TECHNOLOGY AND PUBLIC PURPOSE PROJECT

Building a 21st Century Congress

A Playbook for Modern Technology Assessment

Mike Miesen

Laura Manley

FACULTY DIRECTOR

Ash Carter

HARVARD Kennedy School
BELFER CENTER
for Science and International Affairs

PAPER
JUNE 2021

Technology and Public Purpose Project
Belfer Center for Science and International Affairs
Harvard Kennedy School
79 JFK Street
Cambridge, MA 02138

www.belfercenter.org/TAPP

Design and layout by Andrew Facini

Photos by Benn Craig and Adobe Stock

Printed in the United States of America

TECHNOLOGY AND PUBLIC PURPOSE PROJECT

Building a 21st Century Congress

A Playbook for Modern Technology Assessment

Mike Miesen

Laura Manley

FACULTY DIRECTOR

Ash Carter

HARVARD Kennedy School
BELFER CENTER
for Science and International Affairs

PAPER
JUNE 2021

Acknowledgments

The Technology and Public Purpose (TAPP) Project, led by Belfer Center Director, MIT Innovation Fellow, and former Secretary of Defense Ash Carter, works to ensure that emerging technologies are developed and managed in ways that serve the overall public good.

Over the past three years, the TAPP Project has researched how Congress learns about and acts on emerging technology topics. With input from over 200 current and former members of Congress, congressional staffers, business and non-profit leaders, academics, and others, the TAPP Project has published two previous reports in its *Building a 21st Century Congress* series.

This report builds on the TAPP Project's two previous efforts, and similarly relies on the time and expertise of the hundreds of individuals who inform this work. We are grateful for everyone who shared their thoughts and perspectives on congressional capacity and options for reform.

We are especially grateful to the following individuals, who offered their perspectives on technology assessment and congressional capacity or reviewed drafts of this report: Leisel Bogan, Zach Graves, Marci Harris, John Holdren, Lorelei Kelly, Travis Moore, Daniel Schuman, Carmel Shachar, and many others.

Table of Contents

Executive Summary

The current generation of emerging technologies—artificial intelligence, synthetic biology tools, and more—is expected to change societies in profound ways as the tools mature and are increasingly used by governments, businesses, and individuals. The next generation of emerging technologies is primed to do the same.

How these technologies are developed, distributed, and managed will affect how societies reap their benefits and mitigate their costs. Together, we need to imagine the future of these technologies and plan ahead.

Societies will also need to look to the future to imagine future crises and the technologies that might protect against them, then fund the basic and applied research that could help these technologies come to fruition. For example, the first two COVID-19 vaccines to be widely distributed in the United States are mRNA vaccines, which rely on scientific discoveries funded by the federal government over decades.[1] Some future crises, like the effects of climate change and the likelihood of future pandemics, are clear enough; others will require structured foresight. In either case, identifying the potential innovative new technologies that could ameliorate harm from these crises is vital.

How can United States policymakers better understand the next generation of emerging technologies and their societal implications? How can we make more educated decisions on the basic and applied research needed to solve the next generation of emerging threats?

The 117th Congress and the Biden Administration must urgently address these questions to protect the lives and livelihoods of those living in the United States.

A superficial understanding of emerging technologies and future crises is not enough for the legislative branch and Executive Office of the President

1 Arthur Allen, "For Billion-Dollar COVID Vaccines, Basic Government-Funded Science Laid the Groundwork," Scientific American, November 2020, https://www.scientificamerican.com/article/for-billion-dollar-covid-vaccines-basic-government-funded-science-laid-the-groundwork/.

(EOP) to appropriately evaluate and act on them in a timely manner. The pace of technological change, and the diffusion of innovation around the world, necessitates a deeper look at technologies and their implications for society.

This report will argue that the deeper look can and must come from the discipline of technology assessment, both in Congress and in the EOP. The discipline of technology assessment is a vital piece of the process of looking ahead; it is a powerful tool for surfacing the implications of critical or emerging technologies. When done well, technology assessment brings thoughtful policy options to decisionmakers for analysis and action.

WHAT IS TECHNOLOGY ASSESSMENT?

Technology assessment is not one thing; it is best thought of as a process designed to accomplish several goals.

First, at its most basic, technology assessment helps to provide objective, reliable technical information about a technology or issue.[2] This information can then be absorbed and used by decision-makers to accomplish a task or further a goal.

Additionally, as Kathryn Wagner Hill notes, technology assessment "is best understood as a policy analysis process rather than a technical analysis..."[3] In other words, a technology assessment is about more than the technology itself.

As Anthony Mills argues, technology assessment must use a broader lens to "understand and anticipate the nature and the 'physical, biological, economic, social, or political effects' of emerging technologies so that benefits may be reaped, and deleterious effects avoided or mitigated."[4]

Indeed, as the seminal 1969 National Academies book on technology assessment, *Technology: Processes of Assessment and Choice for the House Committee on Science and Astronautics,* noted, technology assessment is ultimately about society: "Indeed, technology as such is not the subject of this report... Our subject, instead, is human behavior and institutions, and our purpose is not to conceive ways to curb or restrain or otherwise 'fix' technology but rather to conceive ways to discover and repair the deficiencies in the processes and institutions by which society puts the tools of science and technology to work."[5]

2 M Anthony Mills, "The Many Meanings of 'Technology Assessment,'" February 2020, 8, https://lincolnpolicy.org/wp-content/uploads/2020/02/MILLS.pdf.

3 Kathryn Wagner Hill, "A New-Old Vision for Congressional Technology Assessment," February 2020, 5, https://lincolnpolicy.org/wp-content/uploads/2020/02/HILL.pdf.

4 Mills, "The Many Meanings of 'Technology Assessment.'"

5 Technology: Processes of Assessment and Choice. (Committee on Science and Astronautics, U.S. House of Representatives: National Academy of Sciences, 1969), 15, https://doi.org/10.17226/21060.

Currently, the Government Accountability Office's (GAO) Science, Technology Assessment, and Analytics (STAA) team conducts technology assessments for the legislative branch. In the EOP, technology assessment products are overseen by the Office of Science and Technology Policy (OSTP) and the President's Council of Advisors on Science and Technology (PCAST).

With the start of a new Congress and a new presidential administration, now is the right time to refocus on technology assessment principles and recommit to the thorough analysis of critical and emerging technologies that is vital for crafting sound legislation, appropriating federal research and development dollars, and more.

Key Pillars of Effective Technology Assessment

When done right, technology assessment is a discipline that unearths insights and considers disparate perspectives on a technology and its potential impact on society.

Technology assessment is a process, not an outcome; a set of tools, not a solution.

While the legislative branch and the Executive Office of the President will necessarily create and use different structures to organize and oversee their technology assessment processes, each should incorporate four 'pillars' of effective technology assessment into their methodologies.

Pillars of Effective Technology Assessment	
STRONG GOVERNANCE	The foundation of any technology assessment organization is strong governance, both at an institutional and a project level.
RESPONSIVE TO CONSUMER NEEDS	Technology assessments must respond to the needs of the end user; they must "scratch real itches."
INFORMED BY EXPERTS	Technical and non-technical experts from within and outside the federal government should be involved in technology assessments, including senior academics and leaders from private and not-for-profit sectors.
POLICY OPTIONS, NOT ANSWERS	Technology assessments should offer policy poptions, where appropriate, to help consumers reckon with the technology and its potential societal implications.

Strong Governance

The foundation of any technology assessment organization is strong governance.

Without a proper governance structure, the technology assessment organization will be threatened by internal and external issues. Internally, mismanagement could lead to the organization straying from its core mission, which could lead to poor performance or a failure to meet the needs of its customers. Externally, affected stakeholders could cast doubt on the effectiveness or authoritativeness of the organization, marshalling political forces to weaken it.

By pairing a permanent standing body capable of providing long-term guidance with short-term external advisory groups, the assessment organization can ensure continuity and expertise. This interlocking and reinforcing governance model allows flexibility and adaptability while keeping a core leadership team in place to create long-term stability and continuity.

Responsive to Consumer Needs

As a general principle, technology assessments should respond to the needs of the end user or the people directly impacted by the technology; they should "scratch real itches" that members of Congress and the President of the United States have. By understanding how the consumer views a problem and what they care about, the technology assessment body can create desired reports that will be used in the policymaking process.

This is not to say that the technology assessment body should *never* produce reports on topics before they are requested. As a discipline, foresight requires scanning the horizon for upcoming issues *before* they would reach the attention of policymakers. Additionally, technology assessments on unrequested topics could become valuable once the issue faces policymakers. In general, technology assessment organization governance bodies should carefully weigh the potential benefits and costs of technology assessments that are not requested.

