REINVENTING PARTICIPATORY TECHNOLOGY ASSESSMENT

CARBON DIOXIDE REMOVAL

SOLAR GEOENGINEERING

NUCLEAR WASTE

FUSION

A panel discussion with rising pTA practitioners and scholars

Nicholas Weller,
Amanda Borth,
Emily Hostetler,
& Jared Owens

Moderation by
Arthur Daemmrich

ASU DC CENTER

JAN 22 || 12-1:30 ET

CSPO

Agenda

12:10 PM | Welcome

12:15 PM | Introduction to pTA

12:20 PM | Panel Presentations

1:00 PM | Open Discussion

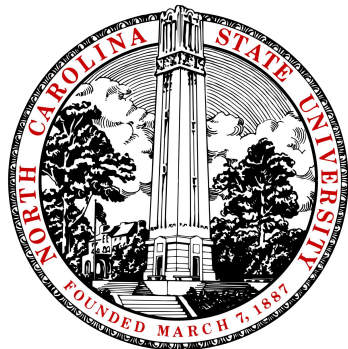1:30 PM | Wrap Up & Explore pTA Materials

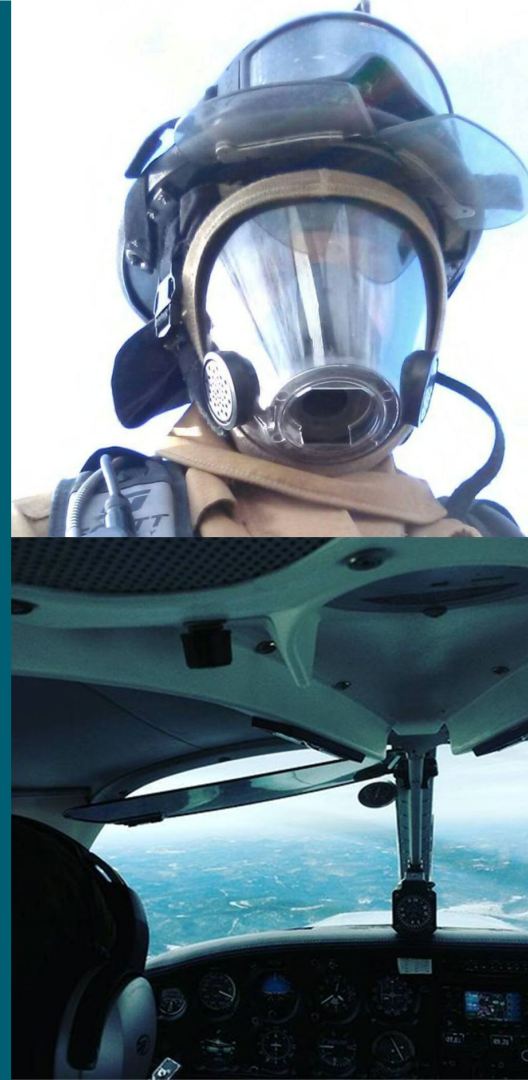# A Brief Introduction to Participatory Technology Assessment (pTA)

01/22/24
Jared Owens; ASU-CSPO; Communication & Engagement Coordinator

About me

pTA: The Big Picture

- **Participatory Technology Assessment (pTA) defined**

- **pTA normative propositions**

- **pTA characteristics**

PUBLICS

STAKEHOLDERS

COMMUNITIES/USERS

*A research, education, and decision-making tool designed to **assess public value**; **manage uncertainty**; & **fill democratic gaps***

pTA & ECAST

- *Participation + expertise*

- *Distributed + agile + collaborative*

- *Institutionally non-partisan*

- *Inviting and integrating diverse value perspectives*

- *Continuous innovation of concepts and practices*

- *Integrated into policy-making + wider societal deliberation + technological R&D*

CLIMATE & ENERGY
ASTEROID INITIATIVE
BIODIVERSITY
NUCLEAR WASTE
SOLAR GEOENGINEERING
DRIVERLESS CARS
GENE EDITING
COMMUNITY RESILIENCE

Experts & Stakeholders
People & Communities
Policy & Decision Makers
Scientists & Engineers

50 FORUMS 20 CITIES 3000 CITIZENS

The pTA Process

Framing & Design

Literature Review

Community Dialogues

Stakeholder Interviews

Design Workshop

Public Deliberations

Content & Protocol Dev.

Recruitment and Training
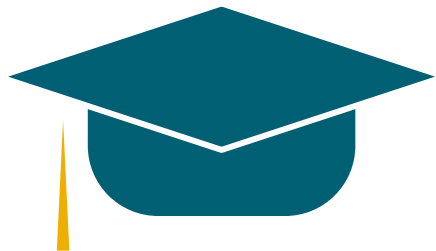
Citizen Deliberation Forums

Results & Integration

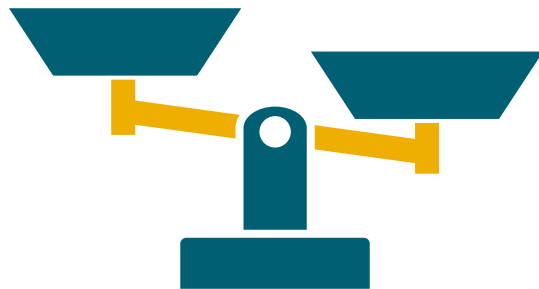Preliminary Results

Results Workshop

Reports and Briefings

Outcomes of pTA

Education	Decisions	Research

pTA Applications

UNCBD 2012:
Biodiversity Negotiations
Citizen Participation

NASA 2014-15:
Asteroid Defense
Public Assessment

NOAA 2015-18:
Community Resilience
Environmental Literacy

UNFCCC 2015:
Climate Negotiations
Citizen Participation

DOE 2016:
Nuclear Waste Siting
Consent Process Design

NIH 2019-22:
Human Gene Editing
Anticipatory Governance

In the Works: pTA Innovations

How do we ensure expert framing of socio-technological problems **includes public hopes and concerns?**

How do we design engagement on technological solutions that are both in **research and deployment phases?**

How do we **meaningfully integrate public values** into the design of large, socially embedded engineered systems?

How do we **work with communities** to drive engagement design?

How do we **scale** public participation research, education and decision-making from national to global scales?

What are your hopes & concerns for the future of pTA?

