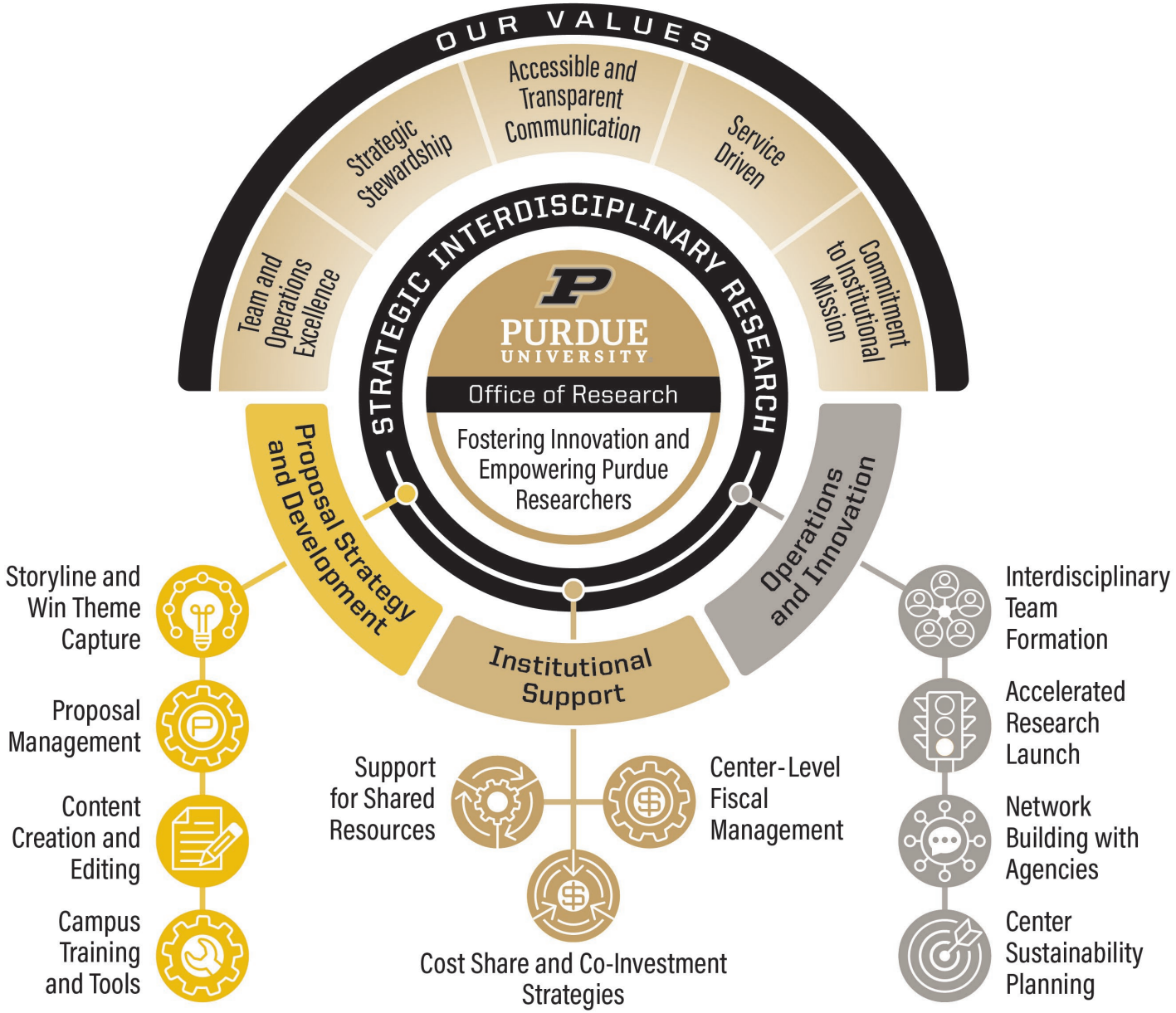
Successful Grant Writing Strategies

Sally Bond
Director, Proposal Strategy and Development
Office of Research
September 2024

PURDUE UNIVERSITY

Strategic Interdisciplinary Research



Congratulations, at this time I am pleased to inform you that your application received in response to Industrial Efficiency and Decarbonization FOA has been selected for negotiation for award. Attached you will find a copy of the letter confirming your application's selection. The award number assigned to your project is DE-EE0010864

Congratulations on your successful application for the Request for Full Application (RFA) 72ASHA21RFA00001. Your application has been favorably viewed by the selection committee and approved for funding. We look forward to partnering with you in the coming years.

This email is being provided to update you on the evaluation of your proposal entitled, "Wolfpack – Enabling Teaming and Cooperative Engagement for Hypersonic Systems."

It is our pleasure to inform you that your proposal has been selected for negotiation and potential award of a project sub-agreement (PSA). Negotiations with TEES and WHS are expected to be forthcoming and we will be in touch to schedule a meeting to discuss the terms of the PSA if necessary.

We are pleased to inform you that your application, "Quantum Photonic Integrated Design Center (QuPIDC)," submitted in response to DE-FOA-0003258, Energy Frontier Research Centers (EFRCs), has been recommended for an award.

The attached Notice of Award, D18HP32125-06-00 for Health Careers Opportunity Program to PURDUE UNIVERSITY, West Lafayette, Indiana is provided by the Health Resources and Services Administration (HRSA).

Thank you for submitting the above application in response to the subject Funding Opportunity Announcement (FOA). Evaluation of your application received in response to the FOA has been completed in accordance with the merit review process contained in the announcement. After a careful review of your application, we are pleased to inform you that your project has been selected for award negotiations.

45 seconds each:

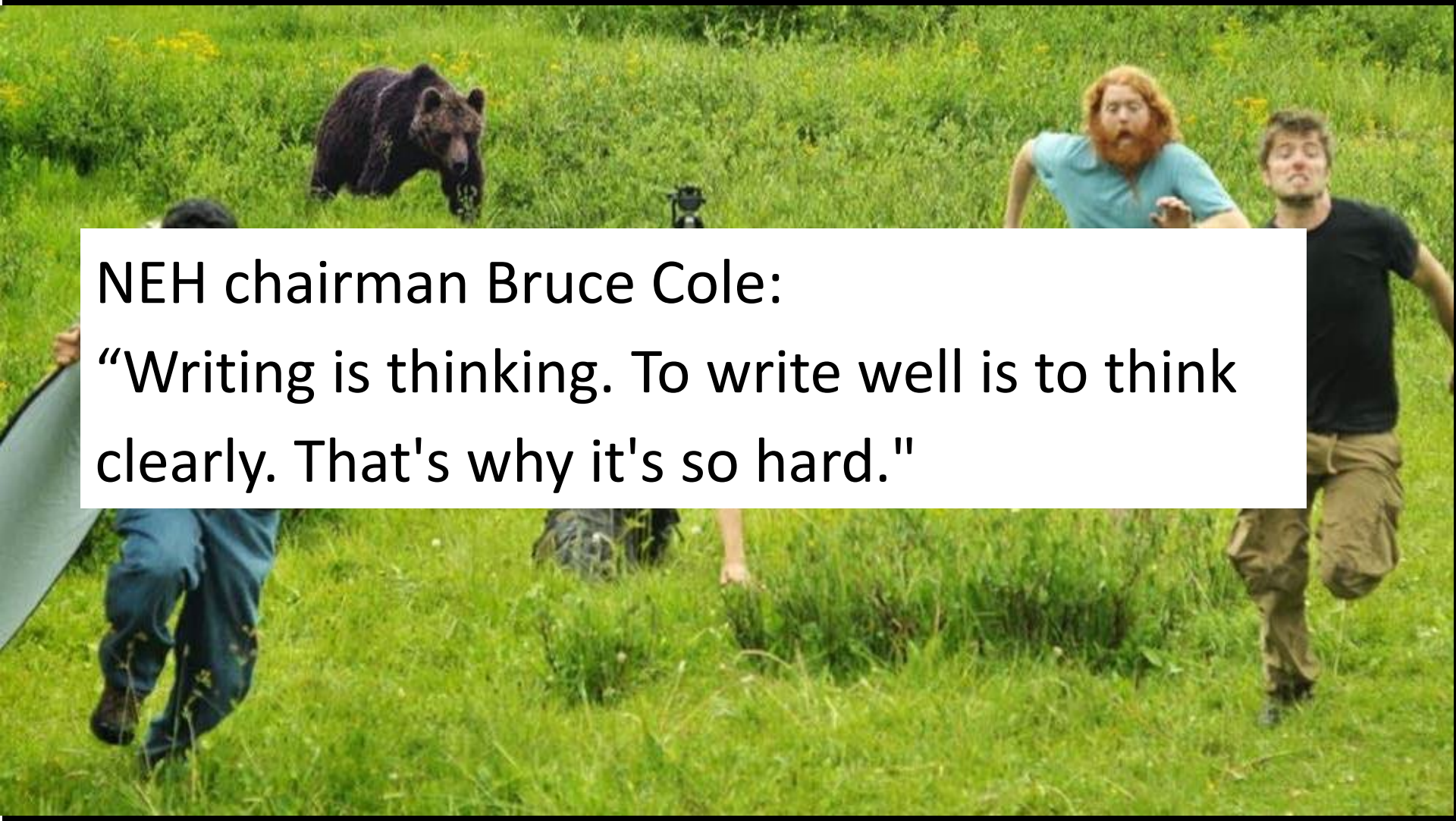
What is something that is lacking/missing/a barrier/challenge in your field and how do you want to address it?

PURDUE
UNIVERSITY

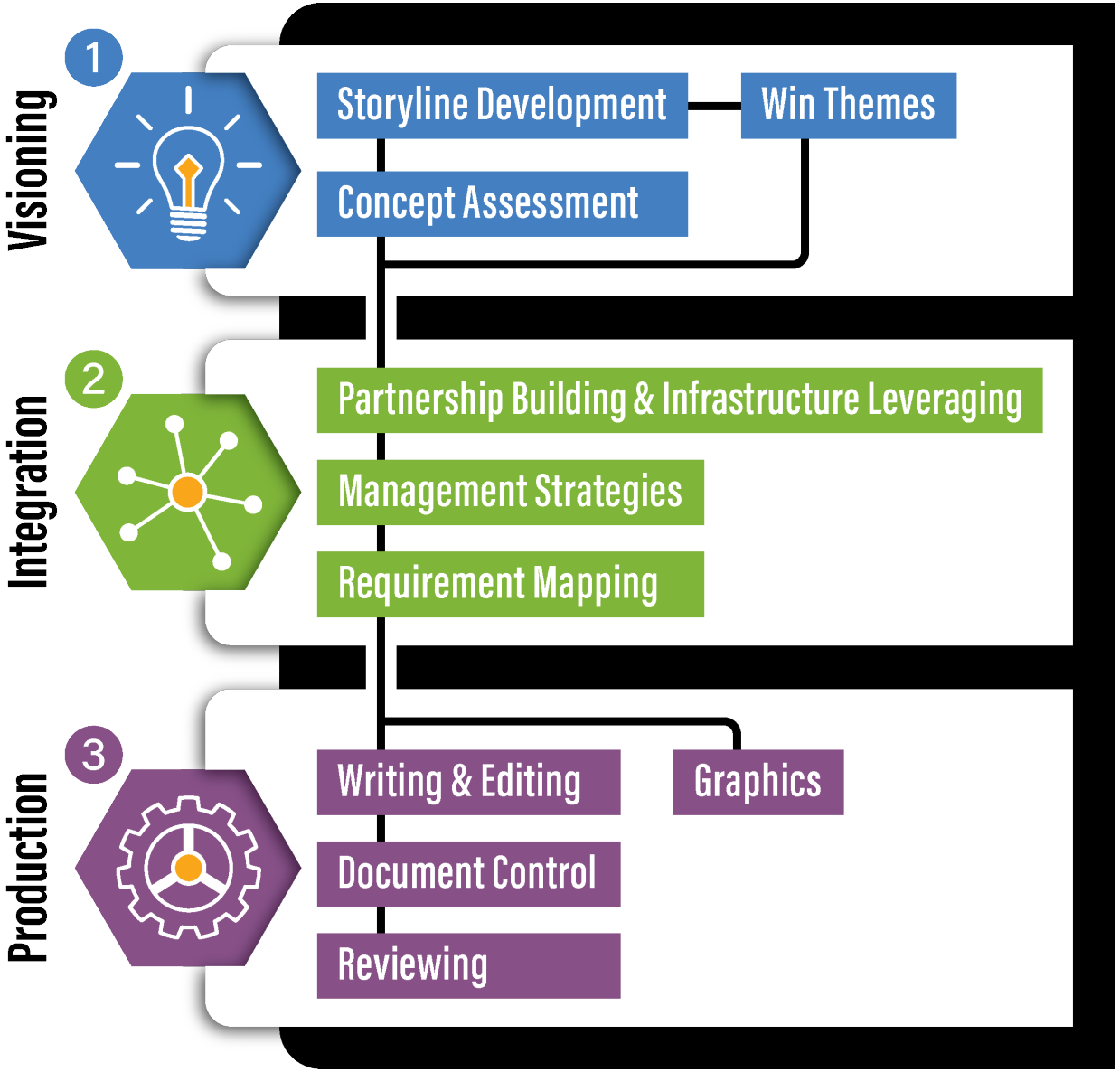
Online Resources

Grant Writing Support

Welcome to the Research Development Services grant writing support site. Here you can access resources for your proposal development as well as request hands-on help from our team of grant writers. If you have any questions, contact **sbond@purdue.edu**.


NEH chairman Bruce Cole:
“Writing is thinking. To write well is to think clearly. That's why it's so hard."

A Strategic Process



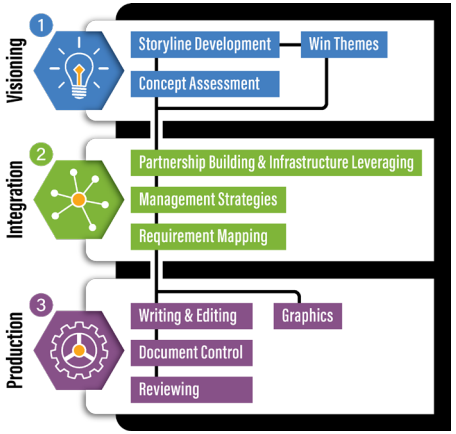
Milestone-Driven Schedule

CISE Expeditions Full Proposal Development Schedule

		Aug	Sep	Oct	Nov	Mon 12/2	Mon 12/16	Thur 12/19	Thu 12/19	Jan	Mon 2/10	Tue 2/11	Mon 2/17	Mon 2/24	Mon 3/3	Mon 3/10	Fri 3/14	Mon 3/17	Fri 3/21	Tue 3/25	Wed 3/26	Fri 3/28
Visioning	Team mtg on proposal development process/schedule																					
	Develop Storyline What is the problem? What has been done to address this problem? What is the gap that still remains? How do you propose to address this gap?																					
	Collaborate on prototyping projects																					
	Identify win theme and Red Panel Review team members																					
	Debrief on preproposal reviews																					
	Revise storyline, vision/goals, thrust/theme strategy, diagram																					
	Initial thrust strategizing/preplanning for template																					
	Finalize org chart/ basic management structure																					
	Conduct review panel for competitive win theme and storyline review with advisory board members				8th																	
	Debrief/revise after win theme review																					
Integration	Finalize team organizations and personnel																					
	Draft initial task/milestone Gantt timeline and discuss for integration																					
	Identify additional graphics																					
	Collect facilities, bios, COA, C&P, synergistic activities																					
	Collect letters of collaboration																					
	Review outline & assign leads				15th																	
	Team writing																					
	Draft1 compile																					
	Editing iterations																					
	Draft2 compile																					
	Core team walk through of draft2																					
	Editing iterations																					
	Draft3 compile for red panel review									20th												
	Write summary									20th												
	Send draft to red panel reviewers									27th												
	Write data management plan																					
	Write mentoring plan																					
	Conduct Red Panel Review																					
	Debrief with core team																					
	Editing iterations																					
	Conduct final Gold Team Review																					
	Editing iterations for final narrative																					
	Submit non-tech docs to PreAward																					
	Submit tech docs to PreAward																					
	Submit list of project personnel to cise-expeditions@nsf.gov																					
	Develop summary ppt slide																					
	Submit to NSF																					

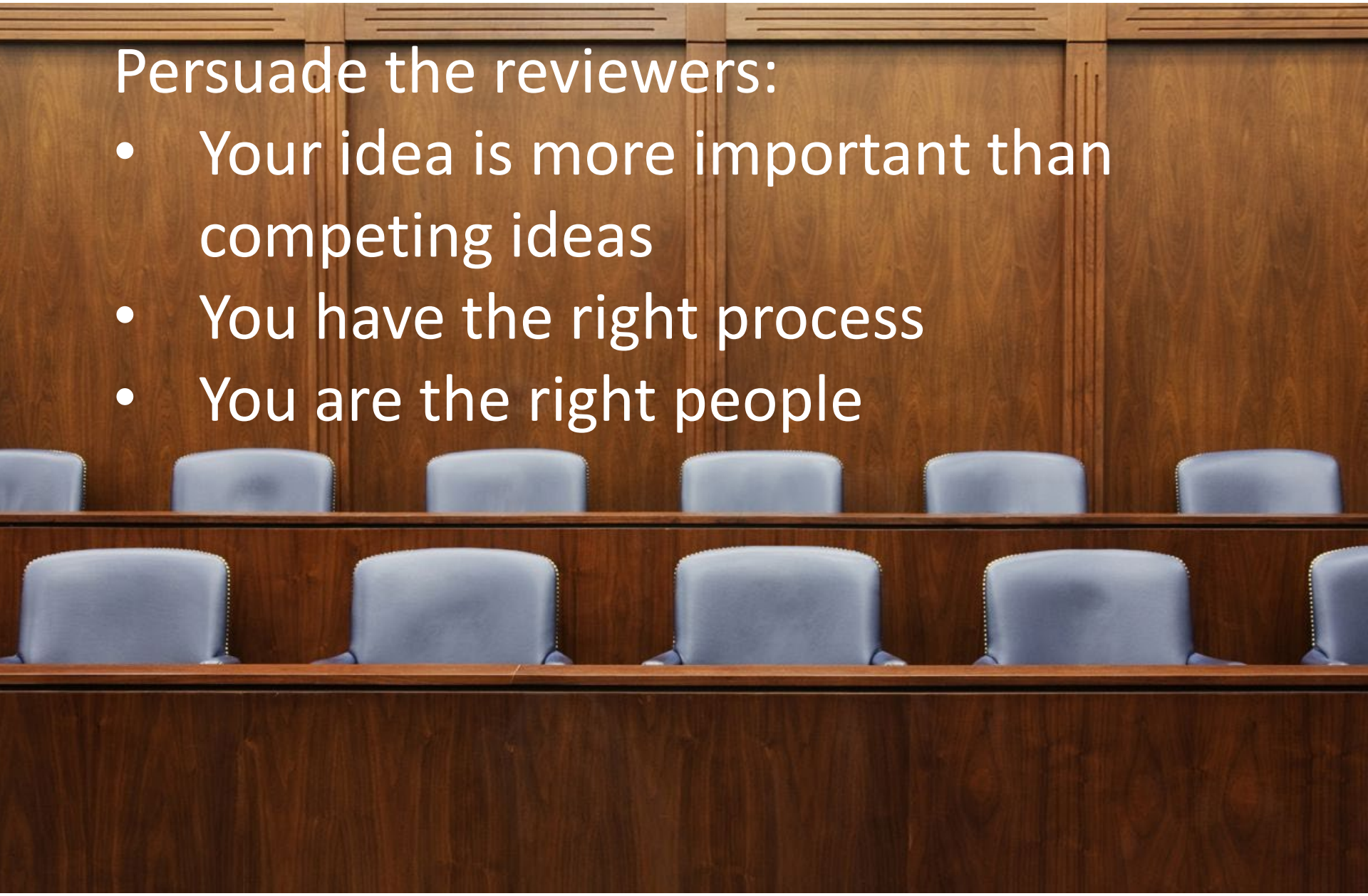
Key Strategies

- Tell a compelling story
- Answer “Why you?”
- Be responsive to agency
- Know what reviewers need
- Plan for internal review



Tell a Compelling Story

Tell a Compelling Story



Persuade the reviewers:

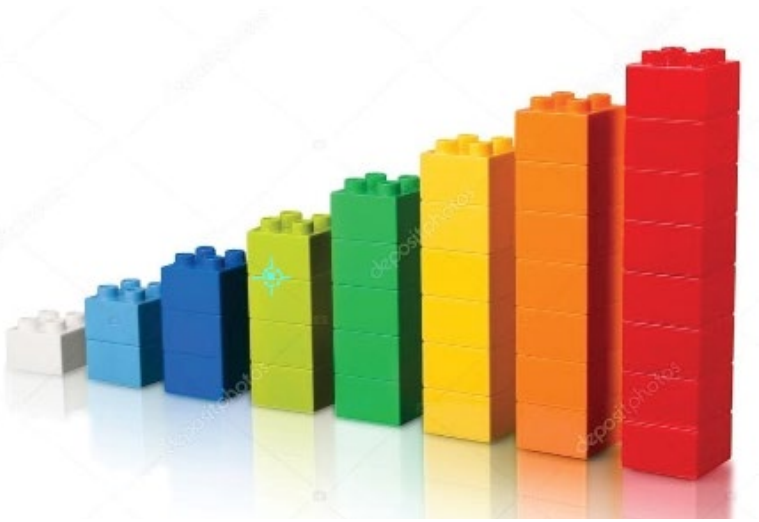
- Your idea is more important than competing ideas
- You have the right process
- You are the right people

Tell a Compelling Story

Data and Facts are Not a Story

Tell a Compelling Story

No “arbitrary” story beats or building blocks/action points.



