

# HABs and Hypoxia by the Numbers

Lonnie Gonsalves and Dave Kidwell

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# Review Steering Committee



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Environmental Scientist  
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David Scheurer  
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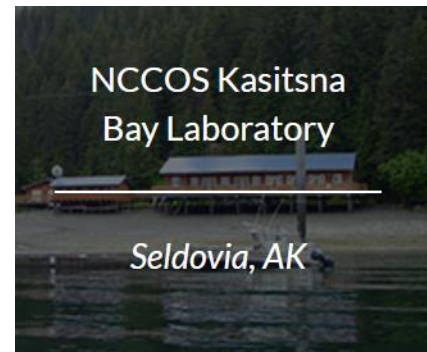


Alex Hounshell  
Research  
Oceanographer  
Beaufort, NC



Kaytee Pokrzywinski  
Research Marine  
Biologist  
Beaufort, NC

## NCCOS Laboratories



HQ in  
Silver  
Spring

280+ staff  
4 labs



Kasitsna Bay, AK





## Congressional Direction- *Harmful Algal Bloom and Hypoxia Research and Control Act*

- Actions Plans and Integrated Assessments of causes, consequences, economic costs, progress of research, and needs for HABs and hypoxia research and control
- Administer competitive grant funding to address research and management needs and accelerate methods of intervention and mitigation to reduce the frequency, severity, and impacts of HABs and hypoxia
- Identify research, development, and demonstration needs and priorities relating to monitoring, prevention, control, mitigation, and response to marine and freshwater HABs and hypoxia
- Enhance communication and coordination among Federal agencies carrying out marine and freshwater HAB and hypoxia activities and research

## Congressional Direction- *Federal Appropriations*

- Manage two separate lines of appropriations
  - *Coastal Science, Assessment, Response and Restoration*
    - “Base appropriation”
    - \$55M in FY23
  - *Competitive Research*
    - Managed by Competitive Research Program
    - \$22.5M in FY23

## Congressional Direction- *Federal Appropriations*

- Since 2018, the annual fiscal Joint Explanatory Statement has routinely specified HABs and hypoxia language for NOAA.
  - Accelerate deployment of effective methods of intervention and mitigation to reduce the frequency, severity, and impact of HAB events in marine and freshwater systems, including the Great Lakes ecosystem
  - Fund long-term HAB research in the Gulf of Mexico that further develops ongoing partnerships involving academic institutions, the private sector, and State governments
  - Identify and prioritize additional watersheds that would benefit from the development of regionally-specific Integrated Assessments and Action Plans (currently Great Lakes and South Florida)



## Congressional Direction- *Federal Appropriations*

- and provided direction for Competitive Research appropriations.
  - “...not less than \$14M for HABs research..”
  - “...within this funding...”
    - ‘\$2M for methods to increase freshwater HAB monitoring’
    - ‘\$1M for domoic acid’
    - “Encouraged” to fund red tide research

# Strategic Plan

1. Advancing Ecosystem Science for Conservation and Sustainable Use
- 2. Developing and Implementing Advanced Observation Technologies and Ecological Forecasts**
  - a. Predict where, when, magnitude/severity, and socioeconomic impacts of HABs and hypoxia using diverse data, models, and observational technology and expanding forecasting capabilities spatially and temporally*
3. Facilitating Resilience and Adaptation to Inundation and Climate Impacts
- 4. Detecting, Monitoring, and Mitigating Impacts of Chemical and Biological Stressors**
  - a. Detect, monitor, quantify, and reduce impacts of HABs and hypoxia*
  - b. Develop and validate toxin analytical methods*
- 5. Advancing Social, Economic, and Behavioral Approaches to Coastal Stewardship**
  - a. Deploy toxin detection tools, training, and products to stakeholders*
6. Investing in our People and Achieving Organizational Excellence

# Strategic Approach

## Observing

### *R&D*

- Research and development of improved detection technologies and validation of data;
- Marine and freshwater satellite remote-sensing;
- PMN monitors marine and estuarine HAB species at over 250 coastal sites.

### *Operations*

- NHABON Implementation Plan with IOOS

## Forecasting

### *R&D*

- Applied research needed to inform ecological forecasts;
- Advancing satellite methods for detecting HABs;
- Developing and delivering regional forecasts.

### *Operations*

- Plan in development with IOOS



## PCM

### *R&D*


- Control advances promising technologies for preventing, controlling, or mitigating HABs;
- HAB Event Response provides enhanced monitoring and response to events;
- Prevention through understanding the causes and impacts of HAB events.

## HAB-F

### HAB Forecast Branch

- Develops and delivers ecological forecasts
- Conducts applied research needed to inform ecological forecasts
- Advances satellite methods for detecting HABs
- Helps stakeholders mitigate HAB impacts

# HABs and Hypoxia Staff - Internal Science

 Management

 Contract Staff

## HAB Forecasting Branch



Marc Suddleson  
Acting Branch Chief  
Silver Spring, MD



Alex Hounshell  
Research  
Oceanographer  
Beaufort, NC



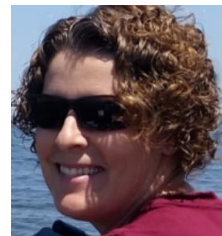
Kaytee Pokrzywinski  
Research Marine  
Biologist  
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Chris Holland  
Oceanographer  
Beaufort, NC



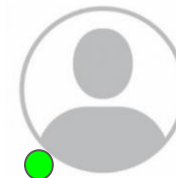
Mark Vandersea  
Environmental  
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Rance Hardison  
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Bryan Eder  
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Kathrine Collins  
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Travis Briggs  
Subject Matter Expert  
Silver Spring, MD



Richard Stumpf  
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Silver Spring, MD



Tim Wynne  
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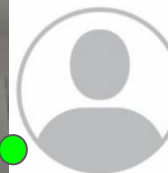
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Yizhen Li  
Scientist  
Silver Spring, MD



Andrew Meredith  
Engineer  
Silver Spring, MD



Wayne Litaker  
Scientist  
Silver Spring, MD

## HAB-M

### HAB Monitoring & Reference Branch

- Produces reference methods, materials and validation
- Designs, fabricates and calibrates toxin sensors
- Advances HAB prevention and control technologies
- Establishes and transitions regional user laboratories
- Sustains citizen science for HAB monitoring and underrepresented communities

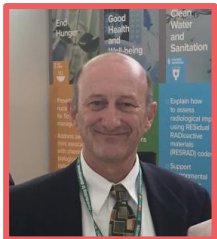


# HABs and Hypoxia Staff - Internal Science

 Management

 Contract Staff

## HAB Monitoring and Reference Branch



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Tina Mikulski  
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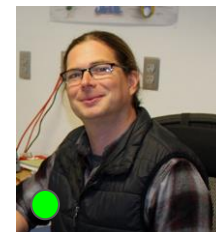
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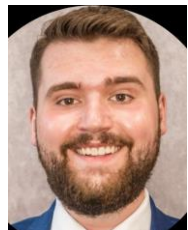
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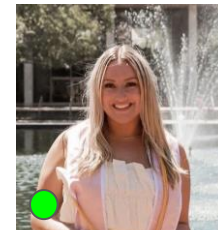
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Tod Leighfield  
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## CRP

### CRP HAB and Hypoxia Programs

- ECOHAB - Ecology and Oceanography
- MERHAB - Monitoring and Event Response
- PCMHAB - Prevention, Control, and Mitigation
- SEAHAB - Social and Economic Assessments (new)
- Event Response
  
- Coastal Hypoxia Research

# HABs and Hypoxia Staff - Internal Science

 Management

 Contract Staff

## Competitive Research Program



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Sarah Pease  
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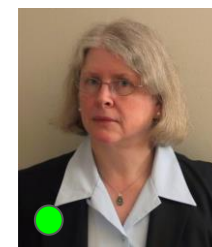
Rebecca Atkins  
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Kimberly Puglise  
Oceanographer  
Silver Spring, MD



Maggie Broadwater  
Program Manager  
Charleston, SC



Quay Dortch  
Senior HAB Scientist  
Charleston, SC

## CRP - Science transition approach

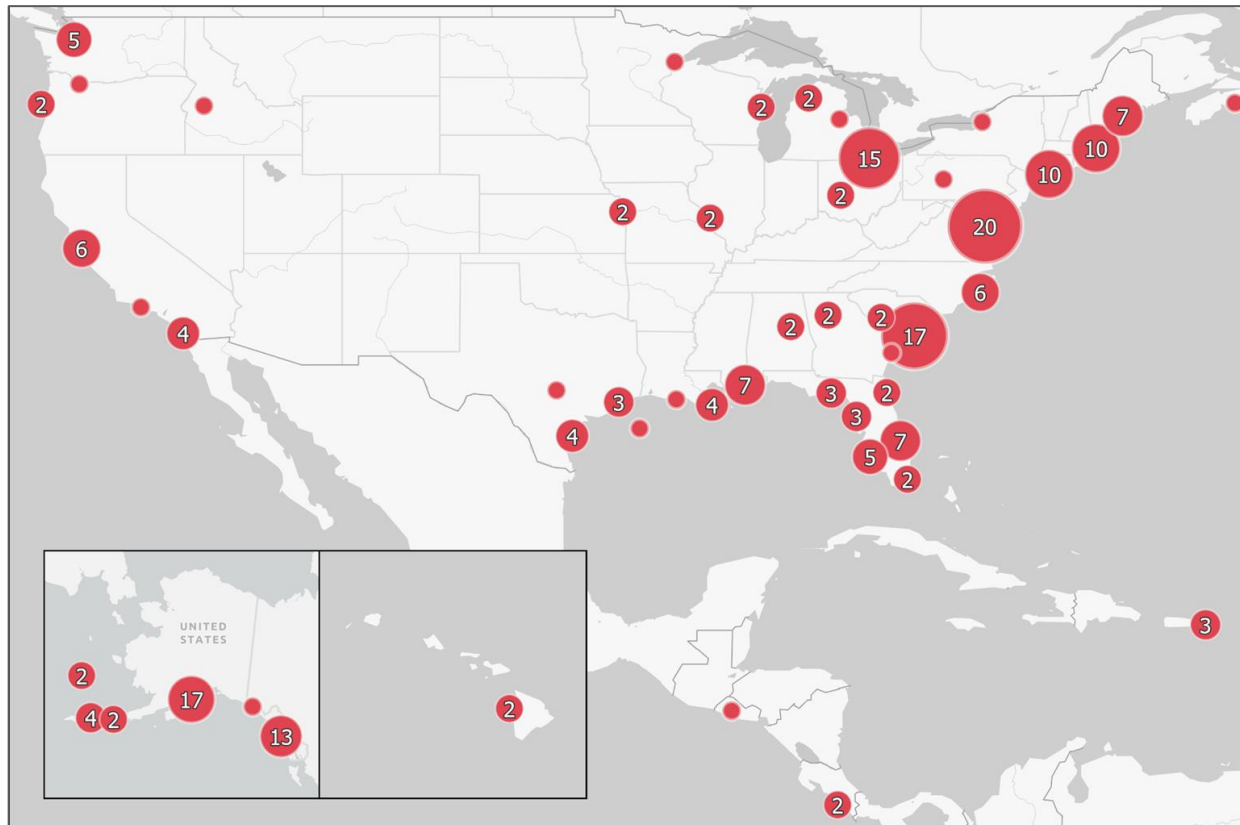
- NOFO's either encourage or require Management Transition Advisory Group
- Proposal review and scoring criteria
  - Relevance and Applicability - 35 pts
  - Technical merit - 35 pts
- Management and stakeholder representatives on panel