Write your hopes on a GREEN sticky note
Write your concerns on a PINK sticky note

Zoom participants, share your hopes and concerns in the chat

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Establishing a Sociotechnical Approach to Fusion Energy

In the Works: pTA Innovations

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ASU

About the project

- Joint project:
    - University of Wisconsin Madison
    - University of Michigan Ann Arbor
    - Arizona State University CSPO

- ***Ultimate goal:*** *To inform the development of a* **design framework that centers energy equity and environmental justice** *for the design of fusion energy systems that can be extended to other clean energy technologies.*
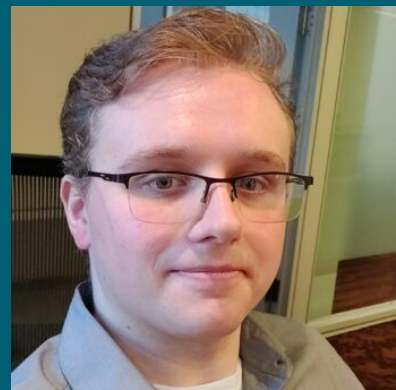
Stephanie Diem
UW-Madison

Aditi Verma
UMich

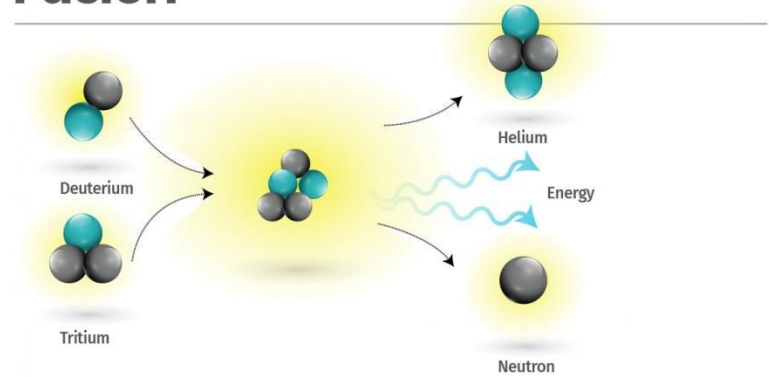**Mahmud Farooque**
*ASU-CSPO; SFIS*

Jared Owens
ASU-CSPO; SFIS

What is fusion?

- *Fusion* refers to a type of nuclear reaction in which **atomic nuclei combine (fuse)**.

- *Fission* refers to a type of nuclear reaction in which **atomic nuclei split**.

- Both fusion and fission release a significant amount of energy, but **there are *major* differences between them with practical implications for power production**.
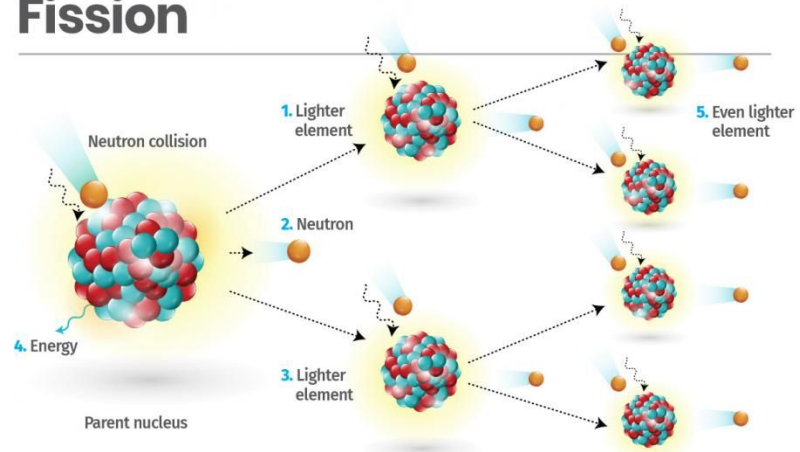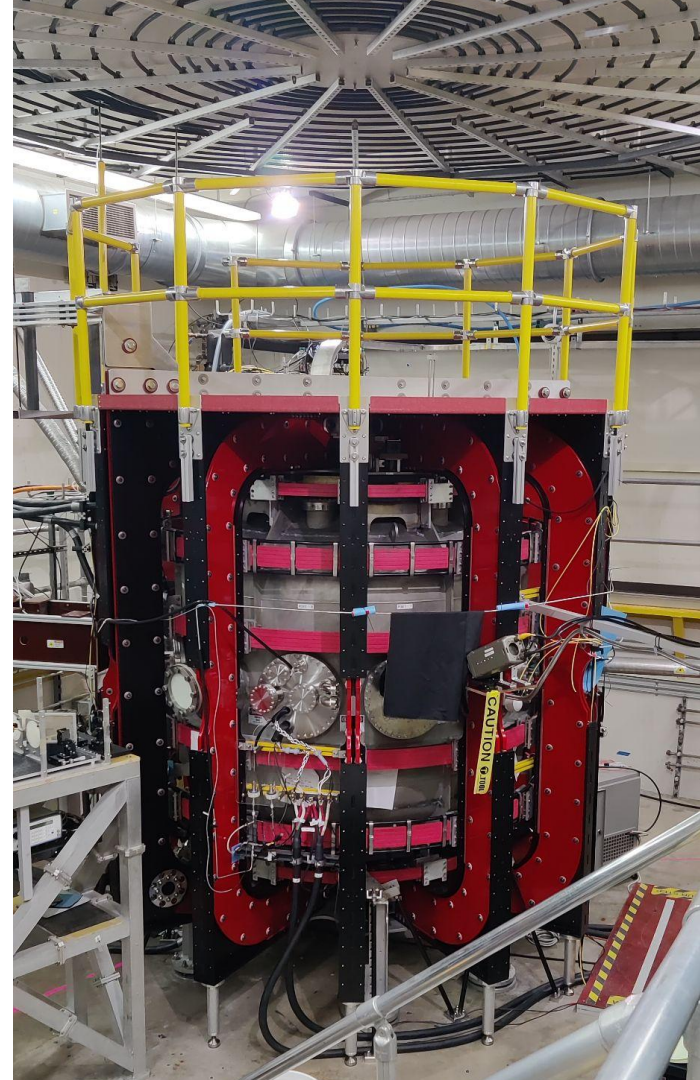
Why does fusion matter?

- Fusion reactions releases *several million* times more energy than hydrocarbon reactions with *no direct carbon emissions*.