Draw on Expertise from Within and Outside Government

Generally, technology assessments written with the input of a small group of in-house technical experts would run the risk of being seen as neither authoritative nor credible products because they would lack an external technical and non-technical perspective.

There is, of course, a great deal of technical expertise in the federal government, but inputs for technology assessments must come from a broad range of sources. Technical experts from both within and outside the federal government should be involved, including senior academics and leaders from private and not-for-profit sectors.

Practically, incorporating disparate perspectives into the process creates a better product, yielding a fuller view of a technology's direct and indirect impacts on society and validating the assessment body's expertise. Incorporating more voices—including contradictory voices—reduces groupthink and makes space for new ideas, and potentially including public

comment processes would enable even more voices to be heard. Importantly, a broader set of inputs can ensure what the writer James Fallows refers to as a "tragic imagination"—visualizing and understanding what could go wrong with the technology or as a result of the technology's use.

Offer Policy Options, Not Answers

A technology assessment is not an argument for a specific policy or set of policies, or the answer to a policy problem.

Instead, a technology assessment should offer policy options, where appropriate, to help policymakers reckon with the technology and its potential implications. A technology assessment should be an important input into the policymaking process without deciding on the "right" option—a task best left to elected officials, who are best suited to represent their constituencies' needs and values as they weigh various policy options.

Practically, members of Congress do not want answers from a technology assessment body, because it is their responsibility to come up with the answers. Legislation that is grounded in the analyses of legislative committees and individual members—and supported by a thorough technology assessment—will be stronger and more likely to pass, as it will be responsive not only to an analysis of the technology but also to constituents. Politically, this ensures that the technology assessment body serves as a resource, not a rival.

Considerations for the 117th Congress and the Biden Administration

Both the 117th Congress and President Biden's Executive Office of the President have bodies working within them that conduct technology assessments. Each is discussed below, along with considerations for how to tackle the process of technology assessment today.

Congressional Technology Assessment

Currently, the Government Accountability Office's Science, Technology Assessment, and Analytics team conducts and oversees technology assessments for Congress.

The STAA attempts to incorporate most of the four pillars of effective technology assessment discussed in the previous section. The STAA has a clear governance structure for technology assessments; is responsive to the needs of Congress, as it only conducts assessments as a result of a congressional request; brings in internal and external expertise, casting a wide net for advice as it builds its products; and offers policy options where it believes them to be appropriate.

As the STAA deepens its technology assessment capabilities and refines its processes, it should consider the following:

Governance

To further build a relationship with Congress, the STAA should develop a broader governing body for its technology assessments that includes members of Congress and gives them an opportunity to weigh in on both the process and content of technology assessments.

Autonomy

Congress should consider several substantive changes to how the STAA is governed and funded.

Expertise

Even as the STAA should continue to rely on external non-technological expertise to develop an understanding of the societal implications of a given technology, it should also consider bolstering its internal expertise in these areas. As its team continues to grow, the STAA should prioritize non-technological expertise, in areas including, but not limited to, ethics, sociology, and law.

Consultation

To offer value to a broader group of members, STAA should consider prioritizing requests on short-term products from any member of Congress. While the GAO's congressional protocols allow for requests from individual members, they are lowest on its list of priorities and, in practice, have not had requests answered in years.

Executive Office of the President

The EOP has several bodies that advise it on science and technology issues, including the Office of Science and Technology Policy and the President's Council of Advisors on Science and Technology. As the new team begins to plan for their work, they should consider the following:

Selectivity

The OSTP and the PCAST should be selective in the range of topics they conduct broad analyses on. While there are myriad worthy topics, the EOP should task the PCAST with a limited number of topics to focus on.

Coordination

Relatedly, experts argue that the OSTP, the PCAST, and the Office of Management and Budget need to coordinate on setting research priorities.

Flexibility

The PCAST should have the resources necessary to adapt to crises that occur.

Attention

President Biden's time is the most precious resource in the executive branch, and what Biden and his top advisers focus on carries a great

deal of weight. It is critical, then, that the PCAST be able to engage directly with the president.

What's Needed to Put Technology Assessment to Good Use

Both the legislative branch and the EOP need science and technology capacity to realize the full value of technology assessments conducted for them. Technology assessment does not exist in a vacuum; it must be interpreted, summarized, analyzed, discussed, and debated before being used in the policymaking processed.

In previous reports, the Technology and Public Purpose (TAPP) Project has investigated Congress's science and technology capacity and offered recommendations for the legislative branch.

This report will not go into detail about all the different ways that Congress could address its STEM capacity issues, but three components are worth addressing: the need for rapid response STEM capacity, the need for additional STEM expertise in personal offices and committees, and Congress's need for greater overall capacity.

Bridging the Divide: Actions to Increase Congress's S&T Capacity

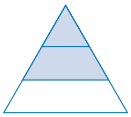
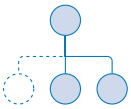
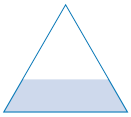
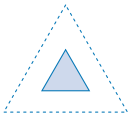
GAPS	ACTIONS
 **INSTITUTIONAL SUPPORT GAP** Congress does not have a support body exclusively focused on S&T issues to provide objective, in-house consultation.	**CREATE A CONGRESSIONAL SUPPORT AGENCY THAT IS** **Embedded** within Congress to ensure 'shared staff' approach **Able to incorporate** all external perspectives **Structured** to be adaptable to the changing needs of Congress **Options-oriented** to give Congress multiple policy options
 **S&T TALENT GAP** Congress lacks robust recruiting pathway for diverse S&T talent.	**REEVALUATE PROCESS FOR FINDING S&T TALENT BY** **Creating Paths for Undergraduates Pursuing S&T Majors to Come to Capitol Hill.** Congress, universities, and foundations should work together to encourage S&T students to work on Capitol Hill. **Reimagining Talent Pathway to Encourage S&T Hires.** Create a mid-career pathway to enable S&T experts to work for Congress at level commensurate with their experience. **Expanding Policy Training.** Ensure that S&T experts can be effective congressional staff members
 **INTERNAL RESOURCING GAP** Congress does not give itself the resources to hire enough people with the right skillsets.	**ADDRESS STRUCTURAL GAPS BY** **Investing in Itself.** Increase the resources available to personal offices, committees, and support agencies.
 **EXTERNAL RESOURCES GAP** While many consider Congress the "most advised body in the world," many of the resources available are less useful than they could be.	**EXTERNAL RESOURCE PROVIDERS SHOULD** **Offer Customized, Concise, and Timely S&T Information.** Congressional staffers highlight these attributes as particularly important. **Build Relationships with Offices Over Time.** A consistent relationship will help ensure that a message is heard by the office.

Figure 7. Actions to increase Congress's S&T capacity.
Source: Interviews, Author Analysis

Additional STEM Expertise for Rapid Response Capacity

Congress needs a resource for rapid-turnaround synthesis and analysis of science and technology issues.

As discussed in *Building a 21st Century Congress: Improving Congress's Science and Technology Expertise,* congressional staffers rely on committee staff to serve as go-to resources for quick answers on science and technology topics, but a dedicated resource would allow for additional requests to be met and for committee staff to spend more time on committee work.

Additional STEM Expertise in Personal Offices and On Committees

As an institution, Congress is not structurally designed to support bringing individuals with STEM backgrounds in as policy advisers—though there are, of course, several STEM experts who offer policy advice on Capitol Hill.

Congressional staffers are overworked and underpaid; institutional underfunding means that most staffers are generalists who handle a broad portfolio of issues. Personal offices and committees prioritize experience working on Capitol Hill for policy roles; individuals with PhDs in STEM subjects usually do not have that background.

While several highly regarded fellowships are designed to give STEM experts an opportunity to advise Congress on science and technology policy, they are time-limited by nature and cannot fill the significant STEM capacity gap in Congress.