Active projects:  
**157 total** (FY19-FY23)  
**86 in FY23**

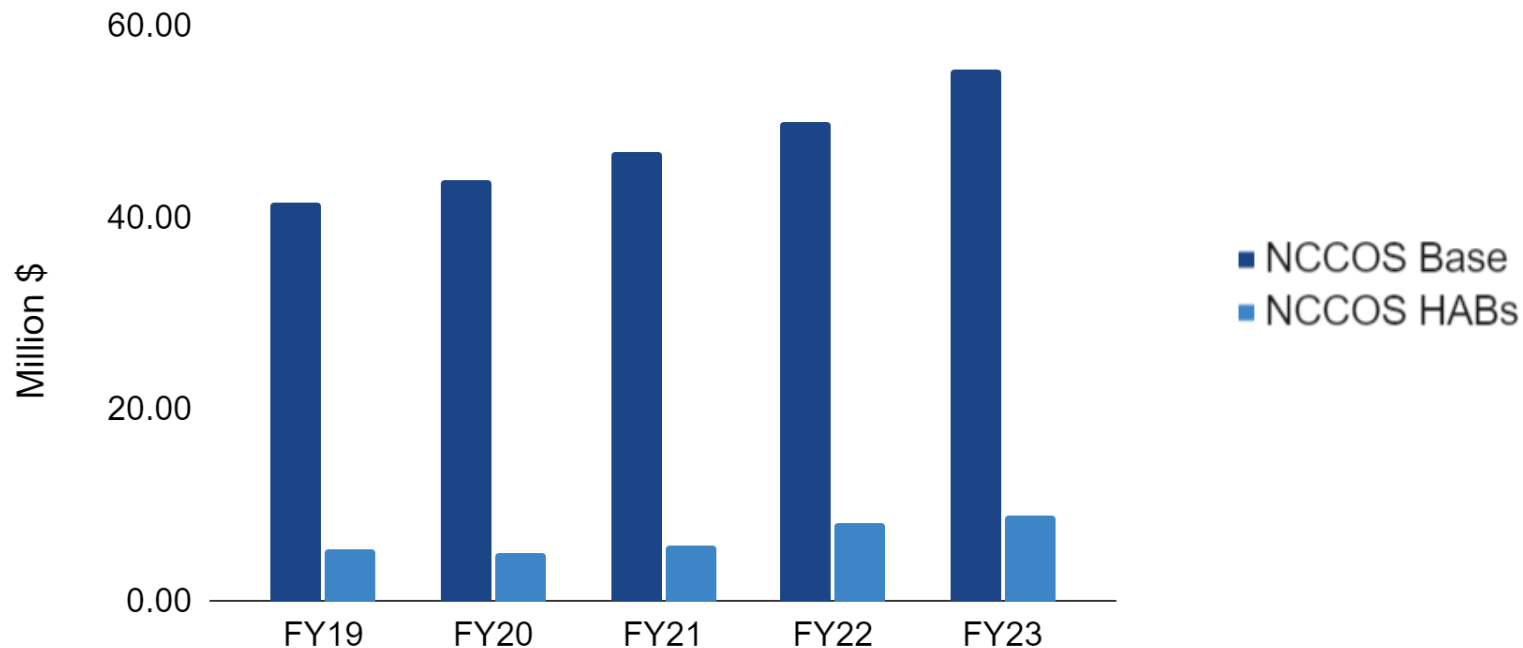
Over 100 partners

288 publications

Point Count

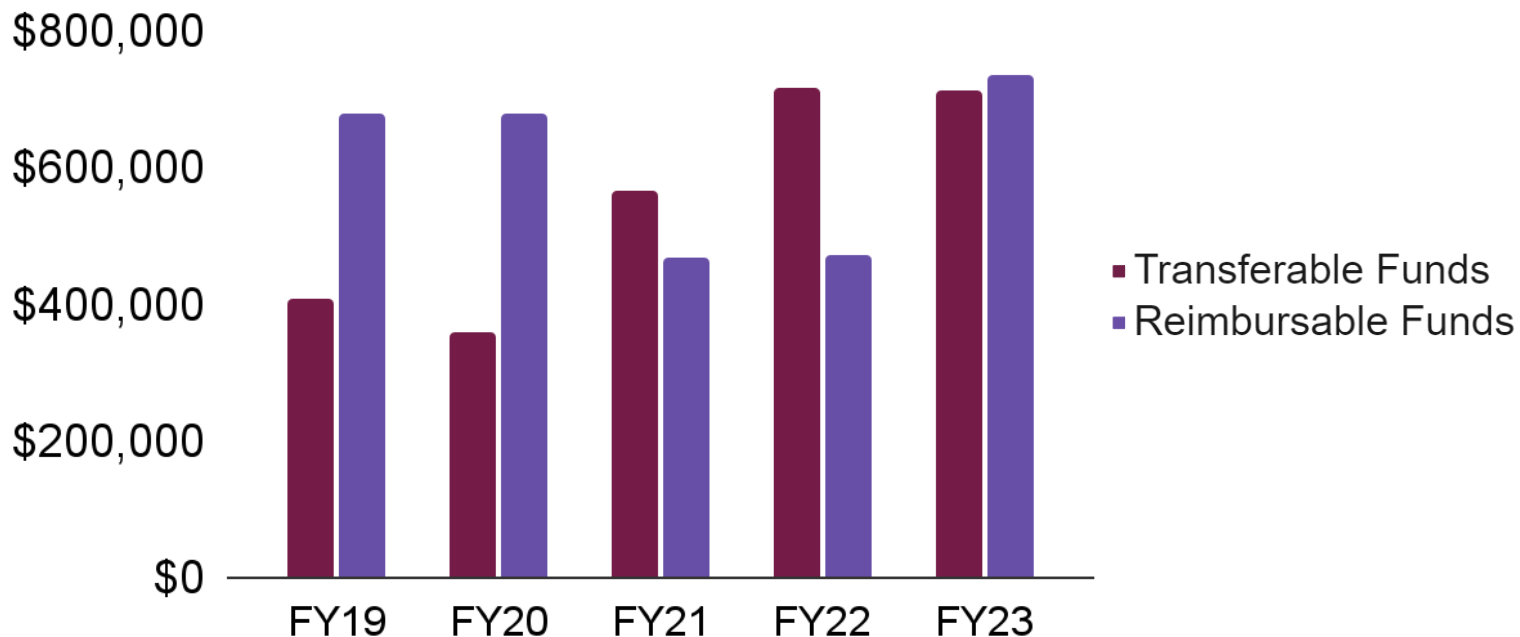


## Funding for HABs and Hypoxia Science