- Other applications:
  - Spacecraft
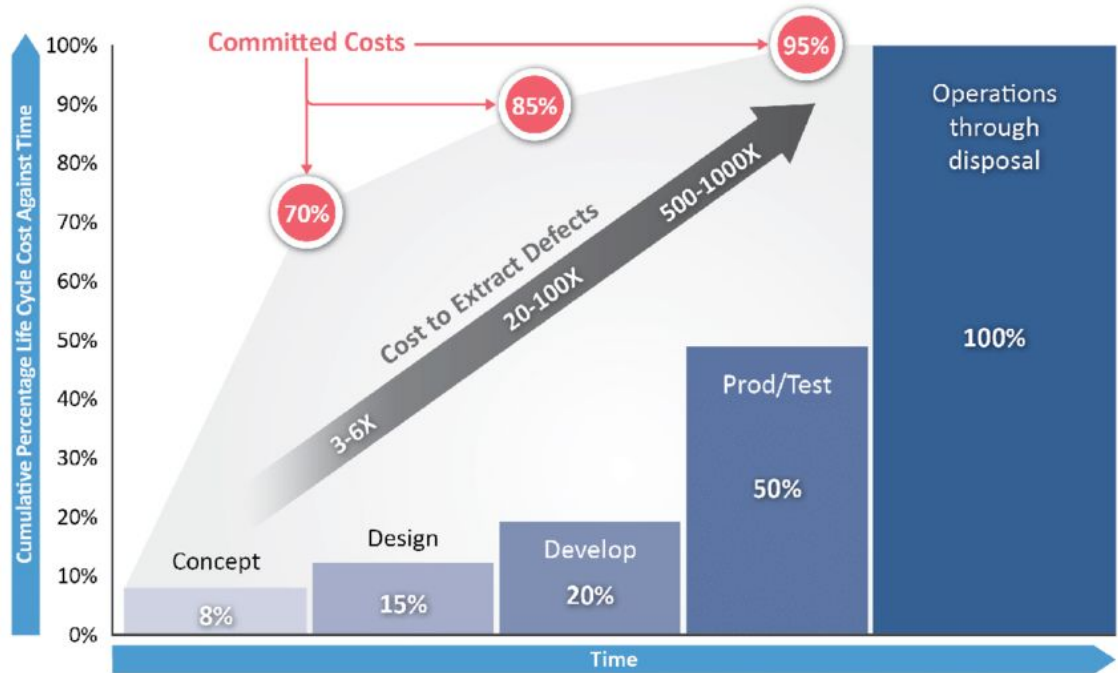 - Medicine
  - Chip manufacturing

Complex Challenges

- **Domains**
  - Engineering
  - Economic
  - Regulatory
  - Social

- **Crosscuts**
  - Complexity
  - High stakes
  - Uncertainty/risk
  - Competing values

*If social cooperation is required, **the way in which a system is implemented and introduced must be an integral part of its architecture** – The Art of System Architecting*

How do we **meaningfully integrate public values** into the design of large, socially embedded engineered systems?

- **pTA can be a powerful tool for:**
  - Developing knowledge for **design & codesign readiness.**
    - Public problem framing
    - Public values mapping
    - Public understanding of S&T
    - Engagement methods and materials testing

  - Complementing **codesign**
    - Methodological symbiosis
    - Process enhancement through policy and values specialization

Q&A
Clarifying questions

In the Works: pTA Innovations

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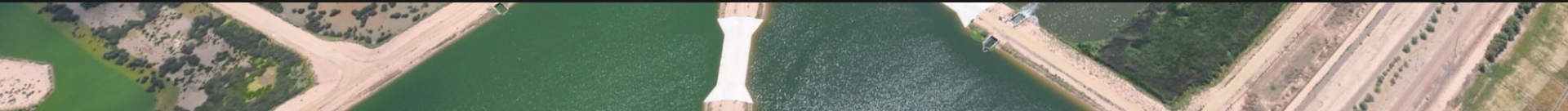
ASU

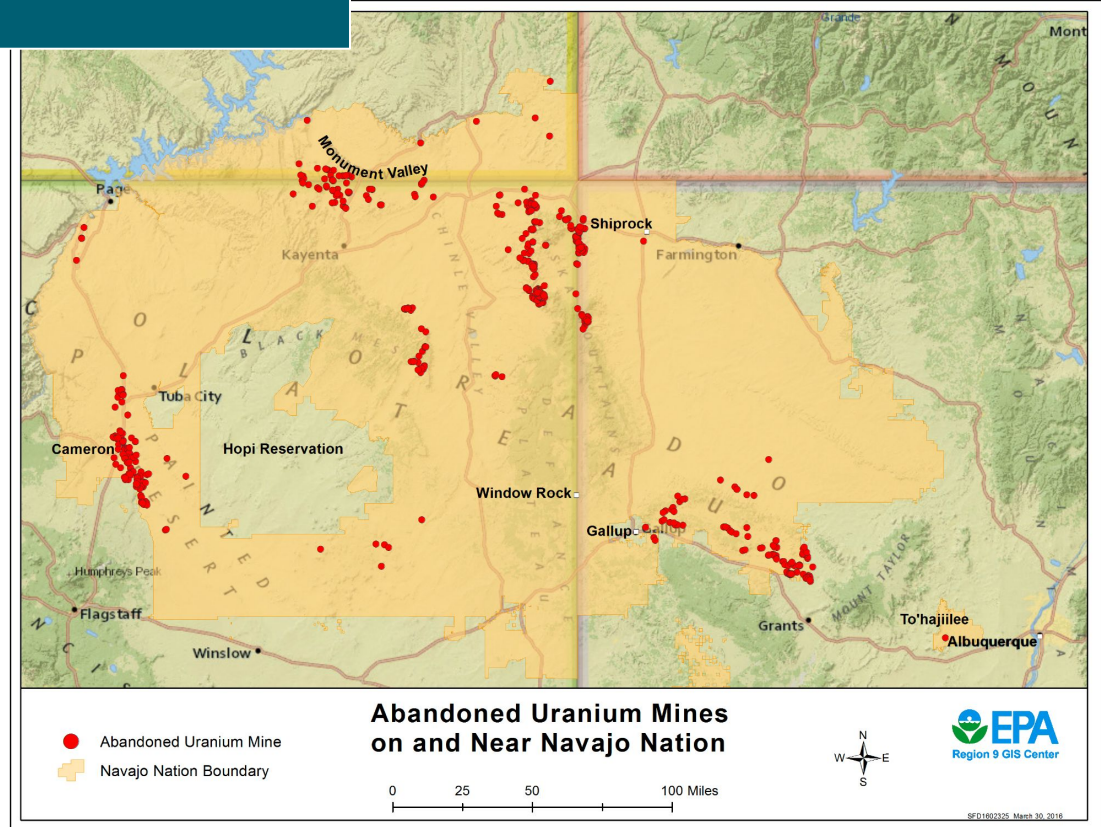# How can we co-create engagement with communities?
Nicholas Weller