Adding STEM expertise in personal offices and committees would allow for better and more rapid analysis of technology assessments and other technical information. In *Building a 21st Century Congress*: *Improving STEM Policy Advice in the Emerging Technology Era,* we included several options for doing so:

Analyzing Opportunities to Improve STEM Pathways

	BENEFITS	DRAWBACKS
 **Build on Existing Successes** Scale successful programs to maximize impact	Leverages existing platforms for speed, simplicity, and cost savings	Could create overreliance on temporary expertise
 **Create New Institutions** Congress and external stakeholders could build a new institution, or set of institutions, to recruit and house STEM talent working on policy issues	Creates a 'Home' for Technical Talent Builds Institutional Memory Creates Reputation for Excellence	Substantively and politically difficult to create
 **Create and Expand University Pathways** Train the next generation of policy advising scientists and technologists by creating and expanding university pathways	Leverages existing pathways and resources Creates generational change	Is not immediate solution to problem Pulls resources away from more immediate solutions
 **Create New Short-Term 'Tour of Duty' Roles** Create new time-limited opportunities for scientists and technologists to work on policy issues on Capitol Hill	Enables talent acquisition and assists with infusions of talent Builds relationships with expert networks Generates bidirectional learning opportunities	Introduces substantive or optical bias Could create overreliance on temporary expertise
 **Create New Fellowship Programs** Develop a new model combining classroom learning, job placement, on-the-job training, and mentoring	Develops alumni network of cross-sector leaders Allows tailoring of program to local circumstances	Could reinvent the wheel unnecessarily Difficult to start new programs May not be resilient to leadership changes.
 **Create Vetted Talent Pools** A trusted entity could offer a curated pool of qualified STEM candidates to congressional personal offices and committees	Relatively simple to create Offers potential for immediate impact	May not be resilient to changes in Congress

Additional Investment in Congress's Overall Capacity

More broadly, Congress needs to invest in itself by increasing its budget, which would allow members to hire more staffers and pay them better. This, in turn, would help Congress attract and retain more subject matter experts and give more junior staffers opportunities to stick around and become subject matter experts, if they wish to do so.

Conclusion

Had the United States Congress not defunded the Office of Technology Assessment in 1996, would the past 25 years of science and technology legislation look any different?

Would Congress, having foreseen the societal implications of large social media companies, acted earlier to mitigate their harms? How might pandemic preparedness have been addressed after several near misses? How might climate have been addressed earlier?

Counterfactuals are hard, and we cannot know for certainty that *anything* would be different. The same forces that led to the defunding of the OTA would still be with us; political considerations still weigh heavy on the legislative process. Funding would remain a constraint, too; perhaps, even recognizing the issues laid out by exhaustive technology assessments, conservative members of Congress would still balk at raising taxes to support a more robust public health system or to invest in green technologies designed to reduce dependence on fossil fuels. Structural problems require structural solutions, and the OTA is but one component of a broader solution.

And yet, with more acute and chronic crises facing the American public, it is vital to ask: is this the best we can do? Is this the most we should expect from the United States Congress?

For our future, and for the sake of generations to come, we must demand more from our elected representatives. Recommitting to the basic

principles and structures of technology assessment is one way for Congress to show it is up to the task of legislating for the 21st century.

Similarly, the Biden Administration should continue to focus on hiring and deploying scientists and technologists to identify, research, and explain emerging technologies to policymakers—and to lead the organizations where those priorities will be enacted.

The next generation of technologies will be transformative; it is up to us to make sure that they help make the world healthier, happier, and more prosperous.

Introduction

In 1969, the National Academy of Sciences produced *Technology: Processes of Assessment and Choice*, a book on technology assessment for the House Committee on Science and Astronautics. *Technology: Processes of Assessment and Choice for the House Committee on Science and Astronautics.* The book noted:

> *"In recent years concern has mounted over society's seeming inability to channel technological developments in directions that sufficiently respect the broad range of human needs. Whether rightly or wrongly, the belief is now widely held that the continuation of certain technological trends would pose grave dangers for the future of man and indeed that the ill-considered exploitation of technology has already contributed to some of the most urgent of our contemporary problems: the specter of thermonuclear destruction; the tensions of .congested cities; the hazards of a polluted and despoiled biosphere; the expanding arsenal of techniques for the surveillance and manipulation of private thought and behavior; the alienation of those who feel excluded from power in an increasingly technical civilization."*[6]

Over 50 years later, the sentiment still rings true. The "contemporary problems" of the late 1960s remain considerable challenges today. In many cases, technological developments have not been channeled in ways that respect human needs; the ill-considered uses of technologies such as facial recognition tools and social media undoubtedly undermine public purpose values and contribute to urgent societal issues.

And the current generation of emerging technologies—artificial intelligence, synthetic biology tools, and more—is expected to change societies in profound ways as the tools mature and are increasingly used by governments, businesses, and individuals. The next generation of emerging technologies is primed to do the same.

6 Read "Technology," 1.

Artificial intelligence-based tools can make workers more productive and unearth valuable insights; they can also be exploited to develop facial recognition tools used to scale surveillance and reduce privacy. Synthetic biology tools helped to create COVID-19 vaccines and could power the bioeconomy of the future; they can also be exploited to widen access to bioweapons.

How these technologies are developed, distributed, and managed will affect how societies reap their benefits and mitigate their costs. Together, we need to imagine the future of these technologies and plan ahead.

Societies will also need to look to the future to imagine future crises and the technologies that might protect against them, then fund the basic and applied research that could help these technologies come to fruition. For example, the first two COVID-19 vaccines to be widely distributed in the United States are mRNA vaccines, which rely on scientific discoveries funded by the federal government over decades.[7] Some future crises, like the effects of climate change and the likelihood of future pandemics, are clear enough; others will require structured foresight. In either case, identifying the potential innovative new technologies that could ameliorate harm from these crises is vital.

How can U.S. policymakers better understand the next generation of emerging technologies and their societal implications? How can we make more educated decisions on the basic and applied research needed to solve the next generation of emerging threats?

The 117th Congress and the Biden Administration must urgently address these questions to protect the lives and livelihoods of those living in America.

A superficial understanding of emerging technologies and future crises is not enough for the legislative branch and Executive Office of the President (EOP) to appropriately reckon with them in a timely manner. The pace of technological change, and the diffusion of innovation around the world, necessitates a deeper look at technologies and their implications for society.

7 Allen, "For Billion-Dollar COVID Vaccines, Basic Government-Funded Science Laid the Groundwork."

Bridging the Divide: Actions to Increase Congress's S&T Capacity

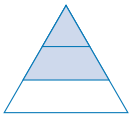
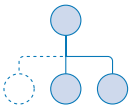
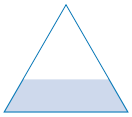
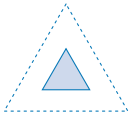
GAPS	ACTIONS
 **INSTITUTIONAL SUPPORT GAP** Congress does not have a support body exclusively focused on S&T issues to provide objective, in-house consultation.	**CREATE A CONGRESSIONAL SUPPORT AGENCY THAT IS** **Embedded** within Congress to ensure 'shared staff' approach **Able to incorporate** all external perspectives **Structured** to be adaptable to the changing needs of Congress **Options-oriented** to give Congress multiple policy options
 **S&T TALENT GAP** Congress lacks robust recruiting pathway for diverse S&T talent.	**REEVALUATE PROCESS FOR FINDING S&T TALENT BY** **Creating Paths for Undergraduates Pursuing S&T Majors to Come to Capitol Hill.** Congress, universities, and foundations should work together to encourage S&T students to work on Capitol Hill. **Reimagining Talent Pathway to Encourage S&T Hires.** Create a mid-career pathway to enable S&T experts to work for Congress at level commensurate with their experience. **Expanding Policy Training.** Ensure that S&T experts can be effective congressional staff members
 **INTERNAL RESOURCING GAP** Congress does not give itself the resources to hire enough people with the right skillsets.	**ADDRESS STRUCTURAL GAPS BY** **Investing in Itself.** Increase the resources available to personal offices, committees, and support agencies.
 **EXTERNAL RESOURCES GAP** While many consider Congress the "most advised body in the world," many of the resources available are less useful than they could be.	**EXTERNAL RESOURCE PROVIDERS SHOULD** **Offer Customized, Concise, and Timely S&T Information.** Congressional staffers highlight these attributes as particularly important. **Build Relationships with Offices Over Time.** A consistent relationship will help ensure that a message is heard by the office.

Figure 7. Actions to increase Congress's S&T capacity.
Source: Interviews, Author Analysis

This report will argue that the deeper look can and must come from the discipline of technology assessment, both in Congress and in the EOP. The discipline of technology assessment is a vital piece of the process of looking ahead; it is a powerful tool for surfacing the implications of critical or emerging technologies. When done well, technology assessment brings thoughtful policy options to decisionmakers for analysis and action.

WHAT IS TECHNOLOGY ASSESSMENT?

Technology assessment is not one thing; it is best thought of as a process designed to accomplish several goals.

First, at its most basic, technology assessment helps to provide objective, reliable technical information about a technology or issue.[8] This information can then be absorbed and used by decision-makers to accomplish a task or further a goal.

Additionally, as Kathryn Wagner Hill notes, technology assessment "is best understood as a policy analysis process rather than a technical analysis..."[9] In other words, a technology assessment is about more than the technology itself.

