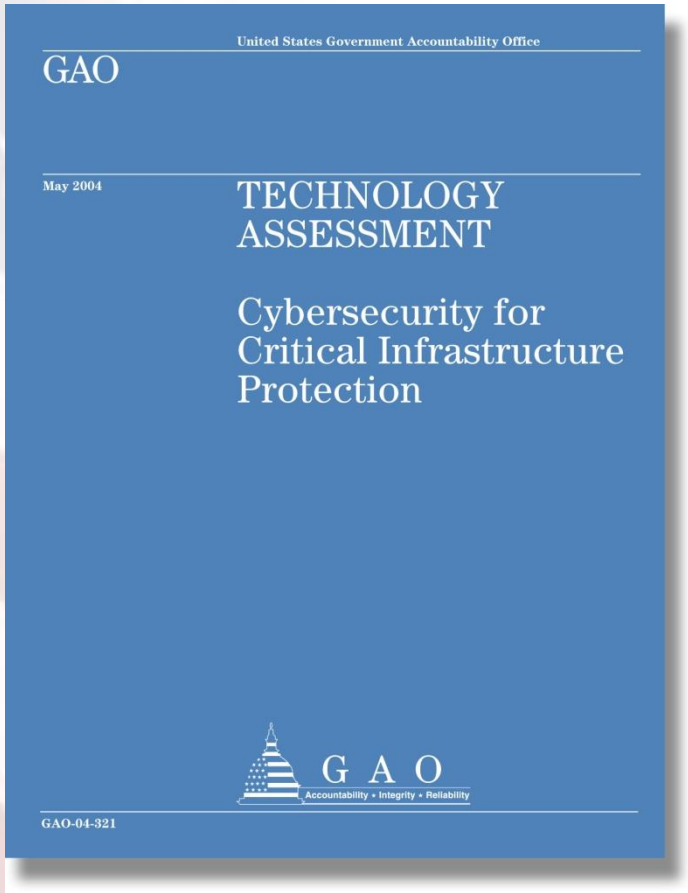
Emerging technologies, such as fire behavior modeling and automated fire detection systems, could prove useful in the future to protect communities from wildland fires

New communications technologies could aid interoperability but better coordination is needed between federal, state and local agencies

IMPACT

Testimony provided on technologies to protect structures and improve communications during wildland fires

GAO-04-321: Cybersecurity for Critical Infrastructure Protection (5/28/04)



RESULTS

Cybersecurity technologies are not being purchased or implemented to the fullest extent

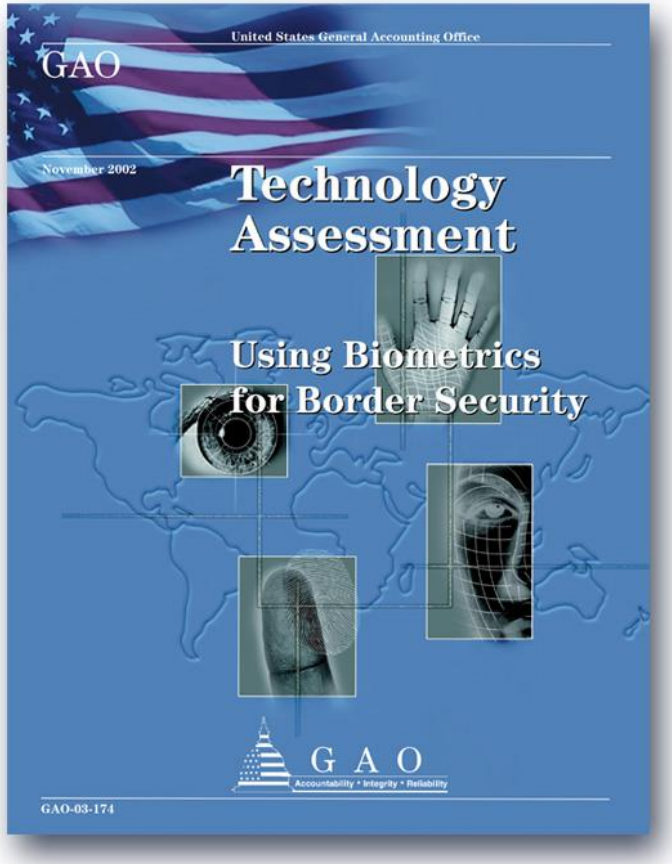
Long-term efforts are needed, such as development of standards, research into cybersecurity vulnerabilities and technological solutions, and the transition of research results into commercially available products

The federal government can play an important role in increasing use of such technologies

IMPACT

Primer report used by interested members of congress to come up to speed on cyber issues

GAO-03-174: Using Biometrics for Border Security (11/14/02)



RESULTS

Biometric technologies could be used to secure nation's border (associating a person with travel documents such as visas or passports) but have limitations

Costs of using facial, fingerprint and iris recognition would be between $1.3-2.9 billion initially & between $0.7-1.5 billion annually thereafter

Important policy implications include privacy & international relations

IMPACT

Testimony on use of biometrics in security before three Congressional committees

Information used to inform Intelligence Reform and Terrorism Prevention Act of 2004

Technology Assessment: *Water Conservation Technologies* (October 2012)

Scope & Methodology

(1) Conduct semi-structured interviews with stakeholders from Federal/State governments, national labs, electric power generation industries, shale gas, coal, and uranium mining industries, as well as academia, advocacy groups, and professional organizations/societies to identify technologies/approaches that address water conservation and scarcity.

(2) Review literature on water conservation technologies applicable to electric power generation, shale oil and gas development, and mining.

(3) Conduct site visits to thermoelectric power and desalination plants and mining sites as appropriate.

(4) Convene a NAS panel of experts for consultation services to include design verification, and S&T quality assurance.