How can we co-create engagement with communities?
Nicholas Weller

Nuclear waste

- Intergenerational/eternal
- History of nuclear injustices
- Fraught with technical, political uncertainty

Abandoned Uranium Mines on and Near Navajo Nation

Nuclear waste

- Intergenerational/ eternal
- History of nuclear injustices
- Fraught with technical, political uncertainty

Consent-based siting

- Deeply contested: What should count as consent?
- Intertwined with local, state, and national politics

CONSENT-BASED SITING ROADMAP

The U.S. Department of Energy is pursuing one or more federal consolidated interim storage facilities to **store the nation's commercial spent nuclear fuel** in the near-term using a **multi-stage consent-based approach** that puts communities' interests at the forefront.

U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

STAGE 1: PLANNING & CAPACITY BUILDING

Build relationships, mutual learning, and develop a common understanding of waste management-related topics.

STAGE 2: SITE SCREENING & ASSESSMENT

Issue initial criteria for suitable sites followed by a national call for volunteers, community-led development of additional criteria, preliminary and detailed assessments.

"Process to inform a process" Experiment to find workable, equitable approaches to community involvement

Consortium for Community Engagement, Innovation and Learning: We seek to develop, test, and experiment as a way of informing future consent-based siting processes

Community-driven framing

"Open" dialogue model through a variety of formats

- What are community priorities?
- How should your community make decisions?
- What about for nuclear waste?

The pTA Process

Framing & Design

Literature Review

Community Dialogues

Stakeholder Interviews

Design Workshop

Public Deliberations

Content & Protocol Dev.

Recruitment and Training

Citizen Deliberation Forums

Results & Integration
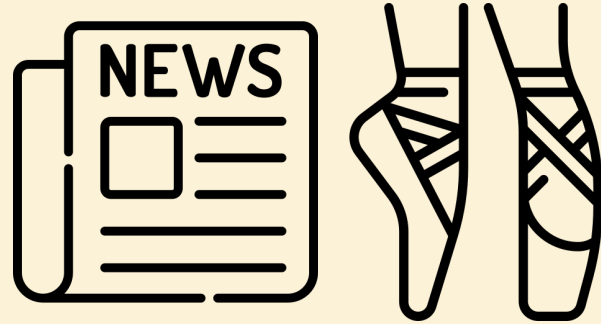
Preliminary Results

Results Workshop

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Emily Hostetler

Project Manager, pTA

1.2 High and Low Priority Reasons for Addressing the Issue of Nuclear Waste

Table # _____ Host site _____

Lowest Priority   Highest Priority

Extreme Precipitation

Today you will act as the resilience planning team for the city of Rivertown. Your team's task is to create a plan that protects Rivertown while considering the values of people who live there, the impacts on the economy and the effects on the environment of the city. Follow the steps below to create your plan, then implement and explore your plan using digital visualizations.

Step 1. Consider Stakeholder Perspectives

Place Stakeholder Cards Here

Step 2. Prioritize Stakeholder Values

KEEP IT OUT			SOAK IT UP			INFORM THE PUBLIC		
ECONOMIC ★☆			ECONOMIC ★★★★			ECONOMIC ★★★		
ENVIRONMENTAL ★★★★			ENVIRONMENTAL ★★★★★			ENVIRONMENTAL ⊘		
SOCIAL ★★★★			SOCIAL ★★★★☆			SOCIAL ★★★★★		
0	$	$$	0	$	$$	0	$	$$

Step 3. Make Your Resillience Plan

KEEP IT OUT		SOAK IT UP		INFORM THE PUBLIC	
Resilience Plan A		Resilience Plan A		Resilience Plan A	
$	$	$	$	$	$
Resilience Plan B		Resilience Plan B		Resilience Plan B	
$		$		$	

Step 4. Implement & Explore Your Resilience Plan

Place Resilience Plan Card Here

Museum of Science   NOAA   ASU Arizona State University   Northeastern University

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Develop your Solar Radiation Management (SRM) research plan

TABLE #

Research Direction
Place your **Research Direction** card(s) here

Explain your process

SRM Methods
Place your **SRM Method** card(s) here

Explain your process

Funder
Place your **Funder** card(s) here

Explain your process

Decision Making Plan
Place your **policy examples** below
- policy 1
- policy 2
- policy 3
- policy 4
- policy 5

Explain your process

Decision Maker
Place your **Decision Maker** card here

Explain your process

Explain your original plan

Explain your final plan

ASU Arizona State University   Museum of Science   Alfred P. Sloan Foundation

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In the Works: pTA Innovations

How do we ensure expert framing of socio-technological problems **includes public hopes and concerns?**

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ASU

Exploring Democratic Governance of Solar Geoengineering Research

Emily Hostetler, Project Manager, CSPO, Arizona State University

Museum of Science.

ALFRED P. SLOAN FOUNDATION

ASU Arizona State University

Project Overview

Cooling a Warming Planet? Public Forums on Climate Intervention Research

November 2019

Final Results Report

Can facilitated deliberation among groups of lay citizens inform geoengineering research?

How will the results of these deliberations influence scientists, funders, and other stakeholders to approach geoengineering research?

Develop your Solar Radiation Management (SRM) research plan

RESEARCH CONSIDERATION

Technological lock-in

Research on SRM methods could make their use more likely. The line between large-scale experimentation and actual deployment is blurry. Technological development tends to attract financial support, political constituencies, and physical infrastructure, so it could eventually command continued commitment to...

Moral hazard

SRM research may develop the capability to limit global temperature increases relatively quickly and inexpensively. But, SRM methods treat the symptoms of, not the causes, of climate change. The proposed SRM methods don't reduce emissions of greenhouse gases or remove them from the atmosphere. Some observers fear that SRM investment may remove incentives to or distract from efforts to reduce fossil fuel use and adapt to the changes climate change is already producing in the environment. Because of the complexity of human political choice, though, it is unclear how accurate such fears may be.