As Anthony Mills argues, technology assessment must use a broader lens to "understand and anticipate the nature and the 'physical, biological, economic, social, or political effects' of emerging technologies so that benefits may be reaped, and deleterious effects avoided or mitigated."[10]

Indeed, as the seminal 1969 National Academies book on technology assessment, *Technology: Processes of Assessment and Choice for the House Committee on Science and Astronautics,* noted, technology assessment is ultimately about society: "Indeed, technology as such is not the subject of this report... Our subject, instead, is human behavior and institutions, and our purpose is not to conceive ways to curb or restrain or otherwise 'fix' technology but rather to conceive ways to discover and repair the deficiencies in the processes and institutions by which society puts the tools of science and technology to work."[11]

Currently, the Government Accountability Office's Science, Technology Assessment, and Analytics (STAA) team conducts technology assessments for the legislative branch. In the EOP, technology assessment products are

8 Mills, "The Many Meanings of 'Technology Assessment,'" 8.

9 Wagner Hill, "A New-Old Vision for Congressional Technology Assessment," 5.

10 Mills, "The Many Meanings of 'Technology Assessment.'"

11 Read, "Technology," 15.

overseen by the Office of Science and Technology Policy and the President's Council of Advisors on Science and Technology.[12,13]

With the start of a new Congress and a new presidential administration, now is the right time to refocus on technology assessment principles and recommit to the thorough analysis of critical and emerging technologies that is vital for crafting sound legislation, appropriating federal research and development dollars, and more.

A note about the scope of this report: There is already a substantial literature base on technology assessment in the legislative branch, with thoughtful commentary on the proper site for a technology assessment body, the history of the de-funded Office of Technology Assessment, the Government Accountability Office's STAA team, and efforts to refund and revitalize a new OTA. We do not seek to duplicate these efforts—many of which we have listed in **Appendix A** for further reading.

Rather, we seek to reinvigorate discussions around technology assessment in the federal government through a discussion of high-level principles that will help technology assessment bodies be successful. We then highlight a few considerations for the 117th Congress and the Biden Administration as both decide how to approach their emerging technology work in the coming years and note the "enablers" that allow Congress to get the most out of technology assessment.

12 Analysis of technologies and their implications occurs throughout the executive branch and for the executive branch by federally funded research and development centers (FFRDCs); these entities are outside the remit of this report. While the technology assessment principles outlined in this report could be used by other executive branch agencies, in narrowing the focus to the EOP we hope to be able to provide specific, actionable considerations.

13 These organizations are discussed in more detail below.

Key Pillars of Effective Technology Assessment

When done right, technology assessment is a discipline that unearths insights and considers disparate perspectives on a technology and its potential impact on society.

Technology assessment is a process, not an outcome; a set of tools, not a solution.

While the legislative branch and the Executive Office of the President will necessarily create and use different structures to organize and oversee their technology assessment processes, each should incorporate four 'pillars' of effective technology assessment into their methodologies.

Pillars of Effective Technology Assessment	
STRONG GOVERNANCE	The foundation of any technology assessment organization is strong governance, both at an institutional and a project level.
RESPONSIVE TO CONSUMER NEEDS	Technology assessments must respond to the needs of the end user; they must "scratch real itches."
INFORMED BY EXPERTS	Technical and non-technical experts from within and outside the federal government should be involved in technology assessments, including senior academics and leaders from private and not-for-profit sectors.
POLICY OPTIONS, NOT ANSWERS	Technology assessments should offer policy poptions, where appropriate, to help consumers reckon with the technology and its potential societal implications.

Strong Governance

The foundation of any technology assessment organization is strong governance.

Without a proper governance structure, the technology assessment organization will be threatened by internal and external issues. Internally, mismanagement could lead to the organization straying from its core mission, which could lead to poor performance or a failure to meet the needs of its consumers. Externally, affected stakeholders could cast doubt on the effectiveness or authoritativeness of the organization, marshalling political forces to weaken it.

With a proper governance structure, the technology assessment organization can weather threats by sticking to its mission and produce authoritative content for its customers, while being shielded from political forces. Proper governance of the technology assessment body allows it to be, and be seen as, an expert and objective resource.

A governance structure should have **support from a standing body** that includes key consumers or stakeholders impacted, leaders in science and technology issues, and respected individuals with a history of public service.

Additionally, each assessment should be **overseen by a separate, temporary external advisory group** that has subject matter expertise and is drawn from government, academia, the private sector, and civil society. This external advisory group would be capable of offering guidance on the content of the work throughout the assessment process and a credible stamp of approval on the final product, lending authority to the analysis. Importantly, a temporary external advisory group can be composed of experts who have authority in a sector or a specific technology, but who may not want to become a full-time employee of the organization.

By pairing a permanent standing body capable of providing long-term guidance with short-term external advisory groups, the assessment organization can ensure continuity and expertise. This interlocking and reinforcing governance model allows flexibility and adaptability while

keeping a core leadership team in place to create long-term stability and continuity.

Responsive to Consumer Needs

As a general principle, technology assessments should respond to the needs of the end user or the people ultimately impacted by these technologies; they should "scratch real itches" that members of Congress and the President of the United States have. By understanding how the consumer views a problem and what they care about, the technology assessment body can create desired reports that will be used in the policymaking process.

There are two major reasons why technology assessments should generally respond to the needs of end users. First, technology assessments are time- and resource-intensive efforts; a core team will only be able to conduct a select few assessments at any given time, and the full process can take a significant amount of time. Depending on the product, the OTA would often take 12-18 months to complete a technology assessment; while perhaps this could be sped up through the use of the internet, video teleconferencing, and other tools that were not widely available during the OTA's time, technology assessment is by its nature a deliberative process that takes time to complete.

Additionally, responding to end users helps to ensure that the benefits of a technology assessment outweigh the costs, as it is likely to be read and considered. Technology assessments that are not asked for could become political flashpoints if they are alleged to be, or perceived as, biased. In an increasingly-polarized political environment, technology assessment—even scientifically sound, authoritative technology assessment—can be perceived as political, or attacked on political grounds. Of course, this was true in the 1980s and 1990s as well, as the demise of the Office of Technology Assessment shows, but Congress is more polarized now than in the 1980s and 1990s.

This is not to say that the technology assessment body should *never* produce reports on topics before they are requested. As a discipline, foresight

requires scanning the horizon for upcoming issues *before* they would reach the attention of policymakers. Additionally, technology assessments on unrequested topics could become valuable once the issue faces policymakers. In general, technology assessment organization governance bodies should carefully weigh the potential benefits and costs of technology assessments that are not requested.

Draw on Expertise from Within and Outside Government

Generally, technology assessments written with the input of a small group of in-house technical experts would run the risk of being neither authoritative nor credible products because they would lack an external technical and non-technical perspective.[14]

There is, of course, a great deal of technical expertise in the federal government, but inputs for technology assessments must come from a broad range of sources. Technical experts from both within and outside the federal government should be involved, including senior academics and leaders from private and not-for-profit sectors.

Perspectives from non-technical experts are also a vital component of the technology assessment process. Activists, advocates, ethicists, social scientists, designers, user experience researchers, and others have valuable perspectives that, at the very least, deserve a fair hearing.

As the authors of the 1969 National Academies book referenced earlier noted, "Indeed, the best guarantee of objectivity might well be to open the new mechanism to as wide as possible a range of countervailing influences rather than to attempt to shut out such influences altogether."[15] For both practical and political reasons, accepting a wide range of inputs helps to create objectivity and reinforce the institution's perceived objectivity.

14 There are topics for which this is not wholly true. As one reviewer noted, in cases where the relevant expertise about a topic can be found in a small number of federal agencies, it may be possible for an in-house group of experts to produce authoritative and credible technology assessment products.

15 Read "Technology," 83–84.

Practically, incorporating disparate perspectives into the process creates a better product, yielding a fuller view of a technology's direct and indirect impacts on society and validating the assessment body's expertise. Incorporating more voices—including contradictory voices—reduces groupthink and makes space for new ideas, and potentially including public comment processes would enable even more voices to be heard. Importantly, a broader set of inputs can ensure what the writer James Fallows refers to as a "tragic imagination"— visualizing and understanding what could go wrong with the technology or as a result of the technology's use.

Politically, casting a wide net for input and giving a fair hearing to all viewpoints validates the assessment body's objectivity, and neutralizes potential detractors. Those that feel like they did not have a chance to offer input could cast doubt on the validity and credibility of the technology assessment, becoming detractors to the broader technology assessment project. Each voice that doesn't feel heard becomes a potential threat to the individual assessment and the broader project.

