TECHNOLOGY, PUBLIC PARTICIPATION, AND THE AMERICAN

BUREAUCRACY:

PARTICIPATORY TECHNOLOGY ASSESSMENT IN UNITED STATES FEDERAL

AGENCIES

by

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DEDICATION

I dedicate this work to all those in my life who have inspired, supported, and put up with my ten-year academic journey to have letters after my name. This milestone is dedicated to my grandfather, a sheep herder and avid lover of nature; to the memory of my grandmother, a farmworker and passionate traveler of the world; to my father, a mechanic and my role model in work ethic and dedication; a mi mama, una mujer sabia quién me enseno la dedicación a la justicia y verdad; to my sister, Yeleny, and brother-in-law, Chad, my patrons when I have had nothing to show for my efforts; and my wife, Jamie, ever patient and supportive these past several years as the last stretch of this journey sometimes made me into a person I do not recognize.

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ABSTRACT

This dissertation analyzes three participatory technology assessment (pTA)

projects conducted within United States federal agencies between 2014 and 2018. The

field of Science and Technology Studies (STS) argues that a lack of public participation

in addressing issues of science and technology in society has produced undemocratic

processes of decision-making with outcomes insensitive to the daily lives of the public.

There has been little work in STS, however, examining what the political pressures and

administrative challenges are to improving public participation in U.S. agency decision-

making processes. Following a three-essay format, this dissertation aims to fill this gap.

Drawing on qualitative interviews with key personnel, and bringing STS, policy studies,

and public administration scholarship into conversation, this dissertation argues for the

significance of "policy entrepreneurs" who from within U.S. agencies advocate for pTA

and navigate the political controls on innovative forms of participation. The first essay

explores how the political culture and administrative structures of the American federal

bureaucracy shape the bureaucratic contexts of public participation in science and

technology decision-making. The second essay is an in-depth case study of the role

political controls and policy entrepreneurs played in adopting, designing, and

implementing pTA in NASA's Asteroid Initiative. The third essay is a comparative

analysis of how eight political and administrative conditions informed pTA design and

implementation for NASA's Asteroid Initiative, DOE's consent-based nuclear waste

siting program, and NOAA's Environmental Literacy Program. The results of this

dissertation highlight how important the political and administrative contexts of federal government programs are to understanding how pTA is designed and implemented in agency science and technology decision-making processes, and the key role agency policy entrepreneurs play in facilitating pTA through these political and administrative contexts. This research can aid STS scholars and practitioners better anticipate and mitigate the barriers to embedding innovative forms of public participation in U.S. federal government science and technology program design and decision-making processes.

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LIST OF ABBREVIATIONS

APA	Administrative Procedures Act
ARM	Asteroid Redirect Mission
COP	Conference of the Parties
DOE	Department of Energy
ECAST	Expert and Citizen Assessment of Science and Technology
ELP	Environmental Literacy Program
FACA	Federal Advisory Committee Act
MSA	Multiple Streams Approach
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
OGC	Office of General Counsel
OGI	Open Government Initiative
OMB	Office of Management and Budget
OTA	Office of Technology Assessment
PRA	Paperwork Reduction Act
pTA	Participatory Technology Assessment
QCA	Qualitative Comparative Analysis
RFI	Request for Information
STS	Science and Technology Studies

CHAPTER ONE: INTRODUCTION

Background

I came to the Public Policy and Administration program at Boise State University with a background in political and environmental philosophy. After years of developing the humanist's tools for examining how political power shapes disparate experiences of justice and injustice, I grew apprehensively aware that I lacked the tools to examine empirically how the structures of democratic government, and the people within them, exercise this power. Completing coursework in the program left me with a keen interest in the philosophy and ethics of public administration and its relationship to public trust in democratic processes and institutions. In this light, it was inevitable that when writing a dissertation at the intersection of Science and Technology Studies (STS), public policy, and public administration, I would end up examining how the political and administrative contexts of the American federal bureaucracy shape opportunities for innovative public participation in science and technology program decision-making.

In the Spring of 2019, I was fortunate to be selected to work as senior personnel through a graduate assistantship on a National Science Foundation research grant. The project aimed to examine if designing and implementing participatory technology assessment (pTA) exercises at three U.S. federal agencies lead to a shift in perceptions of what the public can contribute to science and technology decision-making. Organized by the Expert and Citizen Assessment of Science and Technology (ECAST) network, these pTA exercises were embedded within agency science and technology programs and, thus,

within the political and administrative structures of the American federal bureaucracy. As my advisor and I conducted interviews for the project, we noticed a theme emerging in the observations agency personnel and ECAST members shared with us about the agencies' cultures concerning the role of the public in technical decision-making. A lot of what we were hearing had to do with how these cultures were heavily informed by the political pressures and administrative challenges agencies and personnel face when trying to do something innovative within bureaucratic constraints. We anticipated some elements of this but were surprised by the themes that were emerging regarding the role public participation plays in unsettling the political and administrative relationships between government institutions.

What no one accounted for, however, was that amid doing the research we found ourselves in a global pandemic that would test, and reveal, the fabric of the relationship between public trust, democratic government, and science. While I was already interested in what we were hearing and what it may mean for STS participatory theory and practice, the COVID-19 pandemic brought into focus my broader and personal interest in the details of what innovative forms of public participation in government decision-making means to democracy and society. Writing a dissertation at the intersection of STS, public policy, and public administration during a global pandemic underscored not only what happens when an already fractured relationship of trust between the public and institutions of democratic government is stressed by the realities of scientific facts, but also what is at stake in not addressing the fractures.

As a field that has for decades examined the social and political relationship between science, technology, and society, there were some within STS that saw the

COVID-19 pandemic as a potential model case of how scientific expertise, the public, and government could work together to address a complex, life-threatening issue. For example, Daniel Sarewitz (2020) wrote that the process of addressing the COVID-19 pandemic in the United States could offer "a powerful and extremely clear lesson about the appropriate role of science in helping guide us towards a better future." According to Sarewitz, the science was good enough to justify government public health policies that would be acceptable enough to the majority of American politicians and to the American public to realign political values towards the agreeable enough goal of preserving life. The hope was that as more scientific information became available, preexisting partisan conflicts would yield to a common goal. Indeed, at the time of this writing in the summer of 2021, the Biden administration is reporting that 52% of Americans have at least one shot of the COVID-19 vaccine (US CDC, 2021a), and infection and hospitalization rates are decreasing overall (US CDC, 2021b).

By early summer of 2020, however, when COVID-19 began to show how devastating it would be to lives the world over, a litany of partisan debates and public protests began to rise around the science regarding the virus (e.g., infectiousness, severity, vaccines) (e.g., COVID vaccine, 2020; Holden, 2020), and the public health policies enacted to mitigate its impacts (e.g., lockdowns, mask mandates, limit or suspend public gatherings) (e.g., Aratani, 2020; Beckett, 2020). This cut short the optimism that expert-informed policies could help temper underlying political tensions enough to move towards a common cause. Moreover, at the time of this writing over a year into the pandemic, no number of empirical public health or medical facts helped reconcile the preexisting conflicts between political values in which the COVID-19 pandemic has

taken place. In fact, scientific facts seem to have reinforced the political positions at the base of the conflicts (e.g., 'Here fire, you hungry?', 2021; Pengelly, 2021; Wilson, 2021).

The degree to which the response to the COVID-19 pandemic in the United States has been divisively partisan despite the volumes of scientific facts at our disposal is a testament to how expertise and technical information is not sufficient for addressing issues of science and technology in society (e.g., Callon et al., 2009; McNeil, 2013; Sturgis & Allum, 2004). It is a stark reminder of Brian Wynne's (1992) critical insights that scientific facts are in and of themselves not vehicles of credibility or trust, and that credibility and trust in government decisions on matters of science and technology are subject to the underlying relationship between the public and government. Moreover, the condition of that relationship is shaped by the histories and structures of political power that have been formed by how the public participates in the various processes of government decision-making (Arnstein, 1969). In short, the virus did not cause irreconcilable political conflicts, nor did it cause the crises of public trust in democratic government. It did act, however, as a vehicle for stressing the preexisting "democratic deficits" between the public and government shaped by a lack of public participation in decision-making processes throughout government (Durant, 1995).

The example of the COVID-19 pandemic in the United States illustrates what is at stake in the relationship between participation, democracy, and the public. Public administration scholarship has long examined how a lack of public participation in different forms of government administration impacts the trust in and effectiveness of democratic institutions (Arnstein, 1969; Durant, 1995; Fung, 2015; Nabatchi, 2010; Ruscio, 1996; Wattenberg, 2002). When it comes to matters of science and technology in

society, STS has also examined how a lack of public participation in addressing these issues has produced undemocratic processes of decision-making. These processes and their outcomes are insensitive to the daily lives of the public and reinforce social and political disparities (Callon et al., 2009; Feenberg, 2012; Foltz, 1999; Jasanoff, 2005; Sclove, 1995; Stilgoe et al., 2014; Wynne, 1992). One of the many theoretical tensions and practical challenges STS encounters in advocating greater and more open participation as an intervention to these undemocratic processes and outcomes, however, is the "policy pathway" problem of getting the results of the field's independently organized participatory exercises to inform formal government decision-making processes (Delborne et al., 2013; Delgado et al., 2011). Additionally, STS participatory theory and practice struggles with the bureaucratic barriers that frustrate attempts to embed innovative forms of public participation in government science and technology programs and decision-making (Depoe et al., 2004; Hamilton, 2003; Hendry et al., 2004).

Against this backdrop, I write a dissertation that brings concepts from public administration scholarship, policy studies, and STS into conversation to reframe how STS engages with the political and administrative conditions that shape barriers to and opportunities for innovative public participation in U.S. federal science and technology decision-making. Doing so may better equip public participation scholars and practitioners to grapple with and address the bureaucratic barriers that resist innovative forms of public participation in government science and technology programs and decision-making. The dissertation follows a three-essay format. First, Chapter 2 provides conceptual analysis that develops the theoretical framework for the latter two mostly empirical essays. Next, Chapter 3 is an in-depth case study of one of these agency

projects, using Multiple Streams Approach (Kingdon, 1984, 2011) to deepen our understanding of how policy entrepreneurs function at the administrative level. Finally, Chapter 4 reports on the results of a comparative study of pTA exercises in three federal agencies – the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), and the National Oceanographic and Atmospheric Administration (NOAA). This work highlights eight factors that may either enable or constrain innovative public participation in the federal bureaucracy.

Overview of Cases and Research Methodology & Methods

Between 2014 and 2018, the Expert and Citizen Assessment of Science and Technology (ECAST) network of academic, policy research, citizen science, and informal science education institutions worked with these agencies to organize, design, and implement pTA exercises. In 2014, ECAST and NASA designed and implemented pTA exercises for the agency's Asteroid Initiative for planetary defense and missions to Mars (Tomblin et al., 2015). In 2016, ECAST and DOE began designing pTA deliberations for the agency's consent-based siting program for nuclear waste. The forums were slated to convene in early 2017. Following the 2016 presidential election, however, in anticipation of policy changes by the new administration, DOE suspended the consent-based siting program and cancelled the pTA project before it could be implemented. Lastly, through a 2018 NOAA Office of Education Environmental Literacy Program grant providing funding and agency support, ECAST designed and implemented several pTA forums around the U.S. on local climate resilience planning.

Under the auspices of a National Science Foundation research grant[1] investigating how designing and implementing pTA exercises embedded within these three agencies impacted their technocratic cultures of expertise, my advisor, Dr. Jen Schneider, and I conducted thirty-two (32) semi-structured interviews with twenty-five (25) participants between June 2019 and October 2020. Interviews were conducted with ECAST members and NASA, DOE, and NOAA personnel who were directly involved with designing and implementing pTA exercises, or who had knowledge of agency culture during the time of the exercises. I conducted qualitative analysis of public documents, mostly used to establish the background details of each case, and of 1670 minutes (or about 28 hours) of interview data. The complete details to the second and third essays' research methodology and methods can be found in their respective chapters.

These essays will identify and analyze the bureaucratic contexts that informed the processes of adopting, designing, and implementing pTA in U.S. federal agency program design and decision-making. While there is a substantial literature in STS that theorizes the importance of public participation in government science and technology decision-making, this dissertation will contribute to our understanding of the political cultures and administrative structures that inform the limits on and capacities for innovative public participation in federal government agencies. By bringing STS into conversation with public administration and policy studies scholarship, this work will help fill gaps in our understanding of how historical, political, and administrative contexts constrain and

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[1] Award no. 1827574 – "Participatory Technology Assessment and Cultures of Expertise in the U.S. Federal Government."

enable public participation in government science and technology decision-making, and which conditions are most likely to lead to successful engagements with pTA exercises.

Table 1.1   Summary of Interviews Conducted for Dissertation

Total Number of Interviewees	Total Number of Interviews		Total Number of Minutes/Hours
25	32		1670 min / ~28 hrs
	NASA	**DOE**	**NOAA**
Number of Interviews	12	11	9
ECAST	7	4	6
Contractor	0	3	0
Agency Personnel	5	1*	2
Former Personnel	0	2	0

*Conducted with NASA personnel familiar w/ DOE's administrative situation.

Overview of Content

My dissertation engages with three questions concerning how STS participatory theory and practice engages with the political and administrative contexts of the American federal bureaucracy when it comes to embedding innovative forms of public participation in government science and technology program design and decision-making. The opening essay (Chapter 2) sets the theoretical stage for the second two essays by answering a call by Jason Chilvers and Matthew Kearnes (2020) for us in STS to remake our approach to the relationship between participation, democracy, and the public. They argue that a preoccupation with designing methods for participation

measured against ideal models of deliberative democracy has hampered the field's capacity to contribute to enhancing public trust, averting crises of expertise and democracy, and building more socially responsive and responsible science and innovation (Chilvers and Kearnes, 2020, p. 347). This is due in large part to a gap in our knowledge of how "the constituent elements of participation emerge and are coproduced through" the diverse social, political, and government contexts in which participation can take place (Chilvers & Kearnes, 2020, p. 354).

One of their suggested research agendas for remaking participation in science and democracy is to "ecologize" STS participatory theory and practice by attending to participation's relational interdependence with larger social and political systems. I examine how a detailed understanding of the wider political culture and administrative structures of American federal government can do this "ecologizing" work. This may help us better understand the bureaucratic barriers to innovative forms of public participation in government science and technology decision-making. I argue that we in STS can look to the well-established public administration theory of "political control." The theory of political control can form the basis for examining how the political pressures and administrative challenges federal agencies and personnel face shape the processes of designing and implementing novel methods of public participation in government science and technology program design and decision-making (Lipsky, 2010; Meier & O'Toole Jr, 2006; Rohr, 1986). The first essay engages with the question "*What can public administration's theory of 'political control' contribute to how STS participatory theory and practice engages with the political and administrative contexts of public participation in U.S. federal government decision-making?*" Answering this can

help us in STS come to better terms with how the challenges we face with bureaucrats'
resistance to novel public participation are core features of American federal
bureaucracy.

The first essay develops a framework of three maxims based in public
administration's theory of political control. These maxims speak to how designing and
implementing innovative forms of public participation in U.S. federal agencies will
invariably face political pressures and administrative challenges:

1. Political pressures on and administrative challenges to innovative public
   participation in program design and decision-making are inherent to the federal
   bureaucracy because of political controls on agency discretion.

2. These political pressures and administrative challenges will shape the processes of
   adopting, designing, and implementing innovative forms of participation; the
   extent of this shaping is widely variable.

3. Pressures and challenges that come with innovative forms of participation can
   often be managed or mitigated by agency personnel with bureaucratic expertise.

The third maxim is the ameliorative component of the framework, and is a vehicle for
examining how agency personnel can soften how these political pressures and
administrative challenges shape pTA with their bureaucratic expertise. The second and
third essays use this framework to inform elements of in-depth case study of pTA in
NASA's Asteroid Initiative and a comparative analysis of the three cases of pTA in
NASA, DOE, and NOAA, respectively. In them, I expand on the second maxim and
underline the importance of the expert bureaucratic work of agency personnel in line with
the third.

Essay Two (Chapter 3) engages with the question of "*how did NASA 'policy entrepreneurs' navigate the 'multiple streams' of the program implementation process to facilitate participatory technology assessment (pTA) exercises be a part of the Asteroid Initiative's program design and decision-making process?*" For the in-depth case study of pTA in NASA's Asteroid Initiative, I use John Kingdon's "Multiple Streams Approach" (MSA) (1984, 2011) for examining the political processes that explain how government policies and programs change but to the programmatic level. Kingdon describes the policy process as composed of three separate yet interdependent "streams" – the problem, policy, and politics streams. Each contains a different set of factors that can align to create opportunities for policy change.

A central element of MSA is identifying "policy entrepreneurs," individuals who use their institutional knowledge and bureaucratic expertise to bring the streams together to create opportunities for policy changes and innovations (Anderson et al., 2019; Cairney, 2018; Kingdon, 2011; Mintrom & Norman, 2009). In line with the second maxim, I use MSA's streams to organize and examine the political and administrative factors surrounding the adoption, design, and implementation of pTA in NASA's Asteroid Initiative. In line with the third maxim, I highlight the crucial role played by NASA policy entrepreneurs to facilitate adopting, designing, and implementing pTA in ways ECAST members could not on their own, due in large part to their bureaucratic expertise in navigating political pressures and administrative challenges.

While this case study reveals the details of how political and administrative contexts shaped the processes of designing and implementing pTA embedded within a U.S. federal agency, it does not afford a broad perspective on how political controls

inform these processes across different contexts. Essay Three engages with the comparative question of "*what were the political and administrative conditions that shaped how participatory technology assessment (pTA) exercises were implemented in NASA's Asteroid Initiative, DOE's consent-based siting program, and NOAA's Environmental Literacy Program?*" I use a "very small-N" Qualitative Comparative Analysis (QCA) approach (Berg-Schlosser et al., 2009; Marx et al., 2014; Ragin, 1987, 2014) to compare the conditions informing these three cases of pTA design and implementation in federal agency programs. The goal of the QCA approach is to explain how within sets of similar cases an outcome occurred in some while in others it did not. This is done by identifying conditions and analyzing the relationships between them in and across cases.

I identified eight political and administrative conditions that shaped the processes of designing and implementing pTA across NASA's Asteroid Initiative, DOE's consent-based siting program, and in NOAA's Environmental Literacy Program. Through an analysis of the relationships between conditions in each case, I explain how each of these three cases of designing and implementing pTA occurred the way it did. These eight conditions are general enough to apply to other cases where innovative forms of public participation were embedded in U.S. federal science agency decision-making, but also specific enough to identify the individual political pressures and administrative challenges that can inform the design and implementation processes. Moreover, I argue that two conditions – Political Priority and Policy Entrepreneurs – contribute the most to informing how innovative forms of public participation are designed and implemented.

Table 1.2   Summary of Identified Political and Administrative Conditions

Condition	Description
Decision Support	pTA results informed decision-making
Cooperative Agreement	The contract between agency and ECAST was a cooperative agreement
Administrative Rules	Administrative rule requirements impacted pTA design
"Top Cover"	Agency managers supported pTA
Controversy	The degree of controversy surrounding the program pTA was embedded in
Agency Culture	The degree to which the agency's organizational culture was open to pTA
Political Priority	The Presidential Administration prioritized greater public participation
Policy Entrepreneurs	Agency personnel actively facilitated designing and implementing pTA

Conclusion

There is a trend in STS participatory theory and practice of being mainly preoccupied with designing and evaluating participation against ideal measures of deliberative democracy. It has left us with a gap in our knowledge and understanding concerning the bureaucratic details that frustrate efforts to embed innovative forms of public participation in American federal government science and technology decision-making. A more attuned reading of these bureaucratic contexts – the political pressures and administrative challenges that agencies face when attempting to innovate on public participation – may help us in STS better anticipate the challenges to and opportunities for embedding innovations in participation. It may also help us be more sensitive to how

these political pressures and administrative challenges can be addressed with the bureaucratic expertise of policy entrepreneurs within government agencies.

This dissertation contributes to filling these gaps in our STS participatory theory and practice by bringing to bear concepts from public administration scholarship on the political control of the bureaucracy and empirical evidence on how we understand bureaucrats' resistance to more open and deliberative forms of public participation in U.S. federal government science and technology decision-making. This different reading of bureaucratic barriers in Essay One can help us in STS engage with the "bureaucracy problem" in the same way we engage with the "problem of expertise": not a problem to be solved or erased, but a tension to be tempered; not an aberration to democracy, but a core feature of American democratic government.

The empirical analyses in Essay Two and Three expand on the details of how political and administrative conditions shaped the design and implementation of an innovative form of public participation and underscore just how crucial policy entrepreneurs within government are to navigating these political pressures and administrative challenges. The bureaucratic expertise of federal government agency personnel, in some cases, can actually enable greater public participation in science and technology decision-making. Filling these gaps in STS participatory theory and practice with this kind of knowledge and understanding may help us develop a greater sensitivity to the inexorable relationship between building public trust in government by innovating on methods of public participation and our capacity to address issues of science and technology in democratic society.

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CHAPTER TWO (ESSAY ONE): THE RULES OF PUBLIC ENGAGEMENT: HOW

POLITICAL CONTROLS IMPACT PUBLIC PARTICIPATION IN AMERICAN

FEDERAL SCIENCE AND TECHNOLOGY DECISION-MAKING

Introduction and Background

Jason Chilvers and Matthew Kearnes (2020) have recently called for us in the

field of Science and Technology Studies (STS) to remake our approach to the

relationship between participation, democracy, and the public. STS has long examined

how a lack of public participation in addressing issues of science and technology in

society has produced undemocratic processes of decision-making. These processes and

their outcomes are not only insensitive to the daily lives of the public but also reinforce

social and political disparities (e.g., Callon et al., 2009; Feenberg, 2012; Foltz, 1999;

Jasanoff, 2005; Sclove, 1995; Stilgoe et al., 2014; Wynne, 1992). Chilvers and Kearnes

(2020) applaud the significant advances made in our methods for designing and

evaluating more open and deliberative forms of public participation in science and

technology (e.g., J. Burgess & Chilvers, 2006; e.g., Delborne et al., 2013; Delgado et al.,

2011; Fiorino, 1990; Guston, 1999; Irwin et al., 2013; Kleinman et al., 2007, 2011;

Powell & Colin, 2008; Powell & Kleinman, 2008; Rowe & Frewer, 2000, 2005; Stirling,

2008). They suggest, however, that "despite notable success, such developments have

often struggled to enhance public trust, avert crises of expertise and democracy, and build

more socially responsive and responsible science and innovation" (Chilvers and Kearnes,

2020, p. 347).

They argue that the predominant reason for this is that a "residual realist" approach dominates STS participatory theory and practice. This "residual realist" approach theorizes participation, democracy, and the public as predefined elements that exist independently of one another and independent of the sociopolitical contexts that produce conflict. Under this approach, participation design and evaluation, heavily informed by normative (and ideal) theories of deliberative democracy (e.g., Dryzek, 2000, 2012; Habermas, 1984; Mouffe, 2000, 2005), becomes deeply focused on achieving predetermined procedural standards of success (Fiorino, 1990; Rowe & Frewer, 2000, 2005; Stirling, 2008). Participatory theory and practice on issues of science and technology is disconnected from the wider social and political contexts in which public participation takes place. In short, a focus on "high church" issues has produced a participatory theory and practice that struggles with "low church" realities (Sismondo, 2008).

For example, STS literature on designing and implementing participation mostly focuses on specific events organized independent of but parallel to government policymaking on science and technology (e.g., Guston, 1999; Kleinman et al., 2007, 2011). Chilvers and Kearnes (2020) would argue that this focus is a product of a linear understanding of the relationship between participation and outcomes. This approach is preoccupied with achieving ideal participation designs that predominantly focus on tempering the tensions concerning expertise (e.g., Collins & Evans, 2002; Gorman, 2002; Jasanoff, 2003a; Nowotny, 2003; Wynne, 2003) and work towards refining ideal methods of deliberative democracy. Little attention is paid to the broader contexts and details that inform how the results of these independent participation events are made a part of

decision-making within democratic institutions. This is evidenced by how the results of these independently organized deliberations often face political and administrative barriers, or "policy pathway" problems, to informing the government policymaking processes they run parallel to and are meant to impact (e.g., Delborne et al., 2013).

While the "policy pathway" problem is just one of many theoretical tensions and practical challenges the field faces (see Delgado et al., 2011), grappling with it is central to creating greater opportunities for more democratic public participation in government science and technology decision-making. Developing our knowledge and understanding of these contexts is key to the interventionist-oriented STS project of redistributing democratic political power through greater public participation (Arnstein, 1969; Carroll, 1971; Nelkin, 1977, 1979). The "residual realist" approach, however, has stifled our understanding of how political cultures and administrative structures impact the processes of designing and implementing more open and democratic public participation in government science and technology decision-making.

Chilvers and Kearnes (2020) suggest that we develop a relational, coproductionist approach to counteract the "residual realist" trend in STS participatory theory and practice. A relational coproductionist approach is grounded in how the "subjects, objects, and formats that make up the constituent elements of participation emerge and are coproduced through" the diverse social, political, and government contexts in which participation takes place (Chilvers & Kearnes, 2020, p. 354). It focuses on the details of how the relationships between participation, democracy, the public are made and remade as "scientific, democratic, and political orders" change (Chilvers & Kearnes, 2020, p. 350; Marres, 2015; Marres & Lezaun, 2011). By developing our knowledge and

understanding of the political and institutional details that shape participation, STS participatory theory and practice may better contribute to intervening on the undemocratic processes and disparate outcomes that have dominated science and technology decision-making.

Chilvers and Kearnes (2020) offer four interrelated research agendas for further developing a relational coproductionist approach. One of these agendas includes the recommendation to "ecologize" STS participatory theory and practice by "recognizing, attending to, and/or mapping the diversities of, and interrelations between, sociomaterial collectives of participation and public involvement that make up wider spaces such as systems, issues, and constitutions" (Chilvers & Kearnes, 2020, p. 358). In their article, they focus on developing techniques for mapping the formation of issues to "enable the identification of diverse collectives of participation and their relative positioning and relations within wider controversy and issue spaces" (Chilvers & Kearnes, 2020, p. 359). However, they also describe "ecologizing" as attending to participation's relational interdependence with larger systems. One of these larger systems is the relationship between the public and participation in government decisions-making. According to Chilvers and Kearnes (2020), a relational coproductionist approach attends to how processes of participation are shaped by the "political cultures and constitutional relations between citizens, science, and the state" (p. 354).

Following this research agenda, this essay is a first step towards beginning to ecologize STS participatory theory and practice within the wider political culture and administrative structures in which American government science and technology decision-making takes place. This process involves addressing two related impacts the

residual realist approach has had on our understanding of public participation in government science and technology decision-making. First, a preoccupation with designing and evaluating participation methods according to "ideal" standards has left our participatory theory and practice ill-equipped to grapple with the messy political and administrative contexts of public participation in government decision-making. Consequently, this has engendered a skepticism towards the political and administrative barriers to more open forms of public participation. This skepticism often reads resistance to public participation as antagonism towards lay perspectives because of a technocratic bias in decision-making. In short, because embedding more deliberative participatory approaches in government agencies is often imperfect when measured against the "residual realist" standard, STS has primarily occupied a place of critique rather than intervention in those systems. This has stifled building a knowledge and understanding of how the political and administrative aspects of public participation in government impact participation in science and technology decision-making.

