SCIENCE PARTNERSHIPS ENABLING RAPID RESPONSE (SPERR)

Final Summary Report

June 2014 – July 2015

Lindley Mease, Center for Oceans Solutions
Theodora Gibbs, Stanford ChangeLabs

Please do not publish this document.

Table of Contents

Project Overview

Over the past year, our team tackled the complex, interdisciplinary challenge of scientific collaboration during large oil spills by generating innovative solutions that go beyond traditional problem-solving strategies. Our goals for this project were threefold:

1. Characterize and understand the obstacles to effective scientific collaboration during environmental crises such as large oil spills, as well as highlight successful instances of collaboration.
2. Design new tools, protocols, and practices—and amplify existing successful ones—that enable scientific exchange between government agency responders and non-governmental scientists from multiple relevant disciplines before and during crises.
3. Craft solutions that are applicable in other complex disaster response contexts beyond marine oil spills, including earthquakes, tsunamis, and public heath crises.

This report provides a brief, step-by-step guide to the insights we gathered, the products we created, and, ultimately, the outcome the project produced.

Why design?

Human-centered design is a problem-solving process focused on human needs and behaviors. Strategically integrated with systems analysis, it is uniquely suited to tackle complex problems and generate durable, impactful interventions for changing the status quo. Importantly, the design process is not a science, but rather an artful process of iteratively framing, understanding, and deconstructing human-system challenges.

The Project Process

1. Initial Problem Framing

At the beginning of a design project, the problem framing should be broad enough to allow you to discover areas of unexpected value. The scope will be revised and tightened after the design ethnography stage.

Target criteria, which we used to evaluate our process throughout:

1) Impact (shifting this leverage point will create significant positive results across the 4 desired outcomes
2) Feasibility (the solution can be effectively shifted within 1-5 years with existing resources and minimal funding)
3) Scalability (the solution applies to other disaster response situations)

2. Design Ethnography

We conducted in-depth ethnography on over 100 key system stakeholders, which included academic scientists, government agency staff, elected officials, industry representatives, and stakeholders from non-governmental organizations (NGOs). A list of these stakeholders is in the Appendix. From these interviews we captured compelling insights, the interviewee's framing of the problem, the primary responsibilities of the interviewee, resources they control, level of agency in decision-making, their relationship with other system stakeholders, key underlying emotions communicated, their role in the system, and potential solutions they envisioned for tackling our project challenge. From these data, we created persona profiles for each of our primary stakeholders (academic local to the disaster site, academic not local to disaster site, U.S. Coast Guard decisionmaker, National Oceanic & Atmospheric Administration (NOAA) scientific-support coordinator). These profiles included the stakeholders' motivations and goals, intrinsic and extrinsic barriers to their agency, and their dominant perceptions of other primary stakeholders. These profiles served as fictitious representations of our stakeholders to ground our analysis in their basic needs, motivations, and behaviors. Persona profiles can be found in the Appendix.

3. Synthesis & Refinement of Problem Framing

The goal of the synthesis was to distill our key findings to guide solution generation. We kicked off this phase by hosting a Concept Generation Workshop in September 2014, during which we refined our problem framing, target outcomes, and key criteria for our project solution (Appendix).

Following our in-person workshop in Washington, D.C., and from the problem framings articulated by our interviewees, we constructed a root cause map. Root cause analysis investigates and links observable phenomena to their underlying drivers. By addressing root causes, the cascade of resulting effects is mitigated, compounding the positive impact of the solution. Our root cause map can be found in the Appendix.

Following root cause analysis, the team identified the leverage points within the system of oil spill preparation and response, and associated non-governmental science. Leverage points are places within a complex system where a small change in one component will produce a large change across the system (Meadows, 1999). Key leverage points for our project challenge can be found in the Appendix.

3. Idea generation

Building from the insights we extracted from our ethnography, we generated over 100 ideas for tackling our problem statement: How might we enable greater collaboration before, during, and after large, environmental crises? We used root causes and leverage points as our springboards for ideating new solutions. The list of all ideas generated by the group can be found in the Appendix.

We then filtered our ideas based on the following criteria:

1. Impact: This solution will create significant positive results across the 4 desired outcomes.
2. Feasibility: This solution can be effectively implemented within 1-5 years with existing resources and minimal funding.
3. Scalability: This solution will create change across hazard types, geographies, and stakeholder groups.

4. Prototyping

We produced prototypes for ten of our project ideas that were identified by our Core Advisory Team as most impactful, feasible, and scalable. Prototyping is valuable for testing specific hypotheses about the value that a proposed solution is designed to create. Prototypes allow us to incorporate user feedback quickly, iteratively, and cheaply. It also identifies ideas that are not effectively grounded in the human needs or system realities we are attempting to resolve. Importantly, low-resolution prototypes often start conversations among stakeholders and end users that uncover additional key insights and help inform improved solutions.

We prototyped our ten ideas through a dozen one-on-one sessions and in one 36-person workshop at the Gulf Science Conference in Houston, TX. Academics, federal government employees (NOAA, U.S. Coast Guard, Environmental Protection Agency), and industry representatives attended. The prototypes were scenario-based and walked users through an experience flow of how their role in the crisis decision-making system and their own behaviors may shift if the solution's target value was realized. These sessions revealed the relative strengths and weaknesses of our solution ideas and helped us identify where differences in perspectives could be resolved to strengthen the prototypes. Ultimately, the solution that users articulated would be the most impactful, feasible, and scalable was the Science Action Network. A sample prototype of the Network can be found in the Appendix.

5. Testing & Refinement

The last phase of our project was testing our final project solution with key system stakeholders and scoping our strategy and target outcomes for a pilot. During a two-day in-person workshop in March 2015, we convened our Core Advisory Team members, Implementation Team members, and other key stakeholders to explore the idea of the Science Action Network and increase its robustness, and identify success milestones for its implementation. Following that convening, we refined the Network's structure and value proposition, and solicited feedback from over 30 other key government decisionmakers, academic leaders, and interagency planning and response bodies. A full list of the stakeholders engaged and public presentations made to federal agencies can be found in the Appendix. The extensive feedback we received helped us to craft the proposed structure for a pilot of the Science Action Network. The overall objectives of the 16-month pilot are to 1) demonstrate that tangible value can be created by the Science Action Network for the preparation and response to incidents in three hazard types (oil spills, hurricanes, and severe winter storms), and 2) refine the Network structure and mechanisms to ensure that it is relevant to, and scalable across, a diverse set of hazard types (i.e., public health crises, earthquakes) A brief of the pilot can be found in the Appendix.

<u>Conclusion</u>

Our process over the last 14 months has exposed deeply entrenched narratives, strong emotions, challenging political and social sensitivities, and innovative visions of a better system for crisis decision-making. We are indebted to hundreds of individuals for sharing their experiences, willingness to participate in novel exercises that pushed them outside their comfort zones, and generously contributing their social capital to our project. We believe our project—in addition to crafting a solution uniquely powerful in addressing the challenge of scientific collaboration during large crises—was successful in generating provocative dialogue, new insights, and lasting partnerships that will have positive and durable impact on our target outcomes.

User Guide to the SPERR Project Key Products

The table below, and associated appendix of products, aims to provide straightforward guidance to current and future practitioners working to address the challenge of rapid scientific collaboration before and during disaster response. Whether you are a member of the Science Action Network implementation team, or a stakeholder seeking to build new solutions to the challenge, this guide will help you understand how to use the knowledge and recommendations that the SPERR team has produced.