A compelling story is not a series of “this…and then this….and then this…and then this.”

Tell a Compelling Story

Build momentum and tension with story shifts.

Instead, a compelling story has causation between thoughts and facts.

“This…but then this…so therefore this.”

Tell a Compelling Story

Persuasion begins with the story

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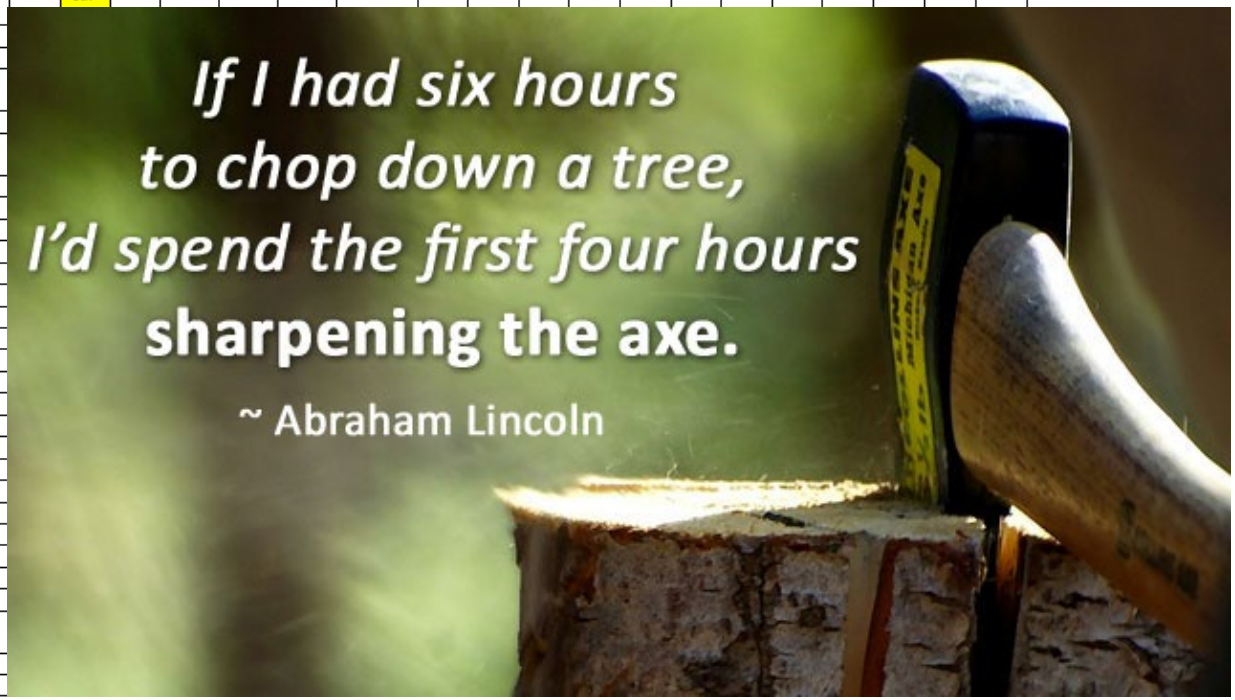

Tell a Compelling Story

Strategies for the strongest proposal submission

1. Tell a compelling story
1. Answer "Why you?"
2. Be resp
3. Know w
3. Plan for

- Identifies a problem beyond "it has not been done yet"
- Provides rationale and coherence for approach
- Written for intelligent lay person
- Hooks reviewers at outset

Tell a Compelling Story

Strategies for the strongest proposal submission

1. Tell a compelling story
1. Answer "Why you?"
2. Be resp
3. Know w
3. Plan for

- What is the problem?
- What has been done already to address the problem?
- What is the gap that remains?
- How do you propose to address this gap?

Tell a Compelling Story

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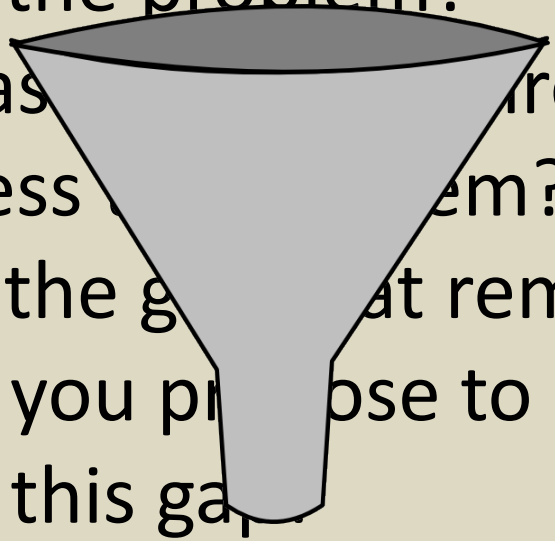
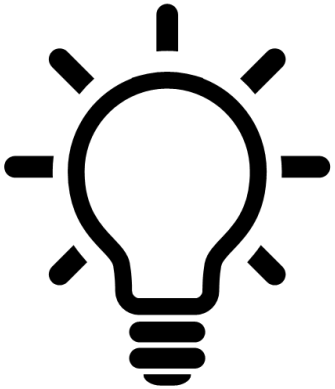


Tell a Compelling Story



I propose to prepare preservice teachers to teach engineering design concepts to their elementary students.

Tell a Compelling Story

Start with phrase answers (Example from Brenda Capobianco NSF IUSE)

What is the problem?

- Next generation standards highlight integration of engineering and technology into science education
- However, current K-12 science curriculum/pedagogy does not equip teachers to include engineering in their classroom. Particularly a problem at elementary level where teachers have less preparation in science and no formal exposure to engineering

What has been done to address this problem?

- Texas UTeach, Boston Museum of Science's Engineering is Elementary, Purdue's Science Learning through Engineering Design
- Integrate engineering design for **inservice** elementary teacher
- Strong proof-of-concept that elementary teachers can effectively translate concepts

What is the gap that remains?

- Despite strong local/regional impact, not scalable or sustainable
- Requires continual district resourcing and limited capacity to reach 1.6 million elementary science teachers

How do you propose to address this gap?

- Immerse **preservice** teachers in authentic engineering design-based science learning

Tell a Compelling Story

Turn phrases into narrative

Continued scientific and technological innovations are critical to fostering sustained economic growth, global competitiveness, and, most importantly, meeting an increased demand for STEM talent. To harness the nation's great scientific and technological potential, attention must be given to improving the state of STEM education and to build a robust STEM workforce (PhRMA, 2014). As noted by the President's Council of Advisors on Science and Technology, "the most important factor in ensuring excellence in K-12 STEM education is great STEM teachers" (PCAST, 2015). Compounding this demand for high-quality STEM teachers is the introduction of new academic standards (NGSS Lead States, 2013). Reform documents such as *A Framework for K-12 Science Education* (NRC, 2012) and the *Next Generation of Science Standards* (NGSS Lead States, 2013) highlight the significant role science and engineering practices play in building students' early understanding of the world around them. The *Framework* indicates that all children should develop competencies in engineering design, and the *NGSS* explicitly includes a "conceptual shift" toward "the integration of engineering and technology into the structure of science education." However, such an imminent shift cannot be realized without adjustment of K-12 science curriculum and pedagogy and a national ***transformation in the preparation of K-12 teachers*** so that teachers possess the knowledge and skills necessary to include the discipline of engineering in their classrooms. This is especially important at the elementary school level where teachers tend to have the most limited academic preparation in science (Abell, 2007; Appleton, 2007; Mellado, Blanco, & Ruiz, 1998) and essentially non-existent formal exposure to engineering (Cunningham & Carlsen, 2014; Wendell, 2014).

To fill this void in professional training of elementary science teachers, considerable national strides have been made to integrate engineering design for inservice elementary science teachers (Capobianco & Lehman, 2015; Capobianco & Rupp, 2014; Sargianis, Yang, & Cunningham, 2012; Yasar, et al., 2013; Yoon, at al., 2014). Programs such as the University of Texas's *UTeach Engineering*, Boston's Museum of Science's *Engineering is Elementary*, Purdue University's *Science Learning through Engineering Design (SLED) Partnership*, The John Hopkins University's *STEM Achievement in Baltimore Elementary Schools (SABES)*, and University of Minnesota's *Fuse: TEAMS* are grounded in the delivery of high-quality, content-rich, engineering design-based experiences for inservice elementary science teachers. Results show strong proof-of-concept that elementary teachers can effectively translate engineering basics into the classroom environment. The successful NSF-funded SLED Partnership, for example, demonstrated that elementary inservice science teachers can develop deep conceptual knowledge of engineering practices, translate knowledge into teaching that facilitates students' science learning, and address both first and second-order classroom challenges with implementing engineering design-based science instruction (Capobianco & DeLisi, 2015; Capobianco, Lehman, & Kelley, 2015).

While such inservice training has had strong impact on students and teachers across various elementary school settings, a significant gap remains in developing a nationally scalable and sustainable solution. Current inservice efforts rely on an existing base of teaching experience, require continual district resourcing for on-site or workshop-oriented training, and have limited capacity to reach the more than 1.6 million elementary science teachers nationwide (NCES, 2015). We lack a strategic, research-based nationwide process for elementary science teacher preparation to answer the call for implementing new engineering standards (Capobianco, 2012, 2015; Wendell, 2014).

To address this gap in engaged student learning, we propose a research-based project that will create an innovative, scalable, and sustainable model for elementary science teacher preparation that can address the unprecedented need to prepare elementary science teachers to teach engineering practices nationwide. In our *IUSE Using Principles of Design to Advance Teacher Education (UPDATE)* project, we will draw on STEM and education expertise to collaboratively transform elementary science teacher preparation by immersing preservice teachers in authentic engineering design-based science learning tasks in a sequence of core required undergraduate science content courses. We will utilize the constructs of *situated learning* and *teacher as learner* to uncover, evaluate, and explain the multiple and diverse ways preservice elementary teachers learn engineering practices, how they begin to conceptualize engineering design, and how they most effectively teach elementary school science using engineering practices.

Tell a Compelling Story

Libai Huang, Biomedical Engineering

What is the problem?
What has already been done to address this problem?
What is the gap that still remains?
How do you propose to address this gap?

Simultaneous spatial and temporal resolutions are crucial for probing dynamic processes that span multiple time and length scales in materials and biological systems. However, while electron microscopy can provide atomic spatial resolution, it has little temporal resolution; similarly, ultrafast spectroscopy offers excellent femtosecond temporal resolution but limited spatial resolution. These resolutions remain separately optimized in conventional spectroscopy and microscopy methods and hinder the elucidating of structural and dynamic factors.

To achieve combined spatial and temporal resolutions, researchers have combined ultrafast nonlinear spectroscopy with microscopy approaches, including optical microscopy, electron microscopy, scanning tunneling microscopy, and scanning probe microscopy. Importantly, using nonlinear spectroscopic signals as imaging contrast has the advantage of providing chemical, structural, and excited-state specific information and is especially useful in probing complex and dynamic interactions.

However, as the nonlinear optical processes are generally much weaker than linear ones, these signals require long integration time at each pixel. As a result, ultrafast nonlinear optical microscopy experiments are time intensive—acquisition time for a single image frame is minutes or hours—and interpretation of nonlinear spectroscopic signals is a daunting task for nonspecialists. Due to these obstacles, ultrafast microscopy has been almost exclusively available in specialized laboratories, which limits wide-range application.

We will address this research gap by developing a novel machine learning multimodal ultrafast optical imaging platform with adaptive sampling across the multidimensional spatiotemporal hypersurface to reduce optical exposure and measurement time by ~100 fold with no significant loss in reconstructed image quality. This novel microscope will enable investigations on energy and heat flow in complex materials and biological systems over a wide range of time scales (10 fs-μs) and length scales (50 nm-μm), which is not currently possible with conventional spectroscopy and microscopy methods.

Tell a Compelling Story

INFEWS/T2: Identifying Sustainability Solutions through Global-Local-Global Analysis of a Coupled Water-Agriculture-Bioenergy System

The global Food-Energy-Water (FEW) system is under increasing pressure to meet rising demands for food, energy, and water while maintaining ecosystem services provided by natural lands and waters. With growing population, rising per capita incomes, and climate change, researchers predict unprecedented resource challenges in the next 30 years. Global crop output is expected to increase by anywhere from 70% to more than 100%; global freshwater demand by 55% as one of the most fiercely contested resources; and global bioenergy demand by more than 1,000%. These challenges are interconnected—both across systems and across scales—so that addressing one system or location will inevitably cascade into others. Decision makers without the capacity to factor in these interconnections risk inadvertently pursuing unsustainable solutions and unintended consequences flowing from FEW system interventions.

Research has focused on analyzing effects within socioeconomic systems and within natural systems and is moving toward increased integration that emphasizes the role of spillover effects from one system to another. Global integrated assessment modeling research provided critical inputs to address tradeoffs between alternative sustainability solutions. However, such analyses typically omit at least one of the four systems— food security, bioenergy, water quality, and groundwater scarcity—and do not account for socioecological feedbacks. As a result, despite significant investments made by the integrated assessment communities at both global and regional scales, ***a critical research gap*** remains in our ability to assess sustainability solutions that have ***both cross-system and cross-scale components***. The absence of feedback from local actions to regional, national, and global effects makes it nearly impossible to achieve a complete analysis of tradeoffs associated with alternative policy and management interventions.

We will address this knowledge gap by building an integrative framework for analysis of FEWS solutions that highlights synergies and tradeoffs resulting from multiple policy levers and thereby allows the development of more comprehensive sustainability solutions. We will begin with the analysis of individual interventions (levers) and progress to multiple interventions that reveal how policy levers interact across systems and scales for a Global to Local to Global community of practice. Our three goals are to:

Goal 1. Single-lever analysis: Establish system behavior and identify the performance of individual levers and feedbacks to the larger integrated system via cascading pathways of impacts.

Goal 2. Multiple-lever analysis: Using the integrated system, identify high-performing strategies composed of multiple levers that reveal the trade-offs, synergies, and economic costs associated with managing FEWS challenges.

Goal 3. Community of Practice: Foster development of a community of practice utilizing Global-Local-Global methods to examine integrative solutions to these FEWS challenges.

Tom Hertel
Distinguished Professor of Agricultural Economics
NSF INFEWS 2018

What is the Problem?

Tom Hertel, Ag Economics

The global Food-Energy-Water (FEW) system is under increasing pressure to meet rising demands for food, energy, and water while maintaining ecosystem services provided by natural lands and waters. With growing population, rising per capita incomes, and climate change, researchers predict unprecedented resource challenges in the next 30 years. Global crop output is expected to increase by anywhere from 70% to more than 100%; global freshwater demand by 55% as one of the most fiercely contested resources; and global bioenergy demand by more than 1,000%. These challenges are interconnected—both across systems and across scales—so that addressing one system or location will inevitably cascade into others. Decision makers without the capacity to factor in these interconnections risk inadvertently pursuing unsustainable solutions and unintended consequences flowing from FEW system interventions.

What has been Done Already?

Research has focused on analyzing effects within socioeconomic systems and within natural systems and is moving toward increased integration that emphasizes the role of spillover effects from one system to another. Global integrated assessment modeling research provided critical inputs to address tradeoffs between alternative sustainability solutions.

What is the Gap that Still Remains?

However, such analyses typically omit at least one of the four systems— food security, bioenergy, water quality, and groundwater scarcity—and do not account for socioecological feedbacks. As a result, despite significant investments made by the integrated assessment communities at both global and regional scales, ***a critical research gap*** remains in our ability to assess sustainability solutions that have ***both cross-system and cross-scale components***. The absence of feedback from local actions to regional, national, and global effects makes it nearly impossible to achieve a complete analysis of tradeoffs associated with alternative policy and management interventions.

How do You Propose to Address this Gap?

We will address this knowledge gap by building an integrative framework for analysis of FEWS solutions that highlights synergies and tradeoffs resulting from multiple policy levers and thereby allows the development of more comprehensive sustainability solutions. We will begin with the analysis of individual interventions (levers) and progress to multiple interventions that reveal how policy levers interact across systems and scales for a Global to Local to Global community of practice. Our three goals are to:

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Tell a Compelling Story

Maggie O'Haire (NIH R01)

What is the problem?
What has been done already to address this problem?
What is the gap that still remains?
How do you propose to address this gap?

With an estimated 16.8 military Veterans committing suicide each day, posttraumatic stress disorder (PTSD) is a critical public health concern. This disorder is complex, often comorbid, and difficult to treat. Although current psychosocial rehabilitation strategies are successful for some individuals, limited effectiveness and palatability for some Veterans have led to treatment dropout and non-response rates as high as 50%. Many of these Veterans seek complementary and integrative health interventions[2] such as partnership with a PTSD service dog[3]. To evaluate this intervention and prepare for the proposed large-scale project, we conducted an NIH-funded feasibility and preliminary efficacy trial (R21HD091896). Our results indicated clinically significant reductions in PTSD symptoms for Veterans with service dogs. Yet despite our preliminary results and encouraging initial findings from independent research groups, *substantial gaps* remain in understanding how, why, and for whom PTSD service dogs are most effective. Without such knowledge, this human-animal interaction strategy will continue to be minimized as a poorly evaluated distraction from evidence-based treatment rather than a valuable addition with clinically meaningful impacts.