within NCCOS

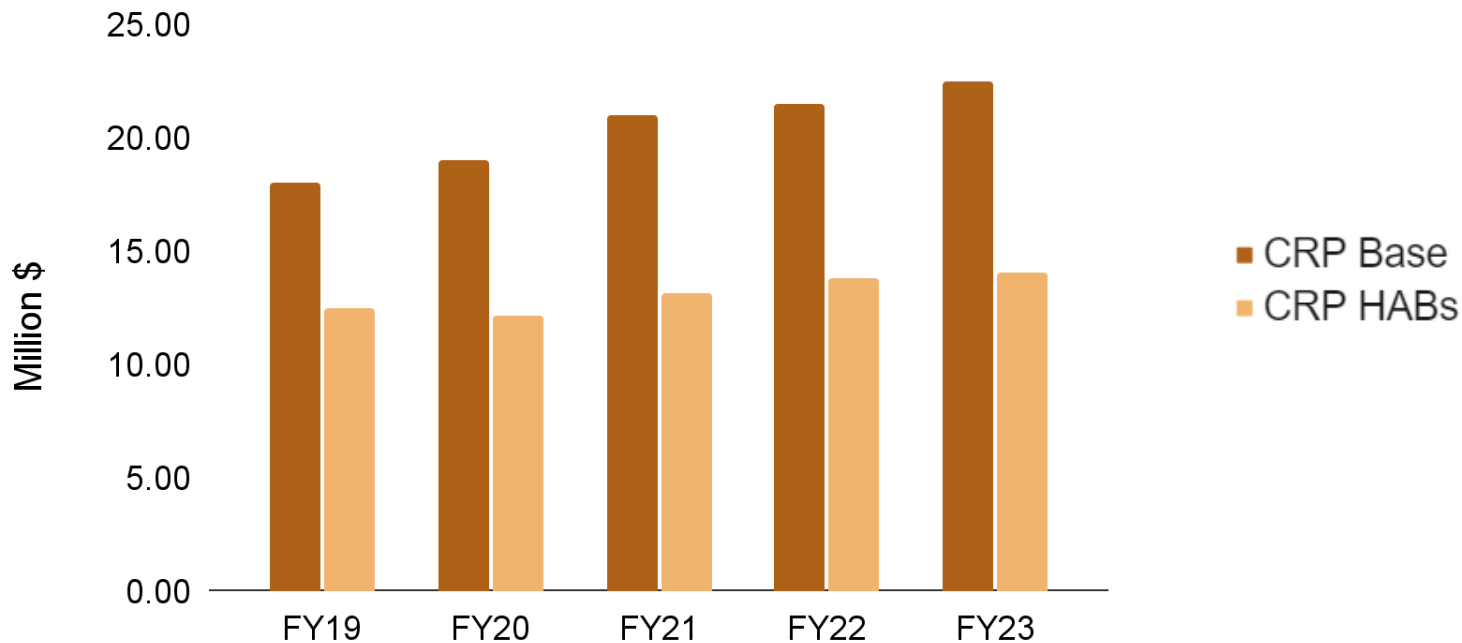




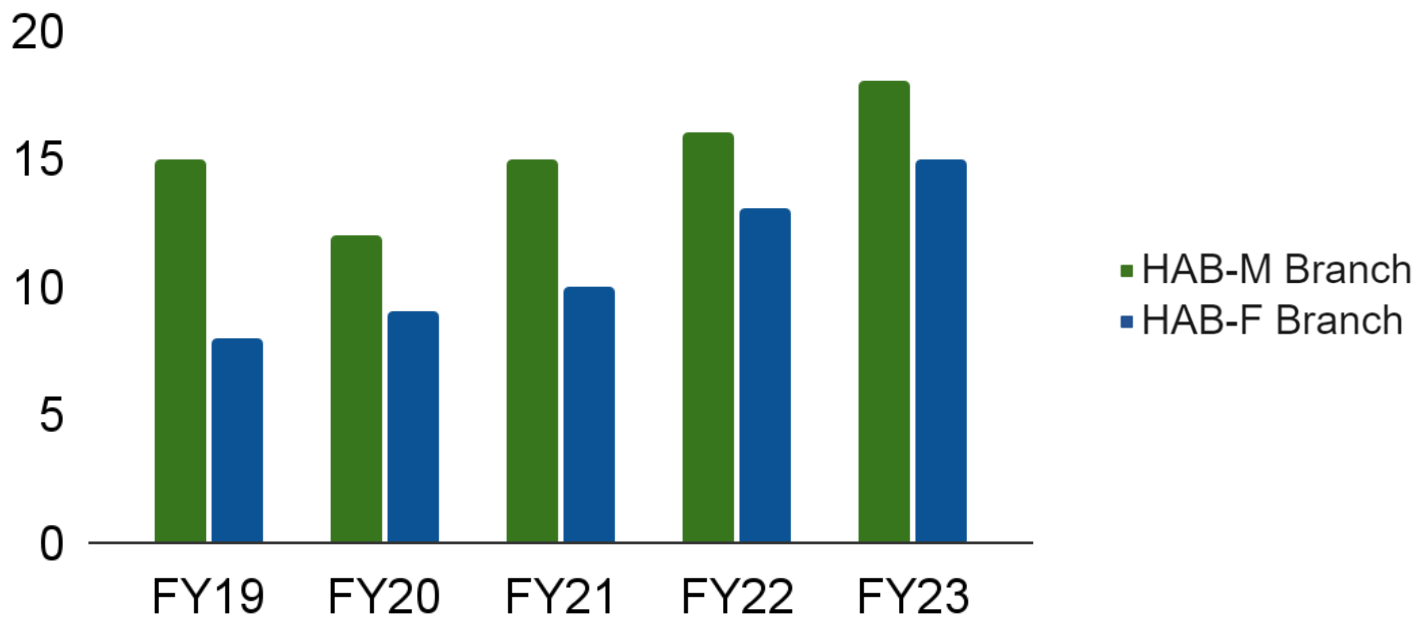
## Breakdown of Internal Science Funds



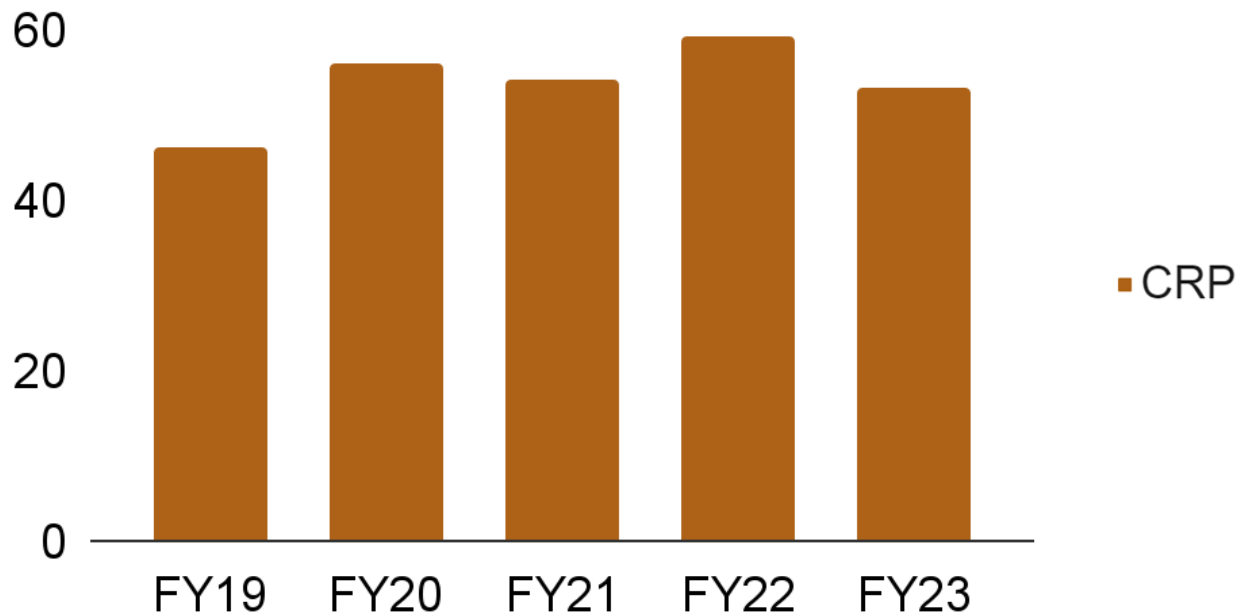
## Funding for HABs and Hypoxia Science within NCCOS