Monetary investment

Research costs money. In researcher and support staff salaries, space usage, materials, electricity and more. Research projects vary widely in scale, but larger ones can involve amounts of money well outside most persons' everyday experience. For example, The National Institutes of Health spent $37.3 billion on research in 2017.
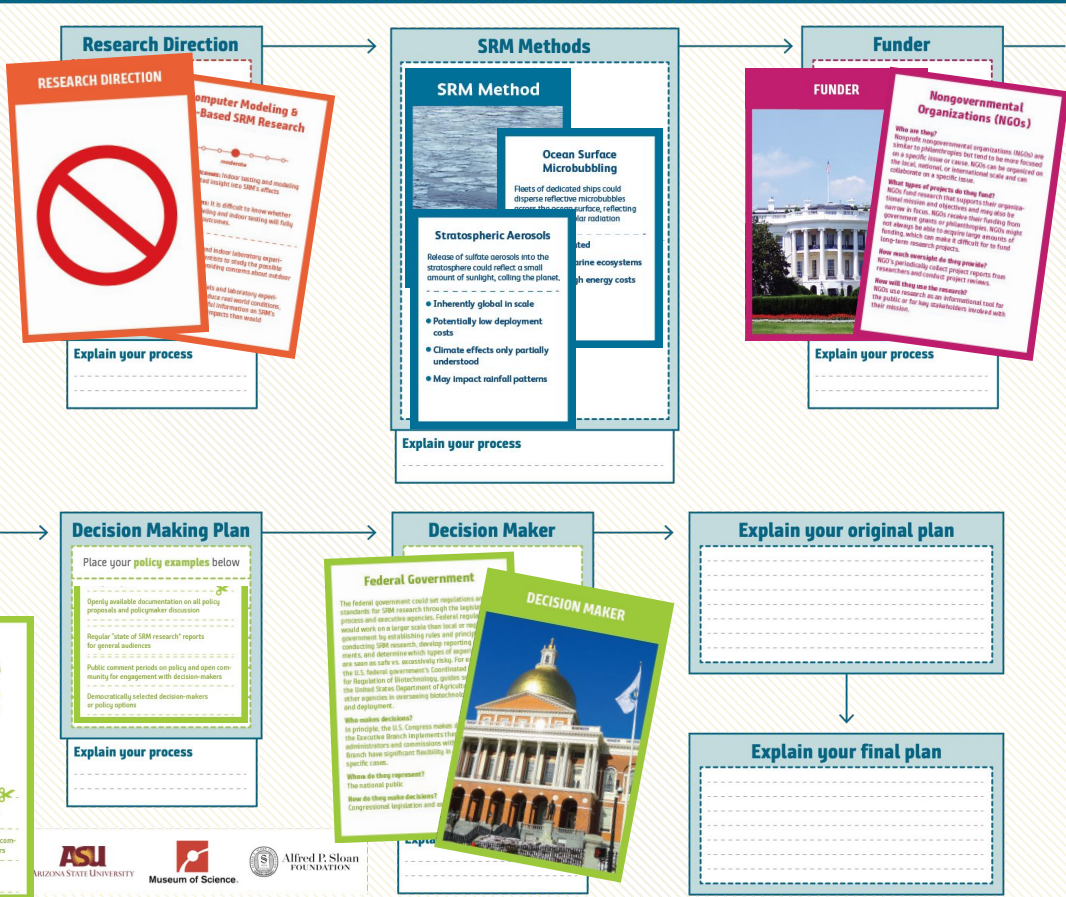
Research Direction

RESEARCH DIRECTION

Computer Modeling & Lab-Based SRM Research

Explain your process

SRM Methods

SRM Method

Ocean Surface Microbubbling

Fleets of dedicated ships could disperse reflective microbubbles across the ocean surface, reflecting solar radiation

Stratospheric Aerosols

Release of sulfate aerosols into the stratosphere could reflect a small amount of sunlight, cooling the planet.

- Inherently global in scale
- Potentially low deployment costs
- Climate effects only partially understood
- May impact rainfall patterns

Explain your process

Funder

FUNDER

Nongovernmental Organizations (NGOs)

Who are they?
Nonprofit nongovernmental organizations (NGOs) are similar to philanthropies but tend to be more focused on a specific issue or cause. NGOs can be organized on the local, national, or international scale and can collaborate on a specific issue.

What types of projects do they fund?
NGOs fund research that supports their organizational mission and objectives and may also be guided by the interests of their funding donors. NGOs receive their funding from government grants or philanthropies. NGOs might not always be able to acquire large amounts of funding, which can make it difficult for to fund long-term research projects.

How much oversight do they provide?
NGOs periodically collect project reports from researchers and conduct project reviews.

How will they use the research?
NGOs use research as an informational tool for the public or for key stakeholders involved with their mission.

Explain your process

Decision Making Plan

Place your **policy examples** below

- Openly available documentation on all policy proposals and policymaker discussion
- Regular "state of SRM research" reports for general audiences
- Public comment periods on policy and open community for engagement with decision-makers
- Democratically selected decision-makers or policy options

Explain your process

Decision Maker

Federal Government

The federal government could set regulations on SRM research through the legislative process and executive agencies. Federal regulation would work on a larger scale than local or regional government by establishing rules and principles conducting SRM research, develop reporting requirements, and determine which types of experiments are seen as safe vs. excessively risky. For example, the U.S. federal government's Coordinated Framework for Regulation of Biotechnology, guides which United States Department of Agriculture and other agencies in overseeing biotechnology and deployment.

Who makes decisions?
In principle, the U.S. Congress makes decisions through the Executive Branch implements them through administrators and commissions within it. The Executive Branch have significant flexibility in interpreting specific cases.

Where do they represent?
The national public.

How do they make decisions?
Congressional legislation and...

DECISION MAKER

Transparency

The public should be informed about what local, state, and federal policies and decisions are being made in a clear and accessible manner, so that researchers and communities understand where to strike the balance between transparency and other important values like privacy or intellectual property.

Having a transparent process can help the public be aware of the progress being made, and slow down the process in a way that interferes with commercial interests or public interests who make tough decisions...

Policy Examples:

Openly available documentation on all policy proposals and...

Regular "state of SRM research" reports for general...