Our *research goal* is to evaluate the longitudinal efficacy, mechanisms, and moderators of service dogs as a complementary intervention to enhance biopsychosocial functioning. We will conduct a methodologically rigorous, multi-site, randomized clinical trial to quantify the therapeutic efficacy of service dogs for N=240 Veterans with PTSD.

Tell a Compelling Story

Where does the storyline belong in the proposal?

- As soon as solicitation allows!
  - In overview, rationale, or vision and goals
  - ~1/2 to 2/3 page
- NIH
  - In significance section and condensed version at start of specific aims page
  - ~ 1/4 to 1/3 page on specific aims page

Tell a Compelling Story

Tips

- Color code to check the funnel of logic
- Adjust level of specificity
- Use “umbrella language” to avoid lists
- A need is an answer and not a problem

Storyline Practice

- What is the problem? (and so what)
- What has been done already to address this problem?
- What is the gap that still exists? (and so what)
- How do you propose to address this gap?

Storyline to One-Page Concept Paper

Preparing for a Successful Meeting with Your Program Officer

You are more likely to receive valuable insight into the funding potential of your idea if you follow these steps:

- Make contact early (at least several months in advance).
- Do not make a "cold call." Email a one-page concept paper along with your agency biosketch and request a phone appointment to discuss.
- Develop your concept paper using the format below. Grant writers in the Office of Research and Partnerships can help you develop this text. Email sbond@purdue.edu to request help.

Why a one-pager? Distilling your ideas into a brief summary — one that starts with a compelling storyline — will best communicate project relevance, highlight the logic of your approach, and allow targeted rather than general feedback. Many program officers will not read more than one page since multiple pages represent a proposal review rather than an idea review. While you will not be told if you are "fundable," the program officer can assess for program fit.

For NIH Use Specific Aims Page

Start with storyline:

- What is the human health problem?
- What has been done already to address this problem?
- What is the gap that still exists?
- How do you propose to address this gap?

Briefly mention why this team is ideal for the project.

Aim X: Use a bold, concrete objective for each aim. Describe each aim in one to three sentences that convey why this work needs to be done as well as what and how.

End with paragraph on expected outcomes.

For All Other Funding Agencies Use Concept Page

Start with storyline:

- What is the problem?
- What has been done already to address this problem?
- What is the gap that still exists?
- How do you propose to address this gap?

List your goals/objectives.

Describe why this team is ideal for the project.

Overview methodology.

Summarize impact of your success.

PURDUE UNIVERSITY | Office of the Executive Vice President for Research and Partnerships

EA/EOU 4/19

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EA/EOU 4/19

Final Production for Email Request

INFEWS/T2: Identifying Sustainability Solutions through Global-Local-Global Analysis of a Coupled Water-Agriculture-Bioenergy System

Thomas Hertel (PI) Distinguished Professor of Agricultural Economics
Purdue University

The global Food-Energy-Water (FEW) system is under increasing pressure to meet rising demands for food, energy, and water while maintaining ecosystem services provided by natural lands and waters. With growing population, rising per capita incomes, and climate change, researchers predict unprecedented resource challenges in the next 30 years. Global crop output is expected to increase by anywhere from 70% to more than 100%; global freshwater demand by 55% as one of the most fiercely contested resources; and global bioenergy demand by more than 1,000%. These challenges are interconnected—both across systems and across scales—so that addressing one system or location will inevitably cascade into others. Decision makers without the capacity to factor in these interconnections risk inadvertently pursuing unsustainable solutions and unintended consequences flowing from FEW system interventions.

Research has focused on analyzing effects within socioeconomic systems and within natural systems and is moving toward increased integration that emphasizes the role of spillover effects from one system to another. Global integrated assessment modeling research provided critical inputs to address tradeoffs between alternative sustainability solutions. However, such analyses typically omit at least one of the four systems— food security, bioenergy, water quality, and groundwater scarcity—and do not account for socioecological feedbacks. As a result, despite significant investments made by the integrated assessment communities at both global and regional scales, ***a critical research gap*** remains in our ability to assess sustainability solutions that have ***both cross-system and cross-scale components***. The absence of feedback from local actions to regional, national, and global effects makes it nearly impossible to achieve a complete analysis of tradeoffs associated with alternative policy and management interventions.

We will address this knowledge gap by building an integrative framework for analysis of FEWS solutions that highlights synergies and tradeoffs resulting from multiple policy levers and thereby allows the development of more comprehensive sustainability solutions. We will begin with the analysis of individual interventions (levers) and progress to multiple interventions that reveal how policy levers interact across systems and scales for a Global to Local to Global community of practice. Our three goals are to:

- **Goal 1. Single-lever analysis**: Establish system behavior and identify the performance of individual levers and feedbacks to the larger integrated system via cascading pathways of impacts.
- **Goal 2. Multiple-lever analysis:** Using the integrated system, identify high-performing strategies composed of multiple levers that reveal the trade-offs, synergies, and economic costs associated with managing FEWS challenges.
- **Goal 3. Community of Practice:** Foster development of a community of practice utilizing Global-Local-Global methods to examine integrative solutions to these FEWS challenges.

Our open-source framework will strategically build on a portfolio of internationally vetted tools we have previously authored as global models of hydrology and water quality (WBM), food systems (SIMPLE-G), bioenergy (ENVISAGE), and U.S. agro-ecology (Agro-IBIS). Our experienced, interdisciplinary team of researchers have a history of productive collaboration across areas of global economic analysis of agriculture and environmental issues, policy trade-offs, and synergies associated with sustainability challenges, hydrology, and water quality. Our novel geospatial science gateway GeoHub will provide a proven cyber platform to accelerate progress toward project milestones.

The proposed system of systems will allow us to evaluate trade-offs and synergies across the FEW system for a suite of sustainability solutions. This framework will inform local/regional decision-making about sustainability goals by developing an open source, gridded FEW modeling system. Powered by NSF-funded technologies GeoHub on HUBzero and utilize GABBs (geospatial data building blocks), as well as the XSEDE computational backbone, the framework will allow fine-scale analysis across broad geographies. We will analyze global drivers of local sustainability stresses as well as feedbacks to national and international levels stemming from local adaptations to national/international FEWS stressors. This will deliver a more complete analysis of tradeoffs associated with different policies and pathways. Education and outreach on the GeoHub will provide spatial analysis capabilities to stakeholders and non-experts without requiring local software resources.

Storyline to One-Page Concept Paper

One-page…taste of your entire grant in a single, bite-sized piece

It forces you to distill all aspects down to their essences and to find a way of piecing things together that is economical, coherent, logical, and compelling […] is totally unforgiving, revealing problems in the clarity of your thinking and presentation, weaknesses in the logic of your research, vagueness in your methods, and failures in the all-important 'so what?' realm. Given the luxury of length, additional verbiage has a way of camouflaging weaknesses (at least from the writer but not so often from the reviewer).

—Robert Levenson, UC-Berkeley

Answer "Why You?"

Strategies for the strongest proposal submission

1. Tell a compelling story
1. Answer "Why you?"
2. Be responsive to agency
3. Know wh
3. Plan for ir

- Identify win differentiators of expertise, facilities, prior work, campus environment, location
- Build team strategically not out of convenience
- Think people and institutions

Answer "Why You?"

Our open-source framework will strategically build on a portfolio of internationally vetted tools we have previously authored as global models of hydrology and water quality (WBM), food systems (SIMPLE-G), bioenergy (ENVISAGE), and U.S. agro-ecology (Agro-IBIS). Our experienced, interdisciplinary team of researchers have a history of productive collaboration across areas of global economic analysis of agriculture and environmental issues, policy trade-offs, and synergies associated with sustainability challenges, hydrology, and water quality. Our novel geospatial science gateway, GeoHub, will provide a proven cyberplatform to accelerate progress toward project milestones.

Be Responsive to Agency

Requirement mapping

1. Tell a compelling story
1. Answer “Why you?”
2. Be responsive to agency
3. Know what [illegible]
3. Plan for int[illegible]

- Follow all instructions
- **Always** outline before writing

Be Responsive to Agency

Know agency guidelines as well as solicitation

NATIONAL SCIENCE FOUNDATION

PROPOSAL AND AWARD POLICIES AND PROCEDURES GUIDE

U.S. National Science Foundation

Effective May 20, 2024
NSF 24-1
OMB Control Number 3145-0058

Faculty Early Career Development Program (CAREER)
Includes the description of NSF Presidential Early Career Awards for Scientists and Engineers (PECASE)

PROGRAM SOLICITATION
NSF 22-586

REPLACES DOCUMENT(S):
NSF 20-525

National Science Foundation

Directorate for Biological Sciences

Directorate for Computer and Information Science and Engineering

Directorate for STEM Education

Directorate for Engineering

Directorate for Geosciences

Directorate for Mathematical and Physical Sciences

Directorate for Social, Behavioral and Economic Sciences

Office of Integrative Activities

Office of International Science and Engineering

Directorate for Technology, Innovation and Partnerships

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

July 27, 2022

Fourth Wednesday in July, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

Deadline changed to the 4th Wednesday of July at 5:00pm local time. Changed from the 4th Monday of July.

New optional single copy document for PECASE eligibility statement

Clarification language added for departmental chair letter supplementary document.

Other Important Information

- The PI needs to meet all eligibility criteria as of the annual deadline
- Clarification regarding the minimum percentage appointment (tenure-track and tenure-track equivalent) for eligibility to the program
- Only one annual deadline applies to all CAREER submissions, regardless of Directorate
- Added guidance on the CAREER proposal submission timeline

Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in Important Notice No. 147 . In support of these efforts, research proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov or via Grants.gov, and may not be prepared or submitted via FastLane.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 22-1), which is effective for proposals submitted, or due, on or after October 4, 2021.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

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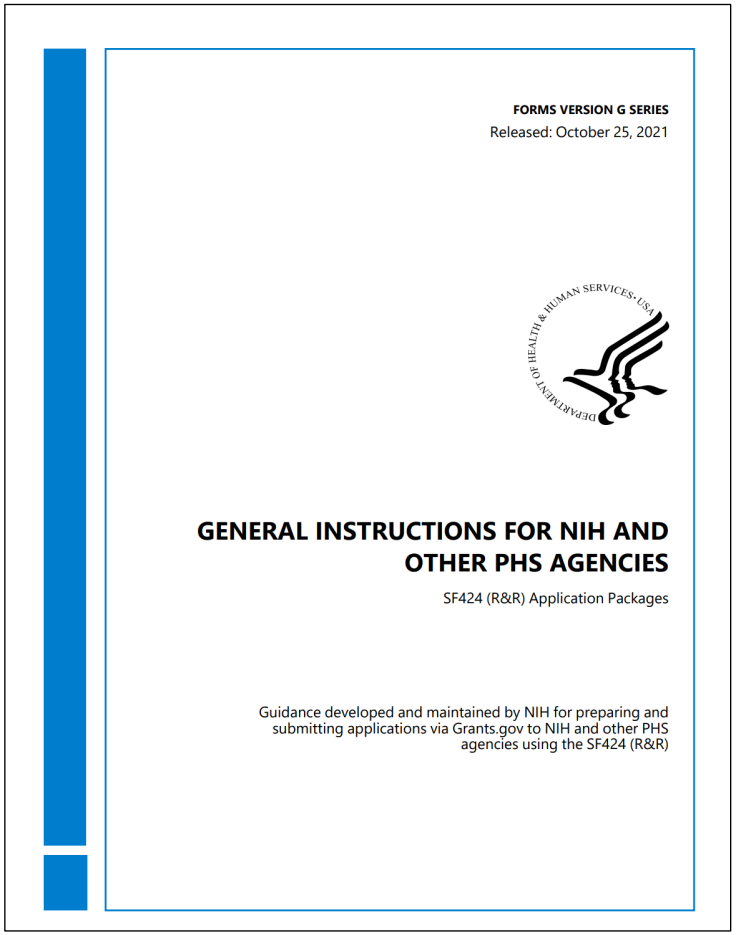
Know agency guidelines as well as solicitation

Department of Health and Human Services

Part 1. Overview Information

Participating Organization(s)	National Institutes of Health (NIH)
Components of Participating Organizations	National Institute of General Medical Sciences (NIGMS)
Funding Opportunity Title	Biomedical Technology Optimization and Dissemination Center (BTOD)(RM1-Clinical Trial Not Allowed)
Activity Code	RM1 Research Project with Complex Structure
Announcement Type	Reissue of PAR-20-104
Related Notices	See Notices of Special Interest associated with this funding opportunity **August 25, 2023** - Notice of NIGMS Informational Webinar for PAR-23-110. See Notice NOT-GM-23-052. NOT-OD-22-195 - New NIH "FORMS-H" Grant Application Forms and Instructions Coming for Due Dates on or after January 25, 2023 NOT-OD-22-189 - Implementation Details for the NIH Data Management and Sharing Policy NOT-OD-22-198 - Implementation Changes for Genomic Data Sharing Plans Included with Applications Due on or after January 25, 2023 NOT-OD-23-012 - Reminder: FORMS-H Grant Application Forms & Instructions Must be Used for Due Dates On or After January 25, 2023 - New Grant Application Instructions Now Available
Funding Opportunity Announcement (FOA) Number	PAR-23-110
Companion Funding Opportunity	None
Number of Applications	See Section III. 3. Additional Information on Eligibility.
Assistance Listing Number(s)	93.859
Funding Opportunity Purpose	This Funding Opportunity Announcement (FOA) encourages applications for NIGMS Biomedical Technology Optimization and Dissemination (BTOD) Centers to support late-stage technology optimization and sustainable dissemination of the technology to the wider biomedical research community. A BTOD Center should be at the leading edge of its field with respect to both technology development and engagement with relevant research communities. BTOD projects should address biomedical research areas within the NIGMS mission. This FOA is an update of the funding opportunity for the Biomedical Technology Development and Dissemination (BTDD) Centers (PAR-20-104). Potential applicants are strongly encouraged to consult with NIGMS staff about adherence of their proposed research strategy to the



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Requirement mapping

- Eligibility, font, page limits
- Prescriptive organization
- Key language and cited documents
- Merit review criteria in ***multiple*** locations

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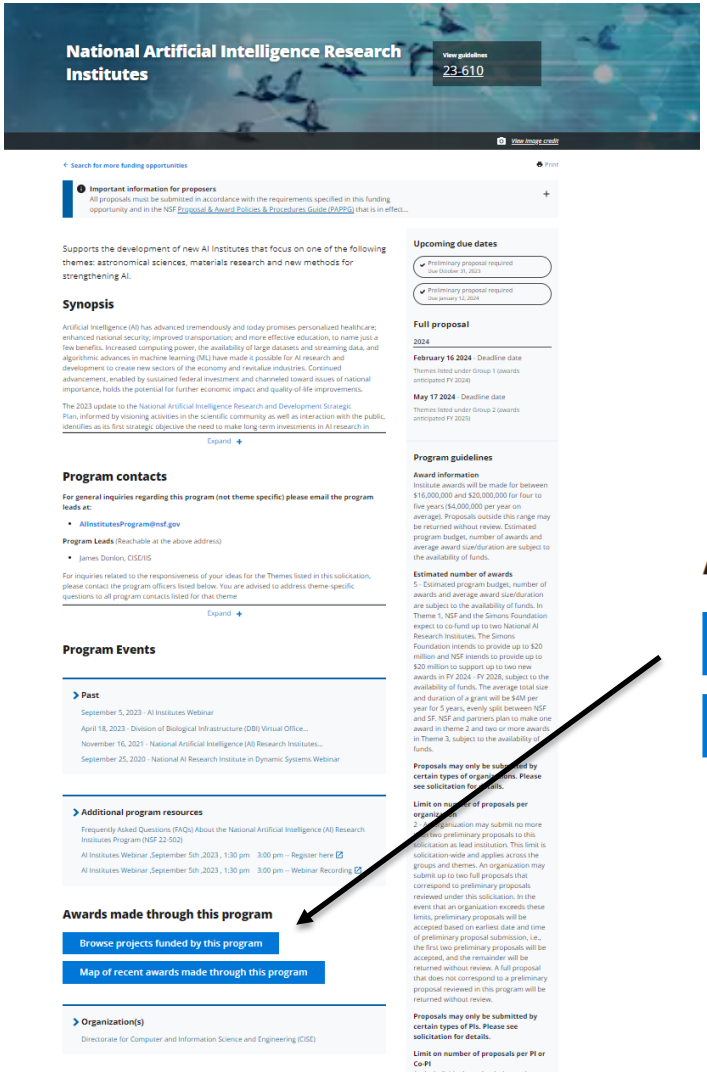
Do some sleuthing

- Project scope and budget
- Team composition and institution
- Education and diversity integration
- Translation expectations
- For NIH, what institute and study section

Be Responsive to Agency

Do some sleuthing



Awards made through this program

Browse projects funded by this program

Map of recent awards made through this program

Be Responsive to Agency

Export up to 3,000 Awards: CSV | XML | Excel | Text — Email this Link | Export All Results

Sort By: Relevance — Results size: 30 per page — Table | List — Page 1 of 2 — Displaying 1 - 30 of 37

AI Institute: Institute for Foundations of Machine Learning
Award Number:2019844; Principal Investigator:Adam Klivans; Co-Principal Investigator:; Organization:University of Texas at Austin;NSF Organization:CCF Start Date:09/01/2020; Award Amount:$17,500,000.00; Relevance:48.0;

AI Institute: AI Research Institute for Fundamental Interactions
Award Number:2019786; Principal Investigator:Jesse Thaler; Co-Principal Investigator:Matthew Schwartz, Taritree Wongjirad, Mike Williams, James Halverson; Organization:Massachusetts Institute of Technology;NSF Organization:PHY Start Date:11/01/2020; Award Amount:$16,300,000.00; Relevance:48.0;

PARTNER: An AI/ML Collaborative for Southeast Florida Coastal Environmental Data and Modeling Center
Award Number:2331908; Principal Investigator:Jason Liu; Co-Principal Investigator:Philippe Tissot, Ruoying He, Leonardo Bobadilla, Jayantha Obeysekera; Organization:Florida International University;NSF Organization:IIS Start Date:09/01/2023; Award Amount:$2,624,092.00; Relevance:48.0;

Molecule Maker Lab Institute (MMLI): An AI Institute for Molecular Discovery, Synthetic Strategy, and Manufacturing
Award Number:2019897; Principal Investigator:Huimin Zhao; Co-Principal Investigator:Scott Denmark, Martin Burke, Saurabh Sinha, Ying Diao, Jian Peng; Organization:University of Illinois at Urbana-Champaign;NSF Organization:CHE Start Date:09/01/2020; Award Amount:$19,000,000.00; Relevance:48.0;

Institute for Trustworthy AI in Law and Society (TRAILS)
Award Number:2229885; Principal Investigator:Hal Daume; Co-Principal Investigator:Thomas Goldstein, Katherine Shilton, Susan Aaronson, David Broniatowski; Organization:University of Maryland, College Park;NSF Organization:IIS Start Date:06/01/2023; Award Amount:$7,626,273.00; Relevance:48.0;