Offer Policy Options, Not Answers

A technology assessment is not an argument for a specific policy or set of policies, or the answer to a policy problem.[16]

Instead, a technology assessment should offer policy options, where appropriate, to help policymakers reckon with the technology and its potential implications. A technology assessment should be an important input into the policymaking process without deciding on the "right" option—a task best left to elected officials, who are best suited to represent their constituencies' needs and values as they weigh various policy options.

Practically, members of Congress do not want answers from a technology assessment body, because it is their responsibility to come up with the answers. Legislation that is grounded in the analyses of legislative

16 Different customers may view the technology as having different policy problems. The technology assessment body should include what it views as the major policy problem, or problems, in addition to what additional potential policy problems arise during the research process.

committees and individual members—and supported by a thorough technology assessment—will be stronger and more likely to pass, as it will be responsive not only to an analysis of the technology but also to constituents. Politically, this ensures that the technology assessment body serves as a resource, not a rival.

Technology assessments in the EOP should offer options for consideration, as well. If asked for by EOP customers and decision-makers, the assessments could have a clearer policy option "front-runner," provided it does not box in the administration into a specific course of action.[17] Additionally, technology assessments in the EOP can also include policy options or recommendations for what the administration should attempt to get Congress to do.[18]

17 Interview with Senior Leader in Science and Policy, February 2021.

18 Interview with Senior Leader in Science and Policy, February 2021.

Considerations for the 117th Congress and the Biden Administration

Both the 117th Congress and President Biden's Executive Office of the President currently have bodies working within them that conduct technology assessments. Each is discussed below, along with considerations for how to best tackle the process of technology assessment today.

Congressional Technology Assessment

Currently, the Government Accountability Office's Science, Technology Assessment, and Analytics team conducts and oversees technology assessments for Congress.

After releasing a draft for public comment in 2019, the STAA recently released an updated "Technology Assessment Design Handbook" to lay out its institutional philosophy on the process of technology assessment.

According to its handbook, the STAA's technology assessment process is similar for both the GAO's traditional audits and its technology assessments, with several differences in kind or in emphasis:[19]

19 "Technology Assessment Design Handbook: Handbook for Key Steps and Considerations in the Design of Technology Assessments" (U.S. Government Accountability Office, February 2021), 4, https://www.gao.gov/assets/720/712458.pdf.

Table 1: Summary of GAO's Technology Assessment Process

Steps in plain text are process steps for both general audit and TA products. Steps in bold italics are either additional process steps or a particular emphasis for technology assessments (TA).[a]

Phase	Steps
Initiation	• Discussion with congressional requesters, if applicable, regarding scope and focus of the engagement[b] • ***Consideration of technology state, relevant stakeholder expertise, and potential policy implications*** • ***Consideration of whether policy options may be appropriate for inclusion***
Design	• Performance of initial research • Consideration of relevant sections of GAO's quality standards and GAO methodological and technical standards and guides • Consultation with GAO subject matter experts and internal stakeholders, as needed • Discussion with agency officials and experts • ***Identification of and consultation with external experts, such as science, policy, and industry experts, who may also serve as external reviewers***[c] • ***Identification of possible policy options, if appropriate***
Message development	• Collection and analysis of evidence • Assessment of evidence and research results • Development of draft findings • ***Ongoing engagement with external experts*** • ***Conduct and discuss policy options assessment, if appropriate***[d]
External review	• Request views from relevant third parties, if applicable, and request comments from relevant federal agencies, ***as appropriate*** • ***Request comments from external experts, and others as appropriate***

Source: GAO-20-246G and additional review of GAO product lines. | GAO-21-347G

While noting that each technology assessment is different, the STAA found that the GAO's technology assessments "generally include one or more of the following categories of design objectives, which are not mutually exclusive: (1) describe status of and challenges to development of a technology; (2) assess opportunities and challenges arising from the use of a technology; and (3) assess policy implications or policy options related to a technology."[20]

According to its handbook, the STAA attempts to incorporate most of the four pillars of effective technology assessment discussed in the previous section. The STAA has a clear governance structure for technology assessments; is responsive to the needs of Congress, as it only conducts assessments as a result of a congressional request; brings in internal and external expertise, casting a wide net for advice as it builds its products; and offers policy options where it believes them to be appropriate. Recently, the STAA created the Polaris Council, "a group of exceptional

20 "Technology Assessment Design Handbook: Handbook for Key Steps and Considerations in the Design of Technology Assessments," 18.

science, technology, and policy leaders and experts from many fields, to advise us on emerging S&T issues facing Congress and the nation."[21]

Additionally, the GAO created the Center for Strategic Foresight to "serve as the agency's principal hub for identifying, monitoring, and analyzing emerging issues facing policymakers."[22] Launched in 2018, the Center for Strategic Foresight brings on non-resident fellows to discuss the future of various emerging technology issues, including deepfakes, identity, brain-machine interfaces, and more.[23]

As the STAA deepens its technology assessment capabilities and refines its processes, it should consider the following:

Governance

To further build a relationship with Congress, the STAA should develop a broader governing body for its technology assessments that includes members of Congress and gives them an opportunity to weigh in on both the process and content of technology assessments. Whether this body should be similar to the OTA's Technology Assessment Board or more advisory in nature, the goal would be to ensure that members of Congress have another avenue for offering input, making them feel heard and empowered. In concert with an advisory group for each technology assessment, the governing body will help to ensure that products are in line with the STAA's mission, are authoritative, and are credible.

Autonomy

Congress should consider several substantive changes to how the STAA is governed and funded. As Daniel Schuman and Zach Graves note, "GAO's internal bureaucracy and culture are a chief

21 Gene Dodaro, "Fiscal Year 2022 Budget Request: U.S. Government Accountability Office. State of Gene L. Dodaro, Comptroller General of the United States," March 10, 2021, 16, https://docs.house.gov/meetings/AP/AP24/20210310/111292/HHRG-117-AP24-Wstate-DodaroG-20210310.pdf.3,26]]},"issued":{"date-parts":[["2021",3,10]]},"locator":"16","label":"page"}],"schema":"https://github.com/citation-style-language/schema/raw/master/csl-citation.json"}

22 "Center for Strategic Foresight," September 2019, https://www.gao.gov/about/what-gao-does/audit-role/csf.

23 "Center for Strategic Foresight."

concern for STAA's critics."[24] To grant STAA partial autonomy from the GAO's culture and bureaucracy, Schuman and Graves recommend authorizing legislation that would create a separate budget line item and hiring authority to the team. Schuman and Graves also recommend that the STAA takes steps to build its brand with congressional committees and offices, so they are more aware of the available resource.[25]

Expertise

Even as the STAA should continue to rely on external non-technological expertise to develop an understanding of the societal implications of a given technology, it should also consider bolstering its internal expertise in these areas. As its team continues to grow, the STAA should prioritize non-technological expertise in areas including, but not limited to, ethics, sociology, and law.

Consultation

To offer value to a broader group of members, STAA should consider prioritizing requests on short-term products from any member of Congress. While the GAO's congressional protocols allow for requests from individual members, they are lowest on its list of priorities and, in practice, have not had requests answered in 15 years.[26,27] By setting a minimum threshold for conducting work on behalf of individual member requests, the STAA could bolster its brand and ensure its value to all of Congress.[28] Changing the GAO's congressional protocols to prioritize short-term products from any member of Congress would show Congress that the STAA

24 Zach Graves and Daniel Schuman, "Science, Technology, & Democracy: Building a Modern Congressional Technology Assessment Office" (Harvard Kennedy School Ash Center for Democratic Governance and Innovation, 2020), 33, https://ash.harvard.edu/publications/science-technology-and-democracybuilding-modern-congressional-technology-assessment.

25 Graves and Schuman, "Science, Technology, & Democracy: Building a Modern Congressional Technology Assessment Office."

26 "GAO's Congressional Protocols" (U.S. Government Accountability Office, July 2017), https://www.gao.gov/assets/690/685901.pdf.

27 Interview with Congressional Reform Expert, April 2021.

28 This threshold could be either a minimum number of individual requests that are accepted or a percentage of STAA time spent on such requests. Either way, the goal would be to show individual members of Congress that they are valued customers of the STAA.

wants to provide value to all of Congress, and would help bolster the STAA's brand with members of Congress who may currently be unaware of the resource.

Executive Office of the President

The EOP has several bodies that advise it on science and technology issues.