European STS researchers have already begun to develop an ecologizing literature on how political culture informs methods and designs of public participation in the democratic processes of government institutions (Ezrahi, 2012; Felt et al., 2008; Horst & Irwin, 2010; Jasanoff, 2005; Laurent, 2017; Pallett, 2015; Seifert, 2006). Moreover, they have also begun to detail how the government structures produced by those political cultures impact the designs and outcomes of participation exercise when embedded within government decision-making processes (Emery et al., 2015; Krabbenborg & Mulder, 2015; Krick, 2015; Rask, 2013). For example, a large portion of this literature focuses on the Danish Board of Technology's consensus conference method and how it

has served as an ideal model in STS for how to design and embed public participation into government science and technology decision-making processes (Jensen, 2005; Joss, 1998; Joss & Durant, 1995; Klüver, 2000). Maja Horst and Alan Irwin (2010), however, highlight that the successes of the Danish Board of Technology model in Denmark (i.e., government-sponsored consensus conferences with the formal purpose of informing government decision-making) may be unique to a specific aspect of Danish political culture and to the administrative structures of Danish government. Other approaches should be considered from the vantage point of their own political ecologies. Context matters.

It is against this backdrop that I focus on ecologizing STS participatory theory and practice within the political history and administrative structures of the American federal bureaucracy. A detailed knowledge of the bureaucratic contexts surrounding public participation in U.S. government decision-making may help us better understand the barriers to and opportunities for embedding more open and deliberative forms of public participation in federal agency science and technology programs. American STS scholars and practitioners have only recently begun to examine the contexts surrounding more open forms of public participation embedded within United States federal agency science and technology decision-making processes (e.g., Bertrand et al., 2017; Gustetic et al., 2018; Kaminski, 2012; Tomblin et al., 2017). There has been limited examination, however, of how the political culture and administrative details of the American federal bureaucracy inform the barriers to and opportunities for embedding more deliberative public participation in science and technology program design and decision-making.

I suggest that the well-established public administration theory of "political control" may aid STS participatory theory and practice in understanding the kinds of bureaucratic tensions – political pressures and administrative challenges – federal agencies and personnel face when designing novel methods of public participation in government program design and decision-making (Bertelli & Lynn, 2006; Frederickson et al., 2015; Lipsky, 2010; Meier & O'Toole Jr, 2006). Examining the political controls on the discretion of agency personnel may shed some light on the reasons for resistance to implementing innovative forms of public participation in federal program design and decision-making (Bora, 2010; Long & Beierle, 1999; Shapiro, 2013, 2020). While such resistance may stem from a technocratic mindset opposing lay perspectives to issues of science and technology, this essay argues that there are other factors at play that should be considered. Like with the STS debates surrounding the "problem of expertise" (e.g., Collins & Evans, 2002; Gorman, 2002; Jasanoff, 2003a; Nowotny, 2003; Wynne, 2003), the theory of political control can help us come to terms with how the challenges we face with bureaucrats' resistance to novel public participation are not problems to be solved or erased, but tensions to be tempered. In other words, the impacts of political control that frustrate STS participatory theory and practice are core features of American democracy, not aberrations. They are to be managed because they cannot be avoided.

Moreover, I propose that we can use the theory of political control as the basis of a framework for better approaching the political and administrative barriers to innovative public participation in government science and technology decision-making. I present this framework as three maxims for examining how innovative forms of public

participation are adopted, designed, and implemented in U.S. federal agency program design and decision-making:

1. Political pressures on and administrative challenges to innovative public participation in program design and decision-making are inherent to the federal bureaucracy because of political controls on agency discretion.

2. These political pressures and administrative challenges will shape the processes of adopting, designing, and implementing innovative forms of participation; the extent of this shaping is widely variable.

3. Pressures and challenges that come with innovative forms of participation can often be managed or mitigated by agency personnel with bureaucratic expertise.

The next section presents public administration's theory of political control in the context of public participation in U.S. federal program design and decision-making. After that, I ground the utility of this analytic framework by using the first two maxims to briefly examine what the political pressures and administrative challenges were in three cases of designing and implementing participatory technology assessment (pTA) exercises, a deliberative form of public participation, at three U.S. federal agencies – the National Aeronautics and Space Administration (NASA), Department of Energy (DOE), and National Oceanic and Atmospheric Administration (NOAA).

The third maxim – that bureaucratic experts, or "policy entrepreneurs," can manage and mitigate political controls – is the subject of Essay 2 and 3 of this dissertation, so I do not go into detail on that here. However, I conclude this essay by discussing how this "political control" framework helps us not only ecologize STS participatory theory within the wider political and administrative contexts of public

participation in the American federal bureaucracy, but may also contribute to designing and implementing better STS participatory practices in the American federal government context.

Theoretical Framework

Expert knowledge is often framed as creating an inherent tension in democratic values in that it violates the principle of equal power when it comes to democratic decision-making (e.g., Grundmann, 2017; Jasanoff, 2003b; Ottinger, 2013; Turner, 2001, 2013). STS scholars continue to debate how to best temper this tension to make science and technology decisions that are expertly informed while also responsive to public values (e.g., Collins & Evans, 2002; Gorman, 2002; Jasanoff, 2003a; Nowotny, 2003; Rayner, 2003; Wynne, 2003, 2007). Efforts to temper this tension are complicated by how partisan politics sometimes uses expertise to frustrate the process of making empirically grounded and socially informed science and technology decisions that are in the public's interest (Brown, 2015; M. Burgess, 2014; Hoppe, 2005, 2009; Jasanoff, 1992; Pielke Jr, 2007; Woodhouse & Nieusma, 1997; Wynne, 1992). Greater public participation is championed as a way of better ensuring that the public's values and interests are a central part of government science and technology decision-making (Delgado et al., 2011; Foltz, 1999; Stilgoe et al., 2014).

Government agencies often close off opportunities for more deliberative public participation in decision-making, however, by treating participation events as instrumental pro forma engagements to meet legal requirements (Endres, 2012; Hamilton & Wills-Toker, 2006; Hendry, 2004). Moreover, there is research that has shown that agencies are resistant to hearing from certain publics when their input may complicate an

existing or expeditious political narrative (Condit et al., 2012; Depoe et al., 2004; Innes & Booher, 2004). In short, there is ample evidence to support skepticism towards government-led public participation in science- and technology-related programs. At the same time, one impact of "residual realism" on STS participatory theory and practice is that "high church" commitments to normative and ideal deliberative practices often read the barriers and resistance to greater public participation from government agencies and personnel as antagonism to it. Such a reading is incomplete.

Ecologizing STS participatory theory and practice within the larger issues of public participation in government decision-making prompts a deeper examination into how the political culture and administrative structures of government inform these barriers to more open and deliberative participation. Understanding the reasons for these political and administrative barriers may lend STS participatory theory and practice some insight into how to better approach designing and implementing government-embedded participation. Three elements of public administration scholarship on political control are pertinent to the maxims listed above. First, there is an inherent tension at the heart of American political philosophy concerning the relationship between politics and administration that informs American political culture and government. Second, the political controls placed on government administration as a way of tempering this tension impact the priorities and behaviors of federal agencies. Lastly, political controls in the form of administrative rules on public participation often constrain government agency discretion on how to engage with the public in program decision-making.

The field of American public administration has long examined how the relationship between the political processes of lawmaking and the administrative

processes of implementation shape the behaviors of elected government representatives and unelected bureaucrats (Bertelli & Lynn, 2006; Lipsky, 2010; Meier & O'Toole Jr, 2006; Waldo, 1948). In the American context, it begins with differing political philosophies among the framers of the U.S. Constitution concerning how to maintain democratic accountability within government administration in the face of the separation of legislative and executive powers. The Hamiltonian position for a strong executive with robust administrative discretion stands in contrast to the Jeffersonian position that democratically elected representatives should have direct oversight of and heavy controls on the executive's discretion to administer government (Rohr, 1986). Samuel Krislov and David Rosenbloom (1981) articulate the apprehension concerning administrative discretion this way: "It is not the power of public bureaucracies per se, but their unrepresentative power, that constitutes the greatest threat to democratic government" (p. 21). This Jeffersonian apprehension towards the potential threat administrative discretion poses to the legitimacy of democratic government permeates American political culture and, ironically, forms the basis of some of the bureaucratic barriers to greater public participation in government decision-making.

A consequence of the Jeffersonian position is the imposition of political controls on the administrative discretion of the executive bureaucracy (McCubbins et al., 1987; Wood & Waterman, 1991). The political process often produces laws that are scarce on details and funding that government agencies and personnel are nonetheless required to implement. This motivates an increased use of professional administrative discretion to implement programs in resource- and option-constrained environments (Goodsell, 2014; Lipsky, 2010). As agencies and bureaucrats find ways to implement policies and

programs in ways deemed outside of what the political process intended, however, elected representatives and the public lose trust in the bureaucracy's choices (Cigler, 1990). Elected representatives check the administrative discretion of agencies by imposing political controls in the forms of political pressures and administrative rules. Congress and the Executive Office of the White House use the leverage of budgets and political support as pressures on agencies, while administrative rules dictate the procedural requirements of how to design and implement government programs (McCubbins et al., 1987; Wood & Waterman, 1991). The result of this escalating tension is that both elected officials and government agencies often focus more on institutional politics and preservation than on passing effective laws and implementing programs that are sensitive to public values and address public concerns (R. F. Durant, 1995; Frederickson et al., 2015; Meier & O'Toole Jr, 2006; Wilson, 2019).

The most explicit form of political control on embedding innovative forms of public participation in federal science and technology programs are administrative rules on how agencies can engage with the public. Congressional laws like the Administrative Procedures Act (APA) establish the minimum and mandatory requirements (i.e., public comment periods in the Federal Register; when public hearing and meetings are required, etc.) for public participation in matters of federal agency rule and program decision-making. Public input generated from these minimum requirements, however, has been shown to be ineffective in substantially informing decision-making processes (Bryer, 2013). The Federal Advisory Committee Act (FACA) "governs how the federal government seeks outside advice," and specifically, "who participates in government decision-making, when they participate, how they participate, and what influence

participation has on policy" (Long & Beierle, 1999). While research shows that FACA has had some success with creating opportunities for greater public participation in federal agency decision-making, there are "ambiguities in the law and its regulations which limit the willingness of public agencies to engage the public outside of FACA" rules (Long & Beierle, 1999). Additionally, the Paperwork Reduction Act (PRA) stipulates the procedural requirements for how agencies can collect any type of information from the public. Agency procedures for collecting information from the public need the approval or exemption of the Office of Management and Budget within the Executive Office of the White House. While meant to reduce the total amount of paperwork burden the federal government imposes on private businesses and citizens, some federal agencies have argued that meeting basic PRA requirements make routine administration burdensome (Shapiro, 2013, 2020).

Taken together, the requirements of these administrative rules often create administrative challenges for agencies wishing to engage with the public on program decision-making in innovative ways beyond the minimum requirements mandated by the APA and within the limits set forth by FACA and PRA. Given the administrative burdens and potential legal consequences with administrative rules, there are few incentives for agencies to experiment with innovative forms of public participation in program decision-making. STS scholar Alfons Bora (2010) calls this matrix of legal limits on top of the already rigid technocratic framework of science and technology decision-making the "iron cage of law." Bora (2010), like public administration scholars, highlights the irony in this "iron cage." Even though these rules are meant to ensure that agency discretion does not extend beyond the control of the political will of democratically

elected representatives, in practice they act as limits on how the public can participate in government program decision-making. Political controls meant to maintain democratic legitimacy and accountability of the American federal bureaucracy can in fact act as barriers to more deliberative, and arguably more democratic, public participation.

Administrative rules can pose administrative challenges to embedding innovative forms of public participation in program decision-making. They often disincentivize experimenting with public participation methods beyond APA minimums because of the administrative burdens, and potential legal consequences, of FACA and PRA requirements. Moreover, political pressures from Congress or the Executive Office create potential budgetary consequences or loss of political support for agencies if the processes or results of innovative public participation stray from what Congress or the Executive Office intended. Political controls can form barriers to embedding innovative forms of public participation in program decision-making. Ecologizing STS participatory theory and practice within these bureaucratic contexts does not dismiss agency resistance to innovative forms of public participation. It can help, however, develop our knowledge and understanding of how to examine and approach these bureaucratic barriers in our participatory theory and practice.

Using the theory of political control as a basis for a framework for examining the bureaucratic contexts of embedding innovative public participation in agency science and technology program design and decision-making involves reading barriers as consequences of political control mechanisms. The first and second maxims together recognize that as an inherent feature of the American federal bureaucracy, there will likely be political pressures on the agency and administrative rules for personnel that will

challenge designing and implementing innovative forms of public participation. Given the administrative rules on public participation, there will invariably be potential administrative challenges. Elucidating political pressures will require examining the political relationship between the agency, the specific program, Congress, and the Executive Office of the President. The second maxim is a call to examine how political controls impact the design and implementation processes. Lastly, the theory of political control speaks not only to the limits placed on agencies and personnel, but also to how expert bureaucratic knowledge is used by agency personnel to navigate these pressures and challenges to implement innovative ideas. The third maxim is the ameliorative component of the framework, and is a vehicle for examining how agency personnel can soften the impacts of these political pressures and administrative challenges.

To illustrate how the three maxims at the heart of this chapter can help develop a more attuned knowledge and understanding of these bureaucratic contexts, I use the first two maxims to examine the political controls on embedding pTA into three U.S. federal science and technology programs drawing on three real-world projects that took place between 2014 and 2018. The next section begins with a brief introduction of these projects, organized by the Expert and Citizen Assessment of Science and Technology (ECAST) network, which worked with NASA, DOE, and NOAA personnel to design and implement pTA in agency programs. After this, I highlight some examples of the political pressures and administrative challenges that arose from using pTA as an innovative form of public participation. These examples are drawn from semi-structured interviews conducted with ECAST members and NASA, DOE, and NOAA personnel. This essay does not provide a full, scientific exploration of these three cases (Essays 2 and 3 of this

dissertation do that); rather, this essay pulls illustrative quotes from the three case studies to better articulate how the first two maxims described above work in the American federal bureaucracy. As such, this chapter is exploratory and theoretical in nature, but aims to ground its theorizing in empirical examples. Essays 2 and 3 offer detailed examinations of the three agency cases through an in-depth case study and a comparative analysis that expands on the second maxim and underlines the expert bureaucratic work of agency personnel in line with the third. These latter two essays provide detailed background on the cases and fully formed research methods sections.

Examples of Political Controls on Public Participation

Between 2014 and 2018, the Expert and Citizen Assessment of Science and Technology (ECAST) worked with three U.S. federal agencies – NASA, DOE, and NOAA – to design and implement participatory technology assessment (pTA) exercises as innovative forms of public participation in program design and decision-making. As a network of academic, policy research, citizen science, and informal science education institutions distributed across the U.S., ECAST works with local, state, and federal government organizations to design and implement pTA forums where the public can deliberate on science and technology issues (J. Burgess & Chilvers, 2006; J. Durant, 1999; Guston & Sarewitz, 2002; Hennen, 1999, 2012; Kaplan, Farooque, Sarewitz, & Tomblin, 2021; Sclove, 2010a, 2010b).

In 2014, ECAST and NASA designed and implemented pTA exercises for the agency's Asteroid Initiative for planetary defense and missions to Mars (Tomblin et al., 2015). In 2016, ECAST and DOE began designing pTA deliberations for the agency's consent-based nuclear waste siting program. The forums were slated to convene in early

2017. Following the 2016 presidential election, however, in anticipation of changes in policy direction by the new administration, DOE suspended the consent-based siting program and cancelled the pTA project before it was implemented. Lastly, through a 2015 NOAA Environmental Literacy Program grant, ECAST designed and implemented several pTA forums around the U.S. deliberating on local climate resilience strategies.

Under the auspices of a National Science Foundation grant[2] aimed at examining how pTA exercises in U.S. science and technology agencies impact the technocratic cultures of expertise, interviews were conducted with ECAST members and NASA, DOE, and NOAA personnel who were involved with designing and implementing pTA exercises. Thirty-two (32) semi-structured interviews were conducted with twenty-five (25) participants between June 2019 and October 2020. Participants are referred to by their organizational affiliation (i.e., ECAST, NASA, Former DOE, DOE Contractor, NOAA) and a random number assigned to them (e.g., NASA 3). I conducted member checks with interviewees I have quoted to assure accurate representation of their intention and meaning in context. While conducting these interviews, participants shared examples of how political controls on the agencies in the form of political pressures and administrative rules impacted the processes of designing and implementing pTA.

Political Pressures

NASA's Political Stakeholders

NASA personnel shared that, like most federal agencies, NASA is sensitive to the political processes that impact its budget and its political support for mission direction.

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[2] Award no. 1827574 – "Participatory Technology Assessment and Cultures of Expertise in the U.S. Federal Government."

NASA 1 said that "when NASA says stakeholders, they are talking about a pretty narrow group of stakeholders. NASA is talking about the Presidential administration and the Congress – political stakeholders." While NASA's democratic stakeholders are the American public and its commercial stakeholders are its aerospace technology and engineering contractors, the agency has two political stakeholders: the political body that controls its budget and legislates its mandates (i.e., Congress) and, as a mission-driven agency, the office that decides its mission objectives (i.e., the Executive office of the White House). NASA 1, through several years of working at the agency, said that they have noticed that NASA leadership is "apprehensive about disrupting whatever balance and agreements [it] thinks it has with the White House and the Congress."

An example of this "apprehension" is when agency leadership is deciding on which projects to work on and how those projects are presented to the public and its political stakeholders. NASA 1 described an instance when a project appeared to be something different from what the political stakeholders had sanctioned. They characterized the leadership's attitude as, "We couldn't possibly put that out there because we already knew what we were going to do, because it was already politically blessed." NASA personnel shared that agency leadership had similar concerns that the results of the pTA exercises could disrupt "politically blessed" agreements with its political stakeholders. NASA 2 said that "from a public perception standpoint, some people might see risks associated with asking the public what they think and then does that mean you have to do what they say." NASA 1 added that there were concerns about "what if the public comes in and says we think we should do something 180 degrees different than what we've already got an agreement to do?"

This is an example of how political pressures are institutionalized into an agency's culture. This contributes to shaping their attitude towards public participation in program design and decision-making, in general, and especially innovative forms, like pTA. NASA leadership was concerned about pTA because it could make it difficult to maintain a clear alignment with mission and program ideas that had been "politically blessed" by Congress and the White House. It is an "apprehension" of jeopardizing relationships that shape budgets and political support on mission decisions.

NOAA's Insulation

NOAA personnel shared their thoughts on why the agency tends to have a different experience with political pressures than other agencies. NOAA 2 shared that the agency "is buried within the Department of Commerce and we're not usually visible to the White House or Congress on the first pass [of the budget] because they're so focused on the economy and trade and exports." Additionally, NOAA 2 observed that "because we do have such an important scientific and life and safety role, they don't usually give us a heavily political person. They usually give us somebody that's more competent." They went on to add that this insulates them from the impacts political pressures have on other agencies; "EPA [Environmental Protection Agency] just get thrashed. We watch NASA do somersaults for the politicals [i.e., political appointees]. Department of Energy just gets whiplash on policies. And NOAA just stays under the radar and chugs along." While NOAA does face substantial political pressures on some of its programs, like fisheries management, its placement within the Department of Commerce and its perception as a research and safety agency insulates its programs from the kinds of political headwinds other U.S. federal science agencies face.

As the political control theory holds, political pressures on agencies to make certain decision over others is inherent to the bureaucratic and administrative structures of U.S. government. Moreover, these two examples underscore how political pressures, while an institutional aspect of U.S. federal government, have varying degrees of impact depending on the agency and program. The NASA personnel's observations highlight how the agency has institutionalized an apprehension towards anything that may disrupt its "politically blessed" agreements with Congress and the White House. Reading resistance predominantly as technocratically-motivated individuals opposing lay perspectives on matters of science and technology is incomplete. The NOAA personnel's observations highlight how the organizational structure of an agency shapes the extent to which political pressures impact personnel's discretion to implement innovative programmatic choices, like embedding pTA for innovative public participation.

Administrative Rules

"Myths" about Public Engagement

NASA 2 shared that when it comes to administrative rules concerning public participation in federal government program design and decision-making, "there's a lot of myths about what you can and can't do," leading federal agencies and personnel to be "afraid to engage with the public because they don't know how to do it within the rules." According to NASA 2, "there's always the standard questions around, 'well, how does FACA and the PRA apply to this? If you're getting public input on something, don't you have to go through a lengthy process with OMB?'" NASA 3 recalled that administrative rules controlling public participation had already blocked other forms of public engagement for the Asteroid Initiative:

There is always the potential threat or challenge of FACA. . . . even Paperwork

Reduction. It prevented us from having people volunteer their time to take

telescopes into their backyard and look for asteroids. That was prohibited.

If something as seemingly uncomplicated as the public using telescopes in their

backyards to look for asteroids was prohibited, using pTA to gather the public's thoughts

on the Asteroid Initiative to inform program design and decision-making would likely

face some burdensome administrative challenges.

PRA "Fiasco"

While the administrative challenges to pTA were ultimately addressed for

NASA's Asteroid Initiative, negotiating the requirements of the Paperwork Reduction

Act (PRA) caused significant delays and changes to the design of pTA in the DOE

project to the point of jeopardizing its legal and practical viability. ECAST 1 described

the process of negotiating the PRA requirements as a "fiasco." Negotiations between

ECAST and DOE's Office of General Counsel (OGC) delayed the project at several

points in the design process. DOE's OGC had legal opinions about how acceptable initial

pTA designs were within PRA rules. ECAST 5 shared that this "fiasco" stemmed from

OGC's opinion that ECAST was "not allowed to hand people a piece of paper with a

question on it and have them fill it out" because that would qualify as a survey. Even

once ECAST and the DOE OGC came to an agreement of how to record on paper the

public's responses during the pTA deliberations, that still required approval by OMB, a

process that would take anywhere between six to twelve months. After several months of

delays, to ensure that the forums would be ready to implement on schedule, ECAST

decided to change its pTA design and forgo any use of paper by the public to record their responses.

Administrative rules are fundamental structures to the relationship of political control between elected officials and agencies. These examples highlight how administrative rules control the ways agencies can engage with the public in program design and decision-making. Moreover, the latter DOE example demonstrates how grappling with the administrative challenges they create impacted pTA design to the point of heavily changing pTA design and jeopardizing its implementation. Like with political pressures, administrative challenges will inevitably play a role in shaping the barriers to and opportunities for embedding innovative forms of public participation in U.S. federal government science and technology decision-making.

Conclusion

Answering Chilvers and Kearnes' (2020) call by ecologizing STS participatory theory and practice within the bureaucratic contexts that inform government decision-making does not excuse agency resistance to greater and more open public participation. It does mean, however, that if we want to contribute to enhancing public trust in science and to averting crises of democracy, we can no longer read resistance to public participation in government as antagonism mostly stemming from technocratic opposition to lay perspectives. With the help of public administration scholarship, I have argued that the political pressures on and administrative challenges to agency discretion in public participation are inherent elements of the political controls on the American federal bureaucracy. This means that working towards embedding innovative forms of public participation within government science and technology decision-making

processes will invariably face bureaucratic barriers. Like the "problem of expertise," the "problem of bureaucracy" that STS participatory theory and practice faces is not a problem to be solved but a tension to be tempered.

Given these complexities, and in light of what may seem an impenetrable institutional barrier to innovative public participation in government science and technology decision-making, the long-standing trend in STS of focusing on civil society participation exercises may seem like the better investment of time and resources. However, while these civil society events produce multiple positive outcomes like refinements to design and nurturing citizen empowerment (e.g., Árnason, 2013; Guston, 1999; Sprain & Reinig, 2018), operating outside of the administrative and political structures of the American federal bureaucracy does little to redistribute formal democratic power (Arnstein, 1969). Such extra-institutional efforts are important, they serve as proof-of-concept for public engagement, and they seemingly uphold commitments to independence more easily. They grapple poorly, however, with how we might meaningfully effect policy and administrative processes, which is where most decision-making occurs. We avoid such grappling at our own theoretical and practical expense. There is room in STS to pursue both; we just need more information on and more practice with agency-embedded efforts.

This essay begins to identify and examine the impacts political pressures and administrative rules had on designing pTA in three U.S. federal agencies as a proving ground for the three maxims presented above. These maxims can be used to examine the details of the bureaucratic contexts informing innovative forms of public participation like pTA in these three agencies. Doing so may help build a richer understanding of how

political pressures and administrative rules impact the adoption, design, and implementation of innovative forms of public participation in government science and technology program design and decision-making. This may help develop an STS participatory theory and practice that not only better anticipates bureaucratic hurdles to innovative public participation but that is also better equipped to address them. This is especially true for the ameliorative maxim of the framework, which involves investigating how political pressures and administrative challenges can be overcome by the bureaucratic expertise of agency personnel. The next two essays in this dissertation detail and underscore how this kind of bureaucratic expertise works and thus continue the work of ecologizing STS participatory theory and practice within the wider political and administrative systems of American federal government.

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CHAPTER THREE (ESSAY TWO): THE POLITICS AND ADMINISTRATION OF
PUBLIC PARTICIPATION: A CASE STUDY OF PARTICIPATORY TECHNOLOGY
ASSESSMENT IN NASA'S ASTEROID INITIATIVE

Introduction

We in the Science and Technology Studies (STS) community have several sets of
literatures informing our participatory theory and practice. There is literature on how the
knowledge asymmetry between experts and lay citizens have the potential to produce and
reinforce undemocratic decision-making processes and outcomes in science and
technology issues (e.g., Collins & Evans, 2002; Grundmann, 2017; Jasanoff, 2003;
Liberatore & Funtowicz, 2003; Nowotny, 2003; Sarewitz, 2000, 2004; Turner, 2001,
2013; Woodhouse & Nieusma, 1997; Wynne, 1992). Research in this area also examines
how technical expertise may be used selectively to advance partisan policy positions
(e.g., Hoppe, 2005, 2009; Jasanoff, 1992; Pielke Jr, 2007). There is also extensive
research on designing, organizing, and evaluating different forms of public engagement
on issues of science and technology in society with the goal of addressing these
undemocratic and partisan processes (e.g., Chilvers & Kearnes, 2020; Delgado et al.,
2011; Fiorino, 1990; Guston, 1999, 2014; Kleinman et al., 2007; Powell & Colin, 2008;
Powell & Kleinman, 2008; Rowe & Frewer, 2000, 2005; Selin et al., 2017; Stirling,
2008; Wehling, 2012).

This design literature, especially the work that is centered in the United States, focuses predominantly on public engagement activities independently organized by civic society groups that run parallel to government policy questions but independent of the formal government science and technology decision-making processes (e.g., Delborne et al., 2013; Guston, 1999). STS scholars and practitioners have only recently started to examine how innovative forms of public participation fit into formal government science and technology policy- and decision-making processes (Bertrand et al., 2017; Emery et al., 2015; Gustetic et al., 2018; Kaminski, 2012; Krabbenborg & Mulder, 2015; Krick, 2015; Rask, 2013). This literature is limited, however, in its examination of the bureaucratic processes that inform the political and administrative feasibility of innovative forms of public participation in U.S. federal government agency science and technology decision-making.