CAP: AI-Ready Institution Transforming Tomorrow's Research and Education with AI Focused on Health and Security (Jag-AI)
Award Number:2334243; Principal Investigator:Jeong Yang; Co-Principal Investigator:Zechun Cao, Gongbo Liang, Young Lee; Organization:Texas A&M University-San Antonio;NSF Organization:IIS Start Date:01/01/2024; Award Amount:$385,475.00; Relevance:48.0;

AI Institute for Future Edge Networks and Distributed Intelligence (AI-EDGE)
Award Number:2112471; Principal Investigator:Ness Shroff; Co-Principal Investigator:James Kurose, Elisa Bertino, Robert Nowak, Gauri Joshi; Organization:Ohio State University;NSF Organization:CNS Start Date:10/01/2021; Award Amount:$13,487,334.00; Relevance:48.0;

AI Institute: Planning: Institute for AI-Enabled Materials Discovery, Design, and Synthesis
Award Number:2020243; Principal Investigator:Vasant Honavar; Co-Principal Investigator:Dane Morgan, Adri van Duin, Elsa Olivetti, Mehrdad Mahdavi; Organization:Pennsylvania State Univ University Park;NSF Organization:DMR Start Date:09/01/2020; Award Amount:$500,000.00; Relevance:48.0;

AI Institute for Adult Learning and Online Education (ALOE)
Award Number:2247790; Principal Investigator:Ashok Goel; Co-Principal Investigator:; Organization:Georgia Tech Research Corporation;NSF Organization:DRL Start Date:11/01/2022; Award Amount:$10,063,655.00; Relevance:48.0;

Collaborative Research: EarthCube Data Capabilities: Enabling Analysis of Heterogeneous, Multi-source Cryospheric Data
Award Number:2026962; Principal Investigator:Morteza Karimzadeh; Co-Principal Investigator:Walter Meier, Siri Jodha Khalsa, Andrew Barrett; Organization:University of Colorado at Boulder;NSF Organization:RISE Start Date:09/01/2020; Award Amount:$948,184.00; Relevance:48.0;

AI Institute for Edge Computing Leveraging Next Generation Networks (Athena)

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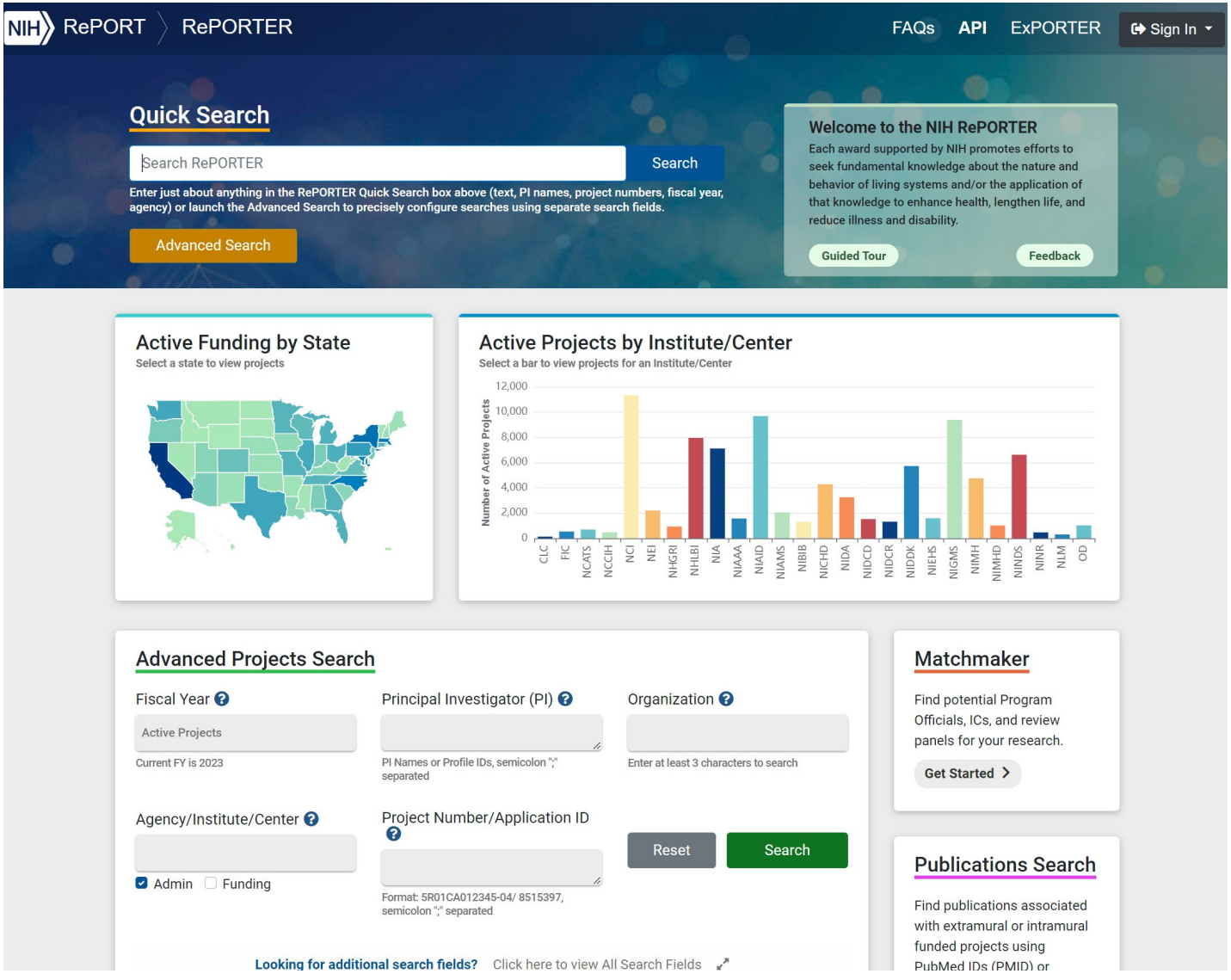
NIH RePORTer http://projectreporter.nih.gov/reporter.cfm.



Be Responsive to Agency

Never write without an outline!

CISE Expeditions Full Proposal Development Schedule

		Aug	Sep	Oct	Nov	Mon 12/2	Mon 12/16	Thur 12/19	Thu 12/19	Jan	Mon 2/10	Tue 2/11	Mon 2/17	Mon 2/24	Mon 3/3	Mon 3/10	Fri 3/14	Mon 3/17	Fri 3/21	Tue 3/25	Wed 3/26	Fri 3/28
Visioning	Team mtg on proposal development process/schedule																					
	Develop Storyline What is the problem? What has been done to address this problem? What is the gap that still remains? How do you propose to address this gap?																					
	Collaborate on prototyping projects																					
	Identify win theme and Red Panel Review team members																					
	Debrief on preproposal reviews																					
	Revise storyline, vision/goals, thrust/theme strategy, diagram																					
	Initial thrust strategizing/preplanning for template																					
	Finalize org chart/ basic management structure																					
	Conduct review panel for competitive win theme and storyline review with advisory board members				8th																	
	Debrief/revise after win theme review																					
Integration	Finalize team organizations and personnel																					
	Draft initial task/milestone Gantt timeline and discuss for integration																					
	Identify additional graphics																					
	Collect facilities, bios, COA, C&P, synergistic activities																					
	Collect letters of collaboration																					
	Review outline & assign leads				15th																	
	Team writing																					
	Draft1 compile																					
	Editing iterations																					
	Draft2 compile																					
	Core team walk through of draft2																					
	Editing iterations																					
	Draft3 compile for red panel review									20th												
	Write summary									20th												
	Send draft to red panel reviewers									27th												
	Write data management plan																					
	Write mentoring plan																					
	Conduct Red Panel Review																					
	Debrief with core team																					
	Editing iterations																					
	Conduct final Gold Team Review																					
	Editing iterations for final narrative																					
	Submit non-tech docs to PreAward																					
	Submit tech docs to PreAward																					
	Submit list of project personnel to cise-expeditions@nsf.gov																					
	Develop summary ppt slide																					
	Submit to NSF																					

Be Responsive to Agency

Map requirements to outline

Example of NSF-style proposal outline

1. RATIONALE [2.5 pages]

- Storyline
  - What is the problem?
  - What has been done already?
  - What is the gap that still remains?
  - What do you propose to do to address this gap?

Goals and Objectives

- List goals and objectives (per goal)

Team Partnership

- Team expertise
- Targeted teacher and/or community college faculty participants
- Institutional commitment

Broader Impacts

- curriculum accessed by underrepresented students through targeted teacher recruitment
- community-based research activities
- integrating research activities into computing-related courses in local high schools
- role models from HCBU partner on HUBzero webinars
- presentation to parent-teacher organizations to include assessment results from DLRC-collected metrics
- presentations at both technology education conferences as well as K-12 STEM learning

2. NATURE OF TEACHER ACTIVITIES [3.5 pages]

- Need clearly articulated research projects and activities
  - Map to goals/objectives
- Teachers must be involved in research project for at least 6 weeks
- Must have orientation session at beginning of the program for the teachers to acquaint them with laboratory methods, safety procedures, analytical methods, etc
- Address approach to research training being undertaken

Research Project

- Include overview statement of spectrum of research projects

Project 1

- Provide detailed descriptions of examples of research projects
  - Include who is doing what role
- Present plans that will ensure the development of RET participant-faculty interaction and communication
- How will you facilitate development of collegial relationships and interactions as teachers work closely in teams with university faculty and students?

Project 2

- Provide detailed descriptions of examples of research projects
  - Include who is doing what role
- Present plans that will ensure the development of RET participant-faculty interaction and communication
- How will you facilitate development of collegial relationships and interactions as teachers work closely in teams with university faculty and students?

Project Timetable

- Need Gantt-style chart such as this.
- Overview sentence

Program Initiatives	Year one	Year Two	Year Three	Year Four	Year Five
CICAWEST Administration					
Advisory Board Meeting					
D&I Team and COD meeting					
Mentoring Academy					
Training of coaches/chairs					
Mentoring pairs					
Departmental Transformation					
Diversity Forums					
Chairs/Dept Heads @ PU					
All Three Institutions					
Transformational Team Visits					
NCWIT Visiting Committees					
Promotion and Tenure Review					
Building Networks					
Summit					
Invited Lectures					
Evaluation and Assessment					
STEM Climate Assessment					
Space/Resource Inventory					
Coaching Measures					
Mentor/Mentee percp/self-eff prod					
Attitudinal Surveys					
Deans and Heads					
Faculty					
Network Analysis					
External Project Analysis					
Dissemination					
Website					
CIC *Women in Academia*					
Summit Attendees Mailings					
Publications					
National Presentations					

3. RESEARCH ENVIRONMENT [2.5 pages]

- Describe the experience and record of involvement with K-12/community college education and research of the PI
- Describe faculty who may serve as research mentors. Consider table such as:

Mentor Name	Dept/School	Expertise

- Describe institution
  - Include emphasis on cross-disciplinary partnership and past record of success in cross-disciplinary collaborations

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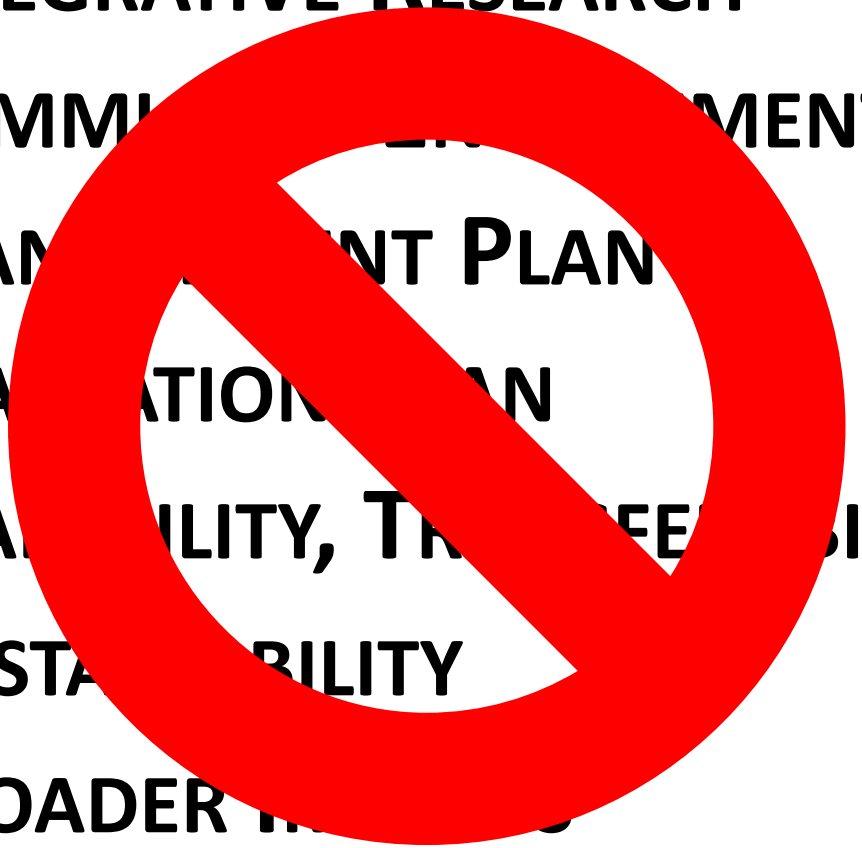
Map requirements to outline

1. Integrative Research
2. Community Engagement
3. Management Plan
4. Evaluation Plan
5. Scalability, Transferability, and Sustainability
6. Broader Impacts

Be Responsive to Agency

Map requirements to outline

1. Integrative Research
2. Comm[illegible]ment
3. Ma[illegible]nt Plan
4. Eva[illegible]tion [illegible]n
5. Sca[illegible]ility, Tr[illegible]fe[illegible]bility, and Susta[illegible]bility
6. Broader [illegible]



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Suggested SCC Outline

1. Integrative Research

- Storyline rationale [<1 page]
  - What is the problem?
  - What has been done already to address this problem?
  - What is the gap that still exists?
  - How do you propose to address this gap. Include how you will:
    - address basic, foundational research
    - address both technological and social science dimensions
    - engage a clearly identified community and how they will be integral to the research
    - Engage multidisciplinary perspectives
- Concisely state why you are the right team to conduct this research
- Concisely summarize impact of your success
  - How will this use high-risk/high-reward approaches/significantly advance theoretical foundations of S&CC sociotechnical research to advance disruptive technologies and concepts
  - Short, medium, and long-term impact on engaging technological and social science dimensions in concert
  - Potential for transferability and scalability

1.1 Integrated Social and Technological Goals and Research Questions [1 page including figure]

- List 3-4 high-level project goals

Research Questions

- detail the specific technological and social science research questions, hypotheses, and research gaps you will address in order to accomplish your project goals

Social and Technological Integration

- Summarize how your team will meaningfully integrate across both social and technological research dimensions to address these questions and accomplish these goals (reference figure)
- frame the social and technological dimensions as how you are exploring them in concert as they impact one another in the short, medium and long term

[include conceptual figure here of your research integration]

1.2 Background and Preliminary Work [1.5 pgs]

- overview 1-3 sentences that provide a roadmap for this section
- arrange topically

Topical Title

Topical Title

Topical Title

1.3 Research Plan [~6-7 pgs]

- overview of approach: how research is organized and integrated
- summarize in what ways (if any) this is high risk, high reward research
- how this is a multidisciplinary effort

Thrust 1 [title]
Name, Institution (lead); Name, Institution (Co-Lead), Name, Institution

- thrust challenges
- key objectives of the thrust
- roadmap of tasks

Task 1.1 [title]. Inline text of methodology.

Task 1.2 [title]. Inline text of methodology.

Thrust 1 Deliverables:

Thrust 2 [title]
Name, Institution (lead); Name, Institution (Co-Lead), Name, Institution

- thrust challenges
- key objectives of the thrust
- roadmap of tasks

Task 2.1 [title]. Inline text of methodology.

Task 2.2 [title]. Inline text of methodology.

Task 2.3 [title]. Inline text of methodology.

Thrust 2 Deliverables:

Thrust 3 [title]
Name, Institution (lead); Name, Institution (Co-Lead), Name, Institution

- thrust challenges
- key objectives of the thrust
- roadmap of tasks

Task 3.1 [title]. Inline text of methodology.

Task 3.2 [title]. Inline text of methodology.

Thrust 2 Deliverables:

1.4 Risk Mitigations

- Since this is high risk/high reward research, describe any risk mitigations for your integrated research plan

2. Community Engagement [1.5-2pgs]

- overview sentence defining the community and summarizing how integral your community stakeholders are in this project
- highlight any community stakeholders in leadership roles

2.1 Participating Community Stakeholders

- describe each stakeholder and provide rationale for inclusion
- consider a table at outset to overview stakeholder team and then provide more descriptive paragraphs under the table
- consider a map graphic

2.2 Collaborative Stakeholder Engagement

- describe activities that reflect meaningful community engagement that is integral to the research
  - include ways in which investigators community stakeholders will work closely to develop, pilot, and evaluate creative approaches to accomplish project goals
  - how they are involved in project and proposal formulation?
- clarify how this engagement will be sustained throughout duration of award

3. Management Plan [2.5-3 pgs]

- overview sentence on how the work will be facilitated by a representative management structure and collaborative mechanisms
  - reference an org chart that shows advisory groups, stakeholder roles, and research organization. E.g. placeholder figure below
  - Highlight PI track record in managing diverse, distributed teams and leading community stakeholder engagement

- describe specific roles and responsibilities
  - systematically walk through the org chart and describe roles of each box

3.1 Team Technical and Social Science Expertise

- describe expertise to address technical and social sciences dimensions and to work with the selected communities
  - highlight how the expertise of each PI or co-PI will enable the project team to address the technical and social sciences research dimensions of the project and work with the selected communities
  - hold first mention of each person
  - consider organizing either per person or (preferably) in topical paragraphs of types of expertise

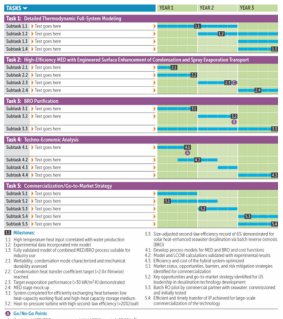
3.2 Results from Prior NSF Support

- report on one project per PI and co-PI. Use common format, e.g.

NEES Operations (0927178, $81,761,788; 10/2009-9/2014). PI: Julio Ramirez. Purdue University, through a cooperative agreement, will lead, manage, operate, and maintain George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) with 14 earthquake engineering and tsunami experimental facilities locally operated by universities across the U.S. and NEESinet cyber platform for collaboration, NEEShub. ***Intellectual merit:*** NEES Community and Communication Center's four-year tenure as headquarters for NEES Operations has facilitated an unprecedented cultural change in how research is performed in earthquake engineering in a new outside-the-university collaboration model using improved data sharing capabilities and tool co-location at NEEShub. Serves as both as an intellectual and practical model for all disaster-related fields that involve distributed sites. ***Broader impacts:*** Diverse group of PIs and professional staff bring a new level of management innovation and capacity building to NEES network-wide operations. NEEShub provides broader access to a wealth of experimental data from work at NEES Laboratories and from international partners, extensive simulation resources, and a rich set of research-grade inquiry tools and streamlined data sharing capabilities. NEEShub now has 5700 registered users, thousands of data downloads from the Project Warehouse per quarter, and more than 55,000 contributors from over 182 nations. ***Publications, products, tools:*** NEEShub platform for cyber collaboration; Bucklin and Ramirez, 2010; Ramirez, 2010; and Browning et al, 2013.