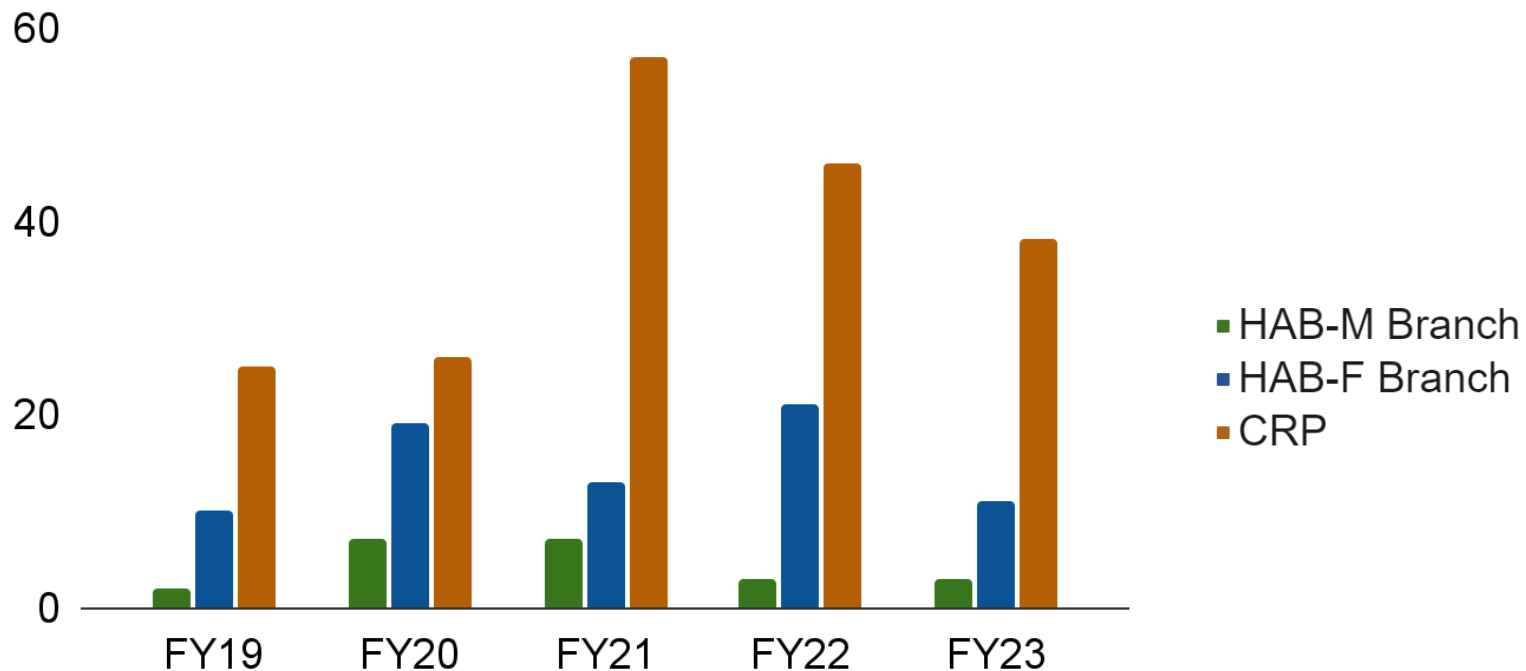
## Active projects each year



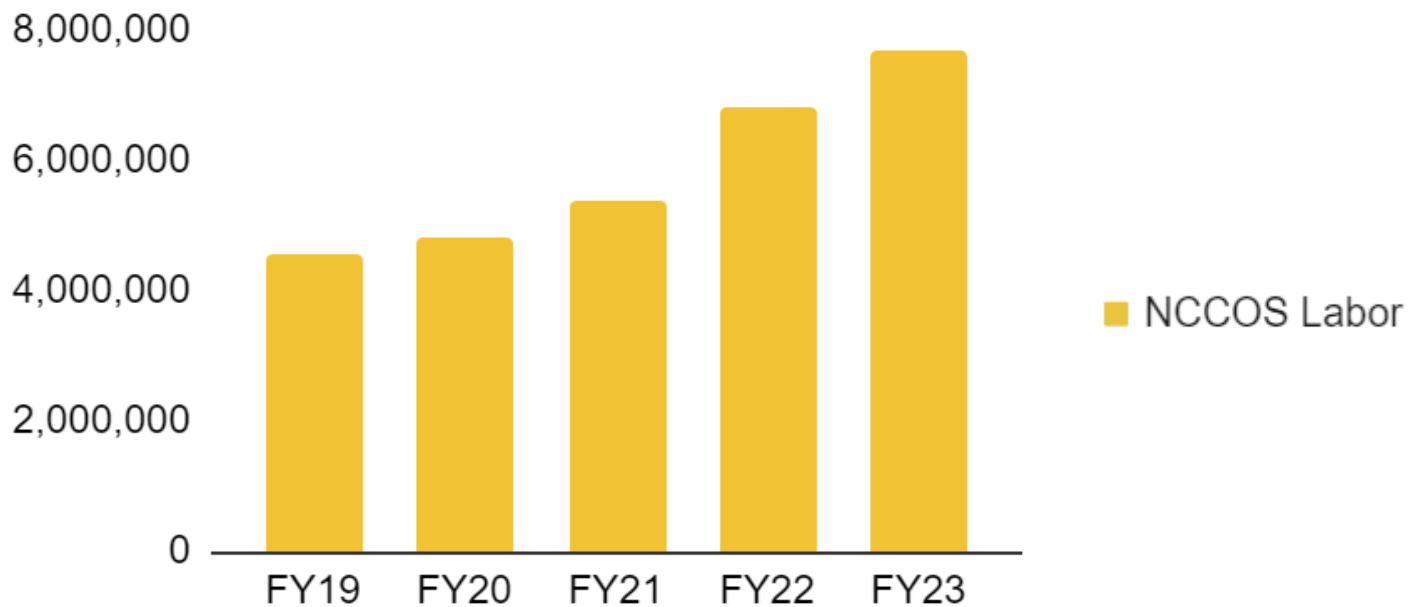
## Active projects each year



## Number of publications each year



## Breakdown of Labor on HABs





## Next Steps and Resources

- 11/07 at 10am EST (virtual): Q&A Session Service Delivery and Research Transitions
- 11/14: Website link release with all review materials
- 11/27: Travel Day
- 11/28 - 30th: Program Review
- [Panelist Charge](#)
- [Research Transitions](#) tutorial video and [full background doc](#)
- [Service Delivery](#) tutorial video and [full background doc](#)

Questions.....

# **(virtual) NCCOS HAB and Hypoxia Program Review: Orientation R2X and Enhanced Service Delivery**

Note: This is not the exact slide deck presentation from the (virtual) NCCOS HAB and Hypoxia Program Review: Orientation R2X and Enhanced Service Delivery.

Abigail Arnold (Testbed Proving Ground Committee Coordinator and Transition Support) shared the following relevant slide deck that ORTA uses to brief program offices on the R2X process.

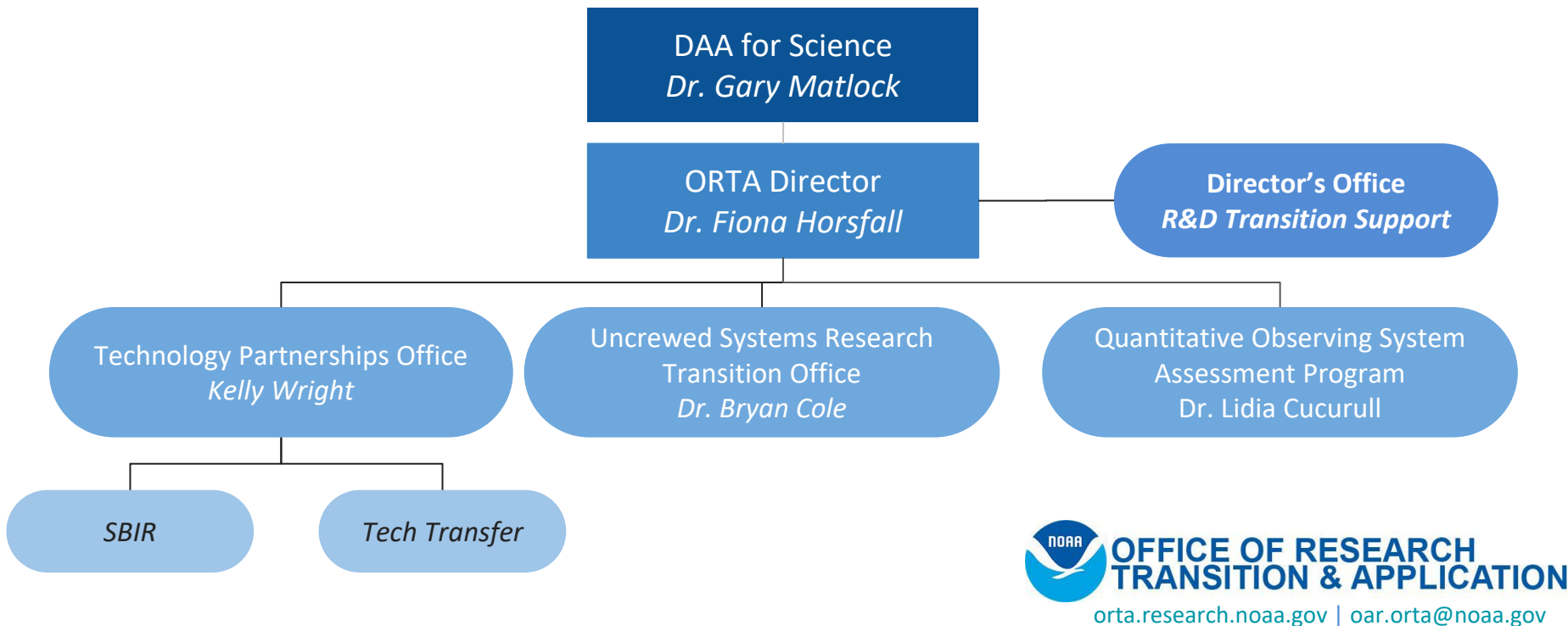


# ORTA Mission

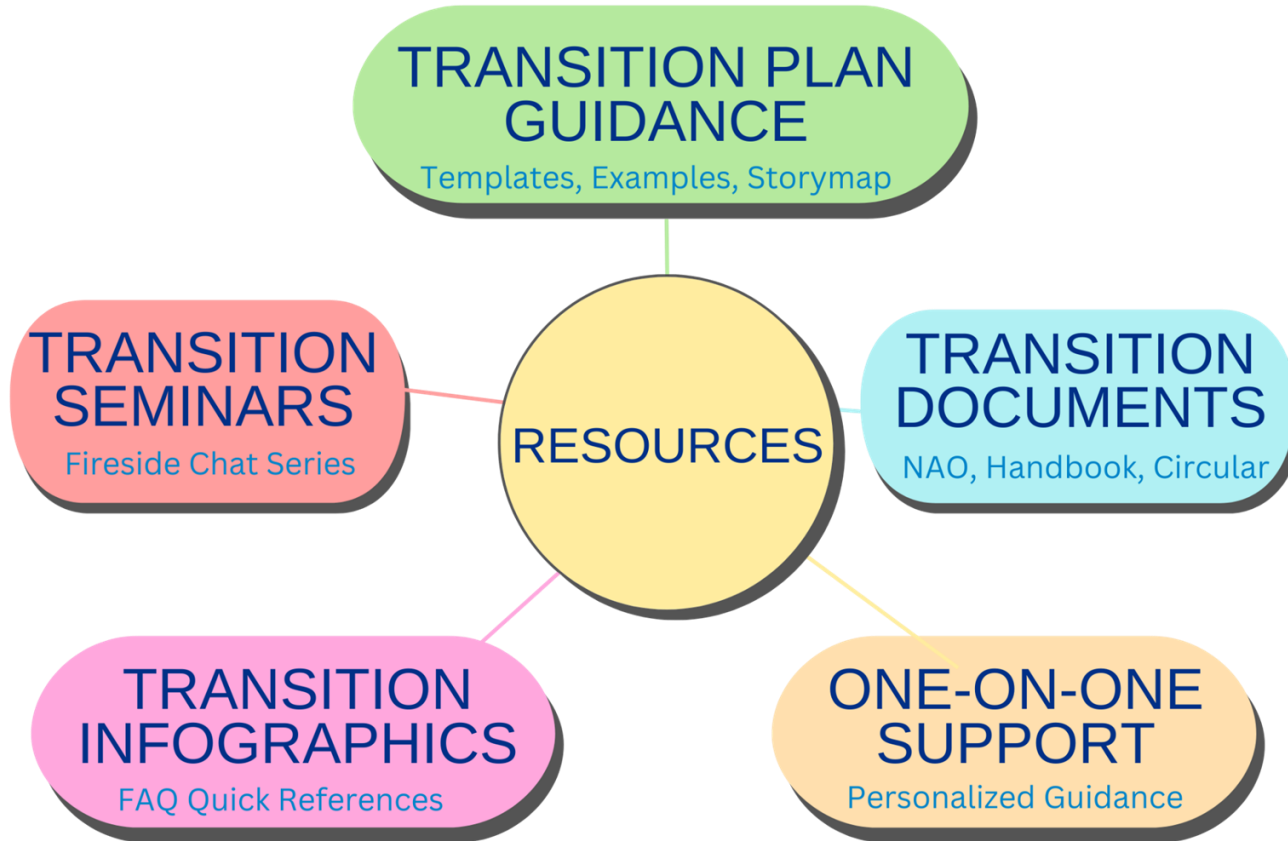
Advance innovative research and development to support NOAA's mission and the US economy