There is a gap in our STS participatory theory and practice regarding how the organizational politics and administrative structures of the U.S. federal bureaucracy inform the ease or difficulty with which innovative forms of public participation are embedded into formal government agency science and technology decision-making processes. Filling this gap is central to creating greater opportunities for more open and deliberative public participation in government science and technology decision-making. Creating these opportunities advances the STS project of intervening in the potentially undemocratic processes and outcomes of the technocratic approach to sociopolitical questions of how science and technology impacts public life (Callon et al., 2009; Feenberg, 2012). Doing so by advocating and creating greater opportunities for public participation is a process of restructuring and democratically redistributing political

power (Arnstein, 1969; Carroll, 1971; Nelkin, 1977, 1979). In this light, an essential

element of this chapter is to report on how innovative forms of public participation

engage with the current structures of bureaucratic and political power in U.S. federal

government agency science and technology decision-making.

This essay aims to fill this gap in our understanding of how participatory practices

might actually work in the context of American federal agencies. I examine how

experimenting with a deliberative form of public participation – participatory technology

assessment (pTA) – in a US federal agency revealed the political pressures on and

administrative challenges to innovative forms of public participation in government

science and technology decision-making. Specifically, this chapter reports on the

National Aeronautics and Space Administration's (NASA) Asteroid Initiative, which

took place during the second Obama Administration's Open Government Initiative. In

2013, the Expert and Citizen Assessment of Science and Technology (ECAST) network

submitted a response to a NASA request for information for the Asteroid Grand

Challenge, a component of the Asteroid Initiative. In their submission, ECAST suggested

pTA as a method of public engagement in the Asteroid Initiative's program design and

decision-making processes. Traditional STS research might examine the impacts pTA

had on the public's sense of empowerment after participating, or the impacts pTA had on

the agency's views on the role of the public in decision-making. This chapter takes a

different tack. Drawing from policy studies and public administration scholarship, I

analyze the political, policy, and administrative contexts surrounding the adoption,

design, and implementation of pTA in NASA's Asteroid Initiative.

I examine what the political, policy, and administrative contexts were for NASA personnel to successfully adopt pTA, and for ECAST and NASA personnel to cooperate on designing and implementing pTA. I use tools from a well-known policy studies theory developed by John Kingdon in the 1980's (1984, 2011) as an analytic framework; the Multiple Streams Approach (MSA). To understand the bureaucratic contexts of American federal government agency program decision-making, I draw from public administration scholarship's "political control" literature (e.g., Rohr, 1986; Frederickson et al., 2015, Chapter 2; Meier & O'Toole Jr, 2006). Meant to keep them accountable to the political process of democratic decision-making, U.S. federal government agencies face controls on their discretion on how to design and implement programs. These political controls often create bureaucratic barriers to experimenting with innovative forms of public participation within federal agency decision-making processes.

Through these frameworks, this case study analysis of pTA at NASA aims to accomplish two goals. We lack theoretical sensitivity to and an empirical knowledge of how the political, policy, and administrative contexts of the U.S. federal bureaucracy create barriers to innovative public participation in government science and technology decision-making. I suggest that we in STS can benefit from policy studies and public administration perspectives. My first goal is to apply the MSA and political control frameworks to develop an understanding of how the (mis)alignment of political, policy, and administrative contexts informs the ease or difficulty with which innovative forms of public participation are embedded in formal U.S. federal government science and technology decision-making processes. A second goal is to highlight the role federal government personnel play as "policy entrepreneurs" (Kingdon, 1984, 2011) in creating

opportunities for innovative forms of public participation in science and technology decision-making processes. STS participatory theory and practice can begin to develop approaches that appreciate how the bureaucratic expertise of federal government agency personnel, in some cases, actually enables greater public participation in decision-making.

Background

There are three background elements useful to understanding this case study. First, I introduce the ECAST research and practitioner network who submitted and collaborated with NASA personnel to design and implement pTA for the agency's Asteroid Initiative. Second, I highlight how the Obama administrations' Open Government Initiative encouraged U.S. federal executive departments and agencies to practice greater transparency, collaboration, and public participation in its work. Third, a summary of NASA's Asteroid Initiative and the pTA exercises that were implemented for the Asteroid Initiative. Details of how each informed the political, policy, and administrative contexts will be elaborated on in the findings section.

ECAST and Participatory Technology Assessment

Established in 2010, the Expert and Citizen Assessment of Science and Technology (ECAST) is a network of academic research, policy analysis, citizen science, and informal science education institutions distributed across the United States that works towards greater public involvement in issues at the intersection of science, technology, and society (Sclove, 2010a, 2010b; Kaplan, Farooque, Sarewitz, & Tomblin, 2021). Building on the work once done by the now-defunct Congressional Office of Technology Assessment (OTA) of informing policymakers on the social impacts of science and

technology, ECAST designs and organizes peer-to-peer deliberations on issues of science

and technology in society both to educate the public and to solicit their perspectives. The

public participation element in assessing science and technology policy options is what

constitutes pTA (Burgess & Chilvers, 2006; J. Durant, 1999; Guston & Sarewitz, 2002;

Hennen, 1999, 2012). ECAST shares the results of these public deliberations with

decision-makers so that science and technology policy can be informed by the public's

values and perspectives. Like many forms of public deliberation on science and

technology, the results of pTA face several political and administrative challenges to

being incorporated into formal government decision-making processes (Delborne et al.,

2013; Griessler, 2012; Loeber et al., 2011; Rask, 2013; Reber, 2006; Saretzki, 2012). One

of ECAST's normative goals is to create opportunities to embed pTA within formal

government science and technology decision-making processes.

Obama Administrations' Open Government Initiative

On January 21st, 2009, President Barack Obama signed the "Memorandum on

Transparency and Open Government" (M-09-12). This, along with two other memos (M-

10-06; M-10-11) from the Office of Management and Budget (OMB), are the

administrative basis for the Obama administrations' "Open Government Initiative"

(OGI). The OGI embodied the administrations' commitment to "creating an

unprecedented level of openness in Government" through promoting practices that would

implement the principles of transparency, participation, and collaboration throughout

executive departments and agencies (Holdren et al., 2009, p. 3). Implementing these

principles would "ensure the public trust," "strengthen our democracy, and promote

efficiency and effectiveness in Government" (Holdren et al., 2009, p. 3). In terms of

participation, the rationale for why government should be participatory was because "public engagement enhances the Government's effectiveness and improves the quality of its decisions" (Holdren et al., 2009, p. 3). As such, the federal government "should offer Americans increased opportunities to participate in policymaking and to provide their Government with the benefits of their collective expertise and information" (Holdren et al., 2009, p. 3). The latter two associated OMB memos directed "executive departments and agencies to take specific actions to implement the principles of transparency, participation, and collaboration" along with providing guidance on how "Prizes and Challenges" could be used to promote open government, respectively (Orszag, 2009; Ziens, 2010).

NASA's Asteroid Initiative and the Citizen's Forum

In April 2013, NASA announced its Asteroid Initiative. The motivation behind the Initiative were twofold. A Congressional mandate ordered NASA to detect all hazardous asteroids in near-Earth space and to develop a planetary defense strategy. The Obama Administration White House directed NASA to progress on the longstanding goal of a human mission to Mars. This involved developing an asteroid capturing and redirecting system as a technological proving ground for missions to Mars. As such, the goal of the Asteroid Initiative was to build a "proving ground" for the technologies that would enable a crewed journey to Mars by first preparing and demonstrating the ability to "safely live and work away from Earth for extended periods before attempting a mission" (Tomblin et al., 2015, p. 5). To do this, the Asteroid Initiative had two components: the Asteroid Redirect Mission (ARM), and the Asteroid Grand Challenge (AGC). The ARM was NASA's project "to capture a small asteroid, redirect it into a stable orbit in

translunar space, and explore it with astronauts carried onboard the Orion spacecraft as early as 2021" (U.S. National Aeronautics and Space Administration, 2013a). The goal of the AGC was to create "an increased focus on defending our planet against the threat of catastrophic asteroid collisions" (U.S. National Aeronautics and Space Administration, 2013a).

In June of 2013, NASA opened a request for information (RFI) through the AGC for the Asteroid Initiative. As a "grand challenge," the AGC was touted as "the first opportunity for industry and other potential partners, including private individuals, to offer ideas on planning for NASA's mission to redirect an asteroid for exploration by astronauts and the agency's asteroid grand challenge" (U.S. National Aeronautics and Space Administration, 2013b). The AGC RFI called for input on six areas to "refine the Asteroid Redirect Mission concept, formulate plans for flight systems development, and gather ideas for broadening participation in the mission and planetary defense" (U.S. National Aeronautics and Space Administration, 2013a). The sixth item, "Partnerships and Participatory Engagement," specifically called for "innovative methods such as crowd sourcing, prizes and challenges, citizen science, and public-private partnerships to increase the resources for tackling the planetary defense problem and to broaden participation" (U.S. National Aeronautics and Space Administration, 2013a).

ECAST submitted pTA as an innovative method of participatory engagement for Asteroid Initiative program design and decision-making under the sixth item. Of the 55 submissions to this category, NASA asked 12, including ECAST, to present at an Asteroid Initiative Ideas Synthesis Workshop in October of 2013 (U.S. National Aeronautics and Space Administration, 2014). In January of 2014, NASA published the

results of the workshop in the Ideas Synthesis Workshop report. One of the report's

recommendations was for NASA "to consider forums for engaging the public in two-way

policy conversations" regarding the Asteroid Initiative (U.S. National Aeronautics and

Space Administration, 2014, p. 14). By May of 2014, NASA selected ECAST's pTA

proposal and entered into a cooperative agreement to design and implement the pTA

exercises for the Asteroid Initiative. Between May and September of 2014,

representatives from NASA and ECAST met several times to design the content and plan

the implementation of pTA as the Citizen's Forum on NASA's Asteroid Initiative.
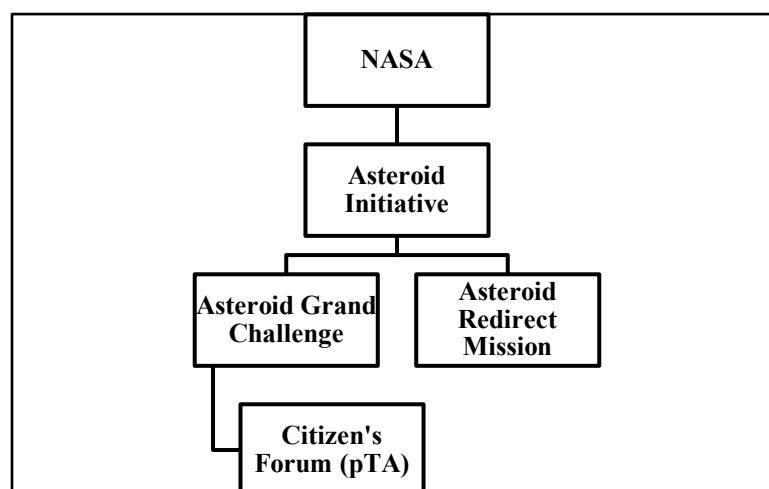
Figure 3.1   Organizational Chart of pTA Exercises within NASA

In November 2014, daylong Citizen's Forums took place in two cities, Phoenix

and Boston. The four topics for deliberation were asteroid detection, asteroid mitigation,

deciding between two engineering options for the ARM, and three scenarios for human

space flights for Mars exploration. During the forums, participants read background

materials to inform them on the four topics, deliberated the topics, engaged with experts

via questions and answers, and, finally, voted on a set of questions jointly prepared by

NASA and ECAST. With the votes and written rationales, ECAST was tasked with

generating "usable outcomes" that would "provide useful input to NASA's decision making" (Tomblin et al., 2015, p. 8). An interim report consisting of the results from the ARM session was delivered to NASA managers in December 2014, prior to their making a downselect decision about which of two options the agency should pursue for the ARM. In March 2015, ECAST made a top-level briefing at NASA headquarters of the pTA results. A summary and full report of the results consisting of additional assessments and evaluation were publicly released in August 2015.

Theoretical Framework

I examine the political, policy, and administrative contexts surrounding the adoption, design, and implementation of pTA at NASA at the intersection of STS, policy studies, and public administration. I draw on the "political control" framework from public administration to describe and explain the political pressures and administrative challenges to designing and implementing pTA. I use the Multiple Streams Approach from policy studies to organize and identify the key elements that contributed to adopting, designing, and implementing pTA in NASA's Asteroid Initiative program design and decision-making. It also highlights the expert bureaucratic work policy entrepreneurs within NASA did at the programmatic level to facilitate adopting, designing, and implement pTA. The rationale for combining these frameworks follows a brief review of their respective literatures.

<u>The Multiple Streams Approach</u>

The field of policy studies offers several frameworks, theories, and models for understanding the social and political processes that explain how laws and policies changes over time (Birkland, 2019; Weible & Sabatier, 2018). One of these frameworks

is the "Multiple Streams Approach" (MSA) developed in the 1980's by John Kingdon (1984, 2011). Kingdon describes the policy process as composed of three separate yet interdependent "streams" – the problem, policy, and politics streams. Each stream represents a set of elements, actors, and processes that interact to create opportunities for change in policy and decision-making processes. The "problem stream" consists of the myriad issues shaped by and brought to the attention of the public, policymakers, and decision-makers. The "policy stream" identifies the suite of new and long-standing policy solutions formulated within a policy community; these are solutions looking for the right problem to be a vehicle for adoption. The "politics stream" denotes the political feasibility of selecting a problem and solution in the context of different political pressures coming from the public, interest groups, and changing Congressional and Presidential agendas. Across these streams move "policy entrepreneurs" who bring together the streams to create "windows of opportunity." Policy entrepreneurs are individuals within and outside of government who, with their political savvy, administrative expertise, connections, influence, and knowledge of institutional politics and culture, facilitate certain problems and policy solutions through the politics stream (Anderson et al., 2019; Cairney, 2018; Mintrom & Norman, 2009).

Compared to other theories of the policy process, MSA is a flexible framework meant to identify a set of variables and the relationships among them (Weible and Sabatier, 2018). Kingdon's work developed MSA by reconstructing how two national-scale policy changes and decisions were made (e.g., major federal healthcare policy in the U.S., and the adoption of a new federal transportation infrastructure funding policy), and the framework is still most frequently used to analyze federal policymaking at a high

level. Using it at the agency programmatic level, which is what this study does, will require some modifications to the MSA framework. There is scholarly precedence for making such modifications in a growing body of literature applying MSA to program-level implementation and decision-making (See Béland & Howlett, 2016; Cairney & Jones, 2016; Fowler, 2019; Rawat & Morris, 2016; Smith et al., 2015).

With some modifications, MSA can help provide STS a framework for identifying and explaining how the (mis)alignment of problem, political, policy, and administrative contexts informs the ease or difficulty with which innovative forms of public participation, like pTA, are embedded within formal U.S. federal government science and technology decision-making processes. Additionally, the policy entrepreneur concept from the MSA toolkit can help us examine how government agency personnel, using their knowledge of organizational culture and bureaucratic expertise, create opportunities for innovative forms of public participation within formal decision-making processes at the programmatic level. MSA, at the very least, can act as a heuristic framework for STS to organize and examine the political and administrative complexity surrounding the use of innovative public participation in U.S. federal agency science and technology decision-making processes.

MSA helps to analyze the problem, political, and policy streams in which innovative forms of public participation may be embedded within formal U.S. federal government science and technology decision-making processes while identifying the crucial role government personnel play as policy entrepreneurs. Analyzing how innovative forms of public participation are embedded within government science and technology decision-making processes involves examining the political pressures and the

administrative challenges government agencies and their personnel face when implementing government programs. These pressures and challenges inform the ease or difficulty with which innovative forms of public participation can be incorporated into program design and decision-making processes. Public administration's theory of "political control" can help us better understand how the political culture and administrative structures of American federal government shape the priorities and behaviors of federal agencies when it comes to public participation.

Political Control

The field of American public administration has long examined how the relationship between the political processes of lawmaking and the administrative processes of implementation shapes the behaviors of elected government representatives and unelected bureaucrats (Bertelli & Lynn, 2006; Lipsky, 2010; Meier & O'Toole Jr, 2006; Waldo, 1948). At the heart of American political philosophy and government is the tension between if the executive branch should have strong administrative discretion or if democratically elected representatives should have direct oversight of and heavy controls on the executive's discretion to administer government (Rohr, 1986). A consequence of the latter position is the imposition of political controls on the administrative discretion of the executive bureaucracy (McCubbins et al., 1987; Wood & Waterman, 1991).

The political process often produces laws that are scarce on details and funds that government agencies and personnel are nonetheless required to implement. This motivates an increasing degree of administrative expertise in uses of discretion to implement programs in resource- and option-constrained environments (Goodsell, 2014; Lipsky, 2010). As agencies and bureaucrats find ways to implement policies and

programs in ways deemed outside of what the political process intended, however,

elected representative and the public lose trust in the bureaucracy's choices (Cigler,

1990). Elected representatives check the administrative discretion of agencies by

imposing political controls in the forms of political pressures and administrative rules.

Congress and the Executive Office of the White House use the leverage of budgets and

political support as pressures on agencies, while administrative rules dictate the

procedural requirements of how to design and implement government programs rules

(McCubbins et al., 1987; Wood & Waterman, 1991). The result of this escalating tension

is that both elected officials and government agencies often focus more on institutional

politics and preservation than on passing laws and implementing programs that are

sensitive to public values and address the public's concerns (Durant, 1995; Frederickson

et al., 2015; Meier & O'Toole Jr, 2006; Wilson, 2019).

The most explicit form of political control on embedding innovative forms of

public participation in federal science and technology programs are administrative rules

on how agencies can engage with the public. Congressional laws like the Administrative

Procedures Act (APA) establish the minimum and mandatory requirements (e.g., public

comment periods in the *Federal Register*) for public participation in matters of federal

agency rule and program decision-making. Public input from these minimum

requirements, however, are shown to be ineffective in substantially informing decision-

making processes (Bryer, 2013). The Federal Advisory Committee Act (FACA) "governs

how the federal government seeks outside advice," specifically, "who participates in

government decision-making, when they participate, how they participate, and what

influence participation has on policy" (Long & Beierle, 1999). There are, however,

"ambiguities in the law and its regulations which limit the willingness of public agencies to engage the public outside of FACA" rules (Long & Beierle, 1999). The Paperwork Reduction Act (PRA) stipulates the procedural requirements of how agencies can collect any type of information from the public. Agency procedures for collecting information from the public need the approval or exemption of the Office of Management and Budget within the Executive Office of the White House. While meant to reduce the total amount of paperwork burden the federal government imposes on private businesses and citizens, some federal agencies have argued that meeting basic PRA requirements make routine administration burdensome (Shapiro, 2013, 2020).

Taken together, the requirements of these administrative rules often create administrative challenges for agencies to engage with the public on program decision-making in innovative ways beyond the minimum requirements mandated by the APA and within the limits set forth by FACA and PRA. Given the administrative burdens and potential legal consequences, there are few incentives for agencies to experiment with innovative forms of public participation in program decision-making. STS scholar Alfons Bora (2010) calls this matrix of legal limits on top of the already rigid framework of technocracy concerning science and technology decision-making the "iron cage of law." Bora (2010), like public administration scholars, highlights the irony in this "iron cage" of administrative rules. Even though these rules are meant to ensure that agency discretion does not extend beyond the control of the political will of democratically elected representatives, they in practice act as limits on how the public can participate in government program decision-making. Political controls meant to maintain democratic

legitimacy and accountability of the American federal bureaucracy can in fact act as barriers to more deliberative, and arguably more democratic, public participation.

The MSA and the "political control" frameworks, when used together, can benefit STS participatory theory and practice by characterizing the political, policy, and administrative contexts that inform the ease or difficulty with which innovative forms of public participation are embedded within formal U.S. federal government science and technology decision-making processes. The joint use of these frameworks highlights the important role policy entrepreneurs within government agencies play in anticipating and grappling with the political pressures and administrative challenges incumbent with embedding innovative forms of public participation in government agency science and technology decision-making. Moreover, the "political control" supplement to the MSA framework demonstrates that the work government personnel do to navigate these political pressures and administrative challenges is what makes them policy entrepreneurs at this level of government science and technology program design and implementation.

Methodology and Methods

I use a case study approach to provide a "detailed examination of an aspect of a historical episode to develop or test historical explanations that may be generalizable to other events" (George et al., 2005, p. 4). A detailed examination of the political, policy, and administrative contexts that supported and constrained pTA in NASA's Asteroid Initiative can help develop an explanatory narrative of adoption, design, and implementation. Constructing the explanatory narrative will draw on two sources of data: public documents from NASA and ECAST; and semi-structured interviews with NASA personnel and ECAST members who worked on the Citizen's Forum pTA project. Public

documents, mostly from NASA (e.g., press releases, request for information), are used to establish background details. Semi-structured interviews comprise the bulk of the data collected.

Subject identification and recruitment for this research was facilitated by the fact that my dissertation work is a subset of a National Science Foundation-funded (NSF) project examining participatory technology assessment and cultures of expertise in U.S. federal government science and technology agencies[3]. The co-principal investigator on the NSF project is an ECAST member. Their network of contacts facilitated access to and introductions with a specific and finite list of NASA personnel and ECAST members who were involved at various stages of the Citizen's Forum pTA project. A snowball sampling technique, however, was still used at the end of each interview to ensure that the specific and finite list of participants was not self-limiting.

Twelve semi-structured interviews were conducted between June and October of 2019: seven with ECAST members, five with NASA personnel, and one with an independent observer of a Citizen's Forum exercise. Interviews ranged from 40 to 70 minutes in length for a total of 750 minutes of interview data. Interviewers (Jen Schneider and I) asked questions and explored topics concerning:

- the purpose of the Asteroid Initiative, its components, and which NASA offices were involved;

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[3] This paper draws on data collected and analyses conducted under the auspices of NSF grant no. 1827574 titled "Participatory Technology Assessment and Cultures of Expertise in the U.S. Federal Government." Institutional Review Board (IRB) documents have been submitted to, approved, and renewed by Boise State University for the NSF grant, along a separate set of IRB documents for this dissertation research.

- NASA's interest in "Partnerships and Participatory Engagement" and pTA for the Asteroid Initiative;

- NASA's strategy and history of public engagement and participation in decision-making processes;

- Sources of resistance and challenges to public participation in NASA decision-making processes;

- the working relationship between NASA and ECAST in designing, implementing, and reporting on the Citizen's Forum.

Interviews were conducted remotely on Zoom and Google teleconferencing platforms and were audio recorded. Audio recordings were transcribed using an online, automated transcription service, TEMI, and were then checked and updated for accuracy and completeness against the audio recordings prior to data analysis. Throughout the chapter, I refer to interviewees by their organizational affiliation (i.e., ECAST and NASA) and a random number assigned to them (e.g., NASA 3). I conducted member checks with interviewees I have quoted to assure accurate representation of their intention and meaning in context.

I conducted data analysis on two levels. First, documents and interview transcripts were imported into NVivo 12 Pro, a qualitative data analysis software, where they were coded for themes among answers to interview questions (Campbell et al., 2013; Fereday & Muir-Cochrane, 2006; Maher et al., 2018).[4] Second, data were further reduced and organized into analytic memos where themes and concepts across interviews were

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[4] Codebook in Appendix A.

brought together to build analytic narratives.[5] Following a modified grounded theory

approach, themes and concepts emerging from the data were used to refine interview

questions to better target explanatory details, and to begin to build a theoretical model

that generalizes those details (Charmaz, 1990, 2017). At the same time, theories from

STS, policy studies, and public administration were used to inform the questions we

initially asked, the analysis of data, and how I coded or named certain social processes –

this is why the approach is "modified" and not considered a purely grounded theory

approach. For example, as the analysis developed, it become clear that a useful

theoretical framework for organizing and analysis is Kingdon's (2011) MSA framework

(i.e., organizing the explanatory narrative by "streams" and analyzing by identifying

policy entrepreneurs and their actions).

Findings

Following the MSA framework, I present the findings from the qualitative

analyses of interviews and public documents in four sections. First, I identify how four

NASA personnel acted as policy entrepreneurs within the agency by using their

knowledge of and experience with the agency's organizational culture and politics

surrounding public participation in program design and decision-making. The "political

control" framework aids in understanding the expert bureaucratic work policy

entrepreneurs do at the program design and implementation level. The next three sections

examine each stream – problem, policy, and politics. The basic conceptual and analytic

elements of the framework remain the same, namely, explaining changes through tracing

the relationship between the processes of the streams and the participants in those

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[5] Examples of analytic memos in Appendix B.

processes (Rawat & Morris, 2016). Applying MSA to program design and
implementation, however, requires some modifications to the elements of the framework.
I elaborate on the relevant modifications to the streams as I present each.

<u>Policy Entrepreneurs</u>

Kingdon describes policy entrepreneurs as advocates within and outside of
government who are willing to use their skills and resources to both take advantage of
and create the conditions for change among the three streams. Kingdon identifies three
basic qualities of a policy entrepreneur: being in a position or having the authority to be
heard; using political savvy and/or expertise in an issue or policy area to skillfully
negotiate a position and soften resistance to change; and persistence (2011). They adapt
their strategy depending on the scale of the system they operate within, anticipating and
taking advantage of opportunities for change in larger systems (i.e., waiting for the "big
wave"), while also creating the conditions for change within smaller systems (i.e.,
bringing the streams together) (Cairney, 2018). Identifying policy entrepreneurs within a
system and tracing their actions within the streams is central to the analytic and
explanatory work of the framework.

There were policy entrepreneurs within ECAST who worked within the policy
stream to develop pTA as a solution to a problem. I focus here, however, on the four
policy entrepreneurs within NASA who did the work within the problem and politics
stream to create the opportunity to successfully adopt, design, and implement pTA in the
Asteroid Initiative's program design and decision-making. Focusing on the work policy
entrepreneurs in government do is key to understanding what the political pressures are
and administrative challenges involved with embedding innovative forms of public

participation in science and technology decision-making. In line with the characteristics observed by Kingdon and subsequent MSA scholars, these four individuals held positions throughout the directorates and offices involved with the Asteroid Initiative where they had the authority to be heard by managers and leadership. Their administrative knowledge and expertise from years of working in the U.S. federal bureaucracy, along with their internal knowledge of NASA's organizational politics and culture, allowed them to skillfully advocate for the pTA option and navigate possible resistance to it. Additionally, it is worth noting that three of the four NASA policy entrepreneurs had graduate-level training in STS that informed their interests in advocating for pTA in NASA's program design and decision-making.