3.3 Collaboration Mechanisms and Timeline

- describe communication methods, processes, platforms, etc that will help you manage across disciplines, institutions, and community entities
- describe how tasks will be integrated over course of project
- provide timeline with principal tasks, milestones and associated interactions, e.g. example format



4. Evaluation Plan [1 pg]

- summarize vision and definition of success related to goals and including metrics to evaluate success.
  - Consider a table or a logic model, eg

Milestones (with embedded evaluation) to track progress are shown for each themes below:

Theme	Activity Milestones (examples)	Vision of Final Outcomes
Theme 1 & 4	# of Schools, Teachers & students recruited in citizen science, # of air quality monitors placed; neighborhoods covered; # of wellbeing surveys; Online uploads of data; Cyber infrastructure created & evaluated by U Spatial; # of Lesson plans developed & student learning evaluated by SP Brown	All US cities have access to: - Online database on SEIU-*WHIte* parameters for US cities (partner cities will have more data) - School-led city *WHIte* citizen science modules - Protocols for fine grain wellbeing, air quality and flood forecasting
Theme 2	Receive spatial data on 120 SEIU-*WHIte* elements from theme 1; data mining algorithms developed; hypothesis developed/tested; correlation insights handed to theme 3	- Holistic understanding of complex SEIU-*WHIte* in cities advancing urban complexity & data sciences - quantifying inequity and infrastructure related outcomes at fine urban scales
Theme 3	Convene city researcher citizen panels; co-develop scenarios/assumptions; develop multi-infrastructure connected models of future smart cities; immersive spatial visualization interface; survey participants to evaluate impacts/value of information	- Advancing the science of developing smart sustainable healthy & equitable cities - Understand spatial implications of new smart infrastructure deployment in cities - All infrastructure scenario models - tools for modeling all infrastructure city futures

- describe criteria, metrics, and methods for assessing progress and outcomes, appropriate to the proposal.
  - Evaluation may employ any of a variety of systematic methods: qualitative and/or quantitative methods, public participation in data collection, periodic and/or longitudinal analyses, experiments, or other approaches required to iteratively improve and successfully evaluate the project.
- Identify key time points/milestones at which you will assess progress towards achieving successful outcomes of research and piloting (reference timeline milestones as appropriate)

5. Scalability, Transferability, and Sustainability [3/4 page]

- identify expected outcomes that have the potential to be scaled and transferred to other communities. the population size that will be directly affected by them in their project, and the characteristics of other communities (e.g.,geog/graphics, size, geographies) that could benefit from their adoption.
- Identify which community stakeholders on the project team have the capability (e.g., influence, experience and networks) to develop pathways to sustain successful project outcomes in the long-term within the piloting community.

6. Broader Impacts [3/4 page]

- Describe the project's potential to benefit society and contribute to the achievement of specific, desired societal outcomes. E.g.
  - Community transformation
  - impact of transferability and scalability
  - how you will advance disruptive technologies and concepts
  - broadening participation
  - next generation STEM workforce (able to work collaboratively across disciplines and engage with communities)
  - science literacy and science communication
- look at broader impacts resources on grant writing website: https://www.purdue.edu/research/oevprp/funding-and-grant-writing/grant-writing-support/broader-impacts.php

Be Responsive to Agency

Map requirements to outline

Goal 1: [title] (1.5 pages)
Name (lead); Names

- Provide overview of objectives so reviewers have a roadmap

Objective 1.1 [Title]

- Describe tasks
  - Include one technical figure
  - Identify novel methodology
- Outline risk mitigations
- Describe outcomes and integration

Objective 1.2 [Title]

- Describe tasks
  - Include one technical figure
  - Identify novel methodology
- Outline risk mitigations
- Describe outcomes and integration

Goal 2: [title] (1.5 pages)
Name (lead); Names

- Provide overview of objectives so reviewers have a roadmap

Objective 2.1 [Title]

- Describe tasks
  - Include one technical figure
  - Identify novel methodology
- Outline risk mitigations
- Describe outcomes and integration

Know What Reviewers Need

1. Tell a compelling story
1. Answer “Why you?”
2. Be responsive to agency
3. Know what reviewers need
3. Plan for ir

- Enable fast/quality review
- Use formatting as roadmap
- Think visually
- Write clear and concise

Know What Reviewers Need

Enable a fast and quality review

The secret to editing your work is simple: you need to become its reader instead of its writer.

—Anna Deavere Smith

Know What Reviewers Need

Parallel organization as a roadmap

1.3 Research Plan [~6-7 pgs]

- overview of approach: how research is organized and integrated
- summarize in what ways (if any) this is high risk, high reward research
- how this is a multidisciplinary effort

Thrust 1 [title]

Name, Institution (lead); Name, Institution (Co-Lead), Name, Institution

- thrust challenges
- key objectives of the thrust
- roadmap of tasks

Task 1.1[title]. Inline text of methodology.

Task 1.2 [title]. Inline text of methodology.

Thrust 1 Deliverables:

Thrust 2 [title]

Name, Institution (lead); Name, Institution (Co-Lead), Name, Institution

- thrust challenges
- key objectives of the thrust
- roadmap of tasks

Task 2.1[title]. Inline text of methodology.

Task 2.2 [title]. Inline text of methodology.

Task 2.3 [title]. Inline text of methodology.

Thrust 2 Deliverables:

Know What Reviewers Need

Parallel organization as a roadmap

Research Strategy (usually 12 pages) Option 2 with common preliminary studies

A. Significance
B. Innovation
C. Approach
- Overview sentence on the team and the approach

Preliminary Studies (for all the aims together)
- For all the aims together

Title of Specific Aim #1 (verbatim from your specific aims section)
- Introductory paragraph

Research Design

Expected Outcomes

Potential Problems and Alternative Strategies

Title of Specific Aim #2 (verbatim from your specific aims section)
- Introductory paragraph

Research Design

Expected Outcomes

Potential Problems and Alternative Strategies

Title of Specific Aim #3 (verbatim from your specific aims section)
- Introductory paragraph

Research Design

Expected Outcomes

Potential Problems and Alternative Strategies

Timetable
- Use Gantt chart

Future Directions (optional)

3 Know What Reviewers Need

Importance of white space

The NEES collaboration created a total of 15 advanced equipment sites for experimental work dedicated to the reduction of the earthquake threat (Figure 4). The current experimental reach of the equipment ranges from the marine to the geotechnical to the structural environments and can address almost any technical question that may arise on issues related to the safety of the built-environment in earthquakes. Development of this massive array of experimental capabilities demanded an intense and sustained effort. In retrospect, it would appear that the leaders of research groups involved in the creation of the 15 sites were totally absorbed, as they should have been, in the proper development of a magnificent experimental capability across the U.S. Unfortunately, there were three unplanned and unintended results: 1) a negative perception among a portion of the research community that equipment access was not equitable; 2) most, if not all, of the research work initiated has not yet been of a quality to transform the engineering community culture; and 3) the information technology infrastructure, which had initially inspired the NEES concept of a network of interconnected laboratories, has yet to reach its potential. The metaphor of a powerful fleet of battleships at anchor is not irrelevant to the current status. Our goal is to get the fleet moving in harmony.

Rapid advance in engineering knowledge and capability requires at least four ingredients: 1) a driving need; 2) a large community of well-educated professionals; 3) financial support; and 4) competing centers of research and development. As emphasized by the tragic disaster in Wenchuan, PRC, in May 2008, there continues to be a critical need for advances in earthquake-loss reduction. Considering the seismic histories of population centers such as San Francisco, Los Angeles, Katmandu, and Istanbul, there is no basis for expecting the earthquake threat to abate in the foreseeable future. In large measure because of the encouragement of the National Science Foundation since the early 1970's, the U.S. is blessed with an impressively large community of professionals well trained in earthquake engineering and related sciences. The first two ingredients are very much in place. As long as the U.S. continues to have a strong economic profile and maintains its proven ability to plan beyond the immediate future, financial support for research and development in earthquake issues will continue. Our mission, then, is for NEES to take the lead in providing the competing centers of research and development to achieve catalysis of the existing essential ingredients as described below. The seminal idea for the NEES network was the creation of an experimental-research infrastructure with many visions and capabilities at different research centers connected with a single purpose through the opportunity provided by information technology. The objective of creating a successful equipment infrastructure has been achieved. A driving challenge now is to resuscitate what was intended to be the cortex of the system: the information technology (IT) that can enable the required catalysis of ideas.

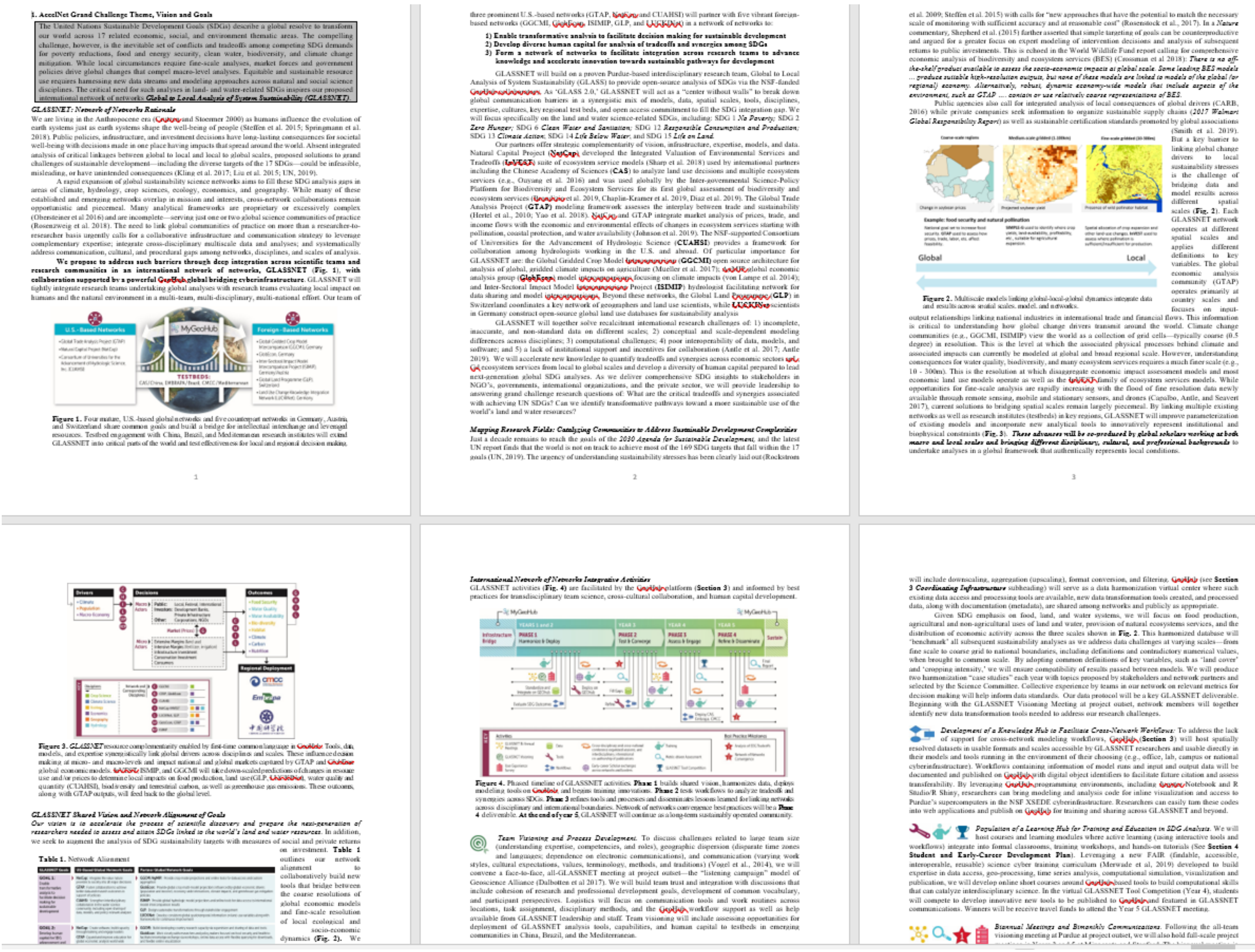
Our overall strategy is designed to: 1) inspire the NEES researcher to pursue a more ambitious research agenda; 2) entice the rest of the research community to compete for the opportunity to benefit from the sites; 3) encourage academic researchers to interact with the professional engineers in order to accelerate the implementation of new knowledge in practice; and 4) develop a NEES *community* that will include all individuals, institutes, agencies, corporations, professional societies, and non-governmental organizations (NGO) interested in protecting society from the harmful consequences of earthquakes.

A brief look at the history of civilizations will reveal that the nuclear ingredient in their development has been the "agora," or the market. Using the opportunities provided by information technology, we plan to develop the intellectual equivalent of the agora in order to get the "fleet at anchor" moving at an ever-increasing pace. We will employ operational excellence, innovative computational tools, outreach that advances knowledge, and an environment for the catalysis of ideas. Among the qualitative and quantitative performance metrics for measuring our success and developing a compelling basis for continued operation are: 1) the *satisfaction* of users (including both physical and analytical researchers); NEEShub users; and education, outreach and training targets; 2) a *greater diversification* of users, research sponsors, operations sponsors, outreach community, and the NEEShub community; 3) *increased research productivity* in earthquake engineering, including the increased use of NEES equipment by remote users; 4) *greater impact* on codes, technical committees, professional societies, and research directions; and, eventually, 5) *reduced losses* from earthquakes.

3

Know What Reviewers Need

Importance of white space and visuals.



Know What Reviewers Need

If I said…

Know What Reviewers Need

Did you see in your mind's eye these words?

Red Fire Truck

Know What Reviewers Need

Or this picture?

Know What Reviewers Need

Wired to "see" words as well as patterns and categories

7032925111

vs

703-292-5111

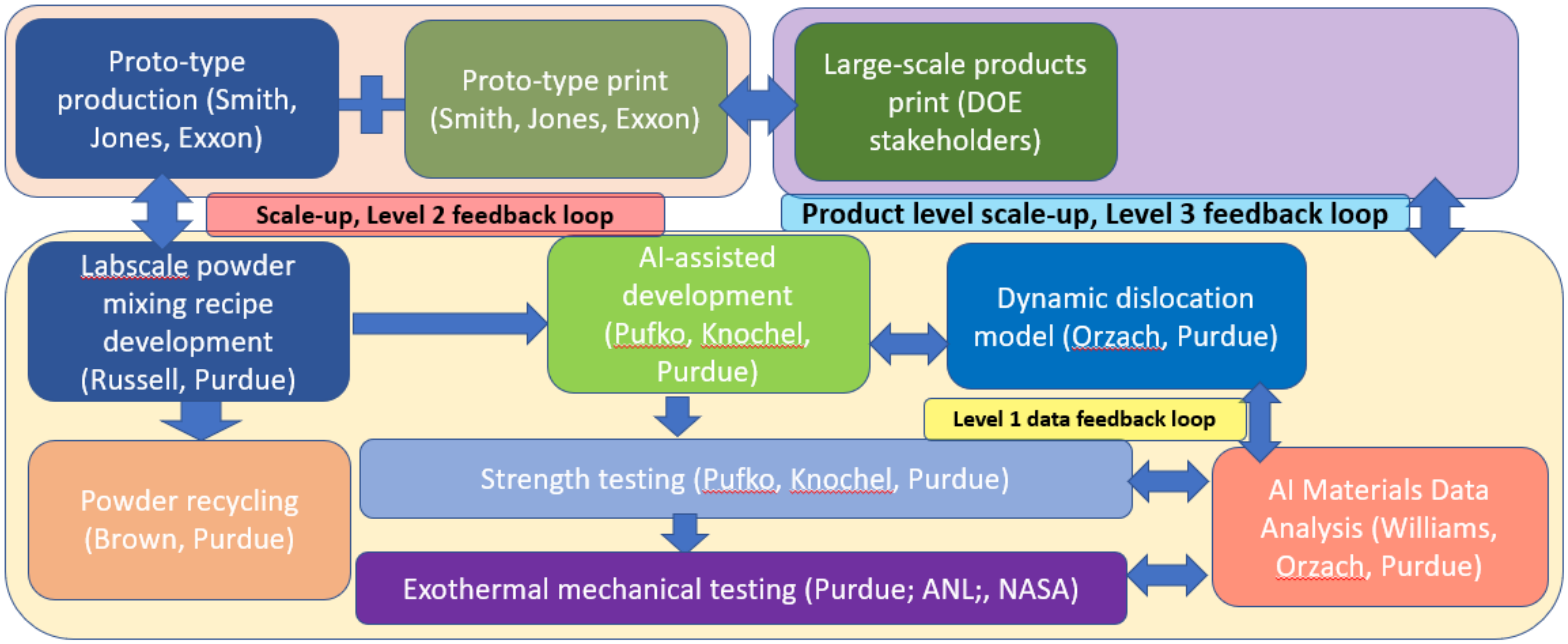
Know What Reviewers Need

Keys to making graphics that work

- Never save space by shrinking graphics so they are not easily readable
- Have a starting point
- "Chunk" organizational components
  - ❑ message is easily synthesized and recalled because of coherent grouping
  - ❑ icons used for repeating elements
- Show integration and not siloed components
- Write rich captions. Don't just label.
  - ❑ Articulate main takeaway point
  - ❑ Walk reviewers through process diagrams