# NOAA OAR Office of Research, Transition, and Application (ORTA)



# ORTA R&D Transition Support



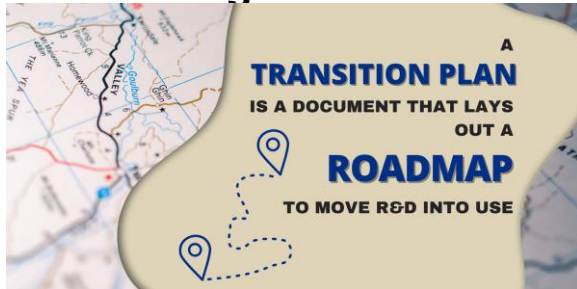


# Why Make A Transition Plan

*The best science is necessary but not sufficient for a successful transition. -Ben Richards, NOAA*

## Transition plans:

- **Bring awareness to the NOAA R&D portfolio and how it furthers NOAA's mission**
- **Layout a roadmap for projects on how they will evolve into usable technologies or knowledge**



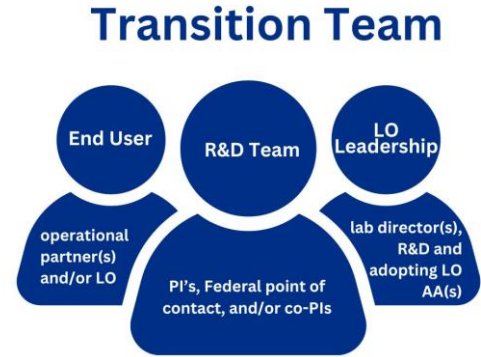
**Transition plans are important tools to ensure that everyone knows and understands the steps and risks of a project, and they are extraordinarily valuable tools for the budget process.**

**Message conveyed to staff by Dr. Richard Spinrad, NOAA Administrator**



# Typical Transition Plan Team

- The R&D team (i.e. PI's, Federal point of contact, and/or co-PIs, CI(s))
- Adopter(s) and/or end-user(s) (i.e. operational partner(s) and/or LO)
- LO leadership (i.e. lab director(s), R&D and adopting LO AA(s))
- For extramural R&D, points of contact from the funding program and/or end user are also an important part of the transition team
- Transition teams typically assist the PI as needed and in some cases are responsible for coordinating transition activities and assisting with identifying, reporting, and responding to significant deviations in the execution of the transition plan



# Transition Plans Facilitate End User Engagement and Transfer of Technology



Transition plans are

- Living documents to be amended as needed
- Signed to provide situational awareness of the work and review / acknowledgement to move forward

A signed transition plan does not represent a binding agreement and/or availability of funding.



# How Much Detail Is Required For A Transition Plan



## Level of detail varies

From a list of milestones to a fully developed program plan. It is reasonable to expect that projects that are less mature and many years from implementation may have less developed transition plans than those that are only a few years from deployment.



## A Transition Plan should:

- Start simple, and gain complexity and detail as a project matures
- Have complexity and level of effort proportional to the scale, risk, maturity and scope of the project

It is reasonable to expect that projects that are less mature and many years from implementation may have less developed transition plans that may not require the full review or approval process.

It is reasonable to expect that transition plans will be proportional in scale, scope, and level of detail relative to the scale, scope, and maturity of the project. Smaller, early [Readiness Level] projects will logically have smaller, less developed transition plans, (if at all) in comparison with larger, more mature projects.

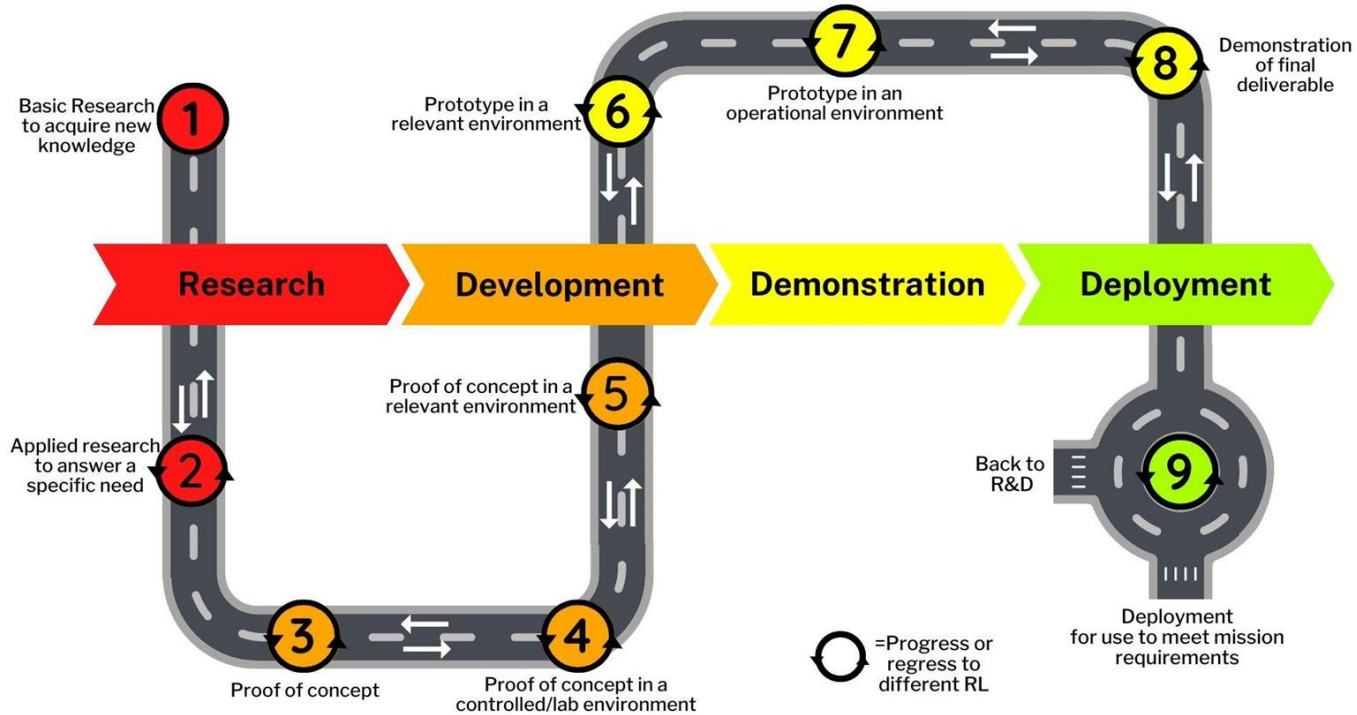
# ORTA Engagement with Transition Planning and Process

*The Office of Research, Transition, and Application (ORTA) fully leverages NOAA's R&D enterprise to serve NOAA's mission and benefit society by accelerating and facilitating the transition of R&D within NOAA to operations, applications, commercialization, and other uses.*



We Assist, Facilitate, Guide and Provide Resources

# Pathway of R&D to Deployment or Use



*Transition Plans inform people what you have in mind if you are successful with your R&D*

# Types of Transition Plans



## Basic

Simplified initial project transition plan; low maturity level R&D transition plan for projects at RL4 or less.



## Standard

Project transition plan for RL4 and above; can sometimes describe complex R&D and transition.



## Multi-Project Umbrella

Transition plan that groups together individual project transition plans with similar subject matter



## Multi-Component Umbrella

Transition plan that describes one project with complex multiple components planned for transition.



## Mission-Focused

Transition plan for technologies that are at a mature stage (RL8-9); some may have already transitioned with an approved transition path, but may not have had transition plan in place.



## Knowledge

Plan for transition of knowledge either to an adopter or a group (e.g. risk managers, hurricane research community, or the general public), and can include knowledge transfer/transition as publication of a journal article, public-facing report, agency recommendations, and other forms of knowledge that are intended for society and/or the scientific community.



## Modular

Transition Plan that documents the overarching, long-term project goal and provides research and development (R&D) history, background, and methodology for the initial work in the Base Transition Plan section II. Modules are added to the Transition Plan to document each component project intended for transition.