STS Training

Three of the four NASA policy entrepreneurs had graduate-level academic training in STS-related fields. NASA 5 said that their STS training familiarized them with the "deliberative ideals for what should really be the goal for involving the public in making decisions, and what are the ultimate rationales you should base science and engineering decisions on." NASA 1 shared that their STS-training informed their professional interest in "the intersection of public engagement with science and technology" and motivated their work of "really widening the aperture of who was involved and where the ideas could come from" for NASA. For NASA 2, their academic and professional training fostered a "fascination with a variety of different ways in which the government and other people work together in order to provide greater value." This motivated NASA 2's view that ECAST's pTA proposal was "a meaningful way to engage the general public with things that would traditionally be thought of as too

technical for them to have an opinion on." Additionally, NASA 2 shared that what they had learned of the history of technology policy in the U.S., they read ECAST's pTA submission as a way of "filling the OTA gap." With the closure of OTA in 1995, the U.S. federal government lacked an office dedicated to examining the social and political impacts of science and technology on the American public. NASA 2 saw pTA as a way of filling this assessment gap but through a deliberative method of public participation at the agency level. This training sensitized all three to the technocratic structures of science and technology decision-making, the resistance to more public participation within these structures, and of the benefits to greater public participation in science and technology decision-making.

<u>Positioned to Work</u>

The four policy entrepreneurs held positions throughout NASA that facilitated the agency adopting ECAST's pTA submission, and their ability to speak with and garner support throughout a broad range of colleagues, supervisors, and managers across different directorates, offices, and programs. NASA 2 and NASA 3 held positions in the AGC branch of the Asteroid Initiative and had working access to managers in all the associated offices and directorates. While NASA 1 and NASA 5 were not in offices directly involved with the AGC or ARM, their STS training sensitized them to how the RFI created an opportunity for greater public participation. NASA 1 shared that when the RFI solicitation went out, "it was something that I definitely was aware of and paid attention to. I became very aware of the ECAST submission and that really made all of us perk up. And that's really when I got on-board." For NASA 5, "once it had been put on

the books, I was basically able to offer my help for free" with full support from their supervisor.

Even though only NASA 2 and 3 worked within the same office together, these four individuals from across the agency came together to form a team within NASA to support pTA becoming a part of the Asteroid Initiative's program design and decision-making. According to NASA 1:

> Given that there are so few people at NASA who really subscribe to public
> participation in this kind of deeper way than just dissemination of information, it
> was kind of easy for us to pull together, to coalesce into a group to work on this.

As I will detail in the politics stream section, working together as a team allowed these policy entrepreneurs to address the different political pressures and administrative challenges to designing and implementing pTA as part of the Asteroid Initiative's program design and decision-making processes. They were able to do this successfully because of their administrative knowledge and expertise from years of working in the U.S. federal bureaucracy, along with their internal knowledge of NASA's organizational culture and politics.

Working from the Inside

When the AGC RFI was released in June 2013, the four NASA policy entrepreneurs had a combined fifteen years of experience in NASA, with an additional ten years of combined experience in other federal agencies. Their combined knowledge of NASA's cultural and political dynamics, in concert with their STS training and their positions within the Asteroid Initiative directorates and offices, equipped them to address the concerns colleagues and managers had about pTA-style public participation in

program design and decision-making. Because of their knowledge of NASA's cultural and political dynamics, they knew they had to work strategically so that their supervisors and NASA managers would accept pTA through the design and implementation phases.

NASA 5 recounted that early on, once ECAST's pTA submission had been selected and the policy entrepreneur team convened, they met amongst themselves to strategize. NASA 5 shared:

Internally to the NASA team, to myself and to [NASA 1] prior to the ECAST members onboarding, [NASA 2] said at one point that there was some concern that we could really freak managers out because there's not a clear-cut story on this. We could get told by NASA management that we have to shut this down. We need to make sure that this starts going smoothly.

Sensitive to the organizational culture of the agency, NASA policy entrepreneurs knew they had to have a clear presentation of the benefits of pTA-style public participation to agency leadership before they could begin to design and implement the pTA with ECAST. Informed by this knowledge, the NASA policy entrepreneur team strategically presented the idea of pTA to agency leadership to foster support and acceptance. NASA 1 explained:

There were meetings that we [NASA policy entrepreneurs] set up with various senior leaders within the agency to gauge their sense of approval and how they felt about this. . . . We did the meetings individually. That was one thing that we were very deliberate about was to do one-on-one meetings versus group meetings. We didn't want it to become group opinions against, or we didn't want anyone to

feel like they couldn't speak up and share their opinion if it was different than what we expect.

NASA 2 described the strategy as a "roadshow" approach:

I think one of the things that I always do is take an approach where you roadshow an idea, meaning you lay out why you think that it's beneficial but hav[e] a kind of a super drafty form so people that might be opponents to it inside an agency feel like they can inform the idea a little bit. You go last to the people that you think are going to be the most opposed to it. By that point, you've already talked to and have a lot of people [who] are supportive, so it's harder for them to say no.

NASA 1 described the success of this strategy when recounting one of these meetings with a senior person within the agency:

I was shocked that he was so supportive of it because it was the kind of thing where I feel like NASA, in public, doesn't do these types of things typically, and sort of has a party line and a message . . . . we were all just in shock that this was relatively easy to get support for.

By presenting the project idea as a rough sketch open to changes, it afforded the policy entrepreneur team flexibility in terms of how to approach senior members of NASA.

Moreover, by strategically approaching senior leaders who would be more supportive of public participation in program design and decision-making first, it allowed them to present the project idea to more potentially resistant leaders as being one that already has support. NASA 2 shared:

> It wasn't that terribly difficult for us to roadshow it because we thought about all
> of the things that people might be nervous about and we had answers to it about
> why they didn't need to be nervous about it.

The combination of the policy entrepreneurs' skills and the amassing approval and support from individual members of senior leadership facilitated their work in the politics stream concerning designing and implementing pTA. How NASA policy entrepreneurs chose to structure the working relationship with ECAST is an example of using their administrative expertise to support pTA.

A Cooperative Agreement

NASA and ECAST did not enter into a conventional grant contract but instead into a cooperative agreement for the Citizen Forum project. A conventional grant contract is "financial assistance by the Federal Government that provides support or stimulation to accomplish a public purpose" wherein an agency funds a project and only the contractor plans and implements (Ziens, 2010). A "Cooperative Agreement" has the "additional criterion that the agency expects to have substantial involvement with the recipient in carrying out the activities contemplated in the agreement" (Ziens, 2010). NASA 2 described a cooperative agreement as "one where both sides were contributing to conducting the activity." NASA policy entrepreneurs' choice to work under a cooperative agreement exemplifies both their administrative expertise and their knowledge of the agency's organizational culture and politics. It allowed NASA policy entrepreneurs to support designing and implementing pTA method in ways ECAST may not have been able to do on its own.

Working under a cooperative agreement was an intentional choice that would facilitate their ability to foster support for pTA and help navigate the political and cultural challenges during the design and implementation processes. According to NASA 1:

We deliberately chose to do this by way of a cooperative agreement. It was not a grant. . . . We wanted to do this as a cooperative agreement because it was so relevant from a practitioner point of view . . . . it wouldn't have carried weight as much if it had been exclusively left to ECAST to do. I think that's a really important point, which is that it needed to be collaborative to be bought into and trusted by NASA leadership.

An example of this was NASA 2's observation that using a cooperative agreement was a way of demonstrating that the NASA policy entrepreneurs would take "personal accountability" of the project to make sure that the agency got outcomes that were useful to the Asteroid Initiative. Additionally, NASA 1 shared that a cooperative agreement "gave us [NASA policy entrepreneurs] the ability to control it. I don't mean that in a negative sense. I mean, arguably, we're more in touch with what's politically permissible within the agency."

A cooperative agreement contract gave NASA personnel the ability to work closely with ECAST on the pTA project. Moreover, this facilitated building trust with NASA leadership because NASA personal knew what was "politically permissible within the agency" and were better able than ECAST to anticipate and temper concerns from NASA managers about designing and implementing an innovative form of public engagement method for the agency.

Administrative Rules of Public Engagement

Opting for a cooperative agreement as the formal working relationship between NASA and ECAST was not the only use of the policy entrepreneurs' administrative knowledge and expertise to support pTA. They also applied it to grappling with the administrative rules regarding public participation in federal government agency decision-making at NASA. According to NASA 2, "there's always the standard questions around, 'well, how does FACA and the PRA apply to this? You're getting public input on something, don't you have to go through a lengthy process with OMB?'" NASA 2 shared that when it comes to these administrative rules concerning public participation in federal government decision-making, "there's a lot of myths about what you can and can't do," leading federal agencies and personnel to be "afraid to engage with the public because they don't know how to do it within the rules." The complexity and legal force of these administrative rules and procedures disincentives innovative forms of public participation due to a sense of these rules being hurdles to public participation, with the potential for breaking the rules. NASA 2 shared that for federal government personnel designing and implementing innovative forms of public participation into agency programs it means that "often times you're paving the way if the agency's just not thought that it was worth it to try to figure out how to do it in the past."

In this light, the team of NASA policy entrepreneurs had to pave a new path through these rules to address the administrative concerns NASA managers could have about pTA. Two NASA policy entrepreneurs mainly did this work: NASA 2 by strategically quelling concerns with OGI support, and NASA 3 by capitalizing on their relationship with NASA's Office of General Counsel (OGC). NASA 2 shared how they

would often refer to M-10-11, "Guidance on the Use of Challenges and Prizes to Promote Open Government," part of the Obama administration's OGI, to quell legal concerns regarding administrative rules and to advocate the benefits of pTA. According to NASA 2, M-10-11 addressed the "common questions around legal hurdles" to innovations concerning public participation by using prizes and challenges to promote public participation. Moreover, M-10-11 was "basically the permission to the agencies to say, 'not only are we supportive of this, but here's the reasons why these things are useful'" (NASA 2).

Even with this broader political and administrative support for innovative forms of public participation from the OGI, NASA 3 shared that there were still technical aspects of the administrative rules surrounding pTA that had to be negotiated with NASA's OGC. According to NASA 3, OGC and their personnel "are paid and in place and they are designed to protect the agency. And they take that job very seriously. And they can be very dead-set in their ways." According to NASA 3, administrative rules had already stopped other forms of public engagement from being a part of the Asteroid Initiative:

> There is always the potential threat or challenge of FACA. . . . even Paperwork Reduction. It prevented us from having people volunteer their time to take telescopes into their backyard and look for asteroids. That was prohibited.

Both FACA and the PRA had to be considered for elements of public engagement and participation in the Asteroid Initiative's AGC. Moreover, if something as seemingly innocuous as the public using telescopes in their backyards to look for asteroids was

prohibited, using pTA to gather the public's thoughts on the Asteroid Initiative to inform program design and decision-making would likely face administrative challenges.

For the NASA team of policy entrepreneurs, however, NASA 3 said that they "were fortunate to have some folks in that office [OGC] that really wanted to figure out how to do things better" in terms of clearing ECAST's innovative pTA method of public participation. NASA 3 found that the NASA OGC staff were:

> Willing to explore and understand what you're trying to accomplish and have conversations with you to figure out how to accomplish that so that you actually become a client of theirs rather than them holding the rules and saying, "you can't do this, that, or the other."

Having this kind of relationship with the OGC, according to NASA 3, was central to building a path through the administrative rules that govern how federal agencies can engage with the public in government programs.

Through a combination of training in STS theory and practice, administrative expertise in federal government bureaucracy, holding key positions in NASA, and general support for greater public participation in agency program design and decision-making, four NASA personnel acted as policy entrepreneurs for pTA in the Asteroid Initiative. As will be detailed in the following sections, their knowledge of NASA's political culture and their administrative expertise was used to bring the multiple streams of the policy process together at the programmatic level.

Problem Stream

As introduced by Kingdon, examining the problem stream consists of identifying and tracing how an issue (e.g., a budget deficit, gun control, crime rates) becomes the

priority of policymakers and the public as the problem that needs to be addressed. Kingdon and MSA scholars find that issues rise in priority through three factors: indicators, focusing events, and feedback. Indicators are specific rates or numbers used to measure the magnitude of a problem, such as the cost of a government program or percentage of Americans without health insurance. Focusing events are high-profile events that highlight an issue area (e.g., when floods or wildfires motivate discussion of how to prevent and pay for future environmental disasters). Feedback describes when a successful solution in one policy area is used on a different problem (e.g., if privatization works as a solution for one problem, other problems are framed as issues of privatization) (Frederickson et al., 2015; Kingdon, 2011; Zahariadis, 2007).

Kingdon's central observation, however, is that every issue has a "perceptual, interpretive element" given the range of sociopolitical values and interests associated with it (Kingdon, 2011). Successful policy entrepreneurs capitalize on the values and interests these factors highlight to shape an issue as not only the problem that deserves attention, but also framing it as a problem that can be addressed by a specific policy solution. In short, policy entrepreneurs use their skills to shape an issue into a priority problem, a problem that is an appropriate vehicle for a policy solution waiting to be adopted.

In using MSA to trace how NASA adopted pTA as a component of program design and decision-making, the three traditional factors of the problem stream do not necessarily apply. However, Kingdon's observations of how policy entrepreneurs frame issues into problems that can be addressed by a specific policy solution does apply. For this case, the problem stream involves tracing how policy entrepreneurs within NASA

shaped the AGC program into a vehicle for pTA to address an agency problem with public engagement.

<u>Initial goal of the AGC</u>

NASA 3 described the Asteroid Initiative as a combination of "the [Obama] administration's desire to have humans go and explore an asteroid" as a proving ground for a future mission to Mars and "a Congressional mandate to find hazardous asteroids." NASA 2 corroborated this in sharing that the Congressional mandate "was an effort that NASA recognized it couldn't do alone and that would take worldwide collaboration and even have roles for citizens, citizen inventors, and citizen scientists to get involved in finding and characterizing more asteroids." NASA would accomplish testing mission to Mars capabilities through the ARM while finding hazardous asteroids would be addressed with the AGC. ARM, according to NASA 3, received "the lion's share of the money in the Asteroid Initiative" but NASA "didn't have the money to effectively accomplish the legislative mandate" from Congress to identify hazardous asteroids. Facing this implementation problem for the Congressional mandate component of the Asteroid Initiative, NASA created the AGC as an effort "to use novel techniques, whether citizen science or public-private partnership or Prizes and Challenges as a way of accelerating work" (NASA 3). Additionally, it was a way to "test a hypothesis of how the public and other nontraditional partners could be involved in achieving things that NASA can't do alone" (NASA 2).

While the first five items of the RFI were reminiscent of previous NASA RFI when it came to addressing technical science and engineering challenges, the sixth item, "Partnerships and Participatory Engagement," was unique to the AGC component of the

Initiative. When asked if this kind of request was common to NASA projects, NASA 3 shared that in years of working in the agency:

> I can't really think of a clear example where a similar question would have been a part of an RFI because it's just not inherent in a mission directorate's plan or designed to have that kind of thinking. So it was, from my perspective, a pretty unique question."

NASA 2 shared that this sixth item in the RFI offered "the ability for people to propose to us unique approaches to public engagement… We were primarily thinking open innovation. So, we were primarily thinking it'd be prizes and citizen science." As originally drafted, the sixth item of the AGC RFI was not a call for deliberative forms of public participation assessing the Asteroid Initiative, but for a more conventional approach to science and technology public engagement, such as citizen science.

A Problem with Public Engagement

According to NASA 1, "public engagement for NASA has historically been largely dissemination of information." The frame of reference NASA 1 provided was the Apollo missions from the 1960s, where the public engagement strategy was "build a big rocket and send it into space and tell everybody how great America is." The 50th anniversary of the Apollo missions were, for NASA 1, an opportunity to reframe NASA's approach to public engagement. Instead, however, they shared that:

> It just kind of grabbed me in a not great way. I feel like NASA was still kind of going back to that mode of "get the word out". . . . we haven't progressed in 50 years."

According to NASA 1, NASA's Office of Communications plays an outsized role in reinforcing this "get the word out" approach to public engagement. NASA 1 described the Office of Communications as "very strong as far as getting the word out through traditional media." When it comes to the use of social media, a relatively new platform compared to what the agency has historically used, "Folks in the office of communication will often tell you that that is two-way engagement."

NASA 5 framed the origins of this "get the word out" strategy of public engagement in context of the agency's founding legislation sharing that, "there's a lot of NASA communications where they truly care about what we're doing as part of NASA's mission through the Space Act of 1958 directing NASA to share our mission with the public." NASA 5, however, went on to share that "I actually think that these days, this propagandistic, potentially public-understanding-of-science-driven view is in the minority. But it can be a powerful minority at some times." Both NASA 1 and 5 articulated the idea that NASA has historically had a predilection to public engagement in the form of information dissemination. It can be read as a commitment to the agency's organic legislation of sharing its mission with the public. It can also be read, however, as a "propagandistic" strategy by a "powerful minority" within NASA where the goal is to tell the American public why what the agency is doing is so great while not being open to inviting the public to have a meaningful voice in what the agency is doing. Scholarly examinations of NASA's political history highlight the agency's approach to public engagement as a tool for garner public support to create political capital (Lambright, 2010).

NASA 1 went on to share that "as far as things like involvement in public policy and decision-making, that is still something that is hugely limited." NASA 1 and 5 noted that even this limited history of engaging the public for the purposes of informing the agency's missions and programs were still modeled after the "get the word out" attitude and had goals of collecting public opinion to better NASA's public image. NASA 1 pointed to the 1986 Paine report (i.e., Pioneering the Space Frontier: The Report of the National Commission on Space) where town hall meetings were held to hear civilian perspectives on the future of space exploration. NASA 5 pointed to similar sets of meetings and focus groups done under NASA Administrator Daniel Golden in the early 1990s.

According to NASA 1, these focus groups asked the public questions like, "What do they think of their space program? What do they most value about the space program? What stands out to them? Do they see the space program as a benefit to them?" In terms of the town hall meetings in the early 1990s, NASA 5 shared that a NASA manager involved with them "actually bragged 'yeah, we went to all these things; we never learned one new thing.'" After speaking with NASA personnel who had been involved in both of these town hall meeting activities in the 1980s and 1990s, NASA 1 shared that they were all "a little skeptical about the real extent of how valuable those were." Moreover, they shared that "it's kind of hard to tell the extent to which anybody was going to take those comments seriously or if these were more to validate what was already going on." NASA 1 was of the opinion that these town hall meetings and focus groups "certainly didn't change the course of anything" at NASA when it came to methods of public engagement for program design and implementation. In this light,

NASA has historically had an instrumental or "closed" approach to public engagement (Stirling, 2008).

<u>Making the AGC a Vehicle for pTA</u>

From interviews with these NASA personnel, it appears that ECAST's pTA submission was not necessarily what NASA personnel initially had in mind for the "Partnerships and Participatory Engagement" item of the AGC RFI. According to interviews with NASA 2 and 3, citizen science projects for identifying and tracking asteroids were the expected kinds of submissions. At the same time, NASA 3 shared that they "hadn't seen another type of engagement like ECAST was proposing, which therefore made it really attractive as a way to enable us to hear from citizens rather than [just] be able to answer their questions." Furthermore, NASA 3 shared that they believed the ECAST pTA method "could be valuable and wanted to then run the experiment on our Asteroid Initiative and show that, yes, this is actually a really effective tool and we could think about using it in future mission design activities."

For NASA 2, even though the initial idea for the RFI's sixth item was citizen science projects, their broader approach to the subject of public engagement in NASA missions and programs was that "there's no clear decisions in space, and they're not always just technical decisions." Their STS training informed this sense of needing to engage with more than just the technical aspects of space policy. NASA 2 read ECAST's pTA submission as a way of "filling the OTA gap in the U.S." of advising government on the sociopolitical impacts of science and technology, but through a deliberative method of public participation in agency mission and program design. Specifically, NASA 2 saw pTA to be:

A bit of a wayfinding activity for NASA. To engage the public in a way beyond just communicating out stuff, but also in a way to be deliberative with them about their own values and thinking through the decisions that are being made about very technical topics and ultimately investments that are going to be made.

Initially framed as a way to address a program implementation problem of accomplishing a Congressional mandate NASA "could not do on its own," NASA personnel, like NASA 2 and 3, worked to transform the sixth RFI item into a vehicle for greater public participation in the Asteroid Initiative's program design and decision-making processes when they saw ECAST's pTA submission. Their interest and training in the benefits of greater public participation in government science and technology decision-making prompted them to capitalize on the AGC opportunity and OGI support to select ECAST's pTA submission as something that answered the RFI's sixth item.

This initial adoption decision, however, was made with program-level discretion. As NASA 5 shared, the pTA project could still have been shut down by agency leadership in the design or implementation phases if they had not organized themselves to address the organizational politics, culture, and administrative challenges facing innovative forms of public participation. I will detail these in the politics stream section. First, however, I examine the policy stream and the role the STS community and ECAST have played to develop pTA as a solution. This will foster a better understanding of how ECAST presented pTA to NASA and add texture to the challenges to come in the politics stream.

Policy Stream

Kingdon describes the policy stream as a space to observe how the "primeval soup" of ideas within a policy area compete for attention and acceptance as a solution to a problem. Policy communities and networks composed of policy researchers, analysts, and practitioners situated within and outside of government shape ideas and present them as solutions to problems. Examining the policy stream is a means of identifying the policy communities, networks, their policy ideas, and tracing how they present these ideas to policy- and decision makers as solutions to problems (Kingdon, 2011). A central component of MSA is that policy solutions often predate policy problems. Policy communities develop ideas, or solutions, and look for specific policy problems they can attach their ideas to. The policy and problem stream interact through how policy entrepreneurs in these policy communities within and outside of government present policy ideas as the appropriate solutions to a policy problem, while simultaneously framing policy problems to be vehicles for their solution.

When applied to reconstructing the contexts surrounding how pTA became a part of NASA's Asteroid Initiative program design and decision-making processes, an examination of the policy stream involves identifying how the larger STS policy community in general and the ECAST policy network in particular positioned pTA as a solution to a public engagement problem facing NASA. This means tracing how ECAST began to develop pTA as a solution to the issue of deficient public participation in science and technology decision-making, and how ECAST shaped pTA as a solution to NASA's public engagement problem. Lastly, an observation of how a strategy in the STS policy community and in the ECAST policy network of training individuals to become

policy entrepreneurs in government science and technology agencies is key to understanding how opportunities are created within formal science and technology decision-making processes.

STS as a Policy Community

Researchers and practitioners in the Science and Technology Studies (STS) community have for decades advocated the need for greater public participation in deciding issues of science and technology in society (Carroll, 1971; Jasanoff, 2012; Nelkin, 1977, 1979). pTA has been developed as a method that creates opportunities for the public to collectively learn and deliberate on questions of science and technology, and as a vehicle to share the results of these public deliberations with decision-makers to inform policy (J. Durant, 1999; Guston, 2011; Hennen, 1999, 2012; Sclove, 2010a). With the advent of the U.S. federal government's National Nanotechnology Initiative (NNI) in 2000, certain segments of the STS community found a source of funding to develop pTA methods and practices. A central goal of NNI was to fund projects that would develop an understanding of how nanotechnology may benefit society. Motivated by the NNI, the National Science Foundation began the National Nanotechnology Coordinated Infrastructure to fund projects in line with the NNI's vision.

A founding member of ECAST (ECAST 11) shared that this funding supported institutions like the Center for Nanotechnology in Society, a member institution of ECAST, to develop and implement pTA in coordination with informal science education centers, citizen science projects, and science and technology policy research institutions, as in the case of the National Citizens' Technology Forum in 2008. The National Citizens' Technology Forum, however, ran parallel with formal government science and

technology decision-making concerning nanotechnology and human enhancement, outside of formal government processes.

<u>ECAST as a Policy Network for pTA</u>

In 2010, a group of research centers, informal science education centers, citizen science programs and non-partisan science and technology policy think tanks from across the U.S. came together and formed the Expert and Citizen Assessment of Science and Technology (ECAST). The network's objective is to create opportunities for pTA where the public can learn and deliberate with each other on complex issues of science and technology in society with the goal of incorporating the results of these deliberations to government policy- and decision makers. Their first large scale pTA project was organizing the U.S. component of the World Wide Views on Biodiversity in September of 2012. Coordinated by the Danish Board of Technology, World Wide Views on Biodiversity was a global democratic deliberation on biodiversity where 25 countries participated in engaging their citizens on biodiversity policy issues with the goal of disseminating the results to the Eleventh Conference of the Parties of the U.N. Convention on Biological diversity (COP11).

While the global results would be presented at COP11, ECAST attempted to share the U.S. results of the U.S. deliberations with the U.S. government representatives to COP11 with the aim of informing the delegation's decision-making. The actual policy impact of the efforts were rather indirect, however, insofar as there was no clear connection between these independently organized deliberations and formal U.S. federal government decision-making processes (e.g., Delborne et al., 2013). With this

experience, ECAST began to look for ways to embed its pTA method into formal U.S. government science and technology decision-making.

The summer of 2013 was an opportunity to open that door with a U.S. federal science and technology agency when an ECAST member attended a meeting of NASA's National Research Council Committee on Human Spaceflight. Sharing their experience in a blogpost, they noted that the portion of the meeting on public and stakeholder opinions was closed to the public except for a 30-minute morning session where only two public participants were present. The 30-minute session was a presentation on the agency's public image with a focus on how surveys and polls show that the public lacks an understanding of NASA's value, and that the agency needs to do a better job of informing the public about what the agency is doing. The ECAST member observed, however, that "NASA, like too many government organizations, has no plans to shape its future by engaging with the public. Only those who have existing knowledge and understanding of NASA's programs are having any influence, while members of the public without space and aeronautics backgrounds are not seen as equal stakeholders in the future of the program" (Mabry, 2013).

The post concludes by suggesting that the definition of "stakeholder" needs to be broadened to include "average citizens and unusual suspects," and that the extent of NASA's public engagement be something more than campaigns informing the public about what it is doing (Mabry, 2013). According to ECAST, the blogger writes, engagement needs to be in the form of a dialogue that can "enrich debate and reflect the values of our democratic society" (Mabry, 2013). They pointed to the pTA method and

format used during the World Wide Views on Biodiversity forums as an example of how it can be done.

Once published, the ECAST blog was picked up by NASA Watch, an independent website that is often critical of the agency's programs and decisions. According to ECAST 1, "everybody from up to the level of administrator will deny ever reading it, but they all follow it very, very closely" as a means of knowing what the criticisms from the science, technology, and engineering communities are of the agency. NASA Watch framed its commentary of the ECAST blog with the headline, "Meetings on Public Opinion on Space Closed to the Public." NASA personnel familiar with ECAST (NASA 5) read the NASA Watch post, contacted ECAST, and informed them that there was an open RFI for the AGC with an item for "Partnerships and Participatory Engagement."

While the language in the RFI made explicit reference to engagement through citizen science, ECAST members thought the RFI represented an opportunity for pTA to be a part of government science and technology decision-making processes. The National Research Council Committee on Human Spaceflight's findings were that NASA needed to do a better job of helping the public understand its projects, programs, and value. In this light, ECAST 1 shared that their approach to the RFI was, "we're going to put one in anyway and make our case that the Asteroid Initiative was one of the most misunderstood programs" in the agency and that pTA could be a tool to address this issue. ECAST 11 elaborated on this strategy of speaking to the agency's concern with public approval of its programs. ECAST 11 shared the insight that:

NASA has very self-consciously tried to deal with the fact that their work is more

in the public eye than certainly NSF [National Science Foundation], probably

NIH [National Institutes of Health] and more than a lot of the other mission

agencies, too. I think some of it does go back to NASA's quasi-populist origin.