Recognizing a gap in the EOP's science and technology capacity, in 1976 "Congress established the Office of Science and Technology Policy as an office within the EOP to, among other things, 'serve as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government.'"[29,30]

Additionally, in 1990, President George H W. Bush created the President's Council of Advisors on Science and Technology (PCAST), which is "an advisory board composed of individuals and representatives from outside the federal government with diverse perspectives and expertise. PCAST advises the President, both directly and through the APST, on science, technology, and innovation policy."[31]

Recently, President Biden nominated Drs. Eric Lander and Alondra Nelson to be Director and Deputy Director of the Office of Science and Technology Policy, respectively. Dr. Lander was also selected to be the Assistant to the President for Science and Technology (also known as the Presidential Science Advisor), a Cabinet-level position for the first time.

In his capacity as Presidential Science Advisor, Dr. Lander will co-chair the President's Council of Advisors on Science and Technology (PCAST), a

29 John F. Sargent and Dana Shea, "The President's Office of Science and Technology Policy (OSTP): Issues for Congress" (Congressional Research Service, January 2014), 3, https://fas.org/sgp/crs/misc/RL34736.pdf.

30 The OSTP was not the first in-house entity to offer scientific and technological expertise to the EOP. The OSTP replaced the President's Science Advisory Committee, which was created by President Dwight D. Eisenhower in 1957, renamed by President John F. Kennedy, and dissolved by President Richard Nixon in 1973.

31 Sargent and Shea, "The President's Office of Science and Technology Policy (OSTP): Issues for Congress," 12.

body composed mainly of non-federal employees.[32,33] The other co-chairs of the PCAST are Dr. Maria Zuber and Dr. Frances Arnold.

How the OSTP and the PCAST choose to offer technology assessment-driven advice to the EOP remains to be seen. As Dr. Lander, Dr. Nelson, Dr. Zuber, and Dr. Arnold build their teams and plan their work, they should consider the following:

Selectivity

The OSTP and the PCAST should be selective in the range of topics they conduct broad analyses on. While there are myriad worthy topics, the EOP should task the PCAST with a limited number of topics to focus on.

This may already be President Biden's strategy. In his Executive Order establishing the PCAST for his administration, President Biden notes that,

> *"The PCAST shall advise the President on matters involving policy affecting science, technology, and innovation, as well as on matters involving scientific and technological information that is needed to inform public policy relating to the economy, worker empowerment, education, energy, the environment, public health, national and homeland security, racial equity, and other topics."*[34]

Coordination

Relatedly, experts argue that the OSTP, the PCAST, and the Office of Management and Budget need to coordinate on setting research priorities. From a report on the PCAST's role in agenda-setting:

32 "Executive Order on the President's Council of Advisors on Science and Technology," The White House, January 27, 2021, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-presidents-council-of-advisors-on-science-and-technology/.

33 The Director of the OSTP may also designate the United States Chief Technology Office as a member of the PCAST.

34 "Executive Order on the President's Council of Advisors on Science and Technology."

"While a higher level of productivity allowed President Obama's PCAST to respond to a broader range of topics, it received criticism for lacking a clear focus that made priority setting challenging, especially when pushing initiatives to the Office of Management and Budget and Congress. William Wells Jr., a former OSTP chief of staff, argued that "PCAST should not be all over the map. It has to focus on a half-dozen or so issues, period, if it is going to help the president. And early in an administration, OSTP and PCAST have to agree on what those half-dozen key issues are going to be."[35]

Flexibility

The PCAST should have the resources necessary to adapt to crises that occur. In the Obama administration, the PCAST "also had the necessary infrastructure and resources—including two full-time staff—to respond quickly to new policy challenges, as evidenced by the H1N1 paper." [36] The need for flexibility and adaptability can be seen in the Obama administration's adept handling of Ebola in 2014, as well.

Attention

President Biden's time is the most precious resource in the executive branch, and what Biden and his top advisers focus on carries a great deal of weight. It is critical, then, that the PCAST be able to engage directly with the president. In the Obama Administration, the PCAST was "successful in influencing public policy decisions… due in part to its direct engagement with the president." [37] To do this, of course, requires that President Biden make time for engaging with the his Presidential Science Advisor, others in the OSTP, and the PCAST.

35 Kenneth M. Evans and Kirstin R.W. Matthews, "Science Advice to the President and the Role of the President's Council of Advisors on Science and Technology" (Rice University's Baker Institute for Public Policy, August 2018), 18, https://www.bakerinstitute.org/media/files/research-document/19342455/st-pub-pcast-081418.pdf.

36 Evans and Matthews, 14.

37 Evans and Matthews, 14.

What's Needed to Maximize the Use of Technology Assessment

Both the legislative branch and the EOP need science and technology capacity to realize the full value of technology assessments conducted for them. Technology assessment does not exist in a vacuum; it must be interpreted, summarized, analyzed, discussed, and debated before being used in the policymaking processed.

This section will primarily discuss Congress's science and technology capacity needs; because the EOP can rely on a broad cross-section of multidisciplinary STEM experts across the executive branch. Additionally, because the Biden Administration has made science and technology advice a priority, its science and technology capacity gap is less of an issue when compared with Congress.

Congress needs to be able to quickly distill science and technology information into digestible takeaways meant for busy generalist members of Congress and their staffers.

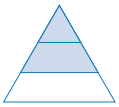
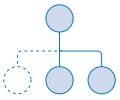
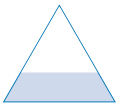
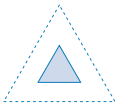
In previous reports, the Technology and Public Purpose (TAPP) Project has investigated Congress's science and technology capacity and offered recommendations for the legislative branch. The TAPP Project's first report on the topic, *Building a 21st Century Congress: Improving Congress's Science and Technology Expertise*, noted that:

> *"Congress is one of the most advised bodies in the world…And yet, when it comes to many emerging technologies, Congress has not shown that it has the necessary capacity and expertise to fully exercise its constitutional duties. While members of Congress in both chambers often produce thoughtful legislation on established science and technology (S&T) issues, in legislation and high-profile hearings, Congress has appeared unprepared to reckon with emerging technologies and their effects on society."*[38]

38 Mike Miesen et al., "Building a 21st Century Congress: Improving Congress's Science and Technology Expertise," Building a 21st Century Congress (Belfer Center for Science and International Affairs: Technology and Public Purpose Project, 2019), 1, https://www.belfercenter.org/sites/default/files/2019-09/ST/Building21stCenturyCongress.pdf.

This report will not go into detail about all the different ways that Congress could address its STEM capacity issues, but three components are worth addressing: the need for rapid response STEM capacity, the need for additional STEM expertise in personal offices and committees, and Congress's need for greater overall capacity.

Bridging the Divide: Actions to Increase Congress's S&T Capacity

GAPS	ACTIONS
 **INSTITUTIONAL SUPPORT GAP** Congress does not have a support body exclusively focused on S&T issues to provide objective, in-house consultation.	**CREATE A CONGRESSIONAL SUPPORT AGENCY THAT IS** **Embedded** within Congress to ensure 'shared staff' approach **Able to incorporate** all external perspectives **Structured** to be adaptable to the changing needs of Congress **Options-oriented** to give Congress multiple policy options
 **S&T TALENT GAP** Congress lacks robust recruiting pathway for diverse S&T talent.	**REEVALUATE PROCESS FOR FINDING S&T TALENT BY** **Creating Paths for Undergraduates Pursuing S&T Majors to Come to Capitol Hill.** Congress, universities, and foundations should work together to encourage S&T students to work on Capitol Hill. **Reimagining Talent Pathway to Encourage S&T Hires.** Create a mid-career pathway to enable S&T experts to work for Congress at level commensurate with their experience. **Expanding Policy Training.** Ensure that S&T experts can be effective congressional staff members
 **INTERNAL RESOURCING GAP** Congress does not give itself the resources to hire enough people with the right skillsets.	**ADDRESS STRUCTURAL GAPS BY** **Investing in Itself.** Increase the resources available to personal offices, committees, and support agencies.
 **EXTERNAL RESOURCES GAP** While many consider Congress the "most advised body in the world," many of the resources available are less useful than they could be.	**EXTERNAL RESOURCE PROVIDERS SHOULD** **Offer Customized, Concise, and Timely S&T Information.** Congressional staffers highlight these attributes as particularly important. **Build Relationships with Offices Over Time.** A consistent relationship will help ensure that a message is heard by the office.

Additional STEM Expertise for Rapid Response Capacity

Congress needs a resource for rapid-turnaround synthesis and analysis of science and technology issues.