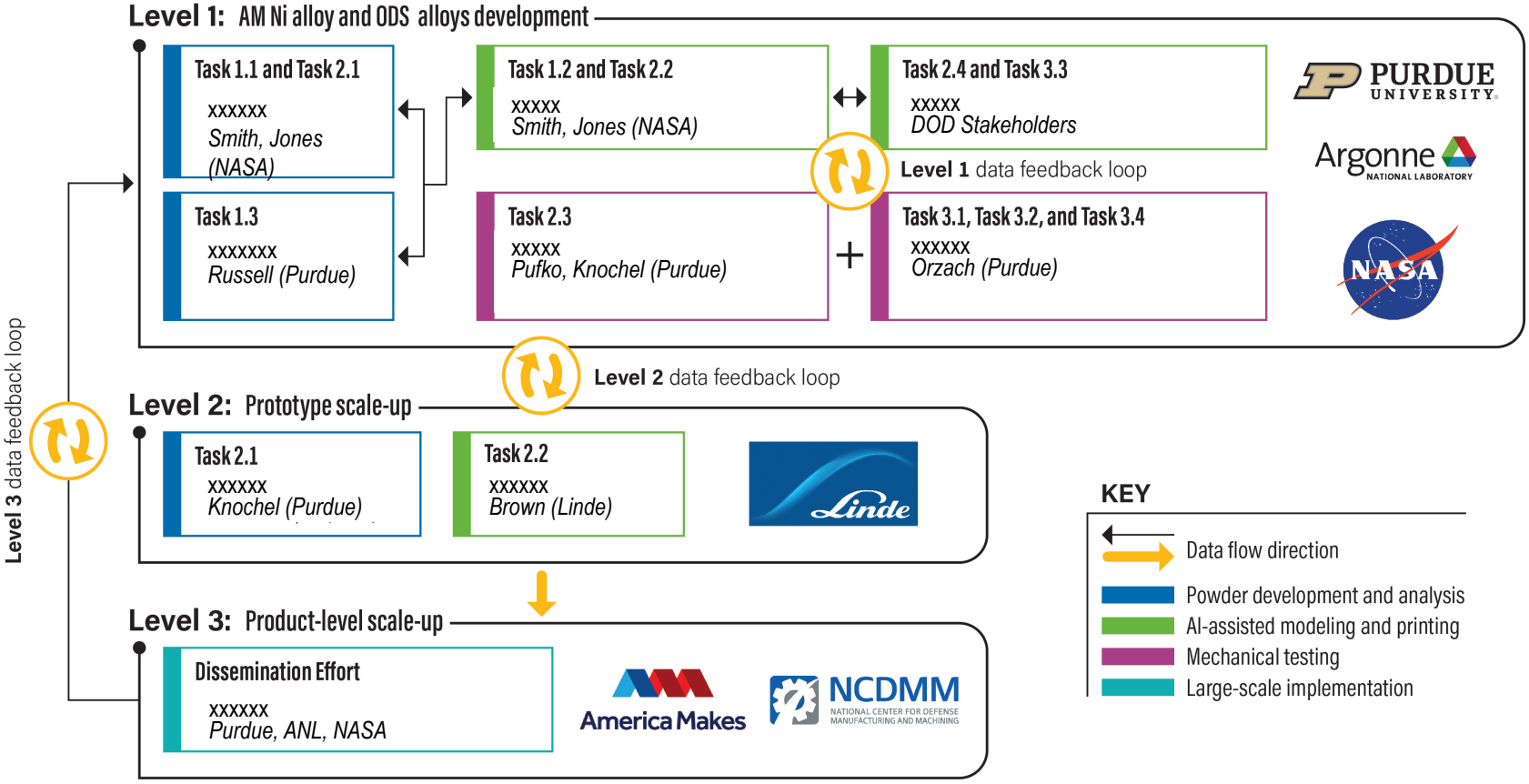
Know Your Audience

Have a starting point and "chunk" to show groupings



3 Know Your Audience

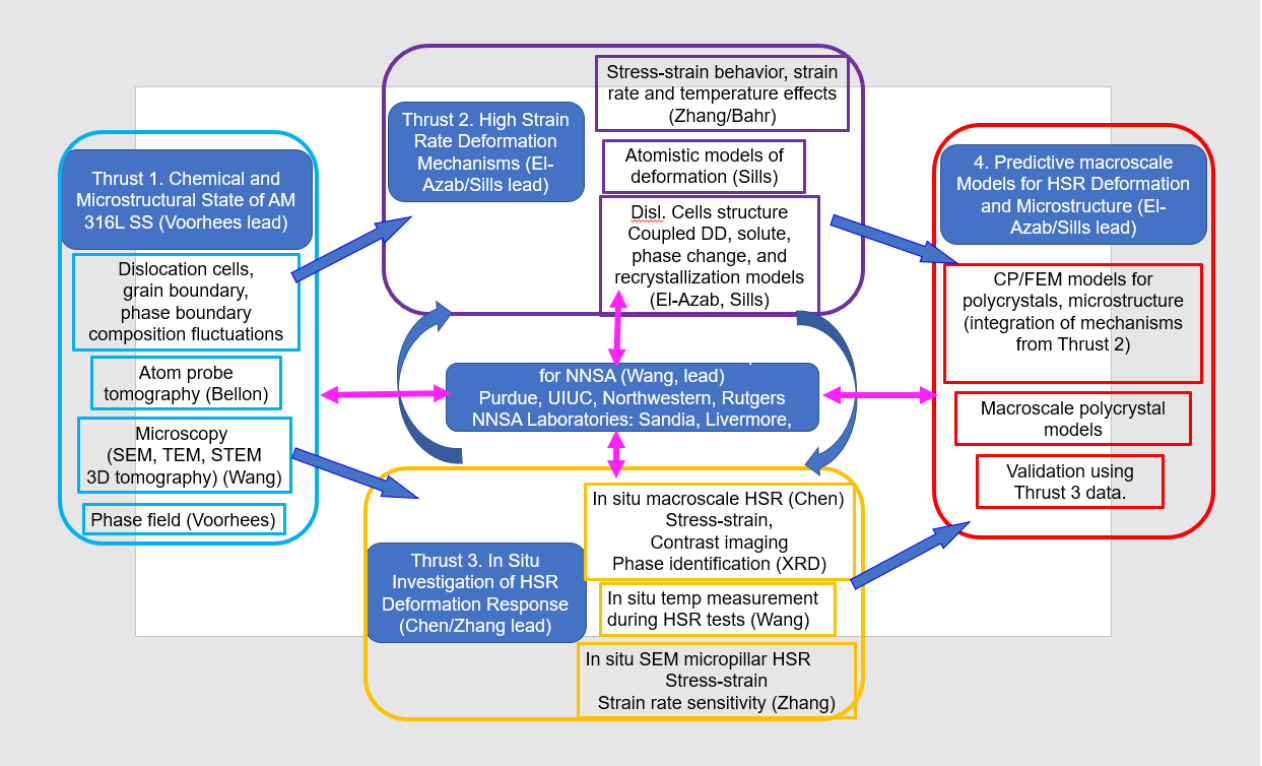
Use graphics to organize in "categories"



- *Categorized boxes (color code) and data flow (icon)*
- *Mapped to tasks and partners for richer communication*

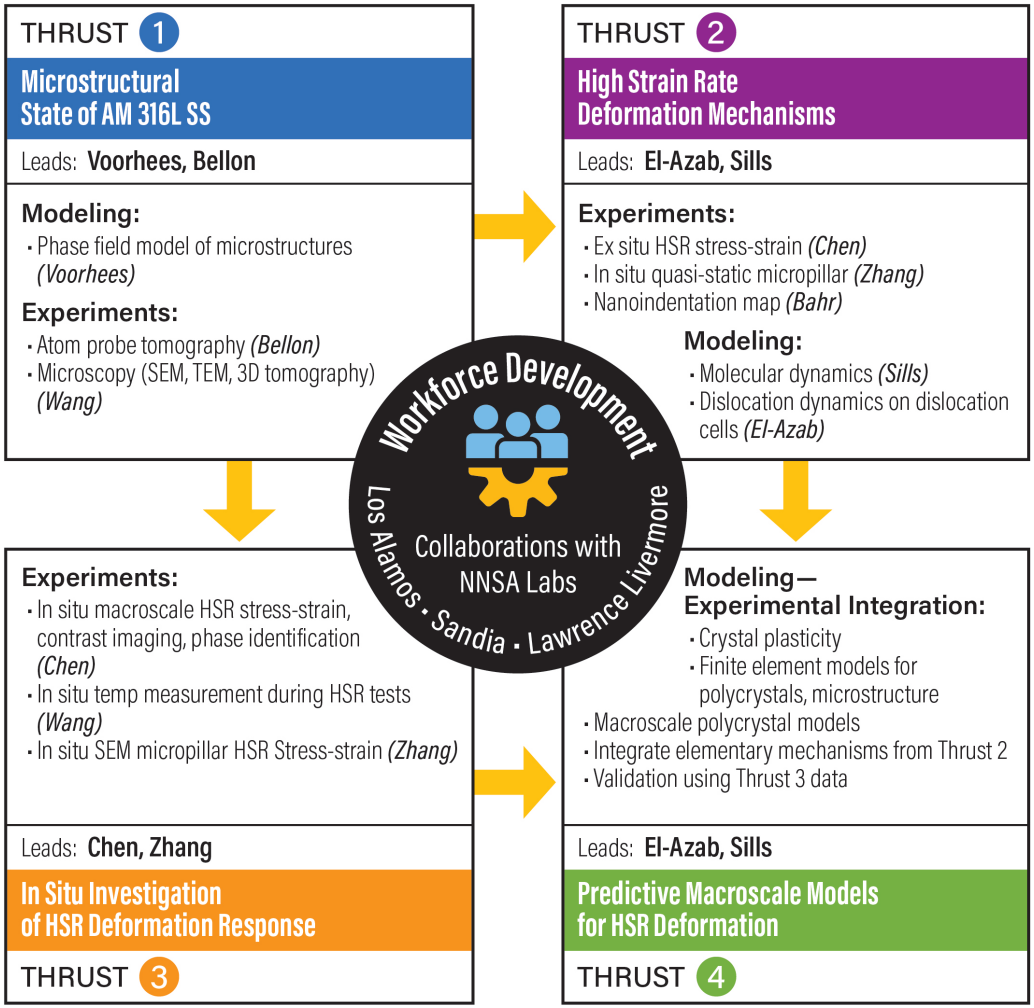
Know Your Audience

Make sequencing clear



Know What Reviewers Need

Make sequencing clear



Simplified message that Thrust 1 provides two routes forward to Thrust 4

Know What Reviewers Need

How can we pull out meaningful patterns?

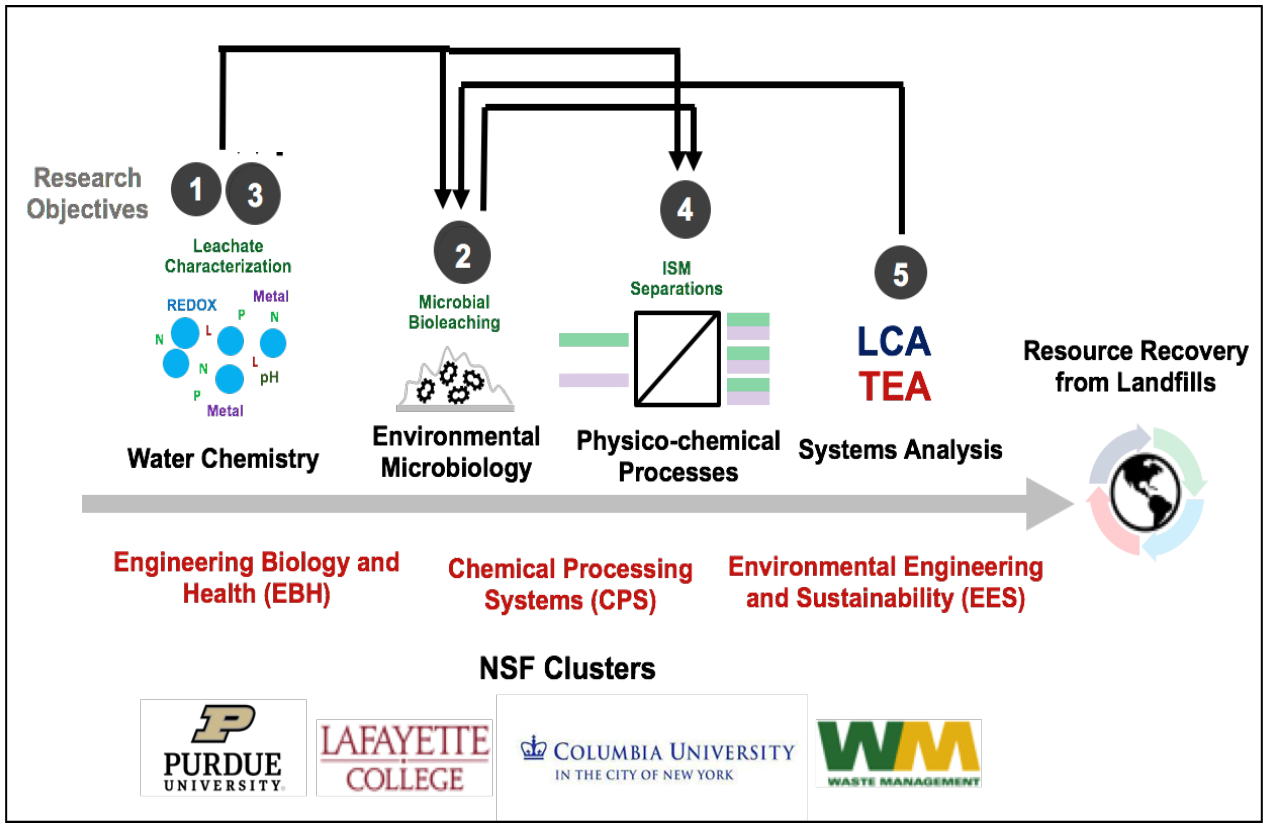


Figure 1: Five project thrusts.

Know What Reviewers Need

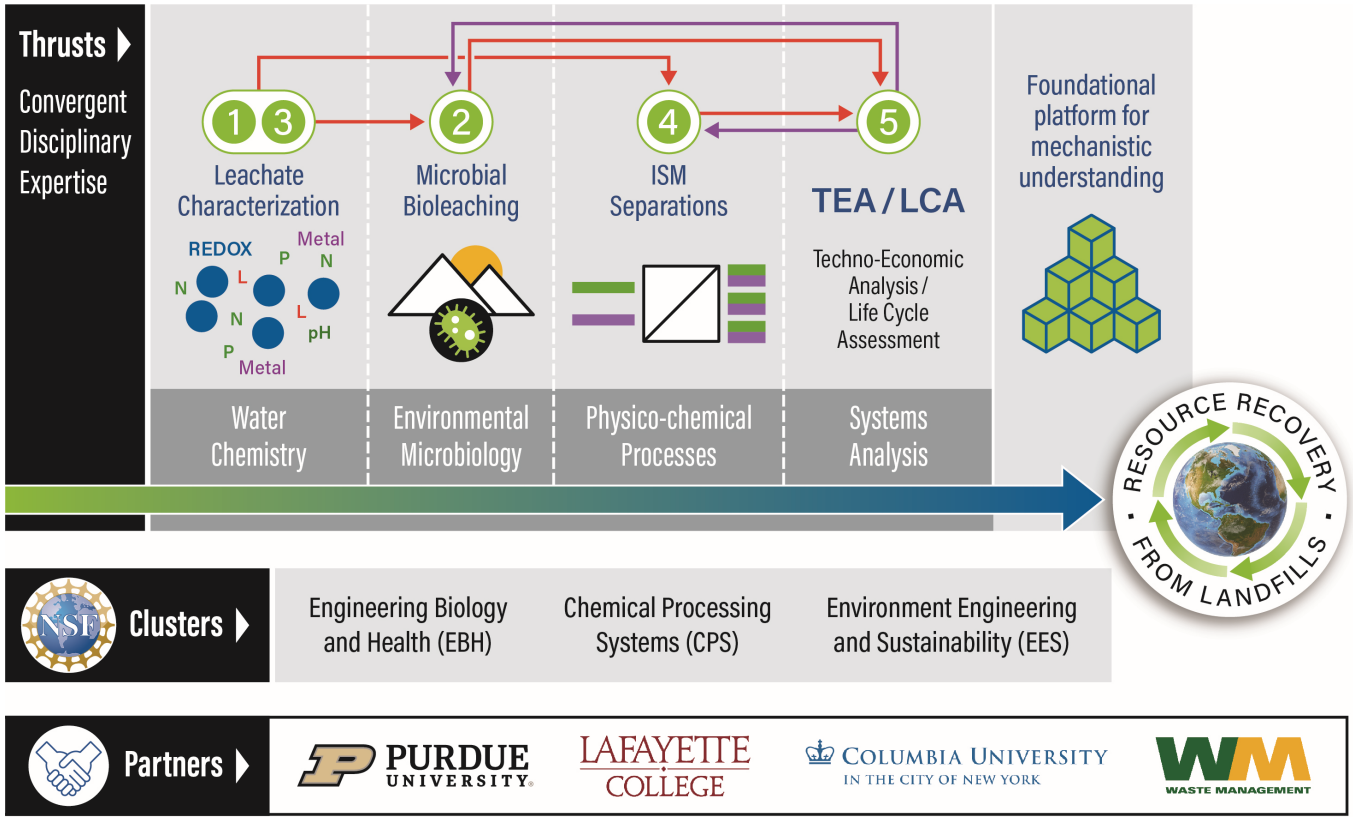


Figure 1: Fundamental framework examined through five integrated thrusts at convergence of multiple NSF cluster areas.

Color code to show forward integration (red arrows) vs feedback loop (purple arrows)

Provide main take away point in the caption rather than just labeling as "Five Project Thrusts"

Know What Reviewers Need

What do the colors mean? What is the take away message?