As a mission-driven agency with a history of high-profile missions with large price tags

and failures that have been nation-wide events, the agency's main concern with the public

is public approval more so than public participation in program design and decision-

making, as highlighted by the findings presented at the National Research Council

Committee on Human Spaceflight 2013 meeting.

At the same time, however, ECAST 11 describes the space community and

NASA as a "bubble" and an "echo chamber" because when NASA announces new

projects and programs, "everybody who follows space gets in real close and tight and

nobody who doesn't follow space gets to have a word in." In terms of its participants,

NASA's public engagement strategy has been limited to those who are already active in

the space community and, in terms of content, limited to asking the public their opinions

on and approval of the agency's programs. ECAST saw the AGC RFI as a potential

vehicle for pTA into the agency's science and technology decision-making processes. It

did this by framing pTA as an opportunity to help the agency with its perceived problem

of how the public misunderstands and undervalues its programs, while also reaching out

to members of the public who are not within the space community.

The ECAST Network within Government

Both ECAST 1 and ECAST 11 shared that key to ECAST becoming aware of the

AGC and its sixth RFI item of "Partnerships and Participatory Engagement" was that a

NASA employee trained in STS and familiar with ECAST-member institutions informed them of the opportunity. Of the four policy entrepreneurs within NASA, three had graduate-level training in STS, and two were familiar with ECAST and its pTA method previous to their involvement in the Asteroid Initiative pTA project. Individuals with graduate-level STS training going into government science and technology agencies is, of course, a matter of personal choice and opportunity. ECAST 11, however, shared that a strategy often deployed by the ECAST network is to maintain and develop relationships with those who have gone through their academic programs and matriculated into government agency jobs.

An outcome of this is that there may be policy entrepreneurs in place who help soften the policy environment within agencies, and that may make pTA more attractive to agency leadership. As I will detail in the politics stream section, these policy entrepreneurs within NASA did soften political concerns agency managers had about an innovative form of public participation in agency program design and decision-making. Moreover, they did this in ways ECAST might not have been able to do from the outside without internal knowledge of agency political culture. As such, this strategy of maintaining and developing relationships with individuals who have gone through STS training proved to be crucial to successfully adopting, designing, and implementing pTA in the programmatic decision-making processes.

Politics Stream

While policy entrepreneurs can do work to shape problems and solutions in the problem and policy streams, the politics stream is composed of the political challenges that must be grappled with to bring the streams together and create opportunities for

change in policy adoption and decision-making. Kingdon identified three main components of the politics stream: the national mood, organized political forces, and internal government events (2011). The national mood refers to how shifts in public opinion about certain issues or policy areas change the political feasibility of addressing problems or applying solutions. Organized political forces refers to how support or opposition from interest groups affects the feasibility of changes to certain policies. Lastly, internal government events are changes in executive administrations (i.e., Presidential or gubernatorial agendas), or when election results change which political party is in control of legislative chambers. Analyzing the political stream means identifying the greatest sources of political pressure around a policy problem and solution, and tracing how those political pressures inform the processes of selecting policy solutions and problems.

At the programmatic level, there are some additional elements to the politics stream. In this case, while there were references to the national mood surrounding asteroid hazards, and how some science, technology, and engineering associations would respond to pTA in agency decision-making, interviews demonstrated these to be minimal concerns for the agency and policy entrepreneurs. Identifying the broader Presidential agenda of greater public participation in government, however, was something that NASA policy entrepreneurs appealed to in order to make their argument in support of pTA to agency leadership. Moreover, interviewees suggested that NASA's culture concerning forms of public participation different from its history of public engagement, and how it may impact the agency's political agreements with its political stakeholders, were the largest components of the politics stream.

Open Government Initiative

The goal of the Obama Administration's OGI was to encourage transparency, participation, and collaboration in U.S. federal government agencies through a series of OMB memos and incentives. For example, one of the memos stated that "it is Administration policy to strongly encourage agencies to utilize prizes and challenges as tools for advancing open government, innovation, and the agency's mission" (Ziens, 2010). NASA policy entrepreneurs capitalized on the administrative support for innovative public participation in agency program design and decision-making from the OGI by using it to soften concerns surrounding the administrative rules regarding pTA. In this case, the OGI provided a backdrop that made implementing innovative forms of public participation more politically feasible within NASA at the time.

Organizational Politics and Culture

Political Stakeholders

NASA policy entrepreneurs shared that like most federal agencies, NASA is sensitive to the political processes that impact its budget and support. NASA 1 shared that "when NASA says stakeholders, they are talking about a pretty narrow group of stakeholders. NASA is talking about the Presidential administration and the Congress – political stakeholders." While NASA has democratic stakeholders in the American public and commercial stakeholders in its aerospace technology and engineering contractors, the agency has two primary political stakeholders: the political body that controls its budget and legislates its mandates (i.e., Congress) and, as a mission-driven agency, the office that directs its mission objectives (i.e., the Executive office of the White House). Moreover, NASA 1, through several years of working at the agency, shared that they

have noticed that NASA is "apprehensive about disrupting whatever balance and agreements the leadership thinks it has with the White House and the Congress."

An example of this "apprehension" is when agency leadership is deciding on which projects to work on and how those projects are presented to the public and its political stakeholders. NASA 1 described an instance when a project appeared to be something different from what the political stakeholders had sanctioned. They characterized the leadership's attitude as, "We couldn't possibly put that out there because we already knew what we were going to do, because it was already politically blessed." Agency leadership is resistant to some ideas because they are sensitive to the need to stay in alignment with the projects and directions that have been "politically blessed" by Congress and the White House.

In the eyes of the NASA policy entrepreneur team, ECAST's pTA approach was a marked departure from the agency's usual public engagement practices. All five NASA personnel interviewed shared that they had never seen anything like the ECAST method of public engagement at the agency before. NASA 1 highlighted how the ECAST approach offered NASA "such a different view of the public role than we had typically seen in the agency." Moreover, according to NASA 1, "ECAST's methodology [of public engagement] was the first I'm aware of that NASA has ever used." NASA 4, speaking from a higher-ranking perspective within the agency than NASA 1, 2, 3, and 5, shared that when it comes to program planning, "to show a public audience something in a very preliminary stage and get their thoughts and reactions, to ask 'what do you think of this idea?' It's certainly not the way the agency usually does those things."

Given how much of a departure it was from NASA's historical use of public engagement as public opinion measuring, pTA was a kind of method that could potentially disrupt the "politically blessed" agreements it had with Congress and the White House. The NASA policy entrepreneur team shared that there were concerns from agency managers and leadership that the results of the pTA exercises could deviate from what had already been politically agreed upon with its political stakeholders. NASA 2 said that "from a public perception standpoint, some people might see risks associated with asking the public what they think and then does that mean you have to do what they say." NASA 1 added that there were concerns of "what if the public comes in and says we think we should do something 180 degrees different than what we've already got an agreement to do?" As presented in the policy entrepreneur section, the NASA policy entrepreneur team knew to anticipate these kinds of concerns from agency management and leadership regarding maintaining a good relationship with their political stakeholders and were able to present pTA in a way that navigated these apprehensions. Specifically, they framed pTA and its results as "one input of many" that could "just be more information for you to talk about when making a decision" (NASA 2). This framing softened the political apprehensions enough to allow pTA to be designed and implemented with minimal obstacles.

Office of Communications

Even though some NASA managers and leadership voiced these kinds of concerns, NASA 1 shared that most of the "apprehension" about what may disrupt "politically blessed" agreements, "really comes from our comms and legislative folks more so than our technical senior leadership." NASA 2 corroborated this and added that

public participation concerns are "more of a communications office fear usually, a hesitance maybe to talk about planning before a decision has been made." NASA 1 shared that the Office of Communications' strategy for controlling messaging can be seen in its hierarchy of information dissemination:

> There are press releases, which are sort of the crème de la crème. This is a really important thing to share and we're going to plaster it everywhere we can. Then we've got things that we call web features, which kind of go up very quietly on the website. You may or may not find them. And then certain things get tweeted out through social media.

According to NASA 1, the communication strategy favors information and projects that are in alignment with the agency's "politically blessed" agreements with Congress and the White House. Information on "politically blessed" projects are touted in formal press releases while other projects that could possibly destabilize these agreements are less visibly presented through web features on the agency's website.

The NASA policy entrepreneurs' knowledge of and experience with the agency's organizational politics and culture equipped them to navigate how the Office of Communications controls messaging in order to avoid speculation about ideas that are not "politically blessed." NASA 1 shared that the team of policy entrepreneurs made it a point to "not push too hard with OCOM [Office of Communications]" during the planning, implementation, and reporting phases of the Citizen's Forum pTA project. NASA 1 detailed that:

> As much as we wanted to tout this and share it and announce it broadly because it was so new and different, it was sort of a soft, quiet announcement. You had to

find it. That was as far as I think both when we announced that we were doing it

and then I think when we closed it. I think they were both very quiet so not to get

the comms people spun up.

Getting the Office of Communications too "spun up" at the beginning could have

possibly meant getting the pTA project flagged as something that would disrupt the

"politically blessed" agreements the agency has with Congress and the White House. The

NASA policy entrepreneurs chose to both announce the Citizen's Forum pTA exercises

and share its results through a web feature to avoid as much scrutiny as possible.

Implications

We can draw at least three implications from this case study. First, because of

their knowledge of the agency's organizational culture and politics and their expertise in

the details of U.S. federal bureaucracy, the work done by policy entrepreneurs within

NASA was essential to adopting, designing, and implementing pTA for the Asteroid

Initiative's mission and program design. This knowledge and expertise was critical to

navigating the barriers and challenges to innovative forms of public participation in

NASA program design and decision-making processes in ways ECAST could not have

on its own. Policy entrepreneurs in ECAST did work in the policy stream to shape pTA

as a solution to problems of public engagement and participation in government science

and technology decision-making. It took policy entrepreneurs within NASA, however, to

create the opportunity to adopt it by transforming aspects of the Asteroid Initiative in the

problem stream so that the AGC could be a vehicle for pTA. We in STS have an

expansive literature on how expertise contributes to creating undemocratic decision-

making processes and outcomes (e.g., Jasanoff, 1992, 2003; Turner, 2001), along with

literature on how expertise can be used as a political tool in partisan policy debates (e.g., Hoppe, 2005, 2009; Pielke Jr, 2007). We lack, however, a rich understanding of how bureaucratic expertise may, in some cases, actually enable more public participation in decision-making.

The second implication follows from the first. This case demonstrates that it took policy entrepreneurs within NASA to navigate the political controls that often create barriers to innovative forms of public participation. Developing a more detailed knowledge and understanding of the bureaucratic contexts in which participation takes place is central to developing participatory theory and practice that is better equipped to take on the challenges of embedding innovative forms of public participation into formal government science and technology decision-making processes. STS participatory theory and practice can benefit from further examining the political pressures on and administrative challenges to innovative public participation that are built into the institutional cultures and administrative structures of the American federal bureaucracy, and how they shape the processes of designing and implementing.

Lastly, we in STS may benefit from using well-established policy studies and public administration frameworks to examine the political, policy, and administrative factors surrounding innovative forms of public participation embedded within formal government science and technology decision-making processes. A modified form of MSA for the U.S. federal agency programmatic level supplemented with the political control framework is useful for organizing, describing, and identifying the central political, policy, and administrative elements that shape how innovative forms of public

participation are embedded within government agency programs, and key actors who facilitate those processes.

Conclusion

This case study of pTA in NASA's Asteroid Initiative's program design and decision-making processes offers us three areas to develop in our participatory theory and practice. First, it highlights the important role played by policy entrepreneurs within NASA in creating opportunities for innovative forms of public participation. Their internal knowledge of organizational culture, politics, and their bureaucratic expertise was vital to managing the barriers to and capitalizing on the opportunities for pTA. Policy entrepreneurs advocating innovations in public participation are important to STS participatory practice. Second, creating greater opportunities for public participation in government science and technology decision-making processes requires a greater knowledge and understanding of the political pressures and administrative challenges facing innovative approaches to public participation in program design and implementation. Third, frameworks from policy studies and public administration scholarship like MSA and political control are useful to STS participatory theory and practice in terms of organizing, describing, identifying, analyzing, and explaining not only the political, policy, administrative contexts but also the actions of behaviors of actors within those contexts.

There are some limitations, however, to this case study. In terms of theory and analytic framework, MSA is typically used to examine larger scale policy change. While applying it with some modifications to this case at the programmatic level has clearly identified important processes and relationships, more research using it in this way will

develop its descriptive and analytic strengths as well as its weaknesses (e.g., Fowler, 2019). In terms of methods, there are two limitations to highlight. First, there is a six-year gap between when the Asteroid Initiative's AGC was started in 2013 and when the interviews were conducted with NASA personnel and ECAST members in 2019. While interviewees recalled important impressions and perspectives on the pTA project, specific details may have been lost to time; when interviewees were unsure about details, we worked to specify or corroborate them, or else we did not reference them in this study. Conducting interviews closer to the completion of the Citizen's Forum pTA exercises may have afforded greater recollection of details from interviewees.

Second, while I was able to conduct interviews with NASA personnel who were policy entrepreneurs for the Citizen's Forum pTA project, there was limited access to NASA mid-level managers and leadership. Quite simply, it became clear that it would be politically uncomfortable for our contacts in the agency to try to arrange those interviews, and it also became clear that others we might have talked to would have had little interaction with the design and implementation of the pTA itself. Even so, while interviews with them may have been sparse on the details of the Citizen's Forum pTA project, mid-level managers and NASA leadership may have had greater insight into the political pressures the agency faces regarding innovative forms of public participation in agency mission and program decision-making processes. It is also possible that the policy entrepreneurs we spoke too might have embellished or aggrandized their roles in shepherding pTA, though their versions of events and the roles they played were corroborated by the ECAST interviews we conducted.

Lastly, this case study is an examination of the political, policy, and administrative contexts surrounding the adoption design, and implementation of pTA into the science and technology program design and implementation decision-making processes of just one U.S. federal agency. It cannot comprehensively speak to all the potential elements that inform the political pressures and administrative challenges different agencies may face because of their history or because of the science and technology issue being addressed. Additional research into cases of innovative forms of public participation, like pTA, that were embedded into U.S. federal agency program design and implementation decision-making processes would afford comparative analyses that could begin to suggest categories and trends across political and administrative environments. Having this kind of empirical knowledge and developing analytic frameworks from it could benefit our participatory theory and practice when it comes to creating opportunities for designing and implementing more innovative forms of public participation in government science and technology decision-making processes.

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CHAPTER FOUR (ESSAY THREE): CONTEXT MATTERS: THE POLITICAL AND
ADMINISTRATIVE CONDITIONS OF IMPLEMENTING PARTICIPATORY
TECHNOLOGY ASSESSMENT AT THREE U.S. FEDERAL AGENCIES

Introduction

The Science and Technology Studies (STS) community has a rich literature on designing and evaluating innovative forms of public participation in questions of science and technology in society (e.g., Delborne et al., 2013; Fiorino, 1990; Guston, 1999; Kleinman et al., 2007; Powell & Colin, 2008; Powell & Kleinman, 2008; Rowe & Frewer, 2000, 2005; Selin et al., 2017; Stirling, 2008). This literature mostly focuses on citizen deliberations organized independent of but parallel to government policy questions (e.g., Guston, 1999). These deliberations often face obstacles to informing formal government decision-making processes (e.g., Delborne et al., 2013). European researchers have developed a considerable literature examining the political cultures and administrative structures that support and constrain embedding innovative forms of public participation within formal government science and technology decision-making processes (e.g., Emery et al., 2015; Horst & Irwin, 2010; Jensen, 2005; Joss, 1998; Joss & Durant, 1995; Klüver, 2000; Krabbenborg & Mulder, 2015; Krick, 2015; Rask, 2013).

In the American context, however, we have only recently begun to develop our knowledge and understanding of the political and administrative contexts surrounding innovative forms of public participation within formal government science and technology decision-making processes (e.g., Bertrand et al., 2017; Gustetic et al., 2018;

Kaminski, 2012; Tomblin et al., 2017). There are still gaps in our knowledge regarding how the bureaucratic contexts and the administrative structures of the U.S. federal government shape the processes of designing and implementing innovative forms of public participation when embedded within government program design and decision-making. Filling these gaps in our STS participatory theory and practice is central to the goal of intervening on the undemocratic processes and outcomes that often result from technocratic approaches to science and technology decision-making in society (Callon et al., 2009; Feenberg, 2012). Intervening on these technocratic approaches with more public participation in science and technology decision-making may promote the redistribution of democratic political power by changing the structures of government administrative power (Arnstein, 1969; Carroll, 1971; Nelkin, 1977, 1979). Doing this, however, first requires filling the gap in our knowledge of how the bureaucratic structures of the U.S. federal government inform the design and implementation of innovative forms of public participation embedded in government science and technology decision-making processes.

This chapter attempts to contribute to developing our knowledge and understanding of how political and administrative contexts of the U.S. federal bureaucracy shape the design and implementation of innovative forms of public participation embedded within formal science and technology decision-making processes. I do this through a Qualitative Comparative Analysis (Ragin, 2014) of three cases where participatory technology assessment (pTA) – a deliberative form of public participation – were embedded within federal agency science and technology programs. Working with the Expert and Citizen Assessment of Science and Technology (ECAST) network, three

U.S. federal agencies adopted pTA exercises: the National Aeronautics and Space Administration's (NASA) Asteroid Initiative; the Department of Energy's (DOE) consent-based siting program; and the National Oceanic and Atmospheric Administration's (NOAA) Environmental Literacy Program.

Familiar STS research might take cases like these and examine the design of pTA in government, if it led to citizen empowerment of those who participated, or if it had an impact on agency program outcomes. This chapter, however, takes a different tack. Recent work in STS has called for STS participatory theory and practice to "ecologize" itself within the wider "political situations" informing the contexts surrounding opportunities and barriers to greater public participation in questions of science and technology (Barry, 2012; Chilvers & Kearnes, 2020). Drawing from qualitative interview data, policy studies, and public administration scholarship, I analyze the political and administrative contexts surrounding the design and implementation of pTA exercises at these three agencies in three specific programs.

This comparative analysis has two goals. The first goal is to identify the sets of political and administrative conditions that supported or constrained implementing pTA in each of and across these three cases. Not all three pTA projects were implemented, however. In the two cases where it was, the reasons behind its implementation were different. Developing a list of the political pressures and administrative challenges federal agencies and their personnel face when it comes to designing and implementing innovative forms of public participation may grant some insight into the conditions for facilitating greater public participation. A second goal is to highlight the outsized role "policy entrepreneurs" (Cairney, 2018; Kingdon, 2011) within government agencies play

in softening the impact these political pressures and administrative challenges have on the processes of designing and implementing pTA in U.S. federal agency programs. A greater knowledge and understanding of these political and administrative conditions, along with the work policy entrepreneurs do to change these conditions, can help STS scholars and practitioners better anticipate, or even mitigate, barriers to innovative forms of public participation in U.S. federal agencies.

One theoretical contribution of this study is that it merges work from policy studies, the study of public administration, and STS. Using tools from a well-known policy studies analytic framework developed by John Kingdon in the 1980's (1984, 2011), the Multiple Streams Approach (MSA), I examine what the role of policy entrepreneurs were in these three cases, and how they were able to bureaucratically support pTA implementation by mitigating some conditions. To understand the bureaucratic contexts of U.S. federal agency program decision-making, I draw from public administration scholarship's theory of "political control" (e.g., Rohr, 1986; Frederickson et al., 2015, Chapter 2; Meier & O'Toole Jr, 2006). Meant to keep bureaucrats accountable to the democratic political process, federal agencies face controls on their discretion on how to design and implement programs. These political controls often create bureaucratic hurdles to experimenting with innovative forms of public participation within federal agency decision-making processes. While STS literature on participation design is detailed and extensive (e.g., Delborne et al., 2013; Fiorino, 1990; Guston, 1999; Kleinman et al., 2007; Powell & Colin, 2008; Powell & Kleinman, 2008; Rowe & Frewer, 2000, 2005; Selin et al., 2017; Stirling, 2008), it has rarely engaged with

how political pressures and administrative rule requirements impact design and implementation within government agencies.

Through these frameworks, I will show how the relationships between political and administrative conditions at each agency for each program informed the design and implementation processes. Moreover, I will highlight the role federal government personnel play as "policy entrepreneurs" (Kingdon, 1984, 2011) in creating opportunities for innovative forms of public participation in science and technology decision-making processes. In that regard, this chapter aims to make not just a theoretical contribution but a pragmatic one as well. In so doing, STS participatory theory and practice may begin to develop approaches that appreciate how the bureaucratic expertise of federal government agency personnel, in some cases, actually enables greater public participation in science and technology decision-making.

Background

There are four organizations that form the backbone of this comparative analysis: the three U.S. federal agencies that adopted pTA, and the ECAST network that worked with these agencies to design and implement pTA. I begin with a brief introduction to ECAST and its work to embed pTA in government science and technology decision-making. This is followed by a summary of each case of pTA: 1) NASA's Asteroid Initiative and the Citizen's Forum pTA exercises that informed program design and decision-making; 2) DOE's nuclear waste consent-based siting program and how pTA results would have informed the consent-based siting process had the program not been suspended and; 3) NOAA's Environmental Literacy Program and the pTA exercises on local climate resilience and decision-making that were funded through it.

ECAST and Participatory Technology Assessment

Established in 2010, the Expert and Citizen Assessment of Science and Technology (ECAST) is a network of academic research, policy analysis, citizen science, and informal science education institutions distributed across the United States that works towards greater public involvement in issues at the intersection of science, technology, and society (Sclove, 2010a, 2010b; Kaplan, Farooque, Sarewitz, & Tomblin, 2021). Building on the mission of the now-defunct Congressional Office of Technology Assessment to inform lawmakers of the complexity of science and technology in society, ECAST designs and organizes peer-to-peer deliberative forums on the impacts of science and technology issues on the public. The public deliberation element in assessing science and technology policy questions is what constitutes it as *participatory* technology assessment (Burgess & Chilvers, 2006; J. Durant, 1999; Guston & Sarewitz, 2002; Hennen, 1999, 2012). One of ECAST's normative goals is to create opportunities to embed pTA within formal government science and technology decision-making processes.

While each pTA exercise is tailored to the technical and sociopolitical contexts of the topic in question, ECAST's method follows a general outline. First, background materials on the topic are drafted in collaboration with subject matter experts. These materials, both text and video, balance the technical aspects of the topic with accessibility to lay members of the public who are the participants in the deliberations. Meanwhile, a representative sample of about 100 or so local members of the public are recruited to participate in one or two daylong deliberation events at local venues. During the forums, participants are divided into smaller groups to read and view the background materials,

and then led in prepared deliberation questions on the topic by trained facilitators. These deliberations often use a role-playing game board to promote discussion among participants about the different impacts of science and technology issues on different communities and stakeholders. Table discussions are frequently audio and video recorded, and sometimes have table observers to take notes on participant's attitudes and responses. After each segment of deliberation, participants are asked to write down their answers to the discussion questions. All these sources of data – audio and video recordings, table observations, and written participant answers – are analyzed by ECAST for patterns and themes, with the findings then shared with the (government or non-government) organization who commissioned and funded the pTA exercises.

NASA's Asteroid Initiative and the Citizen's Forum

In April 2013, NASA announced its Asteroid Initiative. The Asteroid Initiative's two main components were meant to meet two goals. First, the Asteroid Grand Challenge component was a response to a Congressional mandate to detect all hazardous asteroids in near-Earth space and to develop a planetary defense strategy. Second, the Asteroid Redirect Mission (ARM) component was a response to a White House directive to progress on the longstanding goal of a human space flight mission to Mars. To do this, NASA aimed to develop the space flight and engineering capabilities to capture and redirect an asteroid as a technological proving ground for missions back to the Moon and then onto Mars.

In June of 2013, NASA opened a request for information for the Asteroid Initiative to the public and industry with six areas to "refine the Asteroid Redirect Mission concept, formulate plans for flight systems development, and gather ideas for

broadening participation in the mission and planetary defense" (U.S. National

Aeronautics and Space Administration, 2013). The sixth area, "Partnerships and

Participatory Engagement," specifically called for "innovative methods such as crowd

sourcing, prizes and challenges, citizen science, and public-private partnerships to

increase the resources for tackling the planetary defense problem and to broaden

participation" (U.S. National Aeronautics and Space Administration, 2013). ECAST

submitted pTA as a method for broadening public participation in Asteroid Initiative

program design and decision-making under this sixth area. By May of 2014, NASA

selected ECAST's pTA proposal for funding and entered into a cooperative agreement to

design and implement the pTA exercises for the Asteroid Initiative. Between May and

September of 2014, representatives from NASA and ECAST met several times to design

the content and plan the implementation of pTA as the Citizen's Forum.
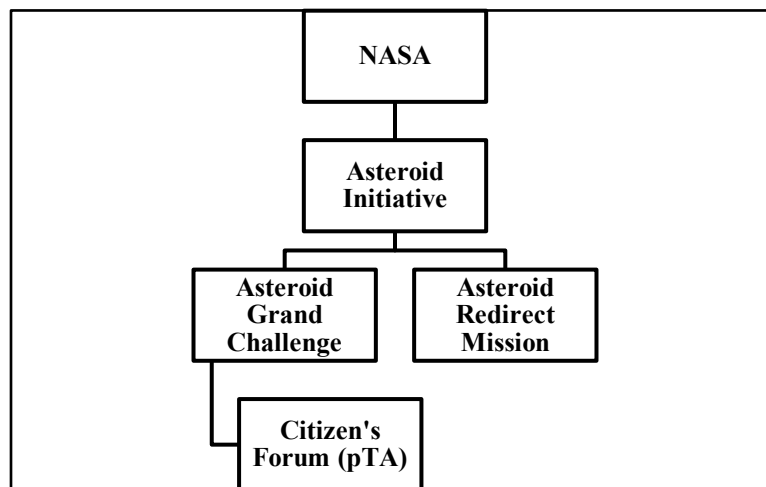
Figure 4.1   Organizational Chart of pTA Exercises within NASA

In November of 2014, daylong Citizen's Forums took place in two cities, Phoenix

and Boston. The four topics for deliberation were asteroid detection, asteroid mitigation,

deciding between two engineering options for the ARM, and three scenarios for human

space flights for Mars exploration. An interim report consisting of the results from the ARM session was delivered to NASA managers in December 2014, prior to making a decision on which of two options the agency should pursue for the ARM. In March 2015, ECAST made a top-level briefing at NASA headquarters of the pTA results. A summary and full report of the results consisting of additional assessments and evaluation were released to the public in August 2015.

<u>DOE, Nuclear Waste Management, and Consent-Based Siting</u>

The Nuclear Waste Policy Act (NWPA) of 1982 mandated the U.S. federal government to dispose of roughly 100,000 metric tons of spent nuclear fuel and high-level radioactive waste produced since the 1950's by power generation and government defense programs. The NWPA amendment of 1987 designated Yucca Mountain in Nevada as the disposal site for the nation's nuclear waste. The State of Nevada, local governments, tribes, and communities, however, strongly opposed the designation (Endres, 2012; Flynn & Slovic, 1995). In 2010, after decades of legal and technical objections, the Obama Administration terminated the licensing process for Yucca Mountain, stating that it was not a workable option.