Product 1: Solution Directives & Executive Design Brief
What It Is: **If you read any part of the report, read the Executive Design Brief.** After conducting multiple rounds of prototyping and reflecting on our insights from ethnography, we distilled down the guiding criteria that we heard were most critical to consider when designing a solution to this collaboration challenge. The Science Action Network was then crafted out of these directives. *How to Use:* This is a guiding compass document. The implementation team should refer to this document as they are crafting the detailed mechanisms and structure of the Network. Other practitioners are seeking to generate other solutions (aside from the Network) should refer to this document in order to generate and evaluate their ideas. This is a distillation of what we view as the insights most critical to success or failure of an idea in this problem space.
Product 2: Science Action Network Brief & Proposed Pilot Structure
What It Is: This is the distilled summary brief of the resulting solution ideas of the SPERR project—the Science Action Network—and the proposed metrics for success for the Network during a 16-month pilot. *How to Use:* The implementation team will directly refer to this document as they move forward with solidifying and launching the pilot, and designing a monitoring and progress evaluation system for it.
Product 3: System Leverage Points & Root Cause Map
What They Are: Root cause analysis enables us to diagram the relationships between observed phenomena and their often so-not-obvious underlying drivers. Mapping the relationships helps ensure that we, as solution designers, target fundamental issues in our problem framing, rather than superficial ones. Leverage points are places within a complex system where a small shift will lead to a dramatic change towards desired outcomes (Meadows 1999). From a solution-seeker's perspective, leverage points are

CENTER FOR OCEAN SOLUTIONS

CHANGE LABS.

strategically advantageous to focus investment on in order to achieve disproportionately large impact. In our case, these are points in the system of oil spill preparation and response, and associated non-governmental science, where our project will lead to a large shift towards scientific collaboration and improved crisis planning and response.

How to Use:
Root Cause Map—We recommend referring to the root cause map in order to:
- Reflect with your team and stakeholders on whether the solution activities are really addressing fundamental, underlying issues of the challenge.
- Identify long-term metrics for success for the Science Action Network or other solutions, based on whether root issues have shifted.

Leverage Points—These are useful tools to:
- Periodically examine your theory of change and maintain a strong resource investment focus on the issues that are most critical to change.
- If your current approach is not working, you can generate new solution ideas based on specific leverage points. See the appendix for examples of this.

Product 4: Persona Profiles

What They Are:
We crafted persona profiles for each of our primary stakeholder types to serve as representations of our target 'end users' of our final project solution. They are based on real quotes, information, and insights from qualitative interviews. The personas are a synthesis tool to clearly articulate dominant and recurring stakeholder motivations and goals, intrinsic and extrinsic barriers to action, and dominant perceptions of other primary stakeholders. These profiles served to ground our analysis in stakeholders' basic needs, motivations, and behaviors, and helped guide our concept generation process, and the potential value that a given solution idea could create.

How to Use:
These personas will be valuable reference documents as the Science Action Network evolves. They will help implementers reflect on whether the Network and its components respond to real stakeholder needs, goals, and constraints. We recommend that the pilot implementation team actively use them as reflection tools at multiple points during the 16-month pilot. Specifically, they are useful to reflect on questions like:
- Does our solution (or specific aspect of the solution) align with stakeholder needs? Will it produce value that they deeply care about?
- What constraints or barriers does the stakeholder have that might hinder them from engaging in our solution?

Product 5: Low-resolution Solution Prototypes

What They Are:

In design, prototyping is a way to quickly test out the human desirability and technical viability of a product or service by building a cheap version of your solution idea and giving it to users to give rapid feedback on. Showing is better than telling—when users have a tangible thing to interact with, they can give more useful feedback than if an idea is explained abstractly to them. Prototyping allows a team to incorporate feedback quickly and to "fail early, fail cheaply" so that they don't invest a lot of resources into something that won't work. For the SPERR project, we built several prototypes of what the solution experience might look and feel like for stakeholders, so that they could give direct feedback.

How to Use:

- When refining the Science Action Network, the implementation team can refer to the solution ideas and low-resolution prototypes for inspiration for new or different elements to the Network that will appeal to the stakeholders
- As the Science Action Network goes into a pilot phase, there are still many details or sub-components of the Network experience that will need to be prototyped. The experiential prototype workbook of the Academic Response Network—an early version of the Science Action Network—is useful reference material to get ideas on how to prototype complex experiences in meaningful ways with stakeholders to get feedback (example in Appendix).

Product 6: Categorized Network of Champions, Endorsers, Gatekeepers, and Diffusion Agents for the Science Action Network

What It Is:

Over the course of the Science Partnerships Enabling Rapid Response (SPERR) project, we have formed a web of key supporters, influencers, and champions for our project solution: the Science Action Network. This list of stakeholders captures the nature of their relationship with the SPERR team members and the prospective roles these stakeholders may be able to play in the Network pilot.

How to Use:

Implementers of the Network pilot (and beyond) are encouraged to draw upon this list in order to increase the reach, visibility, and impact of the Network, and increase the likelihood of success of the pilot.

APPENDIX OF PRODUCTS

Product 1: Solution Directives & Executive Design Brief

Problem Statement

Natural and human-caused disasters are an inevitable part of our country's future, particularly in light of increasingly extreme resource extraction methods and climate variation due to human activities. We are missing critical opportunities to put science into action to improve disaster response and recovery outcomes in the United States. We are also missing the opportunity to strategically use disasters (which are inevitable) as tools and testing grounds for scientific advancement. There is a dual opportunity present for government disaster responders and the academic science community that is not being realized. Why?

Through extensive interviews conducted from February-July 2015, we identified several underlying dynamics. There is a profound gap between how academic scientists perceive the challenge (and missed opportunity), and how government agency crisis planners and responders do. The two groups have dramatically different reward systems and priorities, which deepen the cultural divide between them and weakens the willingness to engage productively. Entrenched perceptions of the other and a lack of trust limits collaboration and relationship-building.

We also found that extrinsic forces, such as limited funding for rapid, opportunistic science during crises; legal liability around governmental data transparency or academic contracting; and time constraints inherent to any crisis response, amplify cultural conflicts and hinder the ability of stakeholders to collaborate.

There is a small community of academics who have long-standing relationships with responders, but many academics do not have those relationships and do not know how to develop them. Existing solutions to bridge science into response, such as the NOAA Scientific Support Coordinators, are great for linking in the small community of "response-minded" scientists who already have relationships with response agencies. There are very few formalized ways, however, for a previously unconnected nongovernmental scientist to contribute ideas or expertise in a way that responders can rapidly assess, react to, and act upon. In particular, high-value potential collaboration could be occurring during incident planning and preparedness exercises but currently is not.

Opportunity Statement

The genesis of our exploration of this scientific collaboration challenge was in the oil spill world—specifically the Deepwater Horizon oil spill that occurred in 2010—but we found similar gaps and needs in other disaster contexts as well. Thus, powerful solutions may be transferable across hazards, whether they take the form of hurricanes, floods, or oil spills.

Tackling this cross-hazards challenge gives us the important opportunities to:

1) Link and share crisis-relevant science across hazard types and across geographies, sustaining research partnerships by broadening the applicability and transferability of previously siloed scientific programs.
2) Leverage the breadth and depth of academic, scientific expertise in the United States to more strategically inform crisis decisionmaking.
3) Enable more efficient and effective identification and investigation of socially and environmentally-relevant scientific unknowns.

There is growing momentum around this challenge and recognition of its importance, both from government offices and from academic institutions. At the executive level, the preparedness directive (PDD-8) issued by President Obama in 2011, continues to drive the focus of the Department of Homeland Security towards improving national preparedness to natural and human-caused disasters. Many large foundations such as Rockefeller are launching programs focusing on managing risk and improving resilience to natural disasters. In academia, events like the Natural Hazards Conference at UC Boulder are seeing their biggest attendance in 40 years.

Challenge Statement

Based on our exploration of this challenge and profound opportunity, we outline several design specifications and criteria for success that any solution-seekers must take into account.

An effective solution must:

- Build trust between academia and the response community, most critically before a crisis hits.
- Map to the existing motivations and priorities both academic scientists and government responders.
- Create genuine and tangible value on relevant time scales for individual users of this solution. For a responder, that might be 2 hours; for an academic, that might be 2 years. The solution must accommodate both.
- Account for the cross-hazards relevance of this challenge (and thus be able to scale across hazard types).
- Be consistently active in order to foster the relationships necessary to rapidly identify, investigate, and communicate about unknown unknowns that emerge during drills and planning exercises, and those unforeseeable ones that occasionally arise during a response.
- Decrease—not add to—the effort (time and money) needed on the part of responders to engage with non-governmental scientists during a response operation.