As discussed in *Building a 21st Century Congress: Improving Congress's Science and Technology Expertise,* congressional staffers rely on committee staff to serve as go-to resources for quick answers on science and technology topics, but a dedicated resource would allow for additional requests to be met and for committee staff to spend more time on committee work.[39]

Rapid response capacity on science and technology topics could be housed in the Congressional Research Service (CRS), the STAA, or a new entity.

The CRS is lauded for its ability to conduct synthesis research on other subjects, but historically has not been resourced to dig into science and technology issues.[40] If resourced appropriately, the CRS could provide rapid-response synthesis and analysis of science and technology issues; however, it does not provide policy options or consult external experts.[41]

While the STAA does some of this type of work, and congressional staffers find it valuable, one congressional staffer noted that the turnaround time for answers is too long and many staffers simply do not know that the resource is available.[42] Should the STAA continue to improve its rapid response capacity, it could provide informal consulting that is more exhaustive than what the CRS may offer. STAA's external networks could also prove a valuable source for outside expertise for congressional staffers.[43]

In the 116th Congress, a bipartisan and bicameral group introduced legislation that would resource a revitalized Office of Technology Assessment to,

39 Miesen et al., 36.

40 Miesen et al., 38.

41 Interview with Congressional Reform Expert.

42 Interview with Anonymous Congressional Staff Member, March 2021.

43 Interview with Congressional Reform Expert.

among other things, field requests for short-turnaround science and technology information requests.[44] As introduced, the Office of Technology Assessment Improvement and Enhancement Act would have renamed the Office of Technology Assessment the Congressional Office of Technology and directed it to, "provide information to Members and committees of Congress in the form of briefings, informal conversations, documents, and similar formats which may be provided expeditiously on the basis of existing research and staff expertise…"[45] Such an office, if properly resourced, would greatly improve Congress's rapid response capacity on STEM topics.

Additional STEM Expertise in Personal Offices and On Committees

As an institution, Congress is not structurally designed to support bringing individuals with STEM backgrounds in as policy advisers—though there are, of course, several STEM experts who offer policy advice on Capitol Hill.[46]

Congressional staffers are overworked and underpaid; institutional underfunding means that most staffers are generalists who handle a broad portfolio of issues. Personal offices and committees prioritize experience working on Capitol Hill for policy roles; individuals with PhDs in STEM subjects usually do not have that background.

While several highly regarded fellowships are designed to give STEM experts an opportunity to advise Congress on science and technology policy, they are time-limited by nature and cannot fill the significant STEM capacity gap in Congress.

44 "Reps. Takano and Foster, Sens. Hirono and Tillis Introduce the Office of Technology Assessment Improvement and Enhancement Act | U.S. Congressman Mark Takano of California's 41st District," accessed March 25, 2021, https://takano.house.gov/newsroom/press-releases/reps-takano-and-foster-sens-hirono-and-tillis-introduce-the-office-of-technology-assessment-improvement-and-enhancement-act.

45 Mark Takano, "Text - H.R.4426 - 116th Congress (2019-2020): Office of Technology Assessment Improvement and Enhancement Act," webpage, September 19, 2019, 2019/2020, https://www.congress.gov/bill/116th-congress/house-bill/4426/text.

46 For more, see Building a 21st Century Congress: Improving STEM Policy Advice in the Emerging Technology Era.

Adding STEM expertise in personal offices and committees would allow for better and more rapid analysis of technology assessments and other technical information. In *Building a 21st Century Congress: Improving STEM Policy Advice in the Emerging Technology Era,* we included several options for doing so:[47]

Analyzing Opportunities to Improve STEM Pathways

	BENEFITS	DRAWBACKS
Build on Existing Successes Scale successful programs to maximize impact	Leverages existing platforms for speed, simplicity, and cost savings	Could create overreliance on temporary expertise
Create New Institutions Congress and external stakeholders could build a new institution, or set of institutions, to recruit and house STEM talent working on policy issues	Creates a 'Home' for Technical Talent Builds Institutional Memory Creates Reputation for Excellence	Substantively and politically difficult to create
Create and Expand University Pathways Train the next generation of policy advising scientists and technologists by creating and expanding university pathways	Leverages existing pathways and resources Creates generational change	Is not immediate solution to problem Pulls resources away from more immediate solutions
Create New Short-Term 'Tour of Duty' Roles Create new time-limited opportunities for scientists and technologists to work on policy issues on Capitol Hill	Enables talent acquisition and assists with infusions of talent Builds relationships with expert networks Generates bidirectional learning opportunities	Introduces substantive or optical bias Could create overreliance on temporary expertise
Create New Fellowship Programs Develop a new model combining classroom learning, job placement, on-the-job training, and mentoring	Develops alumni network of cross-sector leaders Allows tailoring of program to local circumstances	Could reinvent the wheel unnecessarily Difficult to start new programs May not be resilient to leadership changes.
Create Vetted Talent Pools A trusted entity could offer a curated pool of qualified STEM candidates to congressional personal offices and committees	Relatively simple to create Offers potential for immediate impact	May not be resilient to changes in Congress

47 Mike Miesen and Laura Manley, "Building a 21st Century Congress: Improving STEM Policy Advice in the Emerging Technology Era," Building a 21st Century Congress (Belfer Center for Science and International Affairs: Technology and Public Purpose Project, 2020), 10, https://www.belfercenter.org/sites/default/files/2020-11/Pathways.pdf.

Additional Investment in Congress's Overall Capacity

More broadly, Congress needs to invest in itself by increasing its budget, which would allow members to hire more staffers and pay them better. This, in turn, would help Congress attract and retain more subject matter experts and give more junior staffers opportunities to stick around and become subject matter experts, if they wish to do so.

As Representative Katherine Clark put it, "We will never regain our status as a coequal branch of government until we start treating ourselves as a coequal branch. And that requires big ideas and big investments."[48]

There is reason to be optimistic about the future of capacity-building initiatives in Congress. In the 116th Congress, the House of Representative's Select Committee on the Modernization of Congress offered 97 bipartisan recommendations for congressional reform, touching on issues as wide-ranging as congressional capacity and as narrow as mandatory cybersecurity training.[49] This is progress; as Lorelei Kelly, Fellow at the Beeck Center for Social Impact + Impact at Georgetown University, put it,

> *"Although the recommendations put forth by the Modernization Committee might seem like unremarkable workflow tweaks, they are a significant leap forward for a neglected institution—one operating at 1970s staffing levels and which funds its own systems maintenance at 25 percent less than a decade ago."*[50]

48 Clark, Katherine, "Testimony Before the Select Committee for the Modernization of Congress" (2019), https://docs.house.gov/meetings/MH/MH00/20190312/109102/HHRG-116-MH00-Wstate-C001101-20190312.pdf.

49 "The Select Committee on the Modernization of Congress: Final Report" (United States Congress, October 2020), 31, https://modernizecongress.house.gov/imo/media/doc/ModernizationCommittee_10152020r1Compressed%20(newest%20gpo%20report).pdf.

50 Lorelei Kelly, "Push Forward Now: Congressional Modernization and the Future of Democracy" (Georgetown University: Beeck Center for Social Impact and Innovation, March 2021), 10, https://beeckcenter.georgetown.edu/report/push-forward-now-congressional-modernization-and-the-future-of-democracy/.

The Select Committee on the Modernization of Congress was extended for the 117th Congress and is currently planning for its next two years.[51] With experience and greater influence, the select committee can continue to push capacity-building initiatives through hearings, reports, and recommendations.

However, more must be done through committees that have the power to pass legislation, particularly the appropriations committees in both houses. There is bipartisan support for action; Congress should raise member budgets, increase staff caps, and increase committee staff support—all recommendations from the Select Committee on the Modernization of Congress.[52]

Building legislative branch capacity will be a critical enabler of technology assessments, allowing policy options to be understood, debated, and acted on.

51 "House Extends Select Committee on the Modernization of Congress, Adopts Committee Recommendations | House Select Committee on Modernization," accessed March 25, 2021, https://modernizecongress.house.gov/news/press-releases/house-extends-select-committee-on-the-modernization-of-congress-adopts-committee-recommendations.

52 "The Select Committee on the Modernization of Congress: Final Report."

Conclusion

The 1969 National Academies report on technology assessment concluded with a warning:

> *"The future of technology holds great promise for mankind if greater thought and effort are devoted to its development. If society persists in its present course, the future holds great peril, whether from the uncontrolled effects of technology itself or from an unreasoned political reaction against all technological innovation."*[53]

The United States of America did not persist on that course; both Congress and the Executive Office of the President expanded their technology assessment capabilities, allowing both branches of the federal government to think more deeply about technological development and its effects on society.

Unfortunately, Congress defunded its technology assessment organization, the Office of Technology Assessment, in 1996. Had the United States Congress not defunded the Office of Technology Assessment in 1996, would the past 25 years of science and technology legislation look any different?