Also, in 2010, the Blue Ribbon Commission on America's Nuclear Future was formed to develop recommendations for a workable strategy to nuclear waste disposal. The Blue Ribbon Commission's final report to the Department of Energy (DOE) in 2012 included eight recommendations, one of which was to use a consent-based approach to siting nuclear waste disposal facilities as a means to building deeper engagement and partnerships with interested communities. Based on these recommendations, DOE issued a three-phase "Strategy for the Management and Disposal of Used Nuclear Fuel and

High-Level Radioactive Waste." The first phase consisted of engaging with the public and interested parties to learn what elements are important to them in designing a "fair and effective consent-based siting process" (U.S. Department of Energy, 2016). This took two forms. First, the public and stakeholders were invited to public comment through the *Federal Register* between December 2015 and July 2016. Second, DOE held eight public meetings in 2016 designed to encourage participation and to provide multiple opportunities for public input and two-way dialogue. Parallel to and drawing from these public comments and meetings, phase two focused on designing a consent-based siting process that would serve as a framework for working with interested communities. The third phase would have been to take the results of these consent-based deliberations and use them to begin planning and siting disposal facilities.

In February 2016 under phase two, ECAST entered a subcontract with DOE through Allegheny Science and Technology to design and assess pTA exercises on the consent-based siting process. After a scoping meeting with DOE in March 2016, ECAST organized a two-day expert stakeholder workshop in June 2016 in Boston to collect advice about deliberation questions, themes, and background information content for public participants to augment materials and guidance provided by DOE. In the months after the expert stakeholder workshop, DOE and ECAST agreed upon and completed the background material that would be provided to public participants, the design and content of the pTA deliberations on consent-based siting, and had finished selecting forum sites in five cities across the country. The forums were slated to convene concurrently in early 2017. Following the 2016 presidential election, however, in anticipation of changes in

policy directions by the new administration, DOE suspended the consent-based siting

program and cancelled the pTA project before it was implemented.

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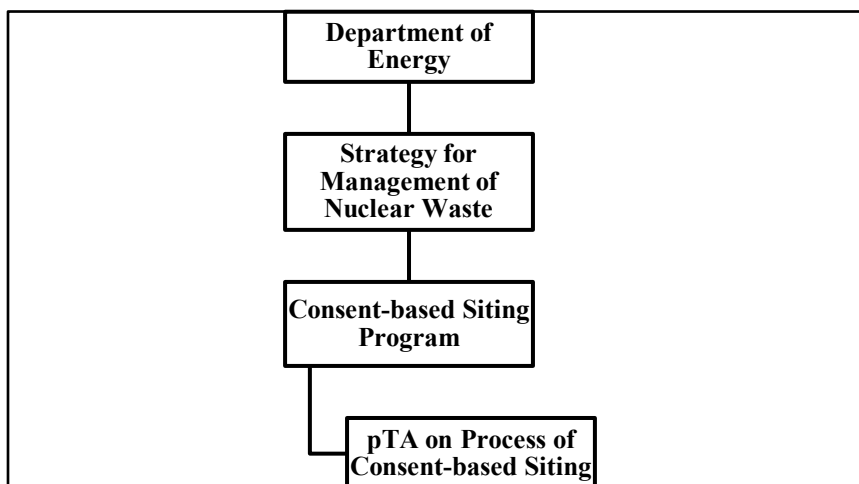
Figure 4.2   Organizational Chart of Planned pTA Exercises within DOE

NOAA, Environmental Literacy, and Local Climate Resilience

The National Oceanic and Atmospheric Administration's (NOAA) Office of

Education works towards "building a future workforce and scientifically literate public

ready to adapt to a changing environment." Since 2005, the Environmental Literacy

Program (ELP) in the Office of Education has supported this mission by funding more

than $75 million in grants to formal and informal science education institutions and

networks. ELP follows a peer-review process of approving and funding proposals. In

September 2015, NOAA awarded ECAST a three-year ELP grant for its proposal to

create a replicable model of building and strengthening local networks of museum staff,

community members, and local officials on creating community resilience plans for four

types of environmental hazards (i.e., sea level rise, extreme precipitation, drought, and

heat waves). While network-building has been an important objective of ELP, ECAST's

pTA approach to creating partnerships and a framework for engagement to foster

communities' abilities to share best practices, build social capital, and generate consensus on resilience measures was novel for NOAA.

Activities for this project were implemented in three phases over three years. In phase one, background materials on four hazards were developed during two workshops with partners and experts to develop deliberation materials for the four hazards. In the second phase, pilot pTA forums were held at two ECAST-member institutions to evaluate pTA materials, design, and to train program managers from six additional science centers throughout the country. In phase three, these six science centers conducted their pTA forums between March and May of 2018. The day-long forums simulate the five steps described in NOAA's Climate Resilience Toolkit, substituting experts with lay citizens, however. The results of these deliberations were presented to local resilience planners to inform local climate resilience strategies.
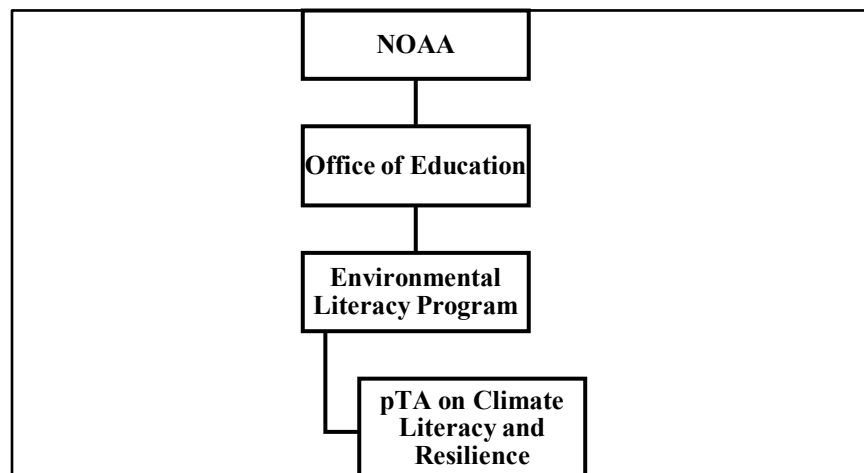
Figure 4.3   Organizational Chart of pTA Funded through NOAA ELP

Theoretical Framework

Jason Chilvers and Matthew Kearnes (2020) have recently called on us in the STS community to remake our participatory theory and practice in a way that is more sensitive

to the coproduced, relational, and diverse character of science and democracy. One of their suggestions is to "ecologize" STS participatory theory and practice by moving away from a focus on discrete, event-based participation studies and towards understanding the wider systems in which participation takes place. This includes examining the wider bureaucratic contexts informing opportunities for deliberative participation in formal government systems. As mentioned in the opening of this chapter, this involves developing our knowledge of what are the current bureaucratic structures of U.S. federal government agency decision-making, and how they shape barriers to and opportunities for imbedding innovative forms of public participation in government science and technology decision-making processes.

Examining the political and administrative conditions surrounding the adoption, design, and implementation of pTA at U.S. federal government agencies, however, calls for working at the intersection of STS, policy studies, and public administration. I used frameworks from policy studies and public administration to inform my approach to investigating and comparing the cases. The "political control" framework from public administration can help explain the political pressures and administrative challenges agencies and personnel face when designing and implementing innovative forms of public participation in program design and decision-making. The "policy entrepreneur" concept from policy studies' Multiple Streams Approach highlights the role government personnel play in facilitating pTA by mitigating some of the impacts of political controls through their bureaucratic expertise.

<u>Political Controls</u>

The field of American public administration has long examined how the relationship between the political processes of lawmaking and the administrative processes of implementation shapes the behaviors of elected government representatives and unelected bureaucrats (Bertelli & Lynn, 2006; Lipsky, 2010; Meier & O'Toole Jr, 2006; Waldo, 1948). Public administration's theory of "political control" can help us better understand how the political culture of American federal government shapes the priorities and behaviors of federal agencies when it comes to public participation in science and technology programs. It begins with observing that at the heart of American political philosophy and government is a tension between if the executive branch should have strong administrative discretion or if democratically elected representatives should have direct oversight of and heavy controls on the executive branch's discretion to administer government (Rohr, 1986). A consequence of the latter position is the imposition of political controls on the administrative discretion of the executive bureaucracy (McCubbins et al., 1987; Wood & Waterman, 1991).

The political process, however, often produces laws that are scarce on details and funding that government agencies and personnel are nonetheless required to implement. This motivates an increased use of professional administrative discretion to implement programs in resource- and option-constrained environments (Goodsell, 2014; Lipsky, 2010). As agencies and bureaucrats find ways to implement policies and programs in ways deemed outside of what the political process intended, however, elected representative and the public lose trust in the bureaucracy's choices (Cigler, 1990). Elected representatives check the administrative discretion of agencies by imposing

political controls in the forms of political pressures and administrative rules. Congress and the Executive Office of the White House use the leverage of budgets and political support as pressures on agencies, while administrative rules dictate the procedural requirements of how to design and implement government programs rules (McCubbins et al., 1987; Wood & Waterman, 1991).

The result of this escalating tension is that both elected officials and government agencies begin to focus more on institutional politics and preservation than on passing effective laws and implementing programs that are sensitive to public values and that address public concerns (Durant, 1995; Frederickson et al., 2015; Meier & O'Toole Jr, 2006; Wilson, 2019). The most explicit form of political control on embedding innovative forms of public participation in federal science and technology programs are administrative rules on how agencies can engage with the public. Congressional laws like the Administrative Procedures Act (APA) establish the minimum and mandatory requirements (i.e., public comment periods in the *Federal Register*) for public participation in matters of federal agency rule and program decision-making. Public input from these minimum requirements, however, are shown to be ineffective in substantially informing decision-making processes (Bryer, 2013). The Federal Advisory Committee Act (FACA) "governs how the federal government seeks outside advice," specifically, "who participates in government decision-making, when they participate, how they participate, and what influence participation has on policy" (Long & Beierle, 1999). There are, however, "ambiguities in the law and its regulations which limit the willingness of public agencies to engage the public outside of FACA" rules (Long & Beierle, 1999). The Paperwork Reduction Act (PRA) stipulates the procedural

requirements for of how agencies can collect any type of information from the public. While meant to reduce the total amount of paperwork burden the federal government imposes on private businesses and citizens, some federal agencies have argued that meeting basic PRA requirements make routine administration burdensome (Shapiro, 2013, 2020).

Taken together, the requirements of these administrative rules often create administrative challenges for agencies to engage with the public on program decision-making in innovative ways beyond the minimum requirements mandated by the APA and within the limits set forth by FACA and PRA. Given the administrative burdens and potential legal consequences, there are few incentives for agencies to experiment with innovative forms of public participation in program decision-making. STS scholar Alfons Bora (2010) calls this matrix of legal limits on top of the already rigid framework of technocracy concerning science and technology decision-making the "iron cage of law." Bora (2010), like public administration scholars, highlights the irony in this "iron cage" of administrative rules. Even though these rules are meant to ensure that agency discretion does not extend beyond the control of the political will of democratically elected representatives, they in practice act as limits on how the public can participate in government program decision-making. Political controls meant to maintain democratic legitimacy and accountability of the American federal bureaucracy can in fact act as barriers to more deliberative, and arguably more democratic, public participation.

Public administration's theory of "political control" highlights how administrative rules can pose administrative challenges to embedding innovative forms of public participation in program decision-making. They often disincentivize experimenting with

public participation methods beyond APA minimums because of the administrative burdens, and potential legal consequences, of FACA and PRA requirements. Moreover, political pressures from Congress or the Executive Office create potential budgetary consequences or loss of political support for agencies if the processes or results of innovative public participation stray from what Congress or the Executive Office intended.

<u>Policy Entrepreneurs</u>

The field of policy studies offers many frameworks for examining and understanding the social and political processes that explain how policies change over time (Birkland, 2019; Weible & Sabatier, 2018). One of these frameworks is the "Multiple Streams Approach" (MSA). Developed in the 1980's by John Kingdon (1984, 2011), MSA describes the policy process as interactions between three separate yet interdependent "streams" – the problem, policy, and politics streams. Each stream represents a set of elements, actors, and processes that interact to create opportunities for change in policy and decision-making processes.

A central component of MSA is the role of "policy entrepreneurs." Identifying policy entrepreneurs within a system and tracing their actions within the streams is fundamental to the analytic and explanatory work of the framework. Kingdon identifies three basic qualities of a policy entrepreneur: being in a position or having the authority to be heard; using political savvy and/or expertise in an issue or policy area to skillfully negotiate a position and soften resistance to change; and persistence (2011). Found both within and outside of government, their political savvy, administrative expertise, and knowledge of institutional politics and culture facilitates certain problems and policy

solutions through the politics stream (Anderson et al., 2019; Cairney, 2018; Mintrom & Norman, 2009). Examining the presence and actions of policy entrepreneurs within government at the programmatic level is key to understanding how to address the political pressures on and administrative challenges to embedding innovative forms of public participation, like pTA, into U.S. federal government science and technology program decision-making.

The MSA framework and the theory of political control, when used together, can "ecologize" STS participatory theory and practice within the bureaucratic contexts that inform the ease or difficulty with which innovative forms of public participation, like pTA, are embedded within agencies (Chilvers & Kearnes, 2020). The "political control" concept can help us identify political pressures and administrative challenges surrounding pTA, and the "policy entrepreneur" concept from MSA can help us explain how these pressures and challenges can be addressed by administratively and politically savvy advocates within U.S. federal government agencies.

Methodology and Methods

Methodology

I use a "very small-N" Qualitative Comparative Analysis (QCA) approach (Berg-Schlosser et al., 2009; Marx et al., 2014; Ragin, 1987, 2014) to compare the conditions informing the three cases of pTA implementation. Developed by Charles Ragin (1987, 2014), QCA has two basic premises. First, change in a system is not caused by just one factor but is often the result of different combinations of conditions. Second, different combinations of conditions can produce the same outcome (Simister & Scholz, 2017). QCA grapples with this complexity by integrating features of the case-oriented approach

with the variable-oriented approach to identifying and analyzing the different sets of

conditions that explain how similar phenomenon happened in some cases but not in

others (Simister & Scholz, 2017). This is a six-step process.

Table 4.1   Summary of QCA Methodology Application

1. *Outcome* – The change or outcome in a system to be analyzed.	Whether pTA was implemented
2. *Identify Cases* – Identify similar cases in which this outcome did and did not occur.	NASA's Asteroid Initiative DOE's consent-based siting program NOAA's Environmental Literacy Program
3. *Conditions* – The factors that contributed to the outcome.	The political and administrative conditions that shaped how pTA was designed and implemented
4. *Score* – Scoring conditions for presence ('1'), absence ('0'), or degree of presence (High, Medium, and Low) in each case.	
5. *Analysis* – Analysis of how each condition contributed to explaining whether the outcome occurred and how it occurred in each case.	Very small-N qualitative analysis
6. *Interpretation* – Claims of which conditions, or relationships between them, most contributed to whether the outcome occurred and how it occurred.	The that most facilitated or constrained designing and implementing pTA

1. Identify a change, or an outcome, to be analyzed. For this research, the outcome

   in question is whether pTA exercises were implemented in U.S. federal agencies.

2. Identify similar cases where this outcome did and did not occur. For this research,

   there are three cases of whether pTA exercises were implemented in U.S. federal

agency programs – NASA's Asteroid Initiative, DOE's consent-based siting program, and NOAA's Environmental Literacy Program.

3. Examine the cases for factors, or conditions, whose absence, presence, or degree of presence most contributed to whether the outcome occurred. For this research, it concerns identifying the political and administrative conditions that most contributed to how pTA exercises at NASA, DOE, and NOAA were implemented. I did this through a qualitative analysis of document and interview data for patterns and themes.

4. Once a nearly exhaustive list of conditions has been created, a score is assigned to each condition for each case. Some conditions are scored using "crisp-set" analysis to indicate presence ('1') or absence ('0') in a case, while others are "fuzzy-set" scored to indicate the comparative degree of presence (i.e. low, medium, high) (Marx et al., 2014; Simister & Scholz, 2017). For this research, most conditions were scored using "crisp-set" (e.g., policy entrepreneurs) with some scored using "fuzzy-set" (e.g., level of controversy).

5. Once all conditions in each case have been scored, analysis of the dataset shows how different combinations of conditions in each case may explain whether a particular outcome occurred. Depending on the number of cases in the dataset, this analysis is either qualitative (very small- and small-N for < 10 cases), quantitative (statistical analysis of large-N for > 50 cases) or mixed (intermediate N for between 11-49 cases). Given the very small number of cases in this research, I conducted a qualitative analysis of the different combinations of

political and administrative conditions in each case to examine how pTA was implemented at NASA, DOE and NOAA.

6. Lastly, interpreting the findings to make claims about which conditions, or which relationships between conditions, most contribute to how the outcome occurred. For this research, it will be an interpretation of which political and administrative conditions most support or constrain implementing pTA in U.S. federal agency science and technology programs.

Methods

This comparative analysis draws on two sources of data to identify the political and administrative conditions surrounding implementing pTA in U.S. federal government agencies: documents and semi-structured interviews. Public documents, mostly from the three federal agencies regarding each project (e.g., press releases, requests for information and proposals, transcripts of public meetings, etc.), are used to establish the background details to each case. Semi-structured interviews, however, comprise the bulk of the data. Subject identification and recruitment for this research was facilitated by my dissertation work being a subset of a National Science Foundation-funded (NSF) project examining pTA and cultures of expertise in these three U.S. federal government science and technology agency projects.[6] The co-principal investigator on the NSF project is a member of ECAST. Their network of contacts facilitated access to and introductions with a specific and finite list of ECAST members, federal personnel, and government

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[6] This chapter draws on data collected and analyses conducted under the auspices of NSF grant no. 1827574 titled "Participatory Technology Assessment and Cultures of Expertise in the U.S. Federal Government." Institutional Review Board (IRB) documents have been submitted to, approved, and renewed by Boise State University for the NSF grant, along with separate IRB documentation for this dissertation research.

contractors involved. All participants were either involved in developing, planning, and implementing pTA exercises at these agencies, and/or had knowledge and experience of the political and administrative contexts of each agency and of the specific program in which pTA was a part. A snowball sampling technique, however, was still used at the end of each interview to ensure that the specific and finite list of participants was not self-limiting.

In total, thirty-two (32) semi-structured interviews were conducted with twenty-five (25) participants between June 2019 and October 2020. Interviews ranged from 40 to 70 minutes in length for a total of 1670 minutes (or over 27 hours) of interview data. For the NASA and NOAA cases, we successfully contacted and conducted interviews with agency personnel who were directly involved with the pTA project. For the DOE case, however, attempts to contact and interview DOE personnel who were directly involved with the pTA project within the consent-based siting program were unsuccessful.

Table 4.2   Summary of Interviews Conducted for Each Case

Total Number of Interviewees		Total Number of Interviews		Total Number of Minutes/Hours	
25		32		1670 min / ~28 hrs	

	NASA	DOE	NOAA
Number of Interviews	12	11	9
ECAST	7	4	6
Contractor	0	3	0
Agency Personnel	5	1*	2
Former Personnel	0	2	0

*Conducted with NASA personnel familiar w/ DOE's administrative situation.

Interviewers (Jen Schneider and I) asked questions and explored topics concerning:

- The purpose and details of each program (i.e., the Asteroid Initiative, consent-based siting, and environmental literacy and resilience), and each program's role within its respective agency's mission.

- Each agency's strategy and history of public engagement/participation in decision-making processes.

- Each agency's interest in pTA for its respective program.

- The sources of political and/or administrative resistance to and/or support for pTA in each agency.

- The kind of working relationship between each agency and ECAST in designing and implementing the pTA exercises.

- Perceptions of each agency's organizational politics and culture, and how they may have informed how pTA was adopted, designed, and implemented.

Interviews were conducted remotely via Zoom and Google teleconferencing platforms and were audio recorded. Audio recordings were transcribed using an online, automated transcription service, TEMI, and were then checked and updated for accuracy and completeness against the audio recordings prior to data analysis. Throughout the chapter, I refer to interviewees by their organizational affiliation (i.e., ECAST, NASA, Former DOE, DOE Contractor, NOAA) and a random number assigned to them (e.g., NASA 3). I conducted member checks with interviewees I have quoted to assure accurate representation of their intention and meaning in context.

I conducted data analysis on two levels. First, documents and interview transcripts were imported into NVivo 12 Pro, a qualitative data analysis software, where they were coded for themes among answers to interview questions (Campbell et al., 2013; Fereday & Muir-Cochrane, 2006; Maher et al., 2018). Second, interview data were further reduced and organized into analytic memos where themes and concepts across interviews were brought together to build analytic narratives and to identify QCA conditions. Following a modified grounded theory approach, themes and concepts emerging from the data were used to refine interview questions to better target explanatory details, and to begin to build a theoretical model that generalizes those details (Charmaz, 1990, 2017). At the same time, theories from STS, policy studies, and public administration were used to inform the questions we initially asked, data analysis in terms of how I coded or named

certain processes and QCA conditions – this is why the approach is "modified" and not considered a purely grounded theory approach. For example, as the analysis developed, it become clear that a useful tool for describing and understanding the actions of federal personnel was Kingdon's (2011) policy entrepreneur concept from the MSA framework.

Findings

<u>Conditions</u>

I found eight conditions that contributed most to explaining how and whether pTA exercises were ultimately implemented for NASA's Asteroid Initiative, DOE's consent-based siting program, and NOAA's Environmental Literacy Program. Four conditions refer to the administrative factors within agencies that informed the processes of designing pTA: Decision Support; Cooperative Agreement; Administrative Rules; and "Top Cover." Three conditions refer to the political factors outside the agencies – Controversy, Agency Culture, and Political Priority. Lastly, whether there were policy entrepreneurs who facilitated addressing the political pressures and administrative challenges surrounding pTA. Each case had a different combination of political and administrative conditions that contributed to how pTA was ultimately implemented. First, I describe each condition and examples of how they informed the design and implementation processes in each case. Following that, I discuss which political and administrative factors most facilitated or constrained implementing pTA in these three U.S. federal agency science and technology programs.

Table 4.3   Summary of Conditions

Condition	Description
Decision Support (0 or 1)	pTA results informed decision-making
Cooperative Agreement (0 or 1)	The contract between agency and ECAST was a cooperative agreement
Administrative Rules (0 or 1)	Administrative rule requirements impacted pTA design
"Top Cover" (0 or 1)	Agency managers supported pTA
Controversy *(High, Medium, Low)*	The degree of controversy surrounding the program pTA was embedded in
Agency Culture *(High, Medium, Low)*	The degree to which the agency's organizational culture was open to pTA
Political Priority (0 or 1)	The Presidential Administration prioritized greater public participation in making progress on the policy area
Policy Entrepreneurs (0 or 1)	Agency personnel actively facilitated designing and implementing pTA

Scoring and Analysis

Decision Support

The "Decision Support" condition is present if the results of the pTA exercises
were intended to be used to inform the decision-making process of an agency program.
Interview data shows that if pTA results were going to be used as decision support, pTA
design and implementation faced greater administrative scrutiny or organizational
apprehension. For both NASA and DOE, pTA results were used, or were going to be
used, to inform agency decisions on program content and design. For the NASA case,
results of pTA deliberations were used to inform a choice between two engineering

options for the Asteroid Redirect Mission in the Asteroid Initiative. For the DOE case, results of the pTA exercises were going to inform the design and content of the agency's consent-based siting process.

For the NOAA case, however, both ECAST and NOAA personnel highlighted that the agency was not the "client" of the pTA deliberation results. The deliberation results were meant to inform local resilience planners. NOAA's interest in pTA was that it was an innovative form of public education on climate resilience and as a way to build climate resiliency planning partnerships between the public and local decision-makers. NOAA 1, aware of the administrative and organizational scrutiny pTA had undergone at NASA, shared that they "definitely heard some criticism [within NOAA], although I don't think nearly as much as maybe occurred like at NASA." NOAA 1 attributed this to the fact that the results of pTA "weren't feeding back to NOAA decisions."

Cooperative Agreement

The "Cooperative Agreement" condition is present if the formal working relationship between the agency and ECAST was a cooperative agreement. In a conventional contract, the government agency provides "financial assistance…that provides support or stimulation to accomplish a public purpose" and only the contractor independently designs and implements the project. A cooperative agreement has the "additional criterion that the agency expects to have substantial involvement with the recipient in carrying out the activities contemplated in the agreement" (OMB M-10-11). Interview data shows that a cooperative agreement structure facilitated designing and implementing pTA because agency personnel were able to help design and implement

pTA in ways sensitive to the agency's organizational culture, political pressures, and administrative challenges.

In the case of NASA, agency personnel chose to enter into a cooperative agreement with ECAST. According to NASA 1:

> We deliberately chose to do this by way of a cooperative agreement. . . . We wanted to do this as a cooperative agreement because. . . .it wouldn't have carried weight as much if it had been exclusively left to ECAST to do. . . . It needed to be collaborative to be bought into and trusted by NASA leadership.

Moreover, through a cooperative agreement, NASA personnel could better foster support for pTA and help navigate the political and cultural challenges during the design and implementation processes because they were "more in touch with what's politically permissible within the agency" (NASA 1).

For the NOAA case, ELP grants are cooperative agreements meant to use agency assets, resources, and expertise. As described by NOAA 2, "contracts are definitely a whole 'nother ball game. We actually have cooperative agreements which provide us a whole lot more flexibility to work with our grantees than a typical grant does. So, of the three different things there [i.e., contract, grant, cooperative agreement], the cooperative agreement is the best." In contrast, work on pTA at DOE was done through a conventional contract. Compared to their experience with NASA, ECAST 5 shared that while interactions with NASA personnel were formal, interactions with DOE personnel were "formal intensified" which made the relationship between ECAST and DOE personnel more like a "business transaction" than a collaboration.

<u>Administrative Rules</u>

The "Administrative Rules" condition is present if the process of negotiating the requirements of administrative rule pertaining to public participation in agency decision-making greatly changed the design of pTA to the point of jeopardizing implementation. Interview data shows that the process of negotiating the administrative requirements of pTA lead to administrative challenges in designing the exercises. In the NOAA case, pTA was not a decision support element. NOAA personnel shared that only grant proposal submission, peer review, and selection process rules applied. In contrast, pTA was a decision support element in the NASA case. NASA 3 shared that pTA in the Asteroid Initiative "always had the potential threat or challenge of FACA." Moreover, the staff in NASA's Office of General Counsel (OGC), the keepers of these rules, are "designed to protect the agency" and they can be "very dead-set in their ways" of protecting the agency from legal trouble (NASA 3). The relationship between NASA 3 and the agency's OGC, however, meant OGC staff were "willing to explore and understand what [NASA personnel working on pTA were] trying to accomplish and have conversations . . . to figure out how to accomplish that. . ." (NASA 3). This contributed to there being minimal administrative challenges to pTA.