Ultimately, a solution must drive towards and achieve the following outcomes:

1) The environmental and human impacts of oil spills and other natural or human-caused disasters are quantifiably mitigated through improved prevention, preparation, response, and/or restoration;
2) Response efforts in future large oil spills and other disasters achieve their harm reduction goals in a cost-efficient manner; and

3) Increased scientific understanding of environmental and human health improves long-term ecosystem management.

Product 2: Science Action Network: Vision and Strategy for Pilot Implementation (and Beyond)

Vision and Theory of Change

The Problem

- Academic scientists and government agency crisis planners and responders have differing reward systems and priorities, which deepen the cultural divide that impedes collaboration.
- Extrinsic forces, such as funding, legal frameworks, and limited time, amplify cultural conflicts and/or hinder the ability of stakeholders to collaborate.
- Stakeholders have entrenched perceptions of their role in informing crisis decisionmaking and a lack of trust of other stakeholder groups, limiting collaboration and relationship-building.

The Opportunity

- Link and share crisis-relevant science across hazard types and across geographies, sustaining research partnerships by broadening the applicability and transferability of previously siloed scientific programs.
- Leverage the breadth and depth of academic, scientific expertise in the United States to more strategically inform crisis decisionmaking.
- Enable more efficient and effective identification and investigation of scientific unknowns

Science Action Network Goals

- Bridge cultural gaps between response agencies, industry, and academic scientists, and create new norms for scientific collaboration;
- Drive disaster-relevant and interdisciplinary scientific research through novel academic-agency partnerships and funding opportunities; and
- Catalyze cross-disaster and cross-institutional scientific exchange.

The Science Action Network will enable cross-disaster preparedness and science-based decision-making through novel academic-agency partnerships, resource sharing, and coordination and delivery of scientific research in a way that is most relevant and useful to disaster responders. The network will consist of 13 Regional Academic Hubs, each associated with a Regional Response Team (RRT). Through the Hubs, non-governmental scientists from academic institutions, professional societies, and scientific NGOs can develop and seek funding for disaster-relevant collaborative research initiatives. During a disaster response effort, government agencies can access Hub members' scientific expertise in a rapid, streamlined manner. A leadership council comprised of representatives from federal response agencies, relevant industry and NGO stakeholders, and academic institutions, will guide the Network. The power of the Network, however, lies in its regionally-based, decentralized structure, which will enable dynamic action.

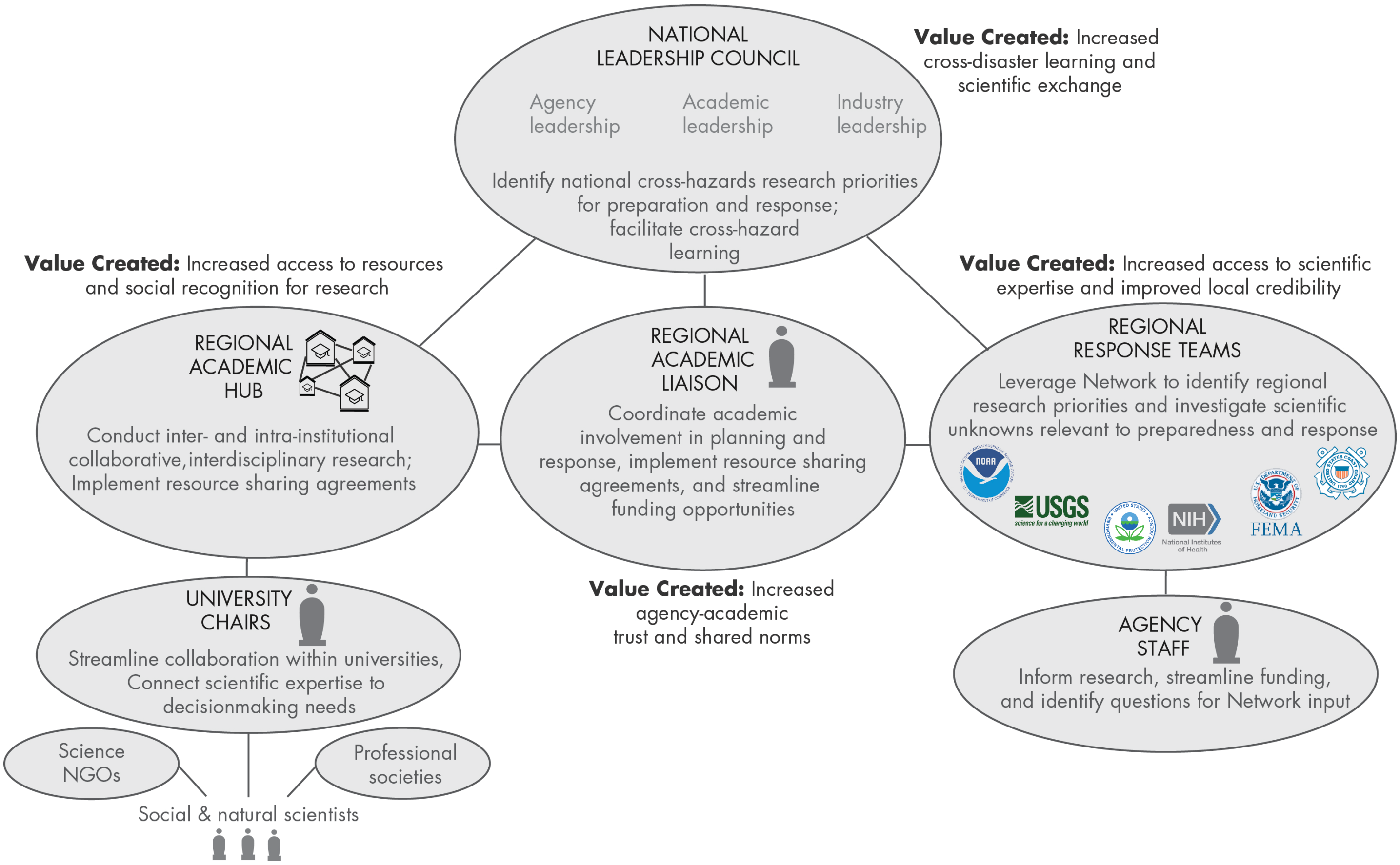
By catalyzing greater collaboration between government responders and the broader scientific community before environmental crises, the Science Action Network enhances the integration of science and scientific expertise into hazard preparedness and response.

<ins>The Unique Value of a Network</ins>

1) The Network sustains participation through novel cross-hazard learning and exchange. Professional relationships are like muscles—they are strengthened by frequent use. Since large disasters such as Deepwater Horizon happen relatively rarely, academic interest in disaster-relevant science wanes between incidents, weakening academics' ties with the response community. The Network is flexed to prepare and respond to multiple types of disasters: thus members will be engaged more frequently and across more disciplines. A cross-hazards approach will also spark innovative research collaborations to explore previously unseen shared challenges and science needs across disaster types.

1) The Network produces compelling value for diverse stakeholders. Differences in the goals and incentives of academics, responders, and industry are a major hindrance to effective collaboration. The Science Action Network strives to create mutual value between these key stakeholders through collaborative resource sharing and joint access to information (the solution map below illustrates this value creation). New or enhanced incentives for academic involvement in agency decision-making through the Network will lead to a broader diversity of disciplinary and geographic expertise in planning and response. Trainings offered to Network members around preparedness and response research needs and processes will increase the usability and applicability of Network research outputs, and enhance the cultural competency of both agency staff and academics to communicate and collaborate between and during crisis situations.

3) The Network leverages and amplifies existing resources and competencies. There are currently no broad-reaching, cross-sector, formalized solutions for enabling rapid scientific collaboration between non-governmental scientists before and during crises. The Network builds on the success of programs such as the National Science Foundation (NSF) RAPID grants, utilized during the Deepwater Horizon incident, and the Department of the Interior's Strategic Sciences Group, which quickly creates nimble scientific advisory teams as needed during disaster response efforts. Many existing solutions are informal and customized to one institution, geography, or hazard type. The Science Action Network fills a critical gap not addressed by existing strategies: it catalyzes interdisciplinary disaster-relevant research *before* incidents occur, ensures that the research is integrated into response preparation, and streamlines decisionmakers' access to necessary scientific expertise during incidents. As a national platform, it can quickly adapt and scale promising solutions to effectively equip academia, agencies, and industry to face an increasingly dynamic future. Finally, it utilizes existing disciplinary relationships within academia to source the best science for scientific unknowns during crises and leverages the place-based knowledge and connections of academics at local institutions to inform decision-making and bridge agency efforts with local community needs.