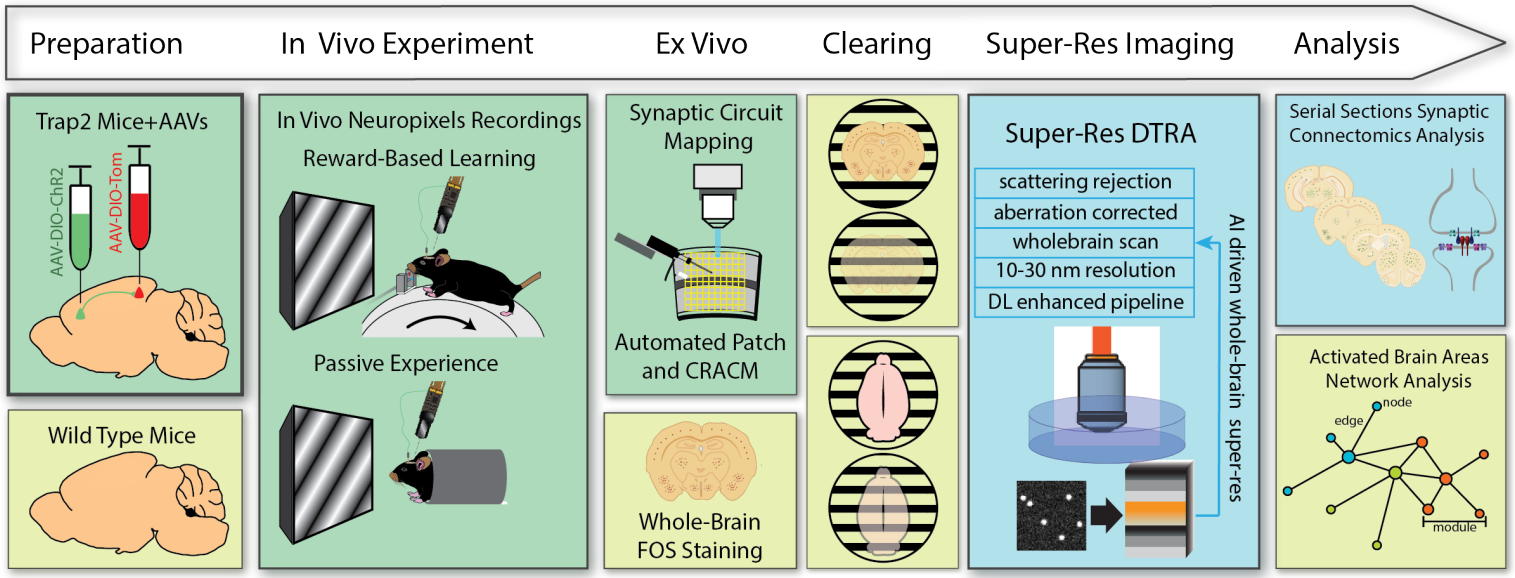


Figure 1. Experimental and Analysis Pipeline

3 Know What Reviewers Need

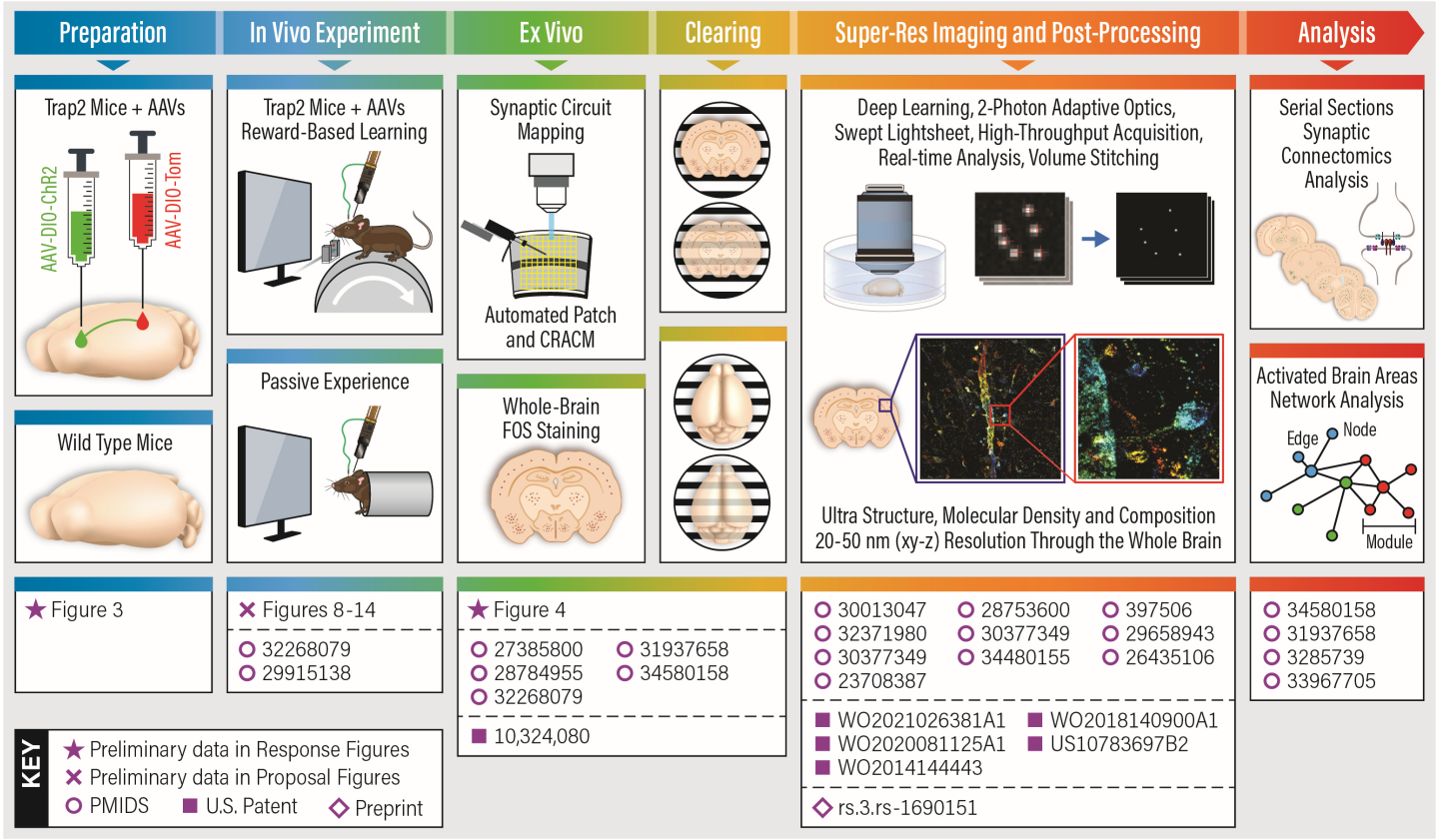


Figure 1: Experimental and Analysis Pipeline correlated to risk-mitigated preliminary work.

Color code to time continuum

Symbols used for groupings to enrich message

Label in caption changed to take away message

Know What Reviewers Need

Use symbols and icons to chunk into groups

LEVERS			GHGs	
Hydrological infrastructure	+	+	–	?
Artificial recharge of aquifers	+	?	–	?
Irrigation efficiency	+	+	?	?
Groundwater restrictions	+	–	?	?
R&D in ag productivity	+	–	?	?
Irrigation expansion	–	+	?	?
Bioenergy production	–	–	+	–
Carbon pricing	?	–	+	–
Nitrogen leaching charge	?	–	+	+
Tile/controlled drainage	?	–	?	+
Increased nitrogen efficiency	?	+	+	+
Wetland restoration	+	–	–	+
Non-ag nitrogen removal	?	–	?	+
Conservation rotation	?	–	+	+

Institutions	Radiation Hardened	Heterogeneous Integration/ Adv. Packaging	Supply Chain	Embedded Systems Security	System on Chip
Purdue University	O	O	O	O	O
Vanderbilt University	O				
Air Force Institute of Technology	O				
Arizona State University	O	O	O		
Brigham Young University	O				
Georgia Tech	O	O	O	O	O
Indiana University				O	O
University of Michigan	O				
St. Louis University	O				
SUNY-Binghamton		O			
Draper Laboratory	O				
Sandia National Laboratory	O				

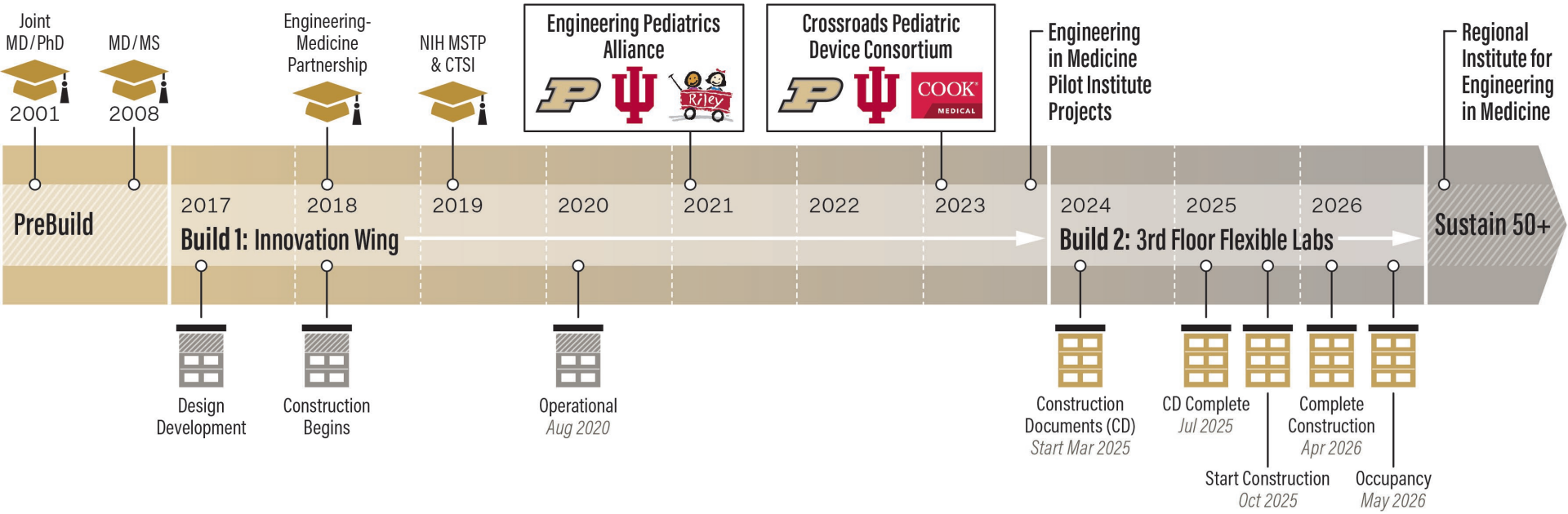
Initial targeted institutions: *Boeing, Lawrence Livermore, Honeywell, BAE, IBM, Northrop Grumman, Raytheon, Rolls Royce, Saab, Lockheed Martin, TechSource*

	MEASUREMENT MODALITIES									CAPABILITIES	
	TM	FFM	SMIM	SthM	C-AFM	MFM	CR-AFM	KPFM	PFM	Wafer Scale	Auto-mation
Asylum Research Cypher S*	O					O	O	O	O		O
Asylum Research Cypher ES	O				O	O	O	O	O		O
Asylum Research MFP3d Bio*	O				O	O	O	O	O		O
Bruker Dimension	O	O				O	O	O	O	O	
Bruker Catalyst	O	O				O	O	O	O		
Bruker Multimode	O	O				O	O	O	O		
☆ **Asylum Research Jupiter XL***	O	O	O	O	O	O	O	O	O	O	O

**Located in the Center for AFM*

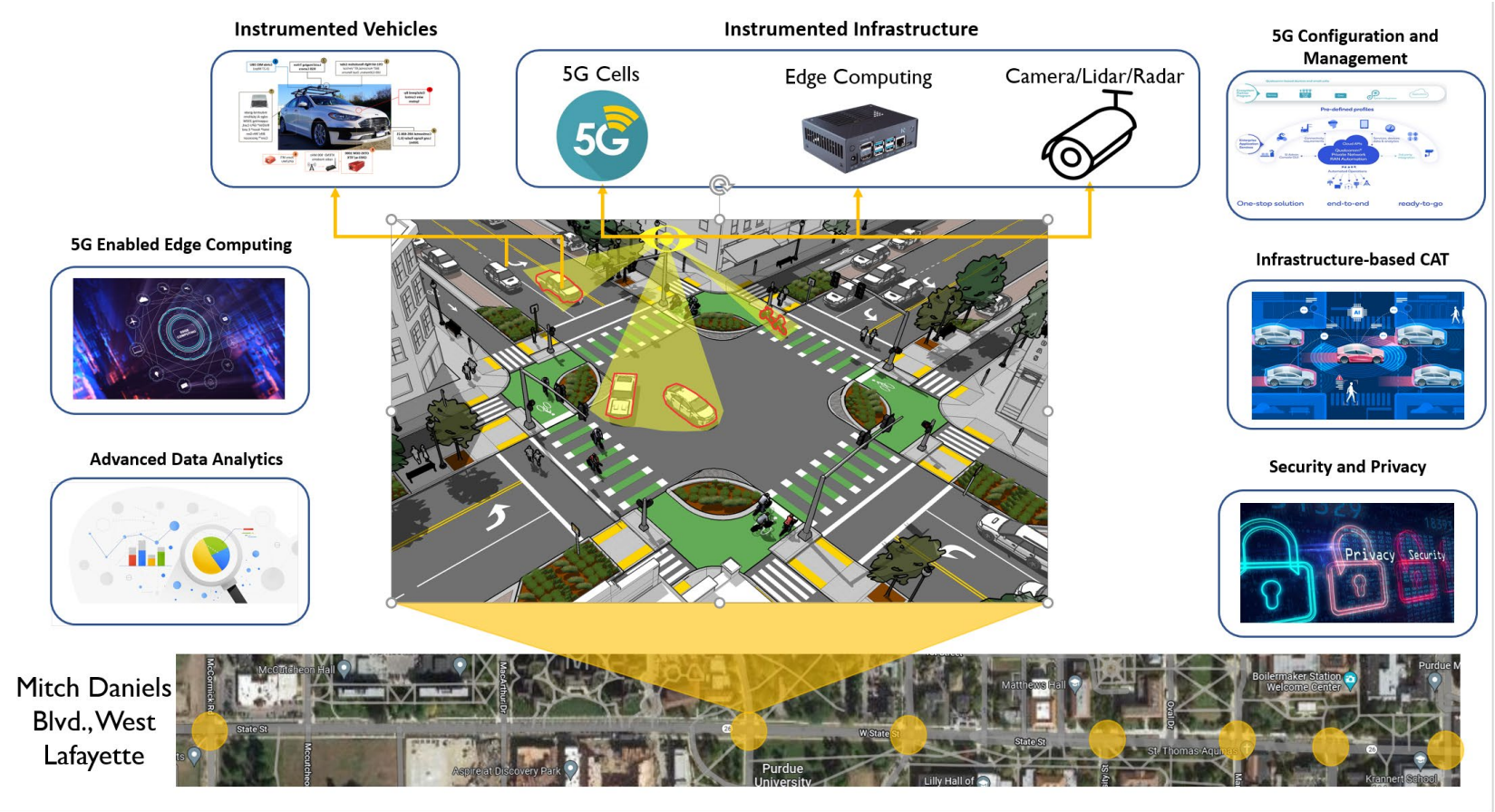
3 Know What Reviewers Need

Use phased timelines to clarify your trajectory



Know What Reviewers Need

Use graphics to organize in "categories"



BEFORE

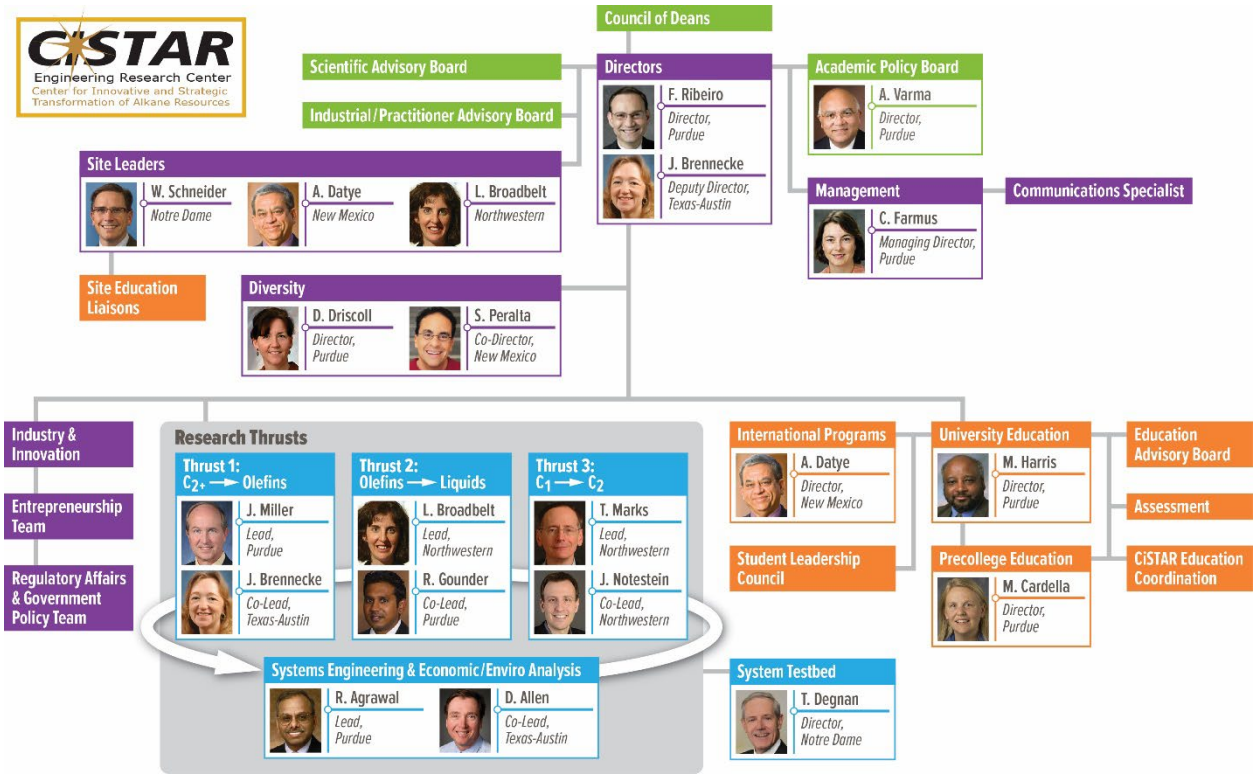
Know What Reviewers Need

Use icons to represent categories and patterns

AFTER

Know What Reviewers Need

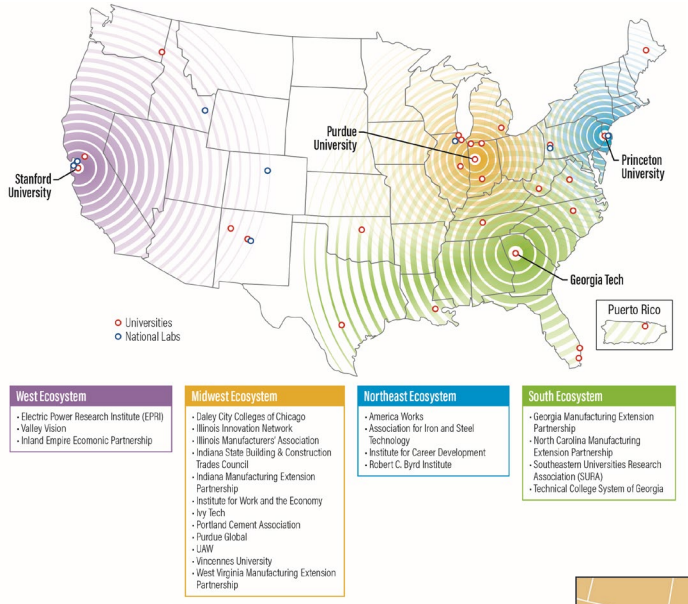
Use color codes to communicate categories



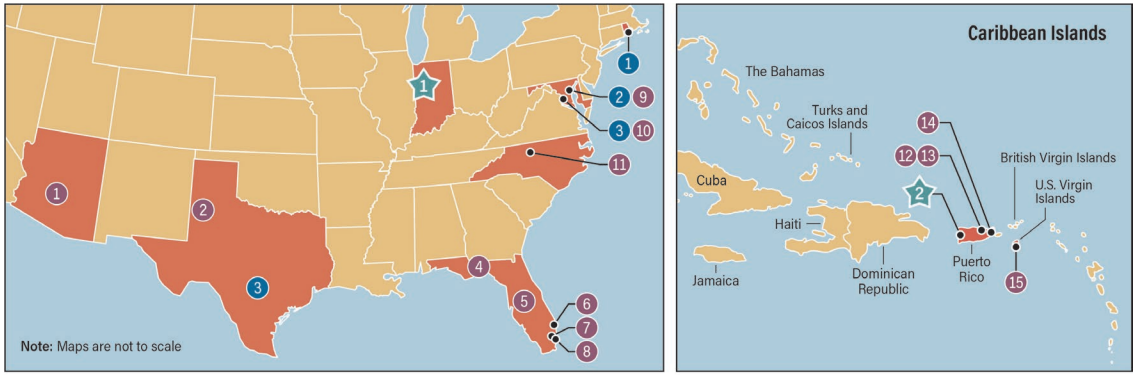
Larger org charts color coded by role is a helpful grouping

Know What Reviewers Need

Use icons, colors, symbols to clarify partnership patterns



Partners categorized by type or location depending upon what is the strategic emphasis.