Would Congress, having foreseen the societal implications of large social media companies, acted earlier to mitigate their harms? How might pandemic preparedness have been addressed after several near misses? How might climate have been addressed earlier?

Counterfactuals are hard, and we cannot know for certainty that *anything* would be different. The same forces that led to the defunding of the OTA would still be with us; political considerations still weigh heavy on the legislative process. Funding would remain a constraint, too; perhaps, even recognizing the issues laid out by exhaustive technology assessments, conservative members of Congress would still balk at raising taxes to support a more robust public health system or to invest in green technologies designed to reduce dependence on fossil fuels. Structural problems require

53 Read "Technology," 118.

structural solutions, and the OTA is but one component of a broader solution.

And yet, with more acute and chronic crises facing the American public, it is vital to ask: is this the best we can do? Is this the most we should expect from the United States Congress?

For our future, and for generations to come, we must demand more from our elected representatives. Recommitting to the basic principles and structures of technology assessment is one way for Congress to show it is up to the task of legislating for the 21st century.

Similarly, the Biden Administration should continue to focus on hiring and deploying scientists and technologists to identify, research, and explain emerging technologies to policymakers—and to lead the organizations where those priorities will be enacted.

The next generation of technologies will be transformative; it is up to us to make sure that they help make the world healthier, happier, and more prosperous.

Appendix A: Additional Reading on Technology Assessment

Bruce Bimber. *The Politics of Expertise in Congress.* SUNY Press. 1996.

Peter D. Blair. "Effective Science and Technology Advice for Congress: Comparing Options." *Science and Public Policy.* January 2021. https://academic.oup.com/spp/advance-article/doi/10.1093/scipol/scaa070/6067289

Aaron Fluitt and Alexandra Givens. "Improving Tech Expertise in Congress: Time to Revive OTA?" Institute for Technology Law and Policy. Georgetown Law. June 2018. https://georgetown.app.box.com/s/2dt0lq0tb6p7kqdf68c7plwewseg3hxs

Zach Graves and Daniel Schuman. "Science, Technology, and Democracy: Building a Modern Congressional Technology Assessment Office." Ash Center for Democratic Governance and Innovation. Harvard Kennedy School. January 2020. https://ash.harvard.edu/publications/science-technology-and-democracybuilding-modern-congressional-technology-assessment

Zach Graves and Kevin Kosar. "Bring in the Nerds: Reviving the Office of Technology Assessment." R Street Institute. January 2018. https://2o9ub0417chl2lg6m43em6psi2i-wpengine.netdna-ssl.com/wp-content/uploads/2018/04/Final-128-1.pdf

John Sargent Jr. "The Office of Technology Assessment: History, Authorities, Issues, and Options." Congressional Research Service. April 29, 2020. https://fas.org/sgp/crs/misc/R46327.pdf

Technology: Processes of Assessment and Choice for the House Committee on Science and Astronautics. National Research Council. The National Academies Press. 1969. https://doi.org/10.17226/21060.

References

Allen, Arthur. "For Billion-Dollar COVID Vaccines, Basic Government-Funded Science Laid the Groundwork." Scientific American, November 2020. https://www.scientificamerican.com/article/for-billion-dollar-covid-vaccines-basic-government-funded-science-laid-the-groundwork/.

"Center for Strategic Foresight." September 2019. https://www.gao.gov/about/what-gao-does/audit-role/csf.

Clark, Katherine. Testimony Before the Select Committee for the Modernization of Congress (2019). https://docs.house.gov/meetings/MH/MH00/20190312/109102/HHRG-116-MH00-Wstate-C001101-20190312.pdf.

Dodaro, Gene. "Fiscal Year 2022 Budget Request: U.S. Government Accountability Office. State of Gene L. Dodaro, Comptroller General of the United States," March 10, 2021. https://docs.house.gov/meetings/AP/AP24/20210310/111292/HHRG-117-AP24-Wstate-DodaroG-20210310.pdf.

Evans, Kenneth M., and Kirstin R.W. Matthews. "Science Advice to the President and the Role of the President's Council of Advisors on Science and Technology." Rice University's Baker Institute for Public Policy, August 2018. https://www.bakerinstitute.org/media/files/research-document/19342455/st-pub-pcast-081418.pdf.

The White House. "Executive Order on the President's Council of Advisors on Science and Technology," January 27, 2021. https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-presidents-council-of-advisors-on-science-and-technology/.

"GAO's Congressional Protocols." U.S. Government Accountability Office, July 2017. https://www.gao.gov/assets/690/685901.pdf.

Graves, Zach, and Daniel Schuman. "Science, Technology, & Democracy: Building a Modern Congressional Technology Assessment Office." Harvard Kennedy School Ash Center for Democratic Governance and Innovation, 2020. https://ash.harvard.edu/publications/science-technology-and-democracybuilding-modern-congressional-technology-assessment.

"House Extends Select Committee on the Modernization of Congress, Adopts Committee Recommendations | House Select Committee on Modernization." Accessed March 25, 2021. https://modernizecongress.house.gov/news/press-releases/house-extends-select-committee-on-the-modernization-of-congress-adopts-committee-recommendations.

Interviews with Anonymous Congressional Staff Members, March 2021.

Interviews with Senior Leaders in Science and Policy, February 2021.

Interviews with Congressional Reform Experts, February 2021.

Interviews with Congressional Reform Experts, March 2021.

Interviews with Congressional Reform Experts, April 2021.

Kelly, Lorelei. "Push Forward Now: Congressional Modernization and the Future of Democracy." Georgetown University: Beeck Center for Social Impact and Innovation, March 2021. https://beeckcenter.georgetown.edu/report/push-forward-now-congressional-modernization-and-the-future-of-democracy/.

Miesen, Mike, Maeve Campbell, Chris Kuang, Laura Manley, and Emily Roseman. "Building a 21st Century Congress: Improving Congress's Science and Technology Expertise." Building a 21st Century Congress. Belfer Center for Science and International Affairs: Technology and Public Purpose Project, 2019. https://www.belfercenter.org/sites/default/files/2019-09/ST/Building21stCenturyCongress.pdf.

Miesen, Mike, and Laura Manley. "Building a 21st Century Congress: Improving STEM Policy Advice in the Emerging Technology Era." Building a 21st Century Congress. Belfer Center for Science and International Affairs: Technology and Public Purpose Project, 2020. https://www.belfercenter.org/sites/default/files/2020-11/Pathways.pdf.

Mills, M Anthony. "The Many Meanings of 'Technology Assessment,'" February 2020. https://lincolnpolicy.org/wp-content/uploads/2020/02/MILLS.pdf.

"Reps. Takano and Foster, Sens. Hirono and Tillis Introduce the Office of Technology Assessment Improvement and Enhancement Act | U.S. Congressman Mark Takano of California's 41st District." Accessed March 25, 2021. https://takano.house.gov/newsroom/press-releases/reps-takano-and-foster-sens-hirono-and-tillis-introduce-the-office-of-technology-assessment-improvement-and-enhancement-act.

Sargent, John F., and Dana Shea. "The President's Office of Science and Technology Policy (OSTP): Issues for Congress." Congressional Research Service, January 2014. https://fas.org/sgp/crs/misc/RL34736.pdf.

Takano, Mark. "Text - H.R.4426 - 116th Congress (2019-2020): Office of Technology Assessment Improvement and Enhancement Act." Webpage, September 19, 2019. 2019/2020. https://www.congress.gov/bill/116th-congress/house-bill/4426/text.

"Technology Assessment Design Handbook: Handbook for Key Steps and Considerations in the Design of Technology Assessments." U.S. Government Accountability Office, February 2021. https://www.gao.gov/assets/720/712458.pdf.

Technology: Processes of Assessment and Choice. Committee on Science and Astronautics, U.S. House of Representatives: National Academy of Sciences, 1969. https://doi.org/10.17226/21060.

"The Select Committee on the Modernization of Congress: Final Report." United States Congress, October 2020. https://modernizecongress.house.gov/imo/media/doc/ModernizationCommittee_10152020r1Compressed%20(newest%20gpo%20report).pdf.

Wagner Hill, Kathryn. "A New-Old Vision for Congressional Technology Assessment," February 2020. https://lincolnpolicy.org/wp-content/uploads/2020/02/HILL.pdf.

Technology and Public Purpose Project
Belfer Center for Science and International Affairs
Harvard Kennedy School
79 John F. Kennedy Street
Cambridge, MA 02138

www.belfercenter.org/TAPP

Printed in the United States of America