Ultimately, we envision the Science Action Network operating at a national scale, with fully operational Hubs formerly linked to federal and regional planning and response bodies, and hundreds of affiliated academic members. Building this national Network requires multiple phases. We outline the four necessary phases to full implementation below, and detail the activities of the Phase 0 (Scoping) and Phase 1 (Pilot).

Actions, Outcomes, and Metrics

PHASE I: SCIENCE ACTION NETWORK PILOT (October 2015 – March 2017)

The overall objectives of the 16-month proof of concept are to 1) demonstrate that tangible value can be created by the Science Action Network for the preparation and response to incidents in three hazard types (oil spills, hurricanes, and severe winter storms), and 2) refine the Network structure and mechanisms to ensure that it is relevant to, and scalable across, a diverse set of hazard types (i.e., public health crises, earthquakes).

At the end of the 16-month period, the Science Action Network advisory board and initial funding partners will be able to make an informed, evidence-based decision on whether to pursue additional funding and partnerships to scale the Network to full operational capacity. The proof of concept activities would focus on oil spills in FEMA Region 10 (Oregon, Washington, Idaho, Alaska) and hurricanes in FEMA Region 6 (Texas, Louisiana, Arkansas, Oklahoma, New Mexico), in order to test the Network's cross-geographic and cross-hazard applicability.

Funded Components of the Pilot:

- Staff Positions (Implementation Team):
  - *1 Program Director*: Curates and maintains membership database, identifies and streamlines funding opportunities for Network members, organizes Network meetings and Network involvement in planning exercises and drills, and manages research partnerships facilitated by Network.
  - *2 Regional Academic Liaisons*: Recruit new academic and professional scientists to the Network, actively engages with NOAA Scientific Support Coordinators, participates in drills and planning processes, negotiates and implements resource sharing protocols, and guides identification of key research priorities. These will be part-time positions for the pilot. The target candidate is a university faculty member with experience working across disciplines.
  - *1 Media and Communications Coordinator*: Develops a communications plan and materials for increasing the Network's visibility among target audiences and holds briefings for key stakeholders across relevant government agencies and academia.
  - *2 Scaling Strategists*: Ensures integration of human behavioral principles into Network structure and implementation, designs a strategy for scaling the Network across hazard types and institutions, and identifies unique opportunities to amplify the Network's impact among key stakeholders.
- Operational Budget Items:
  - Travel for program staff
  - Funding for convening 4 meetings among Network leaders, members, scaling partners, and the Pilot Implementation Advisory Council
  - Media, website, and production of publicity materials
  - Equipment for program staff (i.e., computers, cameras)

Pilot Objective 1: Network Performance in Oil Spill & Hurricane Preparation and Response

Key Actions

- The pilot Implementation Team recruits the Implementation Advisory Council (see draft list of proposed members below)
- The pilot Implementation Team develops recruitment materials, raises the visibility of the Network at key regional conferences and meetings, and conducts individual engagement of key academic influencers and communicators in target geographies

- The pilot Implementation Team and pilot partners liaise directly with regional planning and response bodies (e.g., Regional Response Teams) to identify informal and inform mechanisms to engage early Network membership in planning and response processes
- The pilot Implementation Team co-develops exercises with regional planning bodies to engage Network membership in identifying scientific unknowns relevant to the target hazard

Key Outcomes

- Pilot Implementation Advisory team is recruited; leadership spans relevant federal and state government agencies (e.g., NOAA, EPA, USCG, USGS, FEMA, relevant state-level agencies) and key academic research consortia and institutions (e.g., Gulf of Mexico Research Initiative, Gulf Disaster Response Center, Center for Spills in the Environment, Boulder Natural Hazards Center)
- Network membership spans a diversity of regional academic institutions (public and private; large and small)
- A mechanism for formally engaging University administration is developed and tested
- Integration of the Science Action Network into oil spill response planning and preparation in Region 10 and Region 6
- New research collaborations emerge through Network engagement
- Regional Academic Liaisons are validated and engaged by government planners and responders

Metrics of Success

- The first cohort of Network members are recruited by January 2017 and remain active in the Network (>75 social and natural scientists)
- One tabletop exercise or collaborative workshop per region and per hazard (four total) conducted with academic scientists working with government decisionmakers to identify key research gaps and evaluate protocols for science team activation
- [For oil spills] One Spills of National Significance (SONS) exercise conducted with participation of invited Network members and Regional Academic Liaisons, and Regional Academic Liaisons participate in at least one industry spill management team exercise
- The value and functionality of the Academic Liaison role is tested:
    - Regional Academic Liaisons are reached out to for expertise before and during incidents >3 times
    - >30 new academics per region are recruited
    - Active involvement of academics is facilitated in at least 3 planning processes and exercises at the regional level, and 1-2 post-incident review sessions
- Changes in academic behavior are measured:
    - 1-2 academic research proposals are submitted whose origins can be traced to Network participation
    - When notified of an incident by the Regional Academic Liaison that may require their participation, 60% of academic Network members in that region (who are relevant to the incident type) confirm their availability for providing support and expertise upon request
    - Contributions to Area Contingency Planning processes are made by previously uninvolved academics

    - Attitude shifts (to be measured by pre/post survey)
        - Participation in Science Action Network membership carries academic prestige (i.e., Academic members put Science Action Network on their CV's)
        - Academics have increased awareness and understanding of the incident response structure and responder constraints
        - Academics see new applications for their research as a result of participating in the Network
- Changes in responder behavior is measured:
    - Responders reach out to Regional Academic Liaison or member academics at least twice via email or phone for expertise to inform response decisions
    - Advice from Network members is identified by responders as a key decision source of guidance in at least one post-incident review
    - Previously unconnected academics are offered samples by Network members and/or site access to conduct basic and/or operational research during a response
    - A Regional Response Team proposes to formally incorporate the Science Action Network into local contingency plans
    - Within at least one incident response, a Network member or Regional Academic Liaison is given a formalized position within Incident Command
    - Attitude shifts (to be measured by pre/post survey):
        - Responders feel that they are able to make more efficient use of scientific information as a result of the Network
        - Responders have increased comfort (or decreased stress) with structured academic participation in incident planning and response
        - Responders have increased awareness and understanding of academic Network members' constraints, priorities, and motivations

Pilot Objective 2: Establishment of Cross-Hazards Scalability

Key Actions
- The pilot partners identify key individuals that will serve on the standing National Leadership Council of the Network and ensure its scalability and credibility across government and academia
- The pilot Implementation Team develops communication materials and partnerships that will help the Network scale across hazard types and disciplinary communities
- The pilot Implementation Team enables novel communication between academics from different hazard backgrounds between the two target pilot geographies through calls and in-person meetings

Key Outcomes
- The National Leadership Council of the Science Action Network is established
- A mechanism for cross-hazard learning among federal agencies is established
- Protocol for collaboration between the DOI Strategic Sciences Group, the NIH Disaster Research Response Project, the DHS Centers of Excellence, the NSF RAPID grantmaking process, and the Science Action Network is established

- The Implementation Team engages with relevant cross-hazards government decisionmakers in FEMA and other agencies at the federal and state level
- Visibility of the value and actions of the Science Action Network and its affiliated members across disciplinary communities and across multiple hazard communities is increased
- Scaling partnerships are established with multi-hazard institutions at the regional level (in Regions 6 and 10) and national level
- Lessons learned from oil spill community are shared with and applied to another hazard community

Metrics of Success

- Lessons learned regarding processes for academic participation to support incident planning and response are presented at 2 different academic conferences
- At least 5 articles or op-eds in newspapers and different scientific journals about the Network and its value are published
- 10-20 academics from other hazard types are recruited and join the Network
- Funding secured for scaling Network across geographies and hazards starting in 2017
- Funding secured for providing Network-specific funding for hazard-relevant, interdisciplinary science
- National Response Team and Regional Response Team 6 and 10 serve as sharing venue for lessons learned from the Network's spill activities (i.e., possible value of Network to other regional hazards types discussed and evaluated at 1-2 Regional Response Team meetings)
- Lessons are applied to planning process for other incident types within relevant federal and regional planning and response bodies (e.g., National Response Team and Regional Response Teams)