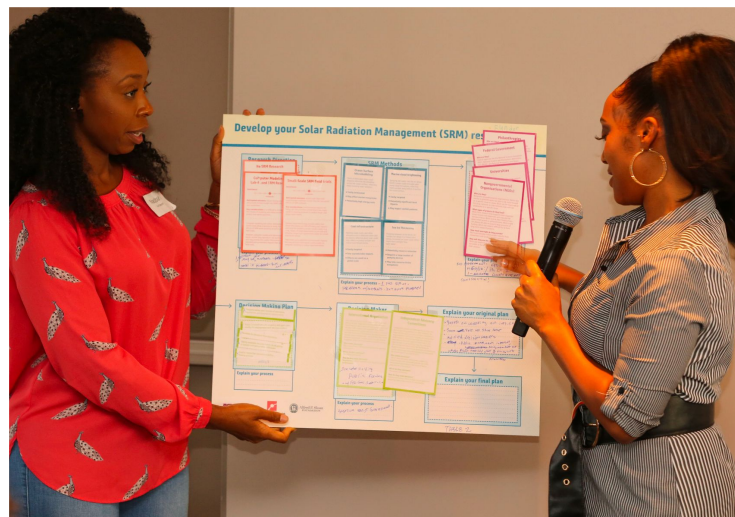Public relevant review approval, process...

Public Involvement

Public involvement in the policymaking process helps to ensure that the community's needs and values are considered throughout the process.

However, Public involvement in decision-making can be time- and resource-intensive. With so many different interests involved, it could mean that no decision is made due to too many conflicting opinions.

Policy Examples:

Public impact reports for proposed research

Public comment periods on policy and open community for engagement with decision-makers

Democratically selected decision-makers or policy options

Explain your original plan

Explain your final plan

ASU Arizona State University · Museum of Science · Alfred P. Sloan Foundation

TABLE # 5

Develop your Solar Radiation Management (SRM) research plan

Computer Modeling & Lab-Based SRM Research

Investment:

Expected outcomes: Indoor testing and modeling provide insight into joint efforts.

Limitations: It is difficult to know whether computer modeling and indoor testing will fully translate into the real-world.

Operational Effort

high

Operational-scale research aims in understanding the impacts of various...

SRM Methods

Cool Infrastructure

Painting roads, roofs, and other infrastructure in reflective colors and increasing reflective plant cover could help reflect incoming sunlight and reduce local temperatures.

- Easily targeted
- Few unpredictable impacts
- Effects are small on a global scale

Marine cloud brightening

Spraying tiny droplets of salt water into the air above Earth's ocean could stimulate additional cloud variations reflecting more sunlight away, before it reaches the ocean surface.

- Easily targeted
- Potentially significant impacts
- May impact rainfall

Place your **SRM Method**(s) here

Sea Ice Thickening

Pumping seawater to the Arctic ice surface can allow it to freeze more easily. Increased ice cover could reflect much more sunlight than open water.

- Potentially resource-intensive
- Requires a large number of pumping devices
- May help conserve Active ecosystems

Explain your process

Federal Government

Who are they?

What types of projects do they fund?

How much oversight do they provide?

How will they use the research?

Philanthropies

Universities

Who are they?

What types of projects do they fund?

How much oversight do they provide?

How will they use the research?

Explain your process

Decision Making Plan

Place your **policy examples** below

- Frequent review and revision of standards, regulations, and procedural requirements
- Regular "state of SRM research" reports for general audiences
- Openly available documentation on all policy proposals and policymaker discussion
- Explicit researcher presence in policy making process
- Anticipatory expert advice to decision-makers

Explain your process

Decision Makers

International Negotiation

Who makes decisions?

Whom do they represent?

How do they make decisions?

Local & Regional Government

Who makes decisions?

Whom do they represent?

How do they make decisions?

Independent Commission

Who makes decisions?

Whom do they represent?

How do they make decisions?

## Explain your original plan

Explain your final plan

ASU Arizona State University   Museum of Science   Alfred P. Sloan FOUNDATION

Innovation in Framing

- Public open framing exercises

- Challenged expert's framing to empower citizens

- Focused on upstream, research-based discussion

Figure 3.1.3: Group choices for research directions in Arizona, Massachusetts, and combined.
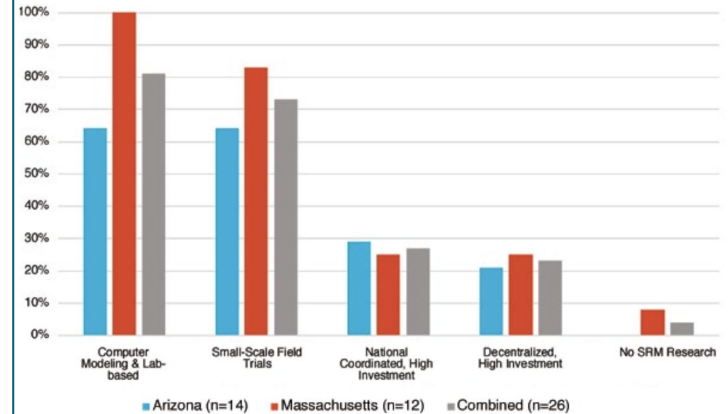
Q&A
Clarifying questions

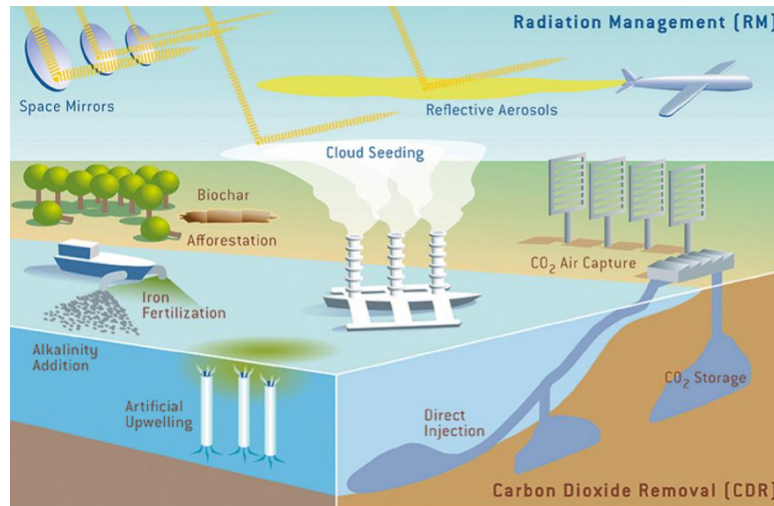**Climate Intervention Technologies (CIT)**

Adapting pTA in Response to CIT Governance Challenges

Amanda Borth, Associate Researcher, CSPO, Arizona State University

What are Climate Intervention Technologies?