## Are you also looking to commercialize?

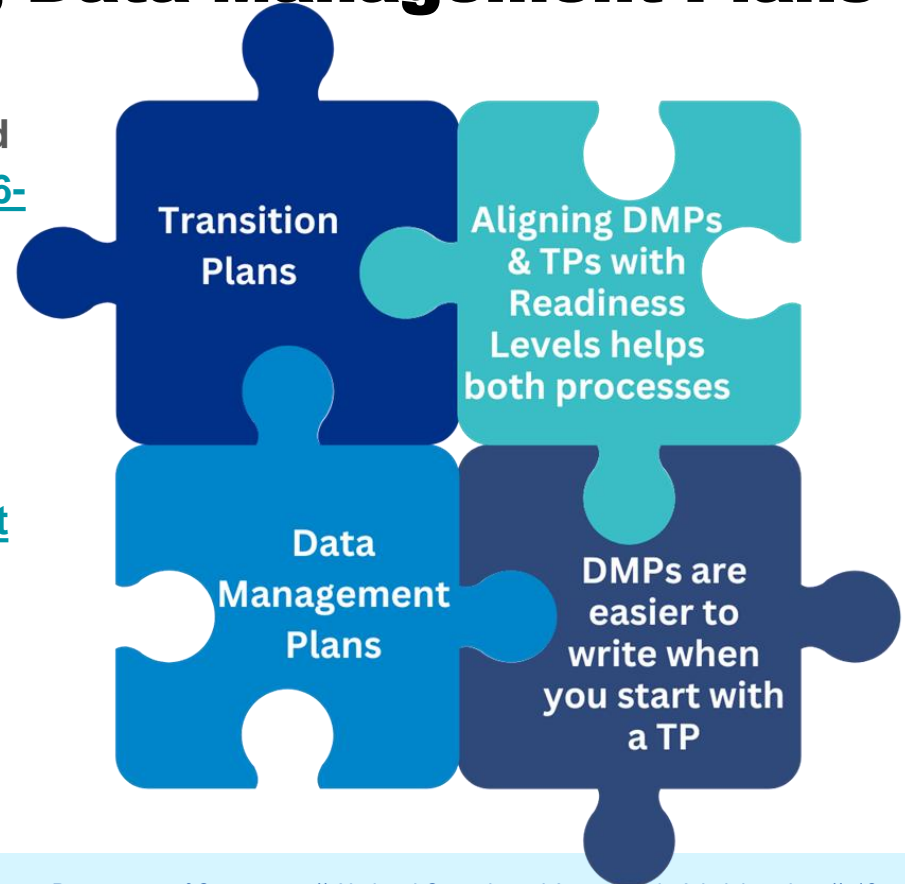
Additional information is required in the transition plan to protect NOAA-developed intellectual property.

<https://orta.research.noaa.gov/plans/>



# Processes and Tools Make it Easy to Complete Policy Requirements, Including Data Management Plans

- Transition plans (TPs) are recommended in [NOAA Administrative Order \(NAO\) 216-105B](#) for projects at RL4 and above
- OAR is issuing a new circular requiring transition plans for projects at RL4 and above
- Data management plans (DMs) are prescribed by [NAO 212-15 “Management of Environmental Data and Information”](#)
- TPs and DMs can be developed in parallel, which reduces the work
- ORTA and NCEI have tools to help with development of both





# Meat & Potatoes of Transition Plans

01

## Purpose for Transition Effort

Transition product, end user(s),  
anticipated results

04

## Transition Gates and Activities

Statement of benefit of the  
technology; milestones, etc.

02

## Research Background

05

## Implementation Strategies

03

## Capabilities and Functions

Readiness Level information

06

## Roles and Responsibilities

# Meat & Potatoes of Transition Plans

07

**Budget Overview**

08

**Risks and Mitigation**

What if/contingencies(s)?

09

**Data Management Plan**

*Potatoes...*

10

**List of Acronyms**

11

**References**

12

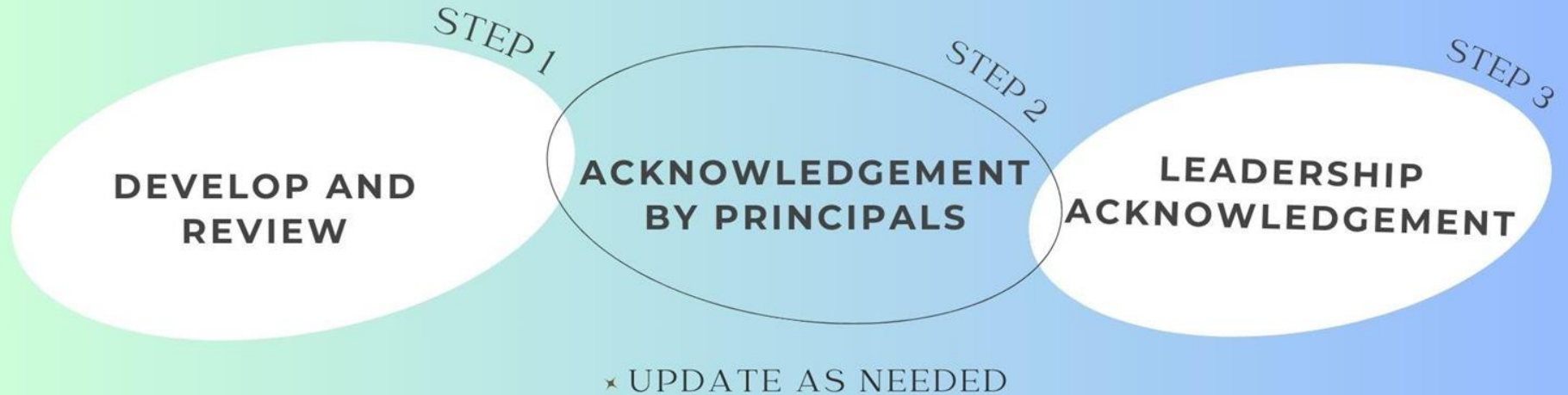
**Letters of Support**

# Collaboration with External Communities



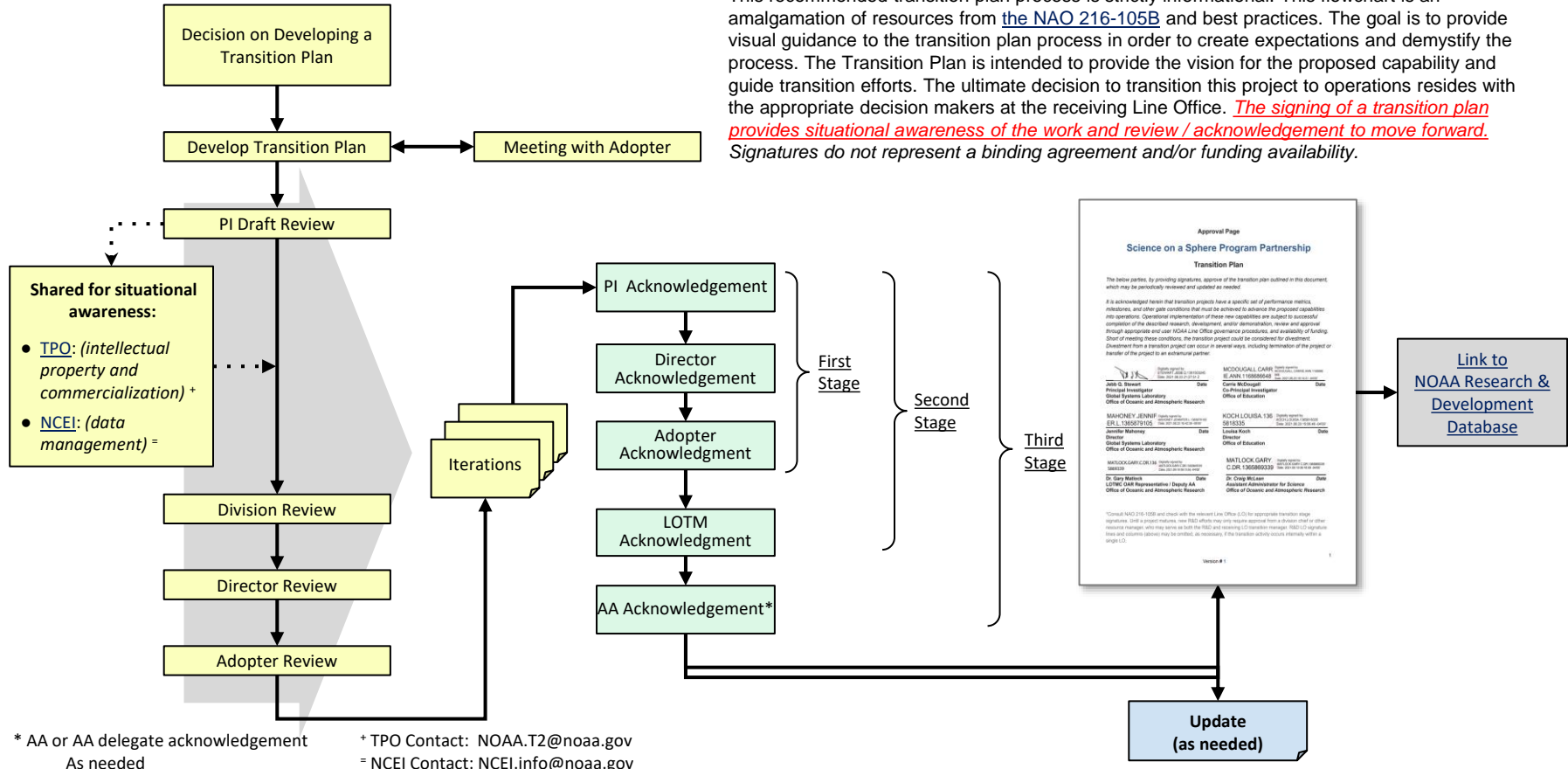
*Used for its intended purpose: Readiness Level 8 we are working on it; Readiness Level 9 it is working for us*