PHASE 2: SCALING (February 2017 – February 2018)

Key Actions

- The pilot Implementation Team builds a catalogue of relevant, interdisciplinary expertise within U.S. academic institutions
- The pilot Implementation Team implements a process for identifying emerging research needs across hazard types
- The pilot Implementation Team implements a process for integrating Network scientists into post-hazard reviews (e.g., hot washes) across the Network

Key Outcomes

- Academics are privy to and participate in agency review processes through Network engagement
- Relevant federal and regional hazard planning and response bodies (e.g., the National Response Team and Regional Response Teams) actively consult and involve the Network is decision-making processes
- New cross-hazard research partnerships emerge within regional hubs and across Network disciplines

Metrics of Success

- Funding secured for providing Network-specific, opportunistic, and interdisciplinary hazard science
- Funding secured for a Network endowment to ensure activities in perpetuity
- Reporters find scientific expertise through the Network for at least one incident
- The Network is scaled and activated to provide scientific guidance and oversight to planning and preparedness processes in at least 3 additional regions and across at least 3 hazard types
- Network membership includes all major U.S. academic institutions
- First annual Science Action Network conference is launched and executed, with participation from all major government response agencies and Network academic members
- Three tabletop exercises are run with academic scientists and overseen by government decisionmakers to identify key research gaps or evaluate protocols for science team activation
- At least two Network science teams are deployed during a hazard incident

PHASE 3: INSTITUTIONALIZATION (February 2018 – July 2019)

Key Actions

- Local Level
  - The Network may be explicitly incorporated into Area Contingency Plans to ensure Network contribution to incident preparedness, and accessibility during incident response to provide input on challenging scientific issues.
  - Regional Academic Liaisons actively engage with Scientific Support Coordinators to catalyze opportunities for Network involvement in science issues in drills and exercises.
  - Regional Academic Liaisons participate in industry spill management team exercises, and work with industry to identify localized scientific unknowns.
  -
- Regional Level
  - Regional preparedness and response bodies leverage Network expertise through the Regional Academic Liaisons to guide identification of key research priorities during planning drills and exercises, as appropriate (e.g., through Regional Response Teams).
  - Regional Academic Liaisons identify and streamline funding 1) for strategic, collaborative, interdisciplinary research between incidents and 2) for opportunistic research during incidents.
  - Regional Academic Liaisons work with University and Disciplinary Chairs to negotiate and implement resource sharing protocols among Network members and between universities.
  - Regional Academic Liaisons work with agency coordinating committees (i.e., Interagency Coordinating Committee on Oil Pollution Research, Federal Radiological Preparedness Coordinating Committee) to improve public access to data before and during incidents.
  - Regional Academic Liaisons coordinate regional Network events to propagate novel, interdisciplinary partnerships and generate momentum around crisis-relevant science, including developing training material and opportunities for Network membership around crisis response frameworks and governance.

- National Level
    - The National Leadership Council works with key members of relevant hazard preparedness and response bodies (e.g., National Response Team, the Emergency Support Leadership Groups) to integrate lessons learned from large-scale disasters into national and regional Network research priorities and activities.
    - The National Leadership Council, which includes Regional Academic Liaisons, leverages regional and disciplinary Network expertise to inform strategic decision-making by national-level disaster preparation and response bodies (e.g., the National Response Team).
    - The Network's role as an advisory resource is formally recognized by national preparedness and response regulatory frameworks (e.g., the National Contingency Plan).

Key Outcomes

- The Network is effectively deployed in all major hazard incidents
- Network fellowship/intern programs are launched
- New interdisciplinary research collaborations and publications are developed and produced between Network members
- The Network's role as an advisory resource is formally recognized by national preparedness and response regulatory frameworks (e.g. the National Contingency Plan)

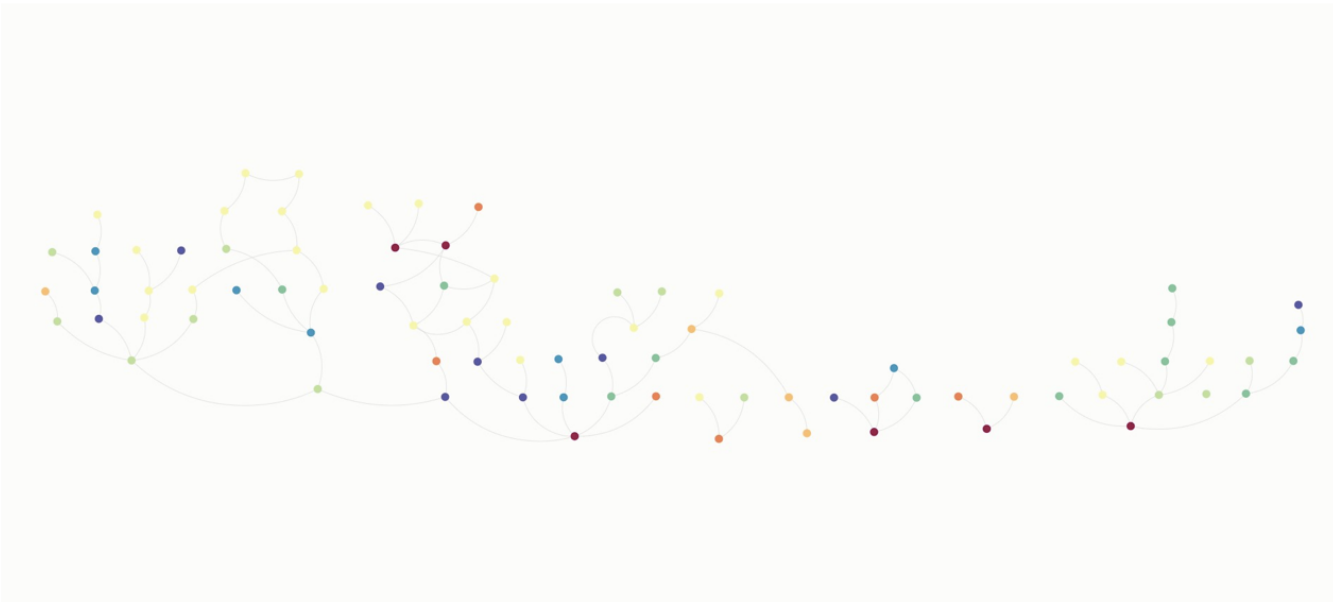
Metrics of Success

- Funding is secured for scaling the Network across all 13 Regional Response Team geographies and hazards types
- Research funded by the Network or conducted by Network members is presented at >30 conference nationwide
- Reporters find scientific expertise through the Network for at least three incidents

Product 3: System Leverage Points & Root Cause Map

Root Cause Map

Our root cause map included over 50 root causes and can be found here.



Leverage Points

Leverage points are places within a complex system where a small shift will lead to a dramatic change towards desired outcomes. Donella Meadows' "Leverage Points: Places to Intervene in a System" paper was disseminated to the SPERR advisory teams before the September Concept Generation Workshop. In our case, these are points in the system of oil spill preparation and response, and associated non-governmental science, where our project will lead to a large shift towards scientific collaboration, and our four desired outcomes.[1]

The categories of leverage points from which we identified strategic places to intervene are the following (in increasing order of effectiveness)

1. The size of buffers and other stabilizing stocks, relative to their flows
2. The lengths of delays, relative to the rate of system change
3. The strength of negative feedback loops
4. The gain around driving positive feedback loops
5. The structure of information flows
6. Mindsets & Perceptions
7. The rules of the system
8. The goals of the system

Through interviews with key stakeholders, targeted idea generation with the advisory teams, and identification of desired project outcomes, we have identified a set of key system leverage points. Below, we list this strategic set of leverage points, as well as a list of all the leverage points we have identified in our research. Ultimately, we will use these leverage points to identify powerful mechanisms for system change.