What are Climate Intervention Technologies (CIT)?

Definition: A suite of large-scale **human interventions** into Earth's physical, chemical, or biological systems intended to **reduce the harmful effects of climate change** as a supplement to emissions abatement.

(Rita Erven/Kiel-Earth-Institute)

(American Meteorological Association, 2022; Harvard Solar Geoengineering Program, 2024; Institute for Carbon Removal Law & Policy, 2024; NOAA, 2021)

What are Climate Intervention Technologies (CIT)?

Decoupling CIT

(American Meteorological Association, 2022; Harvard Solar Geoengineering Program, 2024; Institute for Carbon Removal Law & Policy, 2024; NOAA, 2021)

What are Climate Intervention Technologies (CIT)?

Decoupling CIT

Solar Geoengineering: A set of emerging technologies that seek to **reflect a small fraction of sunlight back** into space or increase the amount of solar radiation that escapes back into space to cool the planet.
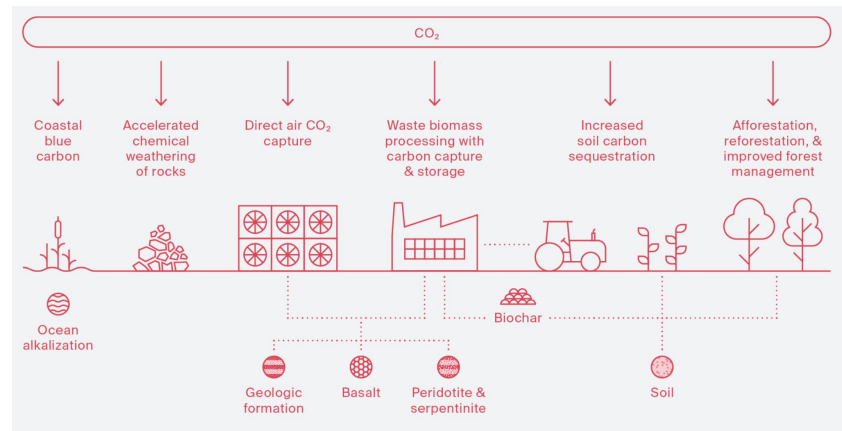
(American Meteorological Association, 2022; Harvard Solar Geoengineering Program, 2024; Institute for Carbon Removal Law & Policy, 2024; NOAA, 2021)

What are Climate Intervention Technologies (CIT)?

Decoupling CIT

Solar Geoengineering: A set of emerging technologies that seek to **reflect a small fraction of sunlight back** into space or increase the amount of solar radiation that escapes back into space to cool the planet.

Carbon Dioxide Removal (CDR): A suite of methods that draw carbon dioxide **out of the atmosphere** and store it **long-term** to help address climate change.

(Wilcox, Kolosz, & Freeman, 2021)

(American Meteorological Association, 2022; Harvard Solar Geoengineering Program, 2024; Institute for Carbon Removal Law & Policy, 2024; NOAA, 2021)

Amanda Borth, Associate Researcher

International Studies & Science Communication

School of International Service, American University

Smithsonian National Air and Space Museum

1

Amanda Borth, Associate Researcher

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School of International Service, American University

Smithsonian National Air and Space Museum

Science & Climate Change Communication

3

Department of Communication, George Mason University

Center for Climate Change Communication

Carbon Removal & Global Climate Governance

2

Institute for Carbon Removal Law & Policy

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Carbon Dioxide Removal pTA

Details & Innovations

Carbon Dioxide Removal pTA

Purpose: Determine **informed publics' perceptions** of CDR and the **implications** that their perceptions have for CDR **governance**.

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Carbon Dioxide Removal pTA

Purpose: Determine **informed publics' perceptions** of CDR and the **implications** that their perceptions have for CDR **governance**.

Innovation: Expanded open framing process by including **expert stakeholder interviews**.

PHASE I: Problem Framing

- Literature Reviews
  - Stakeholder Value Map
  - Governance Map
- Stakeholder Interviews
  - 15 Stakeholders
  - Forum Design Canvas
- Focus Groups
  - 2x15 Participants
  - Public Problem Framing
- Design Workshop
  - 20-30 Stakeholders
  - Expert Panel (6-8 experts)

Carbon Dioxide Removal pTA

Result: Task for forum development is to **close the gap** between public and stakeholder thinking through:

- Mutual information exchange.
- Governance innovations across project lifespan.
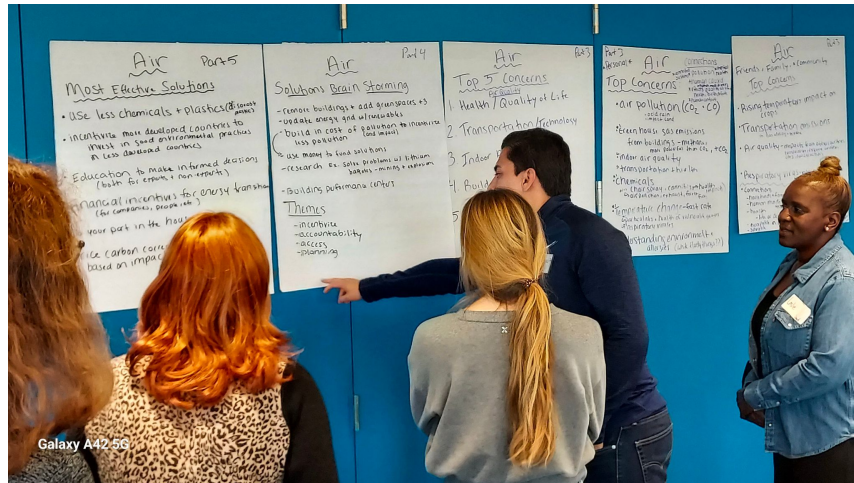
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Proposed Global Center on Participatory Governance of Climate Intervention Technologies

NSF Centers for Research and Innovation in Science, the Environment and Society (CRISES)