# ORTA Recommended Transition Plan Process

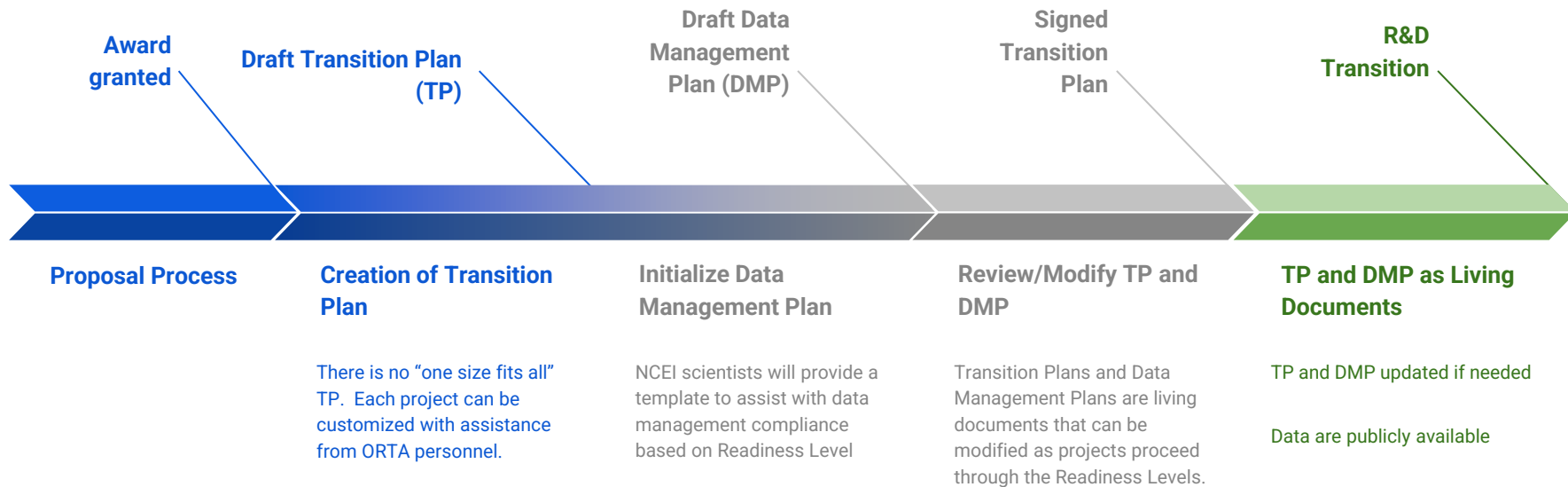


# ORTA Recommended Transition Plan Process

This recommended transition plan process is strictly informational. This flowchart is an amalgamation of resources from [the NAO 216-105B](#) and best practices. The goal is to provide visual guidance to the transition plan process in order to create expectations and demystify the process. The Transition Plan is intended to provide the vision for the proposed capability and guide transition efforts. The ultimate decision to transition this project to operations resides with the appropriate decision makers at the receiving Line Office. ***The signing of a transition plan provides situational awareness of the work and review / acknowledgement to move forward. Signatures do not represent a binding agreement and/or funding availability.***

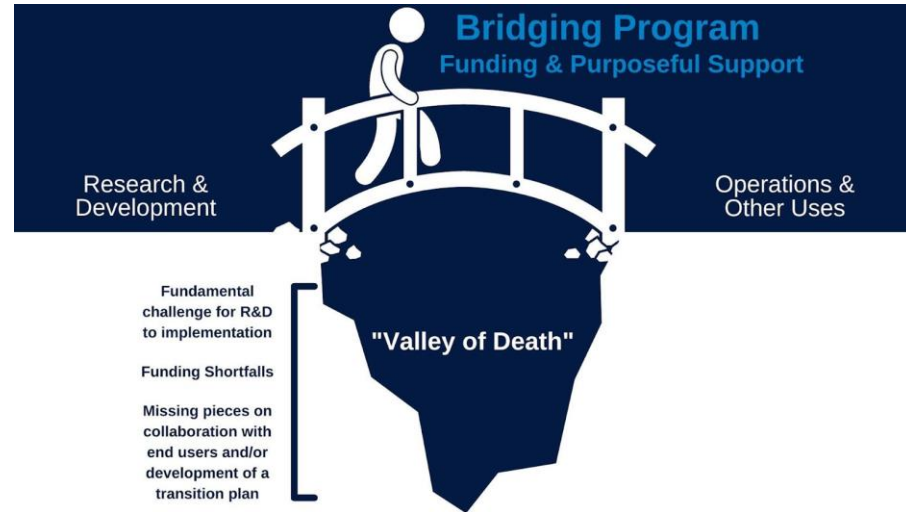


# Transition & Data Management Planning Lifecycle



# ORTA Bridging Program

- Many research and development (R&D) projects are unable to cross the “valley of death,” the term that describes the gap that exists between R&D and operations, mission needs, application, and other uses.
- Examples of possible reasons for the “stall”
  - Funding shortfalls
  - Missing pieces on collaboration with end users
  - Development of a transition plan
  - Hardware issues
- ORTA has a pilot Research to Operations (R2X) Bridging Program to help address projects that fall short of implementation

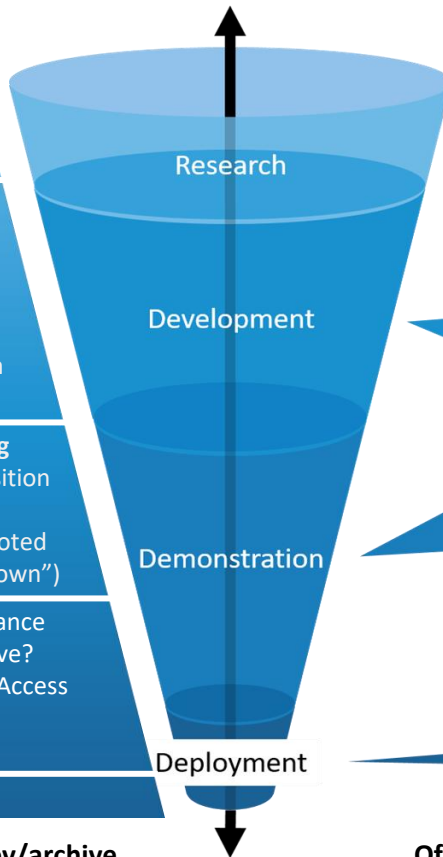


Note: “Crossing the Valley of Death” was outlined in a National Academy of Sciences publication in 2000 as a “fundamental challenge for research and development to implementation.” National Research Council 2000. From Research to Operations in Weather Satellites and Numerical Weather Prediction: Crossing the Valley of Death. Washington, DC: The National Academies Press. <https://doi.org/10.17226/9948>

# ORTA and NCEI Aligning NOAA R&D Transition and Data Management Planning

## Data Mgt Plan Alignment

- RL 1-2  **Project Point of Contact (POC)**  
 Name of the Data, data collection Project, or data producing Program?  
 Summary description of the data
- RL 3-5  **Data Management Plan (DMP) POC?**  
 One-time data collection or ongoing series of measurements?  
 File formats of the data?  
 Estimated total data volume?  
 Have data management resources been identified?
- RL 6-7  Description or diagram of the **processing workflow** from data collection or acquisition to public accessibility and archival?  
 Approximate **percentage of budget** devoted to data management (percent or "unknown")
- RL 8  Do **metadata comply** with Data Governance Committee Data Documentation directive?  
 Do **data comply** with [NAO 212-15](#) Data Access directive for environmental data?  
 **Long-term data archive** location?
- RL 9  Completed [DMP](#) (or SA, SLA)



## Transition Plan Alignment

- RL 1: **Basic research to acquire new knowledge**
- RL 2: **Applied research to answer a specific need**
- RL 3: **Developed a proof of concept**
- RL 4: **Completed the evaluation/testing of proof of concept in a controlled/laboratory environment**
- RL 5: **Completed the evaluation/testing of proof of concept in a relevant environment. Prototype developed**
- RL 6: **Demonstrated the prototype in a relevant environment**
- RL 7: **Demonstrated the prototype in an operational environment**
- RL 8: **Demonstrated the final deliverable in an operational environment. Completed documentations or other requirements for transition**
- RL 9: **Final Deliverable adopted by the intended end user(s)**



# Application of the NOAA Service Delivery Framework to Inform R2O Transition Planning



Cooperative Institute for  
Great Lakes Research

**CIGLR**

*Great Lakes Science for Society*



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# Introduction

(video link to recorded presentation)

# **Bipartisan Infrastructure Law Subseason to Annual Water Level Forecasting**

Designing GLERL's project with service  
delivery in mind

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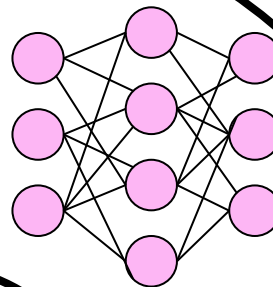
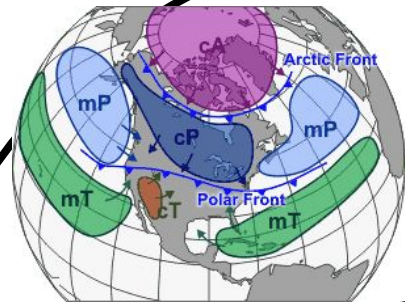
# GLERL BIL SA Project Outcomes

- Advance the modeling behind seasonal water level forecasts by extending outlooks beyond 6 months and incorporating state-of-the-art operational products and data science
- Next generation forecast framework will inform a decision support tool(s) (DST) designed to guide management decisions and coastal resilience planning in the Great Lakes



*Water level data, seasonal water level forecasts, and their applications has evolved over more than a century of binational water management.*

**→ Our project cannot take place in a vacuum!**

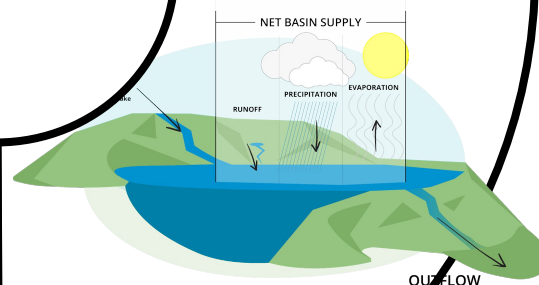


Atmospheric Science

Data Science

Operational Partners  
and End Users

Research  
Engagement and  
Social Science



Hydrology and Water  
Management

# **Research Engagement for Service Delivery**

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# Why Focus on Service Delivery?

As the nation experiences increasing variability and change in the environment (fires, floods, drought, etc.), **NOAA's mission of science, service, and stewardship** becomes of even greater importance

NOAA has been **transforming** from a scientific and technologically constrained set of products and services, to **valuing user needs** as a critical input for developing useful, actionable information



# Research Engagement is....



A two-way interaction between researchers & end-users for the mutually beneficial development & transfer of knowledge, policy decisions, technologies, products, methods, management actions, or other service delivery outcomes.