System Insights and Target-Setting

▼

Leverage Point

▼

Mechanism for Change (Proposed Intervention)

▼

Outcomes

[1] Minimum oil exists in the marine and coastal environments, because responders stop the flow of oil and/or released oil is contained; (2) the environmental and human impacts of the oil spill are mitigated through prevention, preparation, response, and/or restoration; (3) response efforts in future large oil spills are effective and efficient in achieving harm reduction goals; and (4) increased scientific understanding of environmental and human health improves long-term ecosystem management.

Selecting Focus Leverage Points

After creating a list of hypothesized leverage points (below), we narrowed our focus points, based on the following criteria:

4. Impact: Shifting this leverage point will create significant positive results across the 4 desired outcomes
5. Feasibility: The leverage point can be effectively shifted within 1-5 years with existing resources and minimal funding
6. Scalability: The leverage point applies to other disaster response situations (outside marine oil spills)

STRATEGIC SYSTEM LEVERAGE POINTS

Delays & Lag Times in the System

Key time delays before or during the response that were barriers to the desired outcomes

Theory Of Change: Reducing the lengths of these delays would contribute to target outcomes

1. The communication of research needs from responders to academic scientists during oil spills
2. Mobilizing scientific resources (e.g., physical or intellectual) among key institutions to the spill site during oil spills
3. QAQC of spill science during spills
4. (Possible) Adaptive learning among agencies and non-governmental scientists after response drills
5. (Possible) Adaptive learning among agencies and scientists after small or large spills
6. Publication of science conducted before, during, or after spills in academic journals

The Size of Buffers

Buffers maintain system stability and dampen oscillations.

Theory of Change: Depending on your goals, increasing or decreasing the size of current buffers can push system behavior towards desired outcomes

1. Need for increased buffer between spills around research (e.g., bolstering research interest between spills, rather than letting in oscillate drastically between large spill events)
2. Need for increased buffer between the data collection (and scientific process generally) and media headlining (e.g., addressing issue of data publicly shared before it can be QAQCed)
3. Cultural buffer between political appointees vs. government veterans that have risen through the ranks
4. Physical buffer between local communities and federal responders
5. Need for decreased buffer between spill occurrence and grantmaking
6. Need for decreased buffer around procedural action during spills

Feedback Loops

Positive and negative feedback loops before and during the response that helped or hindered the desired outcomes.

Theory Of Change: Enhancing desirable positive feedback loops will create desired outcomes; minimizing undesired feedback loops will create desired outcomes.

Cycles that reinforce time constraints (*goal would be to slow/reduce these*):

1. Media pressures on politicians, responders, and academics (engagement with media takes away time from response and research, but lack of engagement compounds public pressure)
2. Demands or concerns of federal politicians (e.g., limited understanding of ICS structure leads to political demands on response decisionmakers, which in turn reinforces involvement by politicians)
3. Scientists becoming spokespeople on public-facing issues (e.g., once scientists are quoted, they increasingly becomes known as media sources and are sought after)

Cycles that enhance the speed of response activities (*goal would be to amplify these*):

1. Journal publication addendums to allow data sharing
2. Rapid response grants for academic research were disseminated to scientists, leading to greater scientific understanding and increased capacity to secure funding
3. Some scientists who became involved in the response efforts were able to build long-term relationships with government responders, leading to sustained collaboration
4. Intra-agency communications (i.e., mechanisms to transcend bureaucratic hurdles within agencies during crises)
5. Information relevant to human health was efficiently and effectively communicated to decisionmakers

Rules of the System

Governing rules of the system across geographies and time scales

Theory Of Change: Shifting or tweaking the governing rules has cascading effects on resource allocation and system behavior

- The Incident Command Structure (e.g., designation and role of the Responsible Party)
- Area, Regional, and National Contingency Plans
- National Restoration and Damage Assessment
- Tenure system (e.g., academics are rewarded individually for their work, publications valued over service)
- Agency staff often rewarded by their length of service
- Influence of federal politics on agency authority
- National Restoration and Damage Assessment
- Oil Spill Act (e.g., funding mechanisms)
- Annual fiscal year cycle
- Jurisdictional boundaries of U.S. law

- Fishery regulations

Mindsets and Perceptions

Mindsets held by key stakeholders that deeply inform their behavior

Theory Of Change: If we can change the defining mindset of a key stakeholder, their behavior in the system will also change (if they have the external agency to make that change)

- Hyperbolic discounting of disasters by agencies, non-governmental scientists, industry, and the public
- Perception that agencies know what to do during a response and there is no role for academics
- Assumption of no "unknown unknowns" before or during a response
- Academics believe their data will be used by decisionmakers if it is produced, and it is not their responsibility to translate it
- Perception by many academics that research, if informed by applied needs, is biased
- In human-caused disasters, there is often a need for a scapegoat (e.g., blame and distrust of government responders due to relationship with R.P.); there is no sense of collective responsibility for an oil spill occurring
- Responders often have multiple objectives (e.g., mitigate oil spill, meet public expectations), whereas academics often have a singular objectives (e.g., scientific discovery)
- Disaster planning is not a collective challenge and responsibility across agencies
- Responders are often biased towards action, whereas academics are often biased towards scientific precision
- Academic desire for their research to have social relevance

Goals of the System

1. Increase scientific understanding of the human and natural environment
2. Enforce a system of putative accountability
3. Extract oil
4. Maintain human and environmental well-being

Product 4: Persona Profiles

LOCAL ACADEMIC

RATIONAL, CURIOUS

"Science comes first."

MOTIVATIONS

Scientific discovery

Self-determined inquiry

Public recognition and local stature

Personal connection to home ecosystems

Academic credentials

Visibility of research outcomes

Desire to contribute to consequential national effort

GOALS

Obtain funding to conduct research

Maintain independence

Publish articles

Increase relationships with local/state political leaders

Integrate existing knowledge and resources into response

INTRINSIC BARRIERS

Lack of trust of government responders and non-local scientists

Limited collaborative experience

Limited interdisciplinary expertise

Fear of loss of intellectual property rights

Fear of litigation

"It's not natural for institutions of higher education to collaborate."

EXTRINSIC BARRIERS

Lack of familiarity with incident command system

Lack of access to information

Lack of access to research sites

Obligation to other grants and teaching

Limited funding

Media demands

"No matter what you say as a scientist, if you didn't say what they wanted, they come after you."

PERCEIVES:

NON-LOCAL ACADEMIC

- Agencies did not have adequate science capacity to handle spill response
- Research conducted for or with responders may be biased by decisionmaking pressures
- The top-down nature of ICS limits collaboration
- If scientific information is produced, it will be used
- Responders do not have an intrinsic right to my data

RESPONDER

- Injustice of research funding allocation to academics outside the spill geography
- Non-local academics don't recognize local resources; understand local ecosystem
- Non-locals are "captured" by the response system and this taints their research
- Non-locals have relationships with the govt
- They are capable of translating science for CG
- Carpet baggers!

PERSONA PROFILES ChangeLabs.

NON-LOCAL ACADEMIC

CONNECTED, DEDICATED, PRECISE

"It isn't a meritocracy during a crisis. Spills have more to do with your capacity as a team player."

MOTIVATIONS

Recognition by valued government relationships and the public

Prestige

National relevancy

GOALS

Leverage existing knowledge and resources to assist response

Be more integrated into response structure

Facilitate communication between multiple stakeholders/perspectives

Increasing efficiency or effectiveness of response

INTRINSIC BARRIERS

Professional competition

Fear of loss of intellectual property rights

Discomfort with liability

Limited bandwidth

Low tolerance for uncertainty

"If you participate, you have to give up a large portion of your life to conference calls."

EXTRINSIC BARRIERS

Lack of transparency among responders

Lack of access to information

Lack of access to research sites

Limited funding

Geographic distance

Tension with local academics

"There was a huge disconnect. The government was coming in and asking us to step aside."

PERCEIVES:

LOCAL ACADEMIC

- Local academics don't have an understanding of the response system
- Local academics aren't able to see multistakeholder perspectives
- Local academics compromise scientific integrity
- Locals are beholden to local resourcing and politics

RESPONDER

- Doing the best they can
- Responders sometimes put public perception before good science

PERSONA PROFILES ChangeLabs.