CIT Research Center Proposal

Purpose: Propose an international research center for participatory, inclusive, and responsible CIT governance.
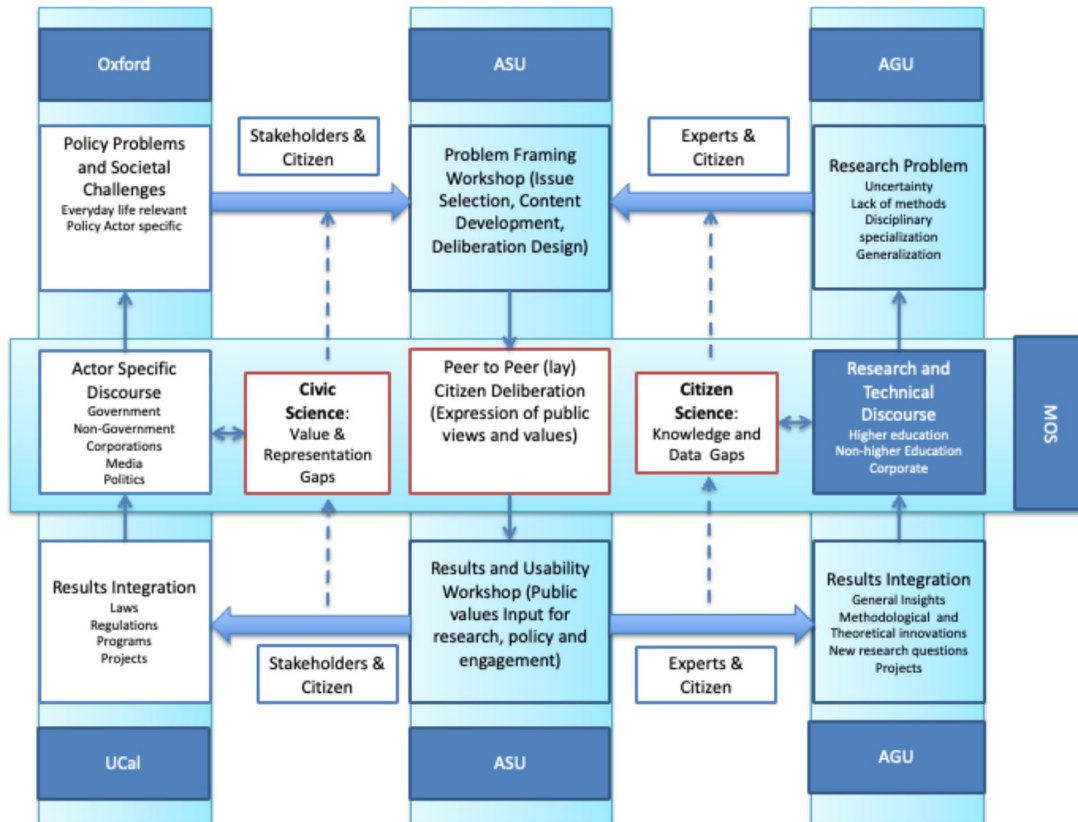
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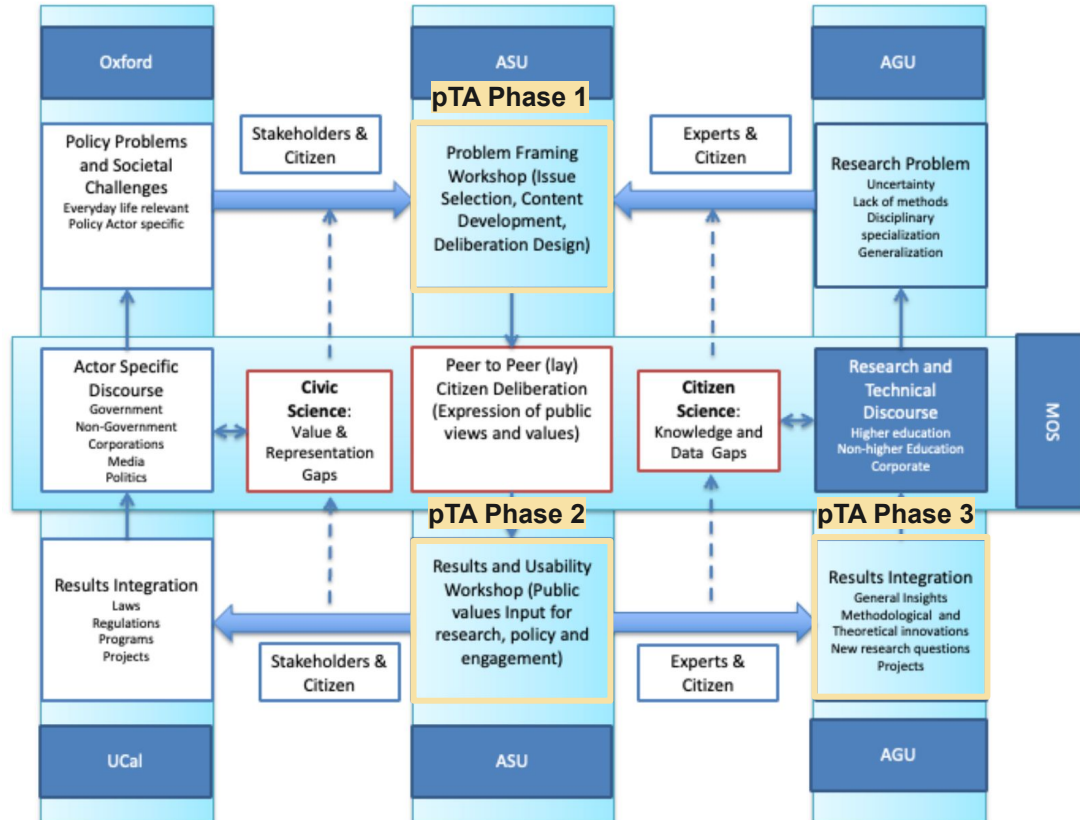
Scaling Up pTA:

- **Foster relationships** between 5 project partners
- **Integrate research and practice** across 5 focal areas
- **Coordinate efforts** with publics and stakeholders

Research Areas

- Foresight & Assessment
- Expert & Stakeholder Engagement
- Anticipatory & Polycentric Goverance
- Evidence-Based Decision & Policy Making
- Civic & Informal Education & Training

Research Center Conceptual Map

Research Center Conceptual Map

Q&A
Clarifying questions

What challenge would you want pTA to take on next?

At your tables, discuss this question and prepare to share out main points from your small group conversation to the large group.

ASU

5 MIN
remaining

3 MIN
remaining

Time's Up!

Select a table representative to share out for 1 min

Audience Q&A

Contacts

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Jared Owens: jared.c.owens@asu.edu

Nicolas Weller: naweller@asu.edu

Emily Hostetler: emily.hostetler.1@asu.edu

Amanda Borth: amanda.borth@asu.edu