In the DOE case, however, negotiating the requirements of the Paperwork Reduction Act (PRA) caused significant delays and changes to the design of pTA to the point of jeopardizing the legal and practical viability of the project. ECAST 1 described the process of negotiating the PRA requirements as a "fiasco." Negotiations between ECAST and DOE's Office of General Counsel (OGC) delayed the project at several

points in the design process. DOE's OGC had legal opinions about how acceptable initial pTA designs were within PRA rules.

ECAST 5 shared that this "fiasco" stemmed from OGC's opinion that ECAST was "not allowed to hand people a piece of paper with a question on it and have them fill it out" because that would qualify as a survey. Even once ECAST and the DOE OGC came to an agreement of how to record on paper the public's responses during the pTA deliberations, that still required approval by OMB, a process that would take anywhere between six to twelve months. After several months of delays, to ensure that the forums would be ready to implement on schedule, ECAST decided to change its pTA design and forgo any use of paper by the public to record their responses.

<u>"Top Cover"</u>

The "Top Cover" condition is present if agency personnel managing the pTA project had the support of their supervisors to design and implement pTA. Interview data shows that having the support of agency leadership gave agency personnel institutional capital when addressing internal apprehensions to using pTA in program design and decision-making. For the NOAA case, as a grant funded through a longstanding education program, top cover was not necessary to advance it through agency administrative and political concerns. Nonetheless, it had the support of NOAA 2, a senior leader in the agency, who saw pTA as an innovative approach to creating education opportunities "to inform people and motivate the kind of actions that they needed to take" to work towards climate resilience. NOAA 2 shared that they "tried to figure out how to make the things that we did that supported the agenda of our leadership

very clear to them, and really not talk about the things that they might not like so much. I feel like my job is to protect good work."

In the NASA case, NASA 3 shared that the Grand Challenge structure through which pTA was adopted afforded NASA personnel some general top cover because it had been "bought in at the highest levels" of the agency to experiment and test innovative approaches to achieving Asteroid Initiative goals. NASA 3 noted, however, that to design and implement such a different method of public engagement for NASA, you "need your boss, or your boss's boss, to be okay and willing to support you on it." NASA 1 shared that they had the support of a "very senior leader" within the agency – NASA 4. NASA 4 was forthright about their support for a project that was, from their perspective, "a refreshing exercise" in asking the American public "what do they want their space program to look like and what should it be doing?" According to NASA 5, NASA 4 shared their support at several meetings among NASA leadership concerning pTA and the Asteroid Initiative.

The DOE case, however, was difficult to score for "top cover" for two reasons. First, we were not able to conduct interviews with any current DOE personnel who were directly involved with the pTA project within the consent-based siting program and, thus, were not able to ascertain from DOE personnel if they had the support of agency managers. We requested interviews with these personnel, and they declined to participate. Second, ECAST, former DOE personnel, and DOE contractors shared that support for the consent-based siting program and the pTA project came from a temporary source: the political leadership of the agency (i.e., DOE political appointees). ECAST 1 shared that the DOE personnel managing the pTA project voiced the frustration that even though

agency political leadership told them how much of a priority the program and project were, "when the actual issues would come, there was not an immediate resolution. . . different people were giving different answers and yet nothing to tell us which direction to go."

ECAST 5 recalled the tension with having support from a member of the agency's political leadership:

> [They] could talk a good game. [They were] basically in a political position, so you could never really tell if [they were] genuine. [They] seemed genuine, but [they] weren't someone who was looking at the details of the project. . . . We often were worried that even if the Trump thing [i.e., the 2016 Presidential election results] didn't happen, that maybe this would never happen because of that kind of tension that was evident in the project.

Additionally, DOE Contractor 2, who also has years of experience in federal government nuclear waste legislation and regulation, shared that there was something amiss with how the political leadership of the agency approached the consent-based siting program and the pTA project. DOE Contractor 2 saw the selection of political leadership for the agency and the consent-based siting program under the Obama Administrations as "stars aligning" for the policy area. After a short time, however, the political leadership "backed off." Had they seriously supported the program and the pTA project, "things could have moved much differently" with fewer delays and obstacles (DOE Contractor 2). So, while there was support from the political leadership of the agency for the program and the pTA project, it was not enough to mitigate the administrative challenges.

<u>Controversy</u>

The "Controversy" condition refers to the degree of social and political controversy surrounding the agency program. Interview data shows that the more controversial and politicized a program is, the greater the likelihood that designing and implementing pTA will have to grapple with obstacles and resistance that comes from political pressures. In the NASA case, the controversy surrounding the Asteroid Initiative had to do with general criticisms of NASA and the purpose of the Asteroid Redirect Mission (ARM). News coverage from the Washington Post called ARM "NASA's mission improbable" given the budgetary, political, and technological issues the agency had been facing for years since the fall of the Soviet Union and the end of the Shuttle program (Achenbach, 2013). NASA Watch, a blog run by a former NASA employee who often makes comments critical of the agency's approaches and decisions, criticized NASA and ECAST for the forum's purpose and methodology surrounding the ARM decision support in a post titled "NASA pays for decision making advice on a decision it already made" (Cowing, 2015). These criticisms of the agency and ARM, however, did not concern the NASA personnel working on the pTA project and had little impact on the design and ultimate implementation of the forums.

For the NOAA case, while the topic of climate change itself is politically controversial, the education program that funded the pTA efforts has remained largely shielded from controversy. NOAA 2 shared that the agency's Office of Education "used to focus on climate change" but it was just "too politically charged" to continue framing their work in that way. Refocusing on environmental literacy and resilience building projects, however, created distance from the political dimension of the climate change

topic. For example, ECAST 1, 6, 8, 9, and 10 shared that the goal of the pTA exercises from ECAST's perspective was to help inform local resilience planners on climate change topics. They all went on to share, however, that from NOAA's ELP perspective the goal was to meet education goals but through an innovative process.

In contrast, DOE's programs for nuclear waste management and disposal have historically been enveloped in high degrees of controversy. Decades of policy delays and changes concerning nuclear waste management and disposal have created a distrust between the public and DOE (e.g., Endres, 2012; Freudenburg, 2004; Kinsella, 2001, 2015; Walker & Wellock, 2010; Weart, 1988). Every interviewee for the DOE case (ECAST 1, 4, 5, 8; Former DOE 1, 2; and DOE Contractor 1, 2, and 3) described the agency's historical approach to nuclear waste disposal siting as technocratic, especially the Yucca Mountain licensing process. ECAST 5 described it as "sending a bunch of scientists out to a site and saying 'this is the best place to do it', and then trying to force it on people. . ." Former DOE 1 shared that "one of the things that became quite apparent through the work of the [Blue Ribbon Commission] was just the degree to which trust in the department and in the federal government as a whole was eroded" because of this technocratic approach. They went on to share that one of the goals of shifting to a consent-based siting approach under the Obama Administrations was to "restor[e] some of the agency's credibility in its engagement with local governments, tribal governments, concerned citizens and organizations" as a way of mitigating the controversy caused by technocratic approaches. This "DOE baggage" (Former DOE 2), however, followed the consent-based siting program as will be highlighted below in "Agency Culture."

Agency Culture

The "Agency Culture" condition is the degree to which the agency's culture is open to experimenting with pTA in its program design and decision-making processes. Data shows that an agency's culture towards public participation is shaped in large part by how its origins, the relationship its programs have had with the public, and how its policy directions have been changed by Presidential administrations have shaped its sensitivity to political pressures. The NOAA case is scored "N/A" because pTA exercises were designed and implemented through an ELP grant and were not an element of agency decision support in program design or decision-making. As such, it cannot be scored given the condition's definition.

It does serve, however, as an interesting example of how an agency's location within the U.S. federal government shapes political pressures and agency culture towards public participation. NOAA personnel shared their thoughts on why the agency tends to have a different experience with political pressures than other agencies. NOAA 2 described the agency as "buried within the Department of Commerce and we're not usually visible to the White House or Congress on the first pass [of the budget] because they're so focused on the economy and trade and exports." Additionally, NOAA 2 observed that "because we do have such an important scientific and life and safety role, they don't usually give us a heavily political person. They usually give us somebody that's more competent." NOAA 1 highlighted that the director of the Office of Education is a career civil servant, not a political appointee. NOAA 2 went on to add that this insulates them from the impacts political pressures have on other agencies; "EPA [Environmental Protection Agency] just get thrashed. We watch NASA do somersaults for the politicals

[i.e., political appointees]. Department of Energy just gets whiplash on policies. And NOAA just stays under the radar and chugs along." While NOAA does face substantial political pressures on some of its programs, like fisheries management, its placement within the Department of Commerce and its perception as a research and safety agency insulates its programs from the kinds of political headwinds other U.S. federal science agencies face.

NASA's political origins, along with how public its successes and failures have been, has made the agency acutely aware of how susceptible its budget and programs are to shifts in national mood, the changing political environments in Congress, and Presidential priorities (Lambright, 2010). The agency's origins in the late 1950's was as much a cultural, social, and political response to Soviet advances in space as it was a technological one. As such, NASA has developed an agency culture invested in fostering public approval and, through it, political capital.

To this point, NASA 1 and 5 were able to point to town hall meetings and focus groups organized in the 1980's and 1990's to hear civilian perspectives on the future of space exploration. After speaking to colleagues that had attended those meetings and groups, NASA 1 commented, however, "it's kind of hard to tell the extent to which anybody was going to take those comments seriously or if these were more to validate what was already going on." They went on to share that "as far as things like [public] involvement in public policy and decision-making, that is still something that is hugely limited" in the agency. While the agency's history of public participation in program design and decision-making may be limited, NASA, as an organization, sees public

approval as necessary for its political capital. Hence, pTA advocates in NASA framed it as form of public engagement that could reach a wider audience than its usual supporters.

For DOE, Former DOE 2 shared that the agency carries with it "baggage" concerning the fears and distrust that come with the nation's history of federal nuclear weapons, power, and waste (e.g., Endres, 2012; Freudenburg, 2004; Kinsella, 2001, 2015; Walker & Wellock, 2010; Weart, 1988). In addition to the enduring distrust between the agency and the public, interview data also pointed to a cultural resistance to consent-based siting within the agency. Years of examining the agency's culture surrounding nuclear waste management informed DOE Contractor 3's observation that an attitude among career personnel in the agency is that they "don't think the public has really anything useful to say. They're the engineers and they know best and they know what to do. I think that kind of permeates the place."

Moreover, when the Obama Administration suspended the Yucca Mountain licensing process and changed to a consent-based siting approach to nuclear waste disposal, it effectively suspended over 20 years of work completed since the passage of Nuclear Waste Policy Act amendment of 1987. DOE Contractor 3 observed that for personnel who had spent their entire careers working on it, the Yucca project had become their "identity." Former DOE 2 corroborated this when sharing that when they heard that the Obama Administration had cancelled the Yucca Mountain project in 2010, "If I had been there [at DOE] at the time, it would have been difficult for me after putting so much work into it."

When you consider the technocratic attitude, DOE has historically taken towards public participation and add the element of damaged identities, the Obama

administration's push for consent-based siting was taking place within an already unenthusiastic agency culture. DOE Contractor 1, with decades of experience working with DOE on nuclear waste siting, was of the opinion that there were people at DOE who "never really want [consent-based siting] to happen" because:

> Yucca Mountain is a religion. If you don't believe that Yucca Mountain is the greatest thing in the world and are ready to devote your life and lay it down on the line, then you are viewed as a heretic. So, there are those who viewed any work in the consent-based siting thing as sacrilegious.

Moreover, DOE Contractor 1 described the agency's culture towards public participation like this:

> It's irresponsible to ask somebody who isn't good at something to be good at something. We're asking DOE, who is genetically, culturally, and politically incapable of engaging with the public, to engage with the problem. . . . They don't want to do it, and they don't see any value in doing it.

Even though there was a big push for consent-based siting from the Obama Administration and the political leadership of the agency, the culture among the agency's careerists was not open to the idea of greater public participation in nuclear waste program design and decision-making.

These examples highlight how sensitivities to political pressures have been institutionalized differently between NASA and DOE, while NOAA has been partially protected from them. For DOE, "whiplash" from major changes in policy has created a culture unenthusiastic of bringing in more public participation to bear on an already tenuous policy direction. This is in addition to the technocratic attitudes they already have

towards participation. An agency's history of facing political pressures contributes to shaping its culture concerning public participation.

<u>Political Priority</u>

The "Political Priority" condition is present if pTA was a part of an agency program in a policy area where the current Presidential Administration has prioritized progress and supports greater public participation to make that progress. Interview data shows that when this condition is present, agencies and personnel may have greater discretion to experiment with innovative forms of public participation in program design and implementation. Interview data also shows, however, that changes in political priorities due to changes in Presidential Administrations can prevent implementing a pTA project regardless of progress made addressing other pressures and challenges. Like with the "Agency Culture" condition, the NOAA case is scored "N/A." Climate change policy has ebbed and flowed as a general priority between Presidential Administrations. These pTA exercises, however, were designed and implemented through the Environmental Literacy Program, a longstanding element of NOAA's Office of Education and not a part of a specific program meant as a vehicle for a Presidential or Congressional priority.

In the NASA case, the Asteroid Initiative was the manifestation of two political priorities from Congress and the White House that took place during the second Obama Administration and its Open Government Initiative (OGI). The goal of the Obama Administration's OGI was to encourage transparency, public participation, and collaboration in U.S. federal government agencies through a series of OMB memos and incentives. NASA policy entrepreneurs capitalized on the administrative support for innovative public participation in agency mission design decision-making from the OGI

by using it to soften concerns surrounding the administrative rules and political pressures regarding pTA. NASA 2 shared how they would often refer to OMB memo M-10-11, "Guidance on the Use of Challenges and Prizes to Promote Open Government," part of the Obama administration's OGI, to quell legal concerns regarding administrative rules and to advocate the benefits of pTA (Ziens, 2010). According to NASA 2, M-10-11 addressed the "common questions around legal hurdles" to innovations concerning public participation by Grand Challenges to promote public participation. Moreover, M-10-11 was "basically the permission to the agencies to say, 'not only are we supportive of this, but here's the reasons why these things are useful'" (NASA 2). In this case, the OGI provided a backdrop that made designing and implementing pTA more politically feasible within NASA at the time.

For the DOE case, this condition is scored as both present and absent because a change in Presidential administrations explains the political support for and subsequent suspension of the consent-based siting program. The Obama Administrations supported the Blue Ribbon Commission's recommendation of more public engagement and participation through consent-based siting to make progress on nuclear waste siting and disposal. While the pTA project was adopted in the last year of Obama's second term, Former DOE 1 shared that "there was no doubt in anybody's mind that this was going to lead seamlessly into the Clinton Administration and that the consent-based siting effort would continue." When Donald Trump was elected President, however, "everything stopped and you couldn't even use the word 'consent' anywhere (DOE Contractor 1)." Corroborating this, DOE Contractor 2 shared that "the notion of consent was actually stripped from the lexicon." DOE Contractor 3 highlighted that once the Presidential

transition began, "the whole program went away. None of those reports are even online anymore." In terms of the Trump administration's approach to nuclear waste siting and disposal, DOE Contractor 2 characterized it as:

> "We don't want to go through all these labor-intensive processes to get to 'Yes.' They're going to cause trouble anyway. We're just going to do it. . . . Instead of the court of public opinion, we'll just see you in court."

The consent-based siting program, and the pTA exercises within it, went from having strong political support during the Obama Administrations to being suspended by the Trump Administration.

Policy Entrepreneurs

The "Policy Entrepreneurs" condition is present if there were agency personnel who facilitated adopting, designing, and implementing pTA. Interview data shows that when policy entrepreneurs are present, they use their administrative expertise to address administrative challenges and their knowledge of an agency's organizational culture to address political pressures that come with using pTA as a vehicle for greater public participation in program design and decision-making.

Four NASA personnel met Kingdon's and other MSA scholar's criteria for a policy entrepreneur: NASA 1, 2, 3, and 5 (Cairney, 2018; Kingdon, 2011; Mintrom & Norman, 2009). Their internal knowledge of the agency's organizational culture and politics made them sensitive to which political pressures and administrative challenges pTA would face. Their administrative expertise of bureaucracy equipped them to help navigate the political pressures and administrative challenges within the agency in ways that ECAST would not have been able to do alone. For example, it was their decision to

enter into a cooperative agreement that allowed them to work closely with ECAST to garner agency support and to be able to address concerns from agency leadership as they came up in the design and implementation process. During meetings to garner support and update NASA leadership on pTA design progress and implementation plans, NASA 2 shared that it was not difficult to address concerns because "we thought about all the things that people might be nervous about and we had answers to it about why they didn't need to be nervous about it." NASA 3's good relationship with the OGC staff helped negotiate the administrative rules requirements in a way that did not drastically change the pTA design. In the case of NASA, policy entrepreneurs within the agency were central to navigating the obstacles that often came with the previously described conditions.

In the NOAA case, one agency personnel met the MSA criteria for a policy entrepreneur: NOAA 1. Even though this case of pTA was a grant funded through an education program, NOAA 1 saw pTA as "very well-aligned with what we see as best practice in community resilience education" and was something that could "get people to take action and make behavior change" in line with NOAA's mission of science, service, and stewardship. While the NOAA case did not face the same kinds of political pressures and administrative challenges as the other two cases, NOAA 1 was an advocate of pTA and supported its design and implementation as something beneficial to the agency.

The DOE case did not have any policy entrepreneurs within the agency who facilitated the pressures and challenges encountered by designing and planning the implementation of pTA. DOE Contractor 3 observed that the DOE manager for the pTA project was "young" in the sense that they had not been at DOE very long and was an

engineer working on a social science project. This made it difficult for them "to grasp the complexity of doing something like this" in the shadow of Yucca Mountain and the agency's larger culture towards public engagement (DOE Contractor 3). ECAST members confirmed that their DOE point of contact, though pleasant to work with and capable in many other ways, struggled with the mixed political and cultural signals being sent to them when designing and planning the implementation of something so different and controversial within the agency.

Table 4.4   Summary of Condition Scores in Each Case

	Administrative				Political				
	Decision Support	Cooperative Agreement	Administrative Rules	"Top Cover"	Controversy	Agency Culture	Political Priority	Policy Entrepreneurs	pTA Implemented
NASA	1	1	0	1	Low	H / M	1	1	Yes
DOE	1	0	1	?	High	Low	1 / 0	0	No
NOAA	0	1	0	1	Low	N/A	N/A	1	Yes

The goal of the QCA approach is to explain how within sets of similar cases an outcome occurred in some while in others it did not. This explanatory work is done by identifying conditions and analyzing the relationships between them in and across cases. For three cases of pTA in U.S. federal government programs in three agencies, the different political and administrative contexts in each explain why the relationships between conditions shaped the processes of designing and implementing pTA differently. Some conditions, however, weigh heavier in some of these relationships than others.

Below are four interpretations of the relationships between conditions, and how some conditions carry greater weight in shaping these relationships.

Implications

<u>Interpretation</u>

From the analysis of how each of the eight conditions informed each case, I make four claims about what most explains how pTA was successfully implemented in these three U.S. federal agencies. First, in the case of NOAA, two conditions creating the context of this case makes it an outlier. Unlike the NASA and DOE cases, pTA at NOAA was not meant as a decision support element in program design and decision-making. When pTA is used as a decision support, it increases the likelihood of facing political pressures and administrative challenges. Additionally, it was designed and implemented through a well-established education funding program in a uniquely organized agency. This insulated pTA exercises at NOAA from many of the political pressures and administrative challenges that were faced at NOAA and DOE. The combination of these conditions made it a minimal political risk for the agency.

Second, an agency's culture can serve as an indicator of how it will approach the political pressures and administrative challenges that come with embedding public participation into program design and decision-making. Of course, some of the relevant aspects of an agency's culture can only be known through the process of designing and implementing pTA. A general sense of how it will approach greater public participation in program design and decision-making, however, can be inferred from its history. Take the differences between NASA and DOE. While NASA may have a limited history of engaging with the public to make program design decisions, it has historically been quite

aware of its dependence on public approval for its political capital (Kaminski, 2012; Lambright, 2010). When adopting, designing, and implementing pTA in the Asteroid Initiative, there was a general openness to the idea given how it was a means of reaching a public audience outside of its usual supporters. Compared to DOE, which carries with it a history of military secrecy, technocratic avoidance of public engagement, and high levels of distrust with the public, it was perhaps unsurprising that it would approach pTA and the larger consent-based siting approach with apprehension, or at least a lack of enthusiasm, even if there was political support for it at first. The interview data collected from the NASA and DOE cases are evidence for how historically shaped institutional cultures respond to innovative approaches to public participation. In short, the more open an agency has historically been to public engagement and participation, the higher the likelihood of investing resources into overcoming the political pressures and administrative challenges that may come with designing and implementing pTA.

The third point follows from this observation about agency culture, namely, the outsized role policy entrepreneurs within an agency play in navigating how an agency's culture will approach the political pressures and administrative challenges that may come with pTA. Take the case of pTA in NASA. While ECAST members are expert scholars and practitioners in the field of public participation in science and technology decision-making, the four NASA policy entrepreneurs were experts in the bureaucratic aspects of what was needed to address the political and administrative concerns that the agency's culture would focus on. They chose to enter into a cooperative agreement with ECAST so they could better address concerns from agency leadership about pTA as a decision support element in ways only they would have known. It was through their administrative

expertise and organizational relationship that the administrative challenges to pTA were overcome. The presence of policy entrepreneurs changes the impacts other conditions will have on pTA design and implementation. If it is the bureaucratic contexts of political pressures and administrative challenges that often make embedding pTA in government decision-making difficult, it may take the bureaucratic expertise of agency personnel acting as policy entrepreneurs to mitigate them.

Lastly, and to complicate the policy entrepreneur observation, the DOE case demonstrates that even without policy entrepreneurs to shepherd pTA through an agency with a culture resistant to public engagement and the many political pressures and administrative challenges facing consent-based siting, the pTA project was progressing towards implementation. It was a change in the Presidential Administration's priorities towards nuclear waste disposal that suspended the entire federal consent-based siting program and canceled the pTA project. Policy entrepreneurs may not have been able to change that outcome. The shift in political priorities between Presidential Administrations is the condition that most explains why pTA was implemented in NASA but not at DOE. On the other hand, if pTA is an element of decision support for an agency program, and barring shifts in Presidential political priorities during the design and implementation planning processes, the work of policy entrepreneurs within an agency was the condition that most explains how pTA navigates the political pressures and administrative challenges during the design and implementation processes.

This last point raises an important question concerning the sustainability of innovative efforts in public participation like pTA in agency program design and decision-making. Of the two cases where the "decision support" condition was present,

NASA and NOAA, neither agency has undertaken another pTA effort since these in 2014 and 2016, respectively. Shifts in policy priorities and approaches of the Trump Administration, especially in the DOE case, have limited opportunities for greater public participation in decision-making, in general. What can be done to institutionalize pTA-like exercises in agency program decision-making to shield them from shifts in political priorities? NASA 4 and 5 independently shared the idea of institutionalizing within the agency pTA for missions or programs that will cost $1 billion or more as a way of gauging public approval. While this fits NASA's agency culture where public approval equals political capital, these kinds of pTA triggers would still likely be subject to shifts in political priorities, especially controversial and costly program with high public visibility. STS practitioners embedding pTA into government decision-making processes will have to grapple with the ebb and flow of the larger political environments, just as they will have to grapple with the combination of conditions that create the context of any government science and technology program.

Conclusion

This chapter set out to achieve two goals. First, to identify the set of political and administrative conditions that supported or constrained implementing pTA in three cases – NASA's Asteroid Initiative, DOE's consent-based siting program, and through NOAA's Environmental Literacy Program. This will contribute to our STS theory and practice a better understanding of the political pressures and administrative challenges (i.e., political controls) federal agencies and their personnel face when embedding innovative forms of public participation into program design and decision-making. Using the QCA approach, I found eight political and administrative conditions that explain how

pTA was successfully implemented or not in each of the three cases. These eight conditions speak to the suite of administrative, political, or organizational aspects that informs the pTA design and implementation processes. Of the eight conditions, two most contribute to explaining how whether or not pTA was implemented – the presence of policy entrepreneurs, and the changes in political priorities that come with new Presidential Administrations.

The second goal is to highlight the outsized role policy entrepreneurs within agencies play in navigating the political pressures and administrative challenges that come with designing and implementing pTA in U.S. federal agency program design and decision-making. While pTA was designed and could have possibly been implemented without the support of policy entrepreneurs in the DOE case, the process of designing pTA faced several more delays and challenges when compared to the NASA case. Agency policy entrepreneurs facilitated pTA by using their knowledge of the agency's culture and their administrative expertise to address the political pressures and administrative challenges that came with designing and implementing pTA in ways ECAST could not have done.

There are, of course, limitations to this analysis. First, there was an unevenness to interviewee access between the three cases. Most noticeably, we were unable to interview any current DOE personnel who were a part of the pTA project. The fact that they declined to participate may be indicative of the political and organization culture of the agency and may also speak to the general reluctance among agency employees about speaking to researchers while the Trump administration was in power. About this, however, we can only speculate. Second, this is a comparative analysis of only three

cases of government-embedded pTA under different combinations of political and administrative conditions. The eight conditions found, however, are general enough to apply to other cases where innovative forms of public participation were embedded in U.S. federal science agency decision-making, but also specific enough to identify the individual political pressures and administrative challenges that can inform the design and implementation processes. Moreover, this kind of knowledge and understanding of these political and administrative conditions, along with the work policy entrepreneurs do to navigate these conditions in support of pTA, can aid STS practitioners better anticipate, or even mitigate, barriers to innovative forms of public participation in U.S. federal government science and technology decision-making.

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CHAPTER FIVE: CONCLUSION

Summary of Dissertation

The three essays at the heart of this dissertation engaged with two related gaps in STS participatory theory and practice. The first is a gap in our participatory theory concerning how we understand the bureaucratic contexts that create barriers to more open and deliberative public participation in government science and technology decision-making. I argued in the first essay that due in large part to the "residual realist" (Chilvers & Kearnes, 2020) trend in STS participatory theory and practice, we read bureaucrats' resistance to public participation in government science and technology decision-making primarily or only as antagonism towards lay perspectives because they do not or cannot understand or contribute to the technical complexities of an issue. This kind of resistance has led us to be dismissive of opportunities for embedded pTA, or question if such opportunities would remain as "open" as we would like (Fiorino, 1990). This has, consequently, led to a gap in our empirical knowledge of how bureaucratic contexts shape the attitudes and behaviors of government agencies and personnel towards implementing innovative forms of participation in program design and decision-making. I suggested that public administration scholarship's theory of political control can benefit us in STS to "ecologize" our participatory theory and practice within the wider political and administrative contexts that inform public participation in government decision-making processes. A sensitivity to the inherent political pressures and administrative challenges that agencies and personnel face may help us not just better understand the

barriers to innovations in participation but to also better recognize how they can be addressed.