NOAA Scientific Support Coordinator

DYNAMIC, TEAM-MINDED

"I like that unpredictability of my job; I never know what's coming tomorrow. It's definitely not a desk job."

MOTIVATIONS

Public service

Social validation and camaraderie of the responder community

Affinity for unpredictability & diverse challenges

Seniority (gained through experience) bring social and knowledge capital

GOALS

Enable an informed yet rapid response

Recognition for effective, high-quality work within the response community

INTRINSIC BARRIERS

Discomfort with challenging authority hierarchy

Low tolerance for "scientific foot-dragging"

"It will take too much time to teach them. It's their responsibility to educate themselves if they want to be involved."

EXTRINSIC BARRIERS

Strict hierarchy of federal response structure

Funding is for response efforts only

Limited timeline of a response effort

Respect is based on seniority

"If they [the senior responders] don't know your name, they just roll right over you. No time to make introductions."

PERCEIVES:

ACADEMIC

- Academics have an individual agenda that is not compatible with my timeline or team dynamic
- Academics only see and value science that is in fancy journals
- Academics can assets once a relationship is established... but high barrier to establish it
- Local knowledge is often a huge asset

AGENCY STAFF

- Generally great allies and collaborators during response

PERSONA PROFILES

Federal Agency Staff

DEDICATED, COLLABORATIVE, PROUD

"I try to share and make transparent as much data as I can....but politics is tough, especially during a crisis."

MOTIVATIONS

Don't rock the boat too much

Commitment to job and country

Trust and dedication to teammates

"We have a lot of bickering internally, but when the bell rang, we were one. Putting in 60-70 hours a week. I don't need more reward…. I do that for every spill".

GOALS

Produce effective tools and exchange information to inform decisionmakers

Account for uncertainty, but not top priority to reduce it. Focus on risk management.

Increase data transparency and availability

INTRINSIC BARRIERS

Discomfort with challenging authority hierarchy

EXTRINSIC BARRIERS

Strict hierarchy of federal response structure

Funding is for response efforts only

Limited timeline of a response effort

Respect is based on seniority

Unwillingness to increase in outreach due to low frequency of large incidents like DWH

PERCEIVES:

ACADEMIC

- Collaboration during non-crisis periods is great... but they have to understand that it's a different legal and logistical game during a crisis.

"Over the years, I've seen that the academics dont want to do want we do-- they want to do research. We do the operational stuff."

GOVT DECISIONMAKER

- The status quo of information sharing is effective
- Decisionmakers do not always trust our scientific skills, or the data/advice that we are giving them

"It would be really nice if everybody up above knew what us underlings were capable of doing."

PERSONA PROFILES

Product 5: Summary of Low-Resolution Prototype Concepts

Idea Title: Incentivizing Public Service for Academia

Brief Description:
Universities typically reward faculty contributions in research, education, and service. Service during oil spills, and other environmental crises, could be explicitly valued as 'good citizenship' in protecting human and environmental communities through the tenure and academic reward system process. We could work with university presidents to provide relevant rewards (i.e., improved tenure prospects) to academic scientists that engage in disaster planning, response, and mitigation.

Theory of Change:

Create reward currencies to which academics will respond directly

▼

Strengthened relationships among relevant academic scientists, and between academic scientists and agency responders

+

Academics have greater familiarity with the response structure and context before a crisis happens

▼

Productive scientific collaboration between agencies and scientists can occur before, during, and after a spill

Analogous Case Studies:
Doctors Without Borders model

Resources to Leverage:
Academic Associations; University presidents

Remaining Uncertainties to Address:
Universities need to understand and agree that by implicitly encouraging this type of public service as part of the promotion and tenure process, it would not: (1) violate university culture, (2) cost anything, (3) and that it will *add* to the social capital of the university by improving (a) university community relations, (b) university-federal agency relations, (c) university-local government relations.

Next steps to develop and test the idea:
- Reach out informally to university presidents to identify interest and feasibility
- Evaluate impact of analogous incentive structures on academic involvement in planning and policy processes

Idea Title: Matchmaking for Academic Mobilization

Brief Description:
During the DWH crisis, strong tension and competition for funding existed between local (Gulf) scientists and non-local scientists who wanted to conduct research during or immediately after the spill. Many local scientists had site access and valued local ecological knowledge to contribute, while the non-local scientists often had more funding and technical resources. Instead of finding synergy between these sets of resources, competition and inefficient, isolated work often emerged. This idea aims to address that challenge and incentivize collaboration during oil spill crises.

We would create and fund research teams that combine local and non-local scientists for preparedness, response, and restoration. This model enables new resources to be created and deployed via RFPs in order to leverage local and outside knowledge, technology, and relationships to meet our four desired outcomes. The "matchmaker" program would consist of (1) establishing new dedicated funding, (2) creating new brokers who can connect local with non-local scientists and academia with NGOs, agencies, and industry (i.e., do match-making), and (3) creating new relationships (e.g., through cooperative agreements, social media, professional society meetings).

The success of the matchmaker program relies on the following specifications:
1. RFPs will require specific types of collaboration (e.g., local to non-local)
2. Brokers are honest intermediaries who are funded to connect parties who need one another, but do not know each other. Brokers facilitate bringing in outside tools and people to complement and leverage local knowledge and connections.
3. Ideally brokers and new partnerships (e.g., cooperative agreements) would be in place prior to a crisis. Funding is needed for this to happen.
4. Local, regional, and national response planning will need to include creation of brokers and mechanisms to leverage new partnerships (e.g., through NRT → SSC and ARD case folks).
5. Although RFPs may require locals and non-locals to collaborate on a team, awards will be based on quality of research and relevance to response (e.g., assessing impact or restoration)
6. Brokers need to inform scientists of constraints and rules of the road for each phase of response

Analogous Case Studies:
None identified

Resources to Leverage:
Potential sources of funding include NSF, NAS, agencies, API, NFWF, RESTORE Act, or GoMRI.

Remaining Uncertainties to Address:
The availability of funding to support the proposed RFP is uncertain. Additionally, the presence of honest brokers prior to a crisis, and fully integrated into local and regional response planning, will be required. There are additional uncertainties around (1) the role of brokers in determining the merit of

applicants, (2) the role of brokers in training scientists in the structures and constraints of response planning, and (3) the requirements for local and non-local collaboration.

Next steps to develop and test the idea:

- Engage members of the National Response Team (especially USCG, EPA, NOAA, BSEE) around the feasibility and impact of this idea
- Identify possible brokering and funding mechanisms for implementation

Idea Title: Social Media for Scientific Collaboration

Brief Description:
This idea centers around the use of social media to create and maintain relationships between local and non-local scientists. Specifically, it would:

- Create new communities of practice (linking local and non-local) around key issues (e.g., dispersants) using social media, or professional society meetings followed by social media.
- Conduct social media analyses to understand and incorporate (apply) information about productive pathways of communication or key players.
- Use social media and crowd-sourcing during crises to share observations about new phenomena (e.g., track oil movement or ID species).

Theory of Change:

Scientists share real-time observations via existing social media channels, and invite commentary and analysis of their observations and data

▼

Rapid collaborative data exchange and analysis
+
Transparency of social media exchange allows responders and agency scientists to quickly contribute to the conversation

▼

"Digital communities of practice" are created
+
Scientists can quickly share with and draw upon each other (and participating agencies scientists) during and after a spill

Analogous Case Studies:
None identified

Resources to Leverage:
National scientific meetings and conferences can serve as the initial connector points (i.e., AGU); the National Pollution Fund Center may serve as a funding source

Remaining Uncertainties to Address:

- QAQC is key, and we need a good system in place for having some degree of QAQC via social media. Are there other case studies where this has been done successfully?
- Who would manage, facilitate, and initiate the social media interactions?
- What are the sustained incentives for agency scientists and responders to be an active part of the digital community?
- How do we ensure the process is not hijacked for non-scientific purposes?
- Given that younger scientists may be more adept at social media tools and willing to engage, how might we avoid an age gap in usage?