Main Partners:
1. Purdue University
2. University of Puerto Rico at Mayagüez

Navy Labs:
1. US Naval Undersea Warfare Center
2. US Naval Air Station Patuxent River
3. US Naval Research Laboratory

Other Partners:
1. Arizona State University
2. Texas Tech University
3. University of Texas at San Antonio
4. Florida A&M University
5. Florida Polytechnic University
6. Florida International University
7. Florida Atlantic University
8. University of Miami
9. Morgan State University
10. Howard University
11. North Carolina A&T State University
12. Polytechnic University of Puerto Rico
13. University of Puerto Rico at Piedras
14. University of Puerto Rico at Humacao
15. University of the Virgin Islands

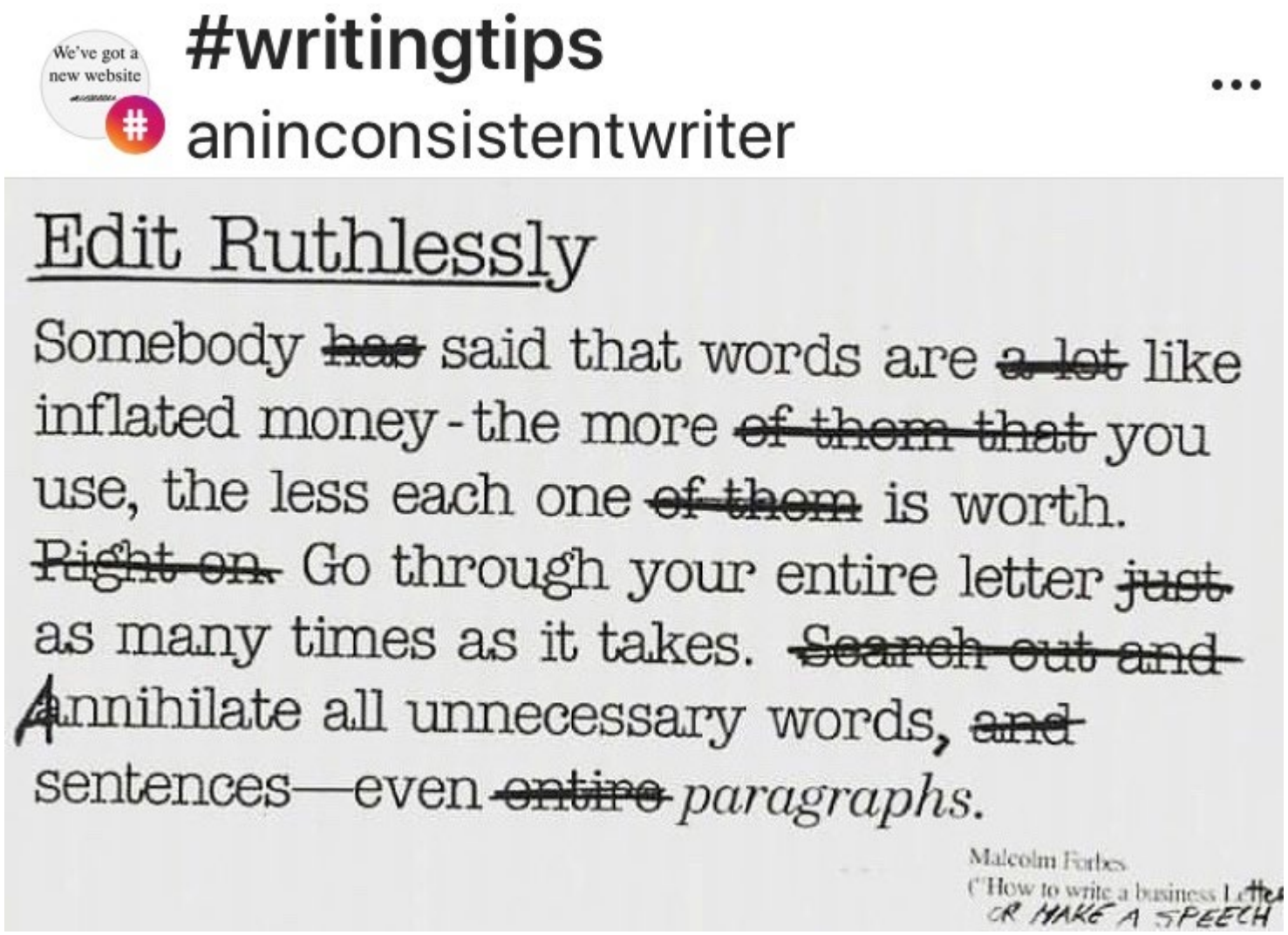
Know What Reviewers Need

Use even simple visuals to summarize narrative when possible.

Research Schedule	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Aim 1: Develop a large animal acquired hydrocephalus model																
Task 1.1: IACUC approval																
Task 1.2: Finalize kaolin injection protocol																
Task 1.3: Finalize MRI protocol																
Task 1.4: In vivo evaluation of acquired hydrocephalus model																
Aim 2: Quantify the lifetime of self-clearing catheter in vivo																
Task 2.1: Fabrication of dual-pore self-clearing catheter																
Task 2.2: Quantify impact of MRI on self-clearing catheter																
Task 2.3: Publication on MRI Interaction																
Task 2.4: Quantify self-clearing catheter performance and failure rate																
Task 2.5: Publication on self-clearing catheter in vivo performance																
Aim 3: Quantify the effect of microactuation duty cycle																
Task 3.1: Quantify the impact of prophylactic actuation																
Task 3.2: Quantify the impact of rescue actuation																
Task 3.3: Publication on the impact of prophylactic vs. rescue actuation																

Know What Reviewers Need

Less is More.



3 Know What Reviewers Need

Avoid long, dense sentences.

There are several innovations of this proposed research, including: a) analysis of air contaminant mixtures and health, particularly with extremely high spatiotemporal resolution; b) consideration of climate change impacts; and c) incorporation of novel risk assessment methodology. (37 words)

Our key innovations include: a) analyzing air contaminant mixtures and health with extremely high spatiotemporal resolution; b) considering climate change impacts; and c) incorporating novel risk assessment methodology. (28 words)

Know What Reviewers Need

Get rid of passive voice

Elemental mapping of animal tissues has been investigated, and results have been documented. (80 characters)

We investigated elemental mapping of animal tissues and documented results.

(65 characters)

Know What Reviewers Need

Delete words that do not add anything

The development of a~~n entire~~ process ~~in order~~ to screen new high-throughput products for further evaluation is ~~certainly~~ one of the most important features.

Know What Reviewers Need

Remove ambiguity particularly with reference words.

When Nature published research that explored gene editing of embryos using CRISPR–Cas9 to correct a specific genetic mutation, it did not include embryos from IVF clinics.

What is “it”? The paper? The research? The gene editing? CRISPR-Cas9?

Plan for Internal Review

- Tell a compelling story
- Answer "Why you?"
- Be respons
- Know what
- Plan for internal review

- Leave time for team editing
- Plan review date at start
- Formal or informal

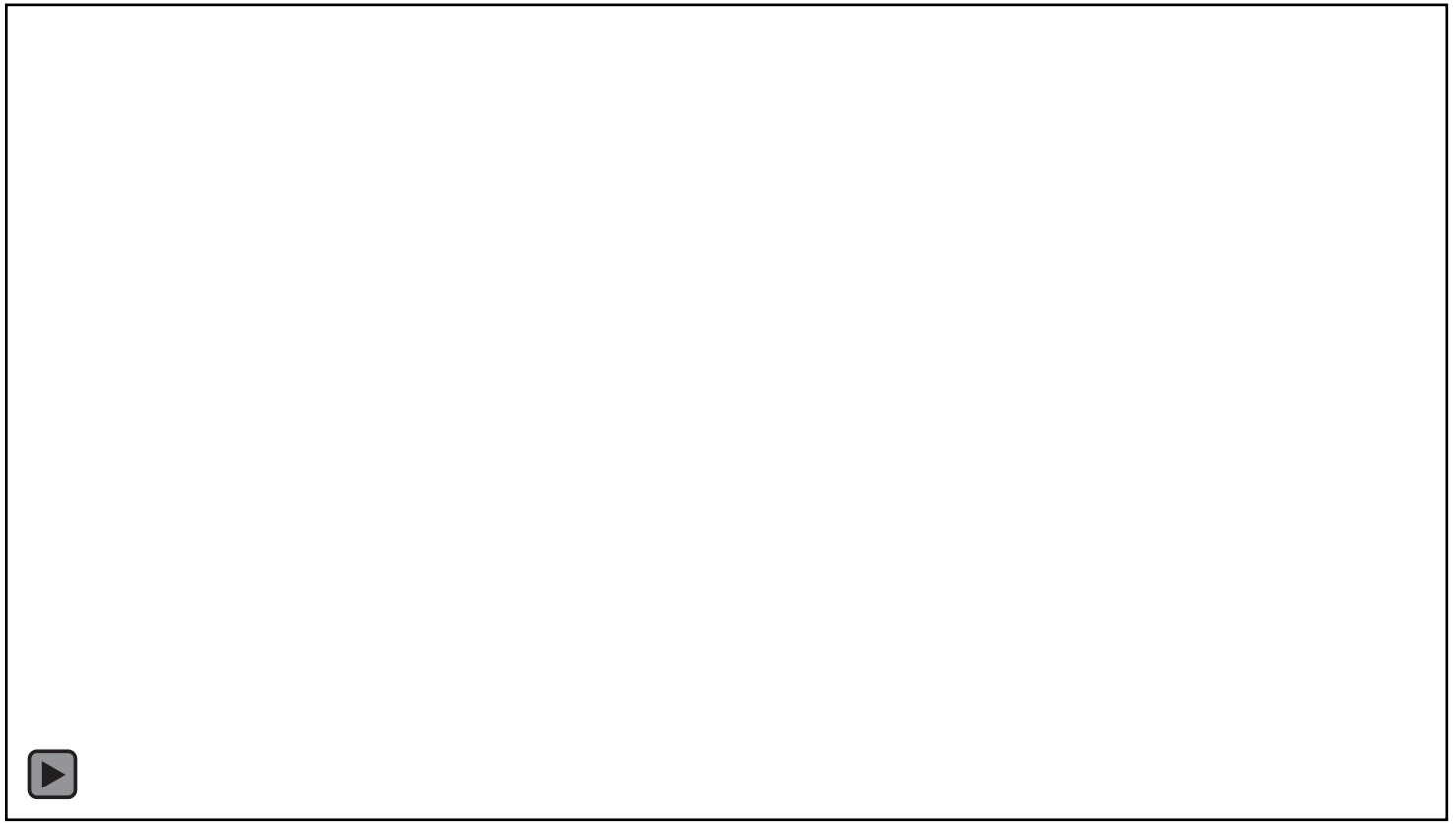
Plan for Internal Review

CISE Expeditions Full Proposal Development Schedule

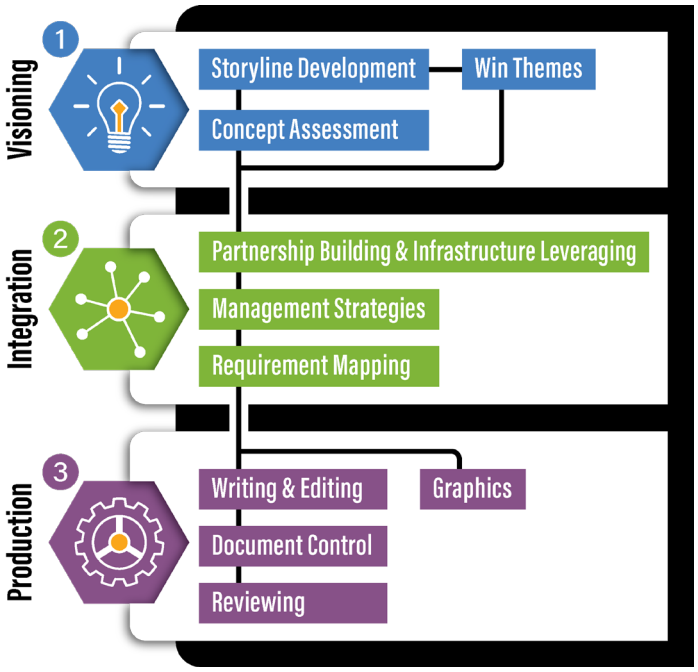
		Aug	Sep	Oct	Nov	Mon 12/2	Mon 12/16	Thur 12/19	Thu 12/19	Jan	Mon 2/10	Tue 2/11	Mon 2/17	Mon 2/24	Mon 3/3	Mon 3/10	Fri 3/14	Mon 3/17	Fri 3/21	Tue 3/25	Wed 3/26	Fri 3/28
Visioning	Team mtg on proposal development process/schedule																					
	Develop Storyline What is the problem? What has been done to address this problem? What is the gap that still remains? How do you propose to address this gap?																					
	Collaborate on prototyping projects																					
	Identify win theme and Red Panel Review team members																					
	Debrief on preproposal reviews																					
	Revise storyline, vision/goals, thrust/theme strategy, diagram																					
	Initial thrust strategizing/preplanning for template																					
	Finalize org chart/ basic management structure																					
	Conduct review panel for competitive win theme and storyline review with advisory board members				8th																	
	Debrief/revise after win theme review																					
Integration	Finalize team organizations and personnel																					
	Draft initial task/milestone Gantt timeline and discuss for integration																					
	Identify additional graphics																					
	Collect facilities, bios, COA, C&P, synergistic activities																					
	Collect letters of collaboration																					
	Review outline & assign leads				15th																	
	Team writing																					
	Draft1 compile																					
	Editing iterations																					
	Draft2 compile																					
	Core team walk through of draft2																					
	Editing iterations																					
	Draft3 compile for red panel review									20th												
	Write summary									20th												
	Send draft to red panel reviewers									27th												
	Write data management plan																					
	Write mentoring plan																					
	Conduct Red Panel Review																					
	Debrief with core team																					
	Editing iterations																					
	Conduct final Gold Team Review																					
	Editing iterations for final narrative																					
	Submit non-tech docs to PreAward																					
	Submit tech docs to PreAward																					
	Submit list of project personnel to cise-expeditions@nsf.gov																					
	Develop summary ppt slide																					
	Submit to NSF																					

3 Plan for Internal Review

Because sometimes what is obvious to you is not obvious to others



How Can We Help You?



- Agency analysis
- Storyline logic flow
- One-page concept paper
- Campus resources
- Outlining and compliance matrices
- Writing and editing
- Document control
- Ancillary documents
- Graphics

Online Resources

Templates and Step-by-Step Guidance

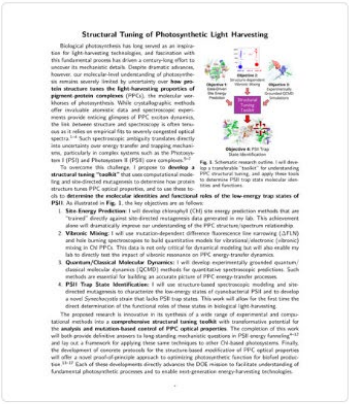
Sample Storylines

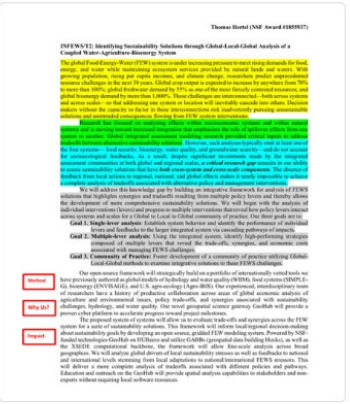
What exactly does a storyline look like? Access color-coded examples from funded proposals.

- Capobianco NSF IUSE Two Step Storyline Process
- Huang MRI Storyline
- O'Haire NIH R01 Storyline
- Teegarden NIH R01 Specific Aims and Project Summary
- Watts NIH R21 Storyline
- Mike Reppert DOE Early Career Storyline
- Levesque-Bristol Improving Undergraduate STEM Education (IUSE)

One-Page Concept Papers

This "how to" document turns your storyline into a tool you can use to talk with program officers, vet your idea with mentors, and recruit collaborators.





Drop-in Text for Resource/Facilities

Data Management Plans

DMP Development Resources

- **Purdue Libraries Data Management Guidelines**
- **Purdue-Affiliated dmptool.org** for data management plans templates, sample documents, and funder guidance.
- **Purdue's Research Repository (PURR)** contains step-by-step instructions for completing the data management plan requirements and citable boilerplate text that can be inserted into your DMP.
- **Data Storage Options at Purdue** explains different data storage options available to the Purdue community

Sample DMPs from funded Purdue projects

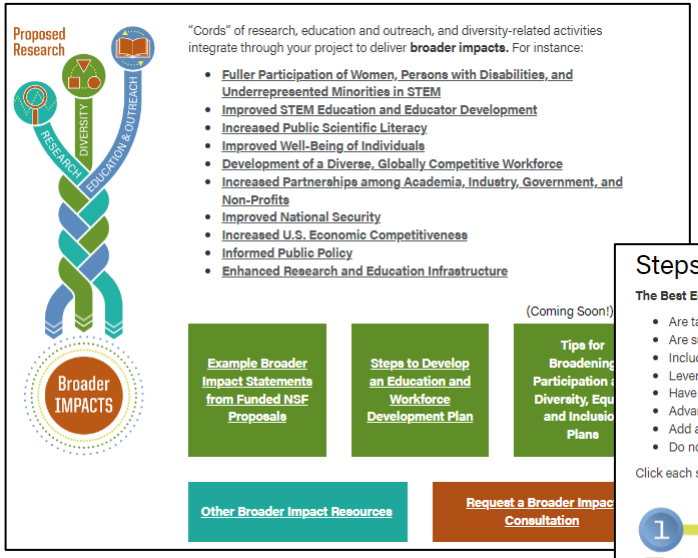
NSF Division of Engineering Education and Centers (CISTAR 2017)

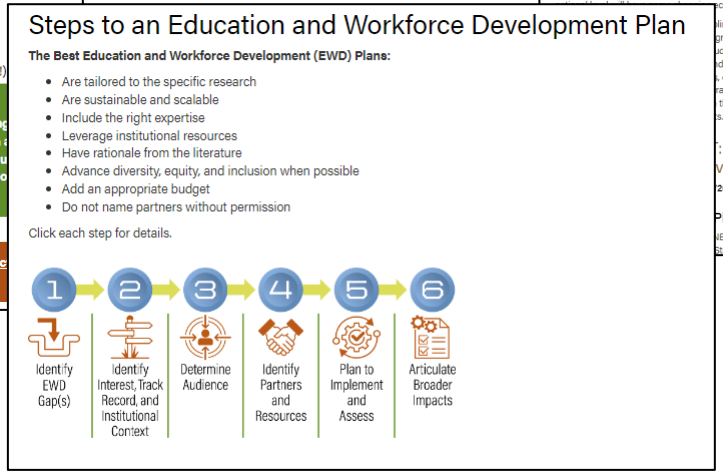
NASA Space Technologies Research Institutes (Dyke 2019)

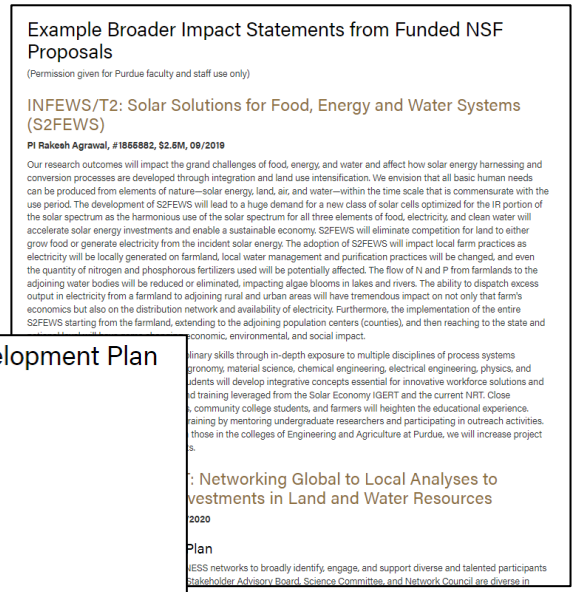
NSF Division of Behavorial and Cognitive Sciences (Ma 2017)

NSF Division of Research on Learning (Ryu 2018)

Broader Impacts & Broadening Participation







Next Steps

- Write a color coded storyline
- Draft a one-page concept paper
- Create a basic milestone schedule for your proposal development
- Develop a compliant, detailed outline with parallel formatting

Next Steps

- Read proposal for visual ideas
- Line up reviewers
- Do your agency/program homework
- Familiarize yourself with grant writing website resources

Next Steps

- Email GrantHelp@purdue.edu