The empirical analyses in Essay Two and Three expanded on the details of how political and administrative conditions shape the design and implementation of an innovative form of public participation, pTA, and underscored the central role policy entrepreneurs within government played in navigating these political pressures and administrative challenges. Using Kingdon's Multiple Streams Approach (Cairney, 2018; Kingdon, 1984, 2011) in Essay Two, I identified and examined how the political and administrative elements shaped the challenges to and opportunities for policy entrepreneurs in NASA to use their bureaucratic expertise to facilitate the processes of designing and implementing pTA for the agency's Asteroid Initiative in 2014. This case study highlighted how many of the political controls agencies face when innovating on public participation requires the knowledge and skills of policy entrepreneurs within government to create programmatic opportunities for adoption, design, and implementation.

In the third essay, I used the Qualitative Comparative Approach (Berg-Schlosser et al., 2009; Marx et al., 2014; Ragin, 1987, 2014) to identify eight political and administrative conditions that informed the bureaucratic contexts for designing and implementing pTA exercises for NASA's Asteroid Initiative in 2014, DOE's nuclear waste consent-based siting program in 2016, and NOAA's Environmental Literacy Program in 2018. By analyzing the relationships between conditions for each case, I made explanatory claims concerning which conditions most contributed to whether pTA was ultimately implemented. Drawing mostly from the NASA and DOE cases, I found

that two conditions most contributed to explaining how much of an impact political and administrative factors would have on the design process and implementation – policy entrepreneurs and changes in Presidential political priorities. The eight conditions found are general enough to apply to other cases where innovative forms of public participation are embedded in U.S. federal science agency decision-making, but also specific enough to identify the individual political pressures and administrative challenges that can inform the design and implementation processes. Moreover, this kind of knowledge and understanding of these political and administrative conditions, along with the work policy entrepreneurs do to navigate these conditions in support of pTA, can aid STS practitioners better anticipate, or even mitigate, barriers to innovative forms of public participation in U.S. federal government science and technology decision-making.

Summary of Limitations

There are some limitations to this research. In terms of theory and analytic framework in Essay Two's case study, MSA is typically used to examine larger-scale policy change; how legislators are influenced to prioritize new approaches, how bills are drafted, and ultimately passed, along with how flagship policy changes are made. While applying it with some modifications to this case at the programmatic level has clearly identified important processes and relationships, more research using it in this way will develop its descriptive and analytic strengths as well as its weaknesses, and can build upon the work other public policy and administration scholars are doing in this area (e.g., Fowler, 2019). The larger political processes described by Kingdon and MSA scholars will need to be replaced with equally operational concepts concerning the bureaucratic features of making changes to programmatic decision-making processes. Elements of

public administration scholarship's theory of political control, for example, can aid in doing this.

In terms of methods, there are several limitations to highlight. First, there were significant time gaps between when the pTA projects were being designed and when the interviews were conducted. For example, there was a six-year gap between when the Asteroid Initiative's AGC was launched in 2013 and when the interviews were conducted with NASA personnel and ECAST members in 2019. While interviewees recalled important impressions and perspectives on the pTA projects, specific details may have been lost to time; when interviewees were unsure about details, we either worked to specify or corroborate them, or else we did not reference them in this study. Conducting interviews closer to the completion of pTA exercises may have afforded greater recollection of details from interviewees. Second, there was an unevenness to interviewee access between the three cases. Most noticeably, we were unable to interview any current DOE personnel who were a part of the pTA project. The fact that they declined to participate may be indicative of the political and organization culture of the agency and may also speak to a general reluctance among agency employees about speaking to researchers while the Trump administration was in power. About this, however, we can only speculate.

Relatedly, while I was able to conduct interviews with current and former agency personnel along with contractors who have experienced the political and administrative environments surrounding public participation in these programs, there was limited access to mid-level managers and agency leadership throughout the agencies. Quite simply, it became clear that it would be politically uncomfortable for our contacts in the

agency to try to arrange those interviews, and it also became clear that others we might have talked to would have had little interaction with the design and implementation of the pTA itself. Even so, while interviews with them may have been sparse on the details of pTA projects, mid-level managers and agency leadership may have had greater insight into the political pressures each particular agency faced regarding innovative forms of public participation in agency mission and program decision-making processes.

Wider Implications and Future Directions

These limitations motivate some suggestions for future research. Continuing the work of "ecologizing" STS participatory theory and practice means gathering more data on the details of the political and administrative conditions that shape the processes of adopting, designing, and implementing innovative forms of public participation in government science and technology program decision-making. Organizing these kinds of embedded exercises are taxing enough, but investigating in parallel what political pressures and administrative challenges agency personnel and managers anticipate as part of innovating on public participation, and examining it in relation to the kind of work this dissertation has undertaken, may aid STS practitioners anticipate challenges and opportunities in real-time.

"Ecologizing" STS participatory theory and practice is a part of answering Chilvers and Kearnes' (2020) call for us to "enhance public trust, avert crises of expertise and democracy, and build more socially responsive and responsible science and innovation" (p. 347). This interventionist-oriented segment of the STS community shares similar goals with the deliberative democracy segment of public administration, namely, achieving the democratic goal of greater public participation at all levels of government

decision-making (Ercan & Hendriks, 2013; Fung, 2015; Gutmann & Thompson, 2009; Nabatchi, 2010). While the STS focus is on matters of science and technology, the shared goal of participation above that which is currently mandated by law is framed as a way to address, or at least temper, the issues of "democratic deficits" in citizen empowerment and trust in government institutions (Durant, 1995). The COVID-19 pandemic in the United States is a clear example of what can happen when government's democratic capital is not robust enough to sustain enough of the public's trust in government (science and technology) decision-making. While greater public participation in government decision-making is not a panacea to these democratic deficits, it is foundational to building public trust in government, in general, and in matters of science and technology, in particular (Wynne, 1992).

The results of this dissertation research are but a small part of this larger democratic project. While the intended audience of my dissertation is primarily the STS community for the reasons articulated in Essay One, public administration scholarship may also benefit from the bureaucratic details uncovered during the processes of embedding these pTA exercises in federal programs. The political and administrative conditions I have identified, along with the profiles I have drawn of policy entrepreneurs at the programmatic level, can help us in both STS and public administration better grapple with the processes that frustrate attempts to embed innovative forms of public participation in government decision-making. A cross-pollination between STS deliberation design and public administration's political control theory for understanding the behaviors of agencies and their personnel can produce a mutually beneficial participatory theory and practice. This dissertation is an example of what this cross-

pollination can look like and what it can yield. I suggest that further investigations into similar cases of innovation in public participation in different programs within different federal agencies in different social and political environments will add texture to our knowledge of how political pressures and administrative challenges shape the adoption, design, and implementation processes. In this way, we in STS and public administration with an interventionist-oriented predilection towards deliberative democracy can be ever more equipped to enhance public trust and avert crises of democracy in American democratic government.

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APPENDIX A

Codebook for Case Study of pTA in NASA's Asteroid Initiative

Table A.1   Analysis Codebook for pTA in NASA's Asteroid Initiative Case Study

Name	Description
Applied STS Interests	Specific applications of STS concepts that federal employees were interested in
Asteroid Initiative Structure	Descriptions of how the NASA Asteroid Initiative was structured
Citizen Forum Topics	References to how the four topics for the Citizen Forum were selected
Collaboration between Agency Policy Entrepreneurs	References to how champions of public participation within agency were connected and collaborating
Concerns about Public Participation	References to the kinds of questions and concerns agency personnel have about the value or risks of public engagement/participation
Control of the Message	References to how agency controls its public and political messaging
Convincing Agency of Participatory Public Engagement	References to how Federal personnel had to be convinced of the value of participatory public engagement; how they were convinced
Criticisms of AGC	References to criticisms against NASA's Asteroid Grand Challenge
ECAST Affiliation & Origin	ECAST member background and role; description of ECAST origins
ECAST Contacts in Agency	References to Federal personnel with ties to ECAST prior to pTA project
ECAST Public Engagement Method	References to ECAST's public engagement/deliberation method

Name	Description
ECAST Reputation Building	Description of the work ECAST had done previous to agency-specific project to build reputation as a credible organization
ECAST-Agency Co-Production	References to the co-production of knowledge and materials between ECAST and agency
Federal Experience	Experience in federal government agencies other than during the ECAST project
Goals for pTA	References to how ECAST and agency frame the goals of pTA
History of Public Engagement	References to agency's history of public engagement
History of Public Engagement for Policy and Decision-Making	References to how the agency has historically used public engagement for policy- and decision-making
Impacts of pTA on Agency	References to how implementing a pTA event impacted the agency in terms of views on public participation in policy- or decision-making; references to why more pTA has or has not happened
Initial Agency-ECAST Connection	Description of how ECAST and agency first connected
Initial Planning of pTA	References to the initial ideas ECAST and agency had about what to do pTA on
Internal Knowledge of Agency Culture and Politics	References to how federal employees had internal knowledge of the politics and organizational culture of their agency; how this knowledge facilitated their ability to promote participatory public engagement/ ECAST pTA

Name	Description
Kind of Formal Working Relationship	Reference to what kind of formal working relationship ECAST and agency had - Cooperative Agreement, Contract, Grant; how the kind of formal working relationship structure impacted the design and implementation of pTA project
Lack of Dialogue-based Public Engagement in Agencies	References to the lack of dialogue-based public engagement by federal agencies; how lack of this kind of engagement impacts the public and agencies
Maintaining Political Balance	Reference to how agency managers adhere to messaging that strategically maintains political agreements made with Congress and the Executive Administration
Meta-Revelation	Moments where federal personnel admit a moment of insight into their agency's political and organizational culture that was prompted by being interviewed
Need for Critical Support from Agency Managers; Top Cover	References from agency employees about how the support of certain supervisors/managers is critical to realizing participatory public engagement event; referred to as "top cover"
Obama Open Government Initiative	Reference to the influence the Obama Administration Open Government Initiative had on promoting pTA in federal agency
Office of Communications	References to the role NASA's Office of Communications plays in controlling public engagement
OMB & Administrative Rules	References to how federal agencies and employees have concerns regarding the Office of Management and Budget; particularly the administrative rules surrounding public engagement

Name	Description
Position in Agency	Federal employee's position in agency during ECAST project; positions at agency before and after ECAST project
Primacy of Technical Knowledge	References to how agency culture holds technical and scientific knowledge as prime to their mission success; public input and participation is secondary
Prizes and Challenges	Reference to how the Prizes and Challenges program at NASA helped promote ECAST project
Proving ECAST Method	References to how trust in ECAST's public engagement method needed to be built
Public Understanding of Science	References to how the public is framed as understanding scientific and technical information
Recommendations for Institutionalizing pTA	Federal personnel making recommendations on how to incorporate innovation into public engagement and/or pTA into agency decision architecture
RFI Evaluation Criteria	References to the official evaluation criteria NASA used for assessing RFI submissions
Setting the Public's pTA Expectations	References to how agency employees framed what members of the public should expect from participating in an engagement event
Social Imaginary of the Public	How federal employees describe and speak of the public
STS Training	Federal employee with academic training in STS or technology policy

APPENDIX B

Examples of Analytic Memos for Case Study of pTA in NASA's Asteroid Initiative

Cooperative Agreement

This analytic memo describes the formal working relationship between NASA and ECAST. Specifically, how the cooperative agreement structure influenced the design, planning, implementation, and reporting of the Citizen's Forum pTA exercises. NASA and ECAST did not enter into a conventional grant contract but instead into a cooperative agreement for the Citizen Forum project. A conventional grant contract is "financial assistance by the Federal Government that provides support or stimulation to accomplish a public purpose" wherein an agency funds a project and only the contractor plans and implements (OMB M-10-11). A "Cooperative Agreement" has the "additional criterion that the agency expects to have substantial involvement with the recipient in carrying out the activities contemplated in the agreement" (OMB M-10-11). Interviewee 6 described cooperative agreement as "one where both, both sides were contributing to conducting the activity."

The interview data demonstrates that the cooperative agreement structure of the working relationship between NASA and ECAST is central to explaining how it was possible to design and implement ECAST's pTA method. The data highlights at least three reasons:

1. It facilitated building trust in ECAST's method of public participation.
2. It facilitated designing, presenting, addressing concerns about, and reporting on the project in a manner sensitive to the agency's cultural and political dynamics.

These two were possible because the cooperative agreement structure allowed NASA employees to use their internal knowledge of the agency's cultural and political dynamics to navigate obstacles in ways ECAST would not have been able.

3. It facilitated cultural and political feasibility associated with the financial
   feasibility of the project.

Instrumental to Building Trust in ECAST's pTA

Having champions of public participation in technical decision-making (see
Analytic Memo 1) inside of NASA helped lend a kind of credibility to the project and
facilitated trust- building with agency leadership that would not have been possible by
ECAST alone. According to Interviewee 4:

> We deliberately chose to do this by way of a cooperative agreement. It was not a
>
> grant. That was really, that's a really important point because…it wouldn't have
>
> carried weight as much, you know, I don't think if, if it had been exclusively left
>
> to ECAST to do. I think that's a really important point, which is that the, it needed
>
> to be collaborative to be bought into and trusted, I think by, by NASA, you know,
>
> leadership.

A cooperative agreement structure was instrumental to building trust in ECAST's method
of public participation because it brought credibility to the project from internal
promoters. While ECAST had a strategy to build trust in and demonstrate the value of
their method of public engagement method (see *Analytic Memo 6*), ECAST lacked an
internal knowledge of the agency's culture, the kind of knowledge needed to address the
usual concerns NASA leadership and technical staff have about public participation (see
Analytic Memo 9 & 10).

Sensitivity to the Agency's Cultural and Political Dynamics

Formalizing the working relationship between ECAST and NASA as a
cooperative agreement allowed NASA employees to utilize their internal knowledge of

the agency (see *Analytic Memo 1*, section 3). This was especially useful in strategically designing, presenting, addressing concerns about, and reporting on the results of the project in a manner sensitive to the agency's cultural and political contexts. According to Interviewee 4, the cooperative agreement structure:

> gave us a, the ability to, I mean, quite honestly control it, you know, to, you know, to the degree that we feel like, and, and not, and I don't mean that in a like in a negative sense either, because I feel that we're also, I mean arguably we're more in touch with what our, you know, what's kind of politically permissible within the agency.

Interviewee 4 speaks to how the active involvement of internal NASA champions in the project allowed them to "control" certain aspects of the process in order to help it align with what is "politically permissible within the agency", thus increasing the likelihood of implementation. To put it a different way, Interviewee 4 stated that "we wanted to do this as a cooperative agreement because it was so relevant from a practitioner point of view." From the perspective of employees at NASA, as practitioners of government projects that sought new and innovative ways of engaging with the public, a cooperative agreement structure would enable them to steer the project in line with Obama-era open government policies (see *Analytic Memo 11*).

The above quote, however, also highlights a tension of the cooperative agreement structure. Arguably, ECAST's submission would not have been selected, nor would have the Citizens Forum project been implemented, if not for the internal champions positions in the agency and their knowledge of the agency's political and organizational culture (see *Analytic Memo 1*; also see *Analytic Memo 11* for further detail on the policy contexts

that made ECAST's submission politically feasible). At the same time, the power dynamic between NASA (a federal agency and the principal) and ECAST (a non-governmental organization and the agent) complicates the degree of collaboration that was possible in at least two related ways. First, the extent to which the NASA team pushed the project in directions that increased the feasibility of agency acceptance at the cost of restraining ECAST's participatory engagement method. Second, the extent to which the project was politically motivated (i.e. just for increasing public support for NASA or appeasing important political figures) versus a genuine attempt at public participation in NASA project design and decision-making.

ECAST interviewees spoke directly to their thoughts on these tensions. In terms of the first tension, Interviewee 3 shared their perspective on how the NASA team did not push any specific position or idea in order to increase the feasibility of the project in the agency. For example, part of the Citizen Forum was a section asking the public to vote between two engineering options for the Asteroid Redirect Mission (see *Analytic Memo 3 &13* for further detail on the Asteroid Redirect Mission and the Citizen Forum content, respectively). While people at NASA had their preferences about which option was better in terms of engineering, Interviewee 3 stated that when it came to the NASA team working on the Citizen Forum, "nobody seemed to be, um, 'I believe this is the right answer and we have to make sure that's the one that public comes to'. They seem to be okay with either direction, which also is an unusual situation." The NASA employees helping with designing the forum did not pressure to frame the two engineering options differently in order to favor one over the other, even if they had knowledge of who at NASA, especially leadership, preferred which option.

In terms of the second tensions, Interviewee 13 shared that, "through the whole entire process, I myself never felt that [NASA was] trying to throw an agenda down our throat that we would then, like, be parrots on their behalf to the public." A way in which the ECAST team substantiated this, as recounted by Interviewee 13, was to ask NASA if they had any preferences as to which cities should host the forums:

> I can recall during the, uh, call that Interviewee 11 was on where he asked NASA that, you know, if we were to have two or three of these locations depending on the budget set up for the public forum, did they have a particular, um, location? Did they have locations in mind that they wanted us to host these events at? And they thought for a little bit and they said, "no, not really". Um, and after or during the call at some point, I remember Interviewee 11 saying, "well, that's the right answer because if you told us it had to be here, has to be there, we wouldn't be able to do this project because then I know it's politically motivated"; they were just trying to get, like, the congressman or senator brought in…They were actually trying to sincerely get some feedback here from the public.

According to the members of the ECAST team, who collectively have decades of experience in the science and technology policy field, academically and in practice, they interpreted the NASA team's intentions and input into project design as sincere; not politically motivated or intent on turning the project into a public relations project.

A member of the NASA team with graduate training in STS spoke directly to this. Speaking for themselves, Interviewee 12 shared that they:

> did have some people after the fact say like, "oh, this seems like NASA, just putting the screws and trying to get some like generic thumbs up from the public".

> In everything that I did, I, I, I honestly don't care if NASA gets more public
>
> support or not. Um, like I genuinely, from my undergraduate work, like I think it's
>
> the right thing to do for us to embed public values in our decisions. So for
>
> whatever intent I had, it was, it was not this sort of stereotype of, trying to sort of
>
> grease the skids for public support.

On behalf of the NASA team on the Citizen's Forum project, Interviewee 12 went on to share:

> Um, I felt like we kind of stood back. We, we viewed the ECAST as the experts
>
> in making content accessible. Um, I, we didn't try to make them sort of say like,
>
> "Yay, the asteroid redirect mission is great". There was no way in which we were
>
> trying to do anything like that.

The NASA team's training in STS concepts of participatory technical decision-making in government, along with the ECAST team's expert sensitivity to federal agency's tendencies to use public engagement as a vehicle for increasing public support for NASA or appeasing important political figures tempered concerns of the project being detrimentally influenced by the power dynamic between the two organizations.

Cultural and Political Feasibility

The cooperative agreement structure helped increase the political feasibility of the pTA project by making it a small financial risk. According to Interviewee 1 [ECAST], the Asteroid Grand Challenge members of the NASA team provided $150,000 for the Citizen Forum project while ECAST, through Arizona State University, provided $50,000. This $200,000 budget, however, was just the cost of implementing the Citizens Forum at two sites, Phoenix and Boston. No one from the ECAST team was compensated

for their work; a payment-in-kind. Interviewee 1 went on to estimate that if the project had been done under a "normal scheme", or contract structure, the price tag would have been at least $500,000.

The lower cost to planning and implementation made the project what Interviewee 6 described as a "low dollar value gamble" in the eyes of NASA program managers and agency leadership. Interviewee 8 corroborated by sharing that "if the, the science or engineering program offices had a choice, they probably wouldn't fund it out of their own pockets", preferring that limited funds go to "instruments or a grad student or on somebody doing the technical work." The cooperative agreement structure allowed the Citizen Forum project to be a low financial risk, making it both financially feasible and more politically feasible for the agency.

NASA's Political Pressure Points

This analytic memo describes the political pressures NASA navigates in order to maintain alignment with its political stakeholders. The interview data sheds light on the political pressures that motivate the agency's concerns about public participation into their mission priorities, designs, and decision-making processes. Insight into how NASA navigates these political pressures is central to understanding the organizational contexts that inform the agency's relationship with public participation. This memo will touch on three points:

1. ECAST's member's opinions on NASA's political savvy.

2. Insight from NASA employees of the agency's political pressure points.

3. Observations from ECAST members of how they experienced the NASA team navigating these pressure points.

ECAST's Observations on NASA's Politics

ECAST researchers, experts in the field of science and technology policy, shared their observations about NASA's political savvy. When discussing NASA's successes in funding the international space station compared to the Department of Energy's lack of funding to complete the superconducting supercollider, Interviewee 11 noted:

> if you think about why one of those happened and why one of those did not, I think you have to come to the conclusion, quite frankly, that NASA does politics better than physicists do…. NASA has some perhaps slightly more sophisticated understanding of how to operate in a high stakes political environment.

Interviewee 11 explained that "the long-term high dollar value of individual projects means that NASA has to work on the stability of its political environment, um, very, very

well. And that requires both the, you know, direct contact with political decision makers and the bank shot to the public as well." For NASA to be able to continue funding its projects, it needs to be acutely aware of its relationships with the political decision makers controlling its budget and directives.

Insight from NASA Personnel of Political Pressure Points

In terms of political decision-makers controlling its budget and directives, interviews with NASA employees reveal that the agency has a culture of acute political sensitivity to its Congressional mandates and its White House directives. Interviewee 4 shared that "when NASA says stakeholders they are talking about a pretty narrow group of stakeholders. NASA is talking about the presidential administration and the Congress, political stakeholders." While NASA has democratic stakeholders in the American public and commercial stakeholders in its aerospace technology contractors, the agency has two political stakeholders: the political body that controls its budget and legislates its mandates (i.e., Congress) and, as a mission-driven agency, the office that directs its mission objectives (i.e., the Executive).

Interviewee 4 added that after nearly twenty years of being involved with NASA policy, the agency has a heightened awareness about its relationship with Congress and the White House. According to Interviewee 4, NASA is "paranoid about disrupting whatever balance it thinks, you know, the, the leadership thinks it has and agreements that it has with, um, um, the White House and the Congress." An example of the "paranoia" is when agency leadership is deciding what kinds of projects to undertake and how those projects are presented to the public and its political stakeholders. Interviewee 4 described an instance when a project appeared to be something different from what the

political stakeholders had sanctioned. They articulated the agency leadership's position as, "we couldn't possibly put that out there because we already knew what we were going to do because it was already politically blessed." Agency leadership is resistant to ideas and projects because they are sensitive to maintain clear alignment with projects and policies that have been "politically blessed" by Congress and the White House.

The ECAST submission for a pTA exercise was a kind of project that could disrupt the alignment with the "politically blessed" ideas from Congress and the White House. While *Analytic Memo 9* details the variety of concerns that members of the NASA project team articulated about public participation in the agency's policy- and decision-making processes, some of these concerns were about how public participation could deviate from what has already been "politically blessed" by its political stakeholders. Interviewee 6 articulated that "some people might see risks associated with asking the public what they think and then does that mean you have to do what they say? You know, from like a public perception standpoint." Interviewee 4 reiterated this concern as, "what if the public, you know, comes in and says, you know, we think we should do something 180 degrees different than what we've already got an agreement to do?"

According to Interviewee 4, however, these kinds of concerns about how public participation may disrupt the "politically blessed" agreements, "really comes from our comms and legislative folks more so than our senior leadership, I mean like the technical senior leadership." Interviewee 6 corroborated that this concern is "more of, like, a communications office fear usually like, you know, a hesitance maybe to talk about planning before a decision has been made." NASA's Office of Communications and the

Office of Legislative Affairs police the agency's projects and information dissemination in order to protect the "politically blessed" arrangements between NASA and its political stakeholders (see *Analytic Memo 4* for more detail on how NASA's Office of Communications controls the agency's messaging in order to maintain political alignment with Congress and the White House). This latter addition, a hesitance to talk about something before a decision has been made, is a dimension of controlling the agency's message in order to avoid speculation that NASA is entertaining ideas and pursuing projects that have not been "politically blessed" beforehand.

Observations from ECAST on NASA Personnel Navigating Political Pressures

While this hesitance was attributed to the Office of Communications, the ECAST members of the project shared their observations of how the NASA team on the project were also concerned about controlling the flow of information both inside NASA and externally to the public and the agency's political stakeholders. Interviewee 5 observed that during the planning stage of the project, the NASA team was:

> very concerned about the wrong kinds of information getting out. Very image conscious. So you know, everything had to be checked with, all right, is this, is this ah, is this question going to cause some kind of backlash outside of NASA? There, there, there was a lot of kind of, it almost seemed like paranoia that like if, if this information got into the wrong hands or people saw this kind of thing in the wrong way, that there could be some kind of public backlash against NASA.

Interviewee 5, an ECAST member, independently corroborates the "paranoia" description Interviewee 4, a NASA employee, articulated. The concern is that public backlash because of uncontrolled information could motivate Congress or the White

House to question NASA's policies, potentially putting into jeopardy the "politically blessed" agreements.

Additionally, Interviewee 5 also corroborated the concern regarding public participation in decision-making processes articulated by Interviewee 4 and 6. Interviewee 5 stated:

> there was also a lot of concern about, you know, they didn't want people to think that we were using this to make any kinds of decisions, right. So it had to be really clear that the information that was being used was not being used to some kind of final decision, right. It's not, it's not a, it's not, but that they didn't use it, but they didn't want people to go, oh, "this is replacing some kind of decision-making process."

This speaks to a concern that public participation in the agency's decision-making process could be seen by officials in the agency and the larger federal government as replacing the conventional process that is mostly aligned with the projects that are "politically blessed" by Congress and the White House.

This sensitivity to political perceptions extended into the reporting phase of the Citizen Forum project. Interviewee 5 also noticed that the NASA team:

> were very careful about that being publicized before they actually had a chance to see the results and see what the results said, right? I remember like when we were, when we were analyzing the results you know, we had to be very careful about who we were sharing this with. And we couldn't announce things until they said it was okay. And this, this was pretty late, right?... they were just carefully

managing the messaging on this and carefully managing when people learned about what we were doing.

The NASA team, sensitive to how the Office of Communications and the Office of Legislative works to maintain political alignment with Congress and the White House, were aware of the need to control when and how to publicize the results of the Citizen Forum. The ECAST-NASA final report took the additional precaution to disclaim that "any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Aeronautics and Space Administration or the institutions with which the authors are affiliated" [28]. And that

> opinions and analysis in this report reflect ECAST and the authors' opinions, and do not necessarily reflect the opinions of the National Aeronautics and Space Administration or the United States Government. ECAST also takes responsibility for the content of the background material here, which was created for deliberation and research purposes and not for establishing policy or technical briefings [28].

Not only do these disclaimers provide evidence for not wanting to disrupt "politically blessed" projects by distancing the agency from the analysis, opinions, findings, and conclusions or recommendations made in the report, but also provides evidence for the institutional hesitance to talk about something before a decision has been made for the same reasons.

Interviewee 5's observation of the NASA team's desire to control the information speaks to Interviewee 4's comment about controlling the project; it stems from wanting

to manage how information is presented so as not to disrupt political peace within and outside the agency. NASA, its leadership and as an agency, due to "the long-term high dollar value of individual projects" and its executive directives, has created a political culture keen on guarding its budgetary and project discretion interests. As such, it is sensitive to anything that may foster speculation on projects that do not align with what has been "politically blessed" by Congress and the White House. Adopting and implementing the Citizen Forum project involved navigating these political pressure points.