Next steps to develop and test the idea:

- Engage social media experts and social scientists to better understand the viability of this strategy
- Identify other examples of successful communication between scientists via social media

<u>Idea Title: Enabling Inter-agency Adaptive Learning</u>

Brief Description:
Intra-agency lessons learned reviews and implementation is well practiced, but *inter*-agency ones are less robust and inclusive, particularly around remediation and follow-on action.

To address this deficit, we propose to

1) Convene the NRT and have agencies present and discuss how they have each acted on their DWH lessons learned
2) Create and formalize guidelines for when the inter-agency lessons-learned process needs to be deployed at the NRT level (i.e., when 3+ agencies are involved in a response effort with national implications, such as dispersant use during DWH)
3) Set up a process to brief (or co-brief across agencies) the political appointees of the lessons learned and follow-on agencies

Expected Outcomes:

- Shared learning and coordinated follow-on actions after a multi-agency spill enable more effective response during the next spill
- Integrated science in future response planning because scientific agencies and response agencies are better linked beforehand
- NRT is recognized as a leadership body by congressional supporters, which will create new pathways for NRT funding to effectively implement lessons learned

Analogous Case Studies:
Chemical spill response

Resources to Leverage:

- FOSC reports
- Existing individual agency reports
- Oil Spill Commission Action Group
- UNH forum is a good example of a retrospective forum

Remaining Uncertainties to Address:

- Agencies may have a disincentive to release their internal lessons learned documents/discussions because it makes them more vulnerable to audits
- There is not enough funding to expand NRT activities; there is a need for congressional advocacy for an increased budget
- The Hill doesn't know about and/or understand the NRT; there is a need for more relationship-building and education around NRT's role among policymakers

Next steps to develop and test the idea:

- Review and stress-test the idea with Dana Tulis and Claudia Gelzer (NRT Chair and Vice chair)
- Investigate the FEMA Executive Support Function Leadership Group as an example
- Solicit advocacy groups to help build Hill support for NRT; use lessons learned and NRT success to demonstrate its value and appeal

<u>Idea Title: Incentivizing Relationship-Building between Local Academics and Agency Staff during the NRDA Planning Process</u>

Brief Description:

This idea is based on leveraging existing incentive structures that exist for local academics and agency staff in order to encourage collaboration during the NRDA planning process. Some of the main ideas include:

- Educating local academics about the realities of NRDA, including opportunities for external engagement and the higher stakes (e.g., legal, political, economic) for the agencies involved.
- Increasing the value placed on engaging in the NRDA planning process by tapping into public service/broader impacts expectations within the academic community.
- Engaging academics during area committee planning and regional planning meetings, which could include gathering knowledge on the capabilities of individuals and institutions that could be deployed during response; building relationships to create a more resilient network of collaborators during spills; and forming a broader system of scientists or academic thought leaders at state, federal, and industry levels interested in spill response.

Expected Outcomes:

- Widespread expectation among academics and agency staff around collaboration during spills and peer recognition for academics who engage in the planning process.
- Agency staff know what resources local academics can contribute to spill efforts and relationships are pre-existing when spills occur.

Analogous Case Studies:
None identified

Resources to Leverage:

- Current academic thought leaders who could publicly advocate for these incentive structures
- NAS and other prestigious groups of academic scientists
- University presidents

Remaining Uncertainties to Address:

- How would these incentive structures be formalized? What will the follow-through look like?
- How would we create and maintain a structure that includes collaboration during the planning process? Are there existing opportunities that lend themselves to this?
- Would there be a body to explicitly manage these collaborations and interactions?

Next steps to develop and test the idea:

- Review and flesh out specific aspects of this idea with Bob Haddad, Dave Westerholm, and Chris Reddy
- Engage academic thought leaders to identify opportunities to create incentive structures

---

An example of a 2 low-resolution experiential prototypes used with stakeholder participants at the Gulf Oil & Ecosystem Science Conference 2015 (Houston, TX) can her found here: https://www.dropbox.com/s/xv0iiwdxh6taqf2/ResearchGate%20and%20ARN%20TG%20v3.pdf?dl=0

Product 6: Categorized Network of Champions, Endorsers, Gatekeepers, and Diffusion Agents

Key Project Stakeholders

Project Advisory Teams

Core Advisory Team

Jane Lubchenco, Oregon State University
Thad Allen, Booz Allen Hamilton
Marcia McNutt, Science
David Kennedy, NOAA
Chris Reddy, Woods Hole Oceanographic Institution
Steve Murawski, University of South Florida
Dave Westerholm, NOAA
Dana Tulis, EPA

Implementation Team

Debbie Payton, former NOAA
Scott Lundgren, NOAA
Nancy Kinner, University of New Hampshire
LaDon Swann, Auburn University
Gary Machlis, Clemson University
Kris Ludwig, USGS
Bob Haddad, NOAA

Prospective Champions for the Science Action Network (individuals with active enthusiasm and willingness to dedicate time to making the Network a reality)

Chris Elfring, National Academies, Gulf Program
David Applegate and Kris Ludwig, Strategic Science Group
Scott Lundgren, NOAA Office of Response and Restoration
Nikola Garber, SeaGrant
Dana Tulis, Chair of National Response Team & EPA
Aubrey Miller, National Institute of Environmental and Health Services
Roger Wakimoto, National Science Foundation
Eric Soucie, FEMA
Kelly Wilson, American Petroleum Institute
Joseph Loring, U.S. Coast Guard
Lisa Graumlich, University of Washington
Nettie LaBelle-Hamer, University of Alaska Fairbanks
Steve Murawski, University of South Florida
Mandy Joye, University of Georgia

Endorsers (publicly support or approve the Network)
Dave Applegate, USGS
Erik Hankin, AGU
Ray Bradley, API
Bill Vocke, ICCOPR; USCG
Greg DeMarco, API and ExxonMobil
Commander Peter Brown, USCG
Scott Deitchman, CDC
Liz Landau, AGU
Amanda Barry, Environment Canada
Pamela Matson, Stanford
Mike Carron, GoMRI
Sarah Brace, Oil Spill Task Force
Casi Callaway, Mobile Baykeeper

Gatekeepers (controls access to resources critical to the Network's success)
Chuck Wilson, GoMRI
Rick Spinrad, NOAA
Kathy Sullivan, NOAA
Kelly Wilson, API
Gregory Symmes, NAS
Mary Landry, USCG
Dana Tulis, EPA

Diffusion Agents (propagate Network messaging and structures to key stakeholders)
Key Diffusion Agents
Mandy Joye, U Georgia
Terry Martinez, FEMA
Eric Soucie, FEMA
Christopher Clavin, IDA Science & Technology Policy Institute
Rhianna Macon, USCG
Joshua Brown, Sea Grant
Nettie Labelle-Hamer, U Alaska- Fairbanks
Jessica Garron, U Alaska- Fairbanks
Sky Bristol, USGS
Susan Finger, USGS
Richard Knutsen, FFWCC
Ann Hayward Walker, SEA Consulting Group
Chris D'Elia, LSU
Margaret Leinen, Scripps
Claudia Gelzer, USCG
Bill Grawe, USCG
Ed Bock, USCG

Gulf Academics: Potential Diffusion Agents
Eugene Turner, Louisiana State University
Arthur Mariano, University of Miami
Nancy Rabalais, Louisiana Universities Marine Consortium
John Valentine, University of South Alabama
Monty Graham, University of Southern Mississippi
Julie Falgaut, Sea Grant

Non-Gulf Academics: Potential Diffusion Agents
Bernard Goldstein, University of Pittsburgh
Ira Leifer, University of California, Santa Barbara
Meg Caldwell, Packard Foundation
Chris Scholin, MBARI
Richard Camilli, WHOI
Anne Guery, National Capital Project

NOAA Staff: Potential Diffusion Agents
Bill Lehr, NOAA
Catherine Berg (formerly USFW), NOAA
Kyle Jellison, NOAA
Jordan Stout, NOAA
Glen Watabayashi, NOAA
Ed Levine, NOAA
Doug Helton, NOAA
Charlie Henry, NOAA
John Tarpley, NOAA
Steve Lehmann, NOAA
Gary Shigenaka, NOAA
Ed Overton, NOAA
Alan Mearns, NOAA