# What does Research Engagement entail?

## Engage



Identify stakeholders & rights holders, build meaningful relationships, & support existing relationships.

## Co-Design



Ensure that research products are useful & usable by involving stakeholders & rights holders in every stage of a project. "Co-design is about designing with, not for."

## Translate



Bridge the gap between scientists & end-users to ensure knowledge & research outcomes translate effectively to decision-support & operations.

## Research



Conduct social science research on engagement methodologies, stakeholder & rights holder perceptions, co-design, decision-support, & other relevant topics.

# Definitions



## Co-Production or Co-Design

Co-produced knowledge joins scientific & technical knowledge with practical, traditional, local, experiential, & other ways of knowing. **Co-design is creating something (e.g., research projects or products) with users, not for users.** These processes are collaborative & involve stakeholder/rights holder input from the beginning to the end of a project.



## Product

A tangible piece of information (printable, visible) that enables a user to learn or take action (e.g., forecasts, models, decision support tools, articles, etc.)

# The Framework

Descriptive, not prescriptive.



**Users: At the center and a focus of the model, our users are:** A person(s), group, or organization who accesses and applies information, products, or services (internal and external)

**Partners: Also near the center, NOAA works with and through our partners in support of the users. Our partners are:** Organizations and individuals with whom NOAA has regular, substantive interaction in order to effectively achieve both of our missions

***EACH ELEMENT IS CRITICAL as is movement into and out of the wheel***



# **Case Study:** **GLERL/CIGLR BIL SA Project**

# Summary of BIL SA Research Engagement Objectives

1. **Identify stakeholders** & rights/title holders in BIL SA project, & appropriate methods for engagement
2. **Recommend transition pathway** from research to operational use of products, & support process of transition
3. **Engage stakeholders**, rights/title holders, end-users, & operational host in co-design of forecast framework & decision support tool(s) to ensure products meet user needs & technical requirements



Gather



Translate



Build



Respond

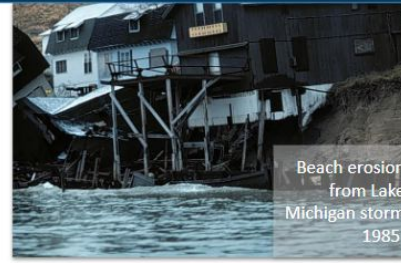


Evaluate



Review

# Project Fact Sheet



## The Future of Great Lakes Water Level Forecasting

*Developing a Next Generation Prediction System for Great Lakes Water Levels to Inform Lake Management Decisions*

The Bipartisan Infrastructure Law (BIL) is a transformational opportunity to make an impact against the climate crisis across the country, improve resilience, strengthen aging infrastructure, and invest in communities. A \$904 million investment in NOAA's climate data and services will result in critical climate information in the hands of decision-makers. With BIL funding, researchers at the NOAA Great Lakes Environmental Research Laboratory (GLERL) and the University of Michigan Cooperative Institute for Great Lakes Research (CIGLR) are developing a next generation prediction system for determining baseline and extreme water levels in the Great Lakes. The forecast will be developed collaboratively with Great Lakes water managers, and will transition from research at GLERL to sustained operations at a federal partner agency.

### Quick facts:

- The Great Lakes is a shared resource between the US and Canada. Successful forecast development and its transition from research to operations will be ensured by leveraging existing federal and binational partnerships that have evolved over more than 100 years of shared water management.
- This project aims to advance the modeling behind current seasonal water level forecasts by extending outlooks beyond 6 months and incorporating state-of-the-art operational products and data science.
- The next generation forecast framework will inform a decision support tool(s) (DST) designed to guide management decisions and coastal resilience planning in the Great Lakes.
- The improved water level forecast will have the potential to inform adaptive management of Great Lakes outflows and prepare commercial shipping, coastal residents, recreational users, and other stakeholders for potential hazards due to fluctuating lake levels.
- This 5-year project began in October 2022 and will be completed in September 2027.



Build



Deliver

# Stakeholder List & Code Map

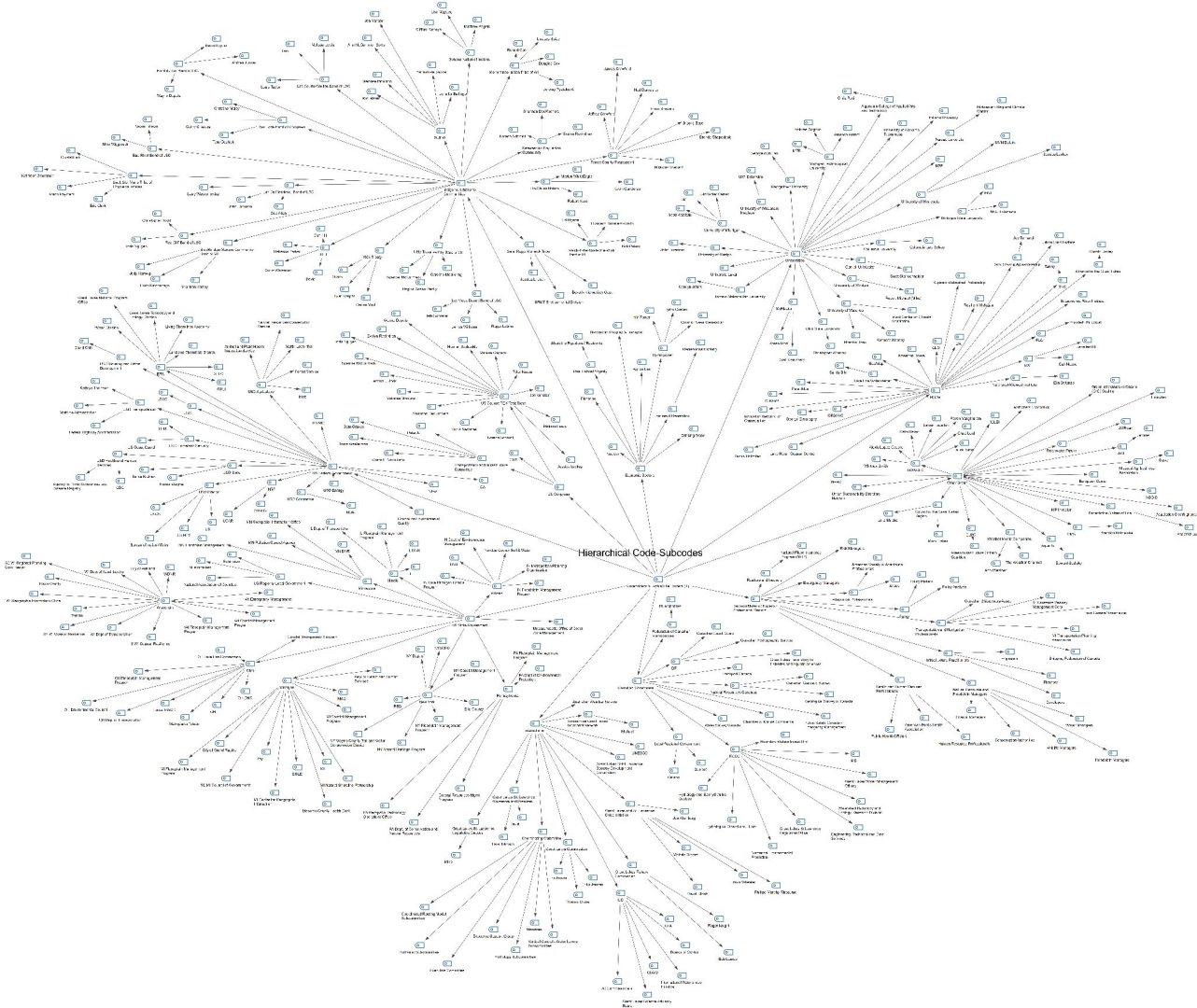


Gather



Translate

2,600+  
Stakeholders &  
Rights/Title  
Holders Identified  
to Date



# Workshop: Collaborating on SA Water Level Forecasting in the Great Lakes



Build



Gather



Translate

## Purpose

- To **increase collaboration** in SA water level forecasting in the Great Lakes.

## Objective

- To **bring together water level prediction operators & users to share information** on agency/office missions, project scopes, & existing/in development products relevant to Great Lakes SA water level forecasting & decision support.
- To **identify a research to operations pathway** for a next-generation forecast that is in development at GLERL/CIGLR.

## Attendee Affiliations

- CIGLR, ECCC, GLAM, IJC, Michigan Tech, University of Michigan, USACE, USGS
- NOAA CO-OPS, GLERL, NOS, NWC, NWS, PSL, OAR, OCM, OHD, ORTA, OWP, RFC, Sea Grant (GL, MI, MN, WI)

## Outcomes

- [Workshop Summary](#)
- Data for R2O pathway recommendation
- Engagement & recruitment of technical co-designers, users



# Recommendation for R20 Pathway



Translate



Review



Respond



Deliver

## Workshop Results

- **USACE Detroit** main agency to express interest in operation of forecast
- DST surplus - how can we integrate next-gen forecast into existing tools to **reduce stakeholder fatigue?**
- **Engagement & co-design** is critical to success of service delivery

## Qualitative Results

- USACE as potential host due to **mission, capabilities, existing operations**
- **Concerns about computational power, software restrictions** at USACE
- DST needs to meet needs of the people, **connect with other tools**, have interactive dashboard features

# Forecast Co-design

## Forecast User Needs Survey



- Distribute to forecasts users
- Analyze resultant data to inform co-design

## Transition Planning



- Project team drafting umbrella transition plan, with ORTA assistance
- Co-design kick-off meeting with USACE to discuss workflows, roles/responsibilities, and other topics that might help streamline the co-design and transition process
- Engage co-designers for letters of support & input



# Next Steps: September 2023 to 2027

## Forecast Development



- Technical working groups to support co-design
- Alpha/beta testing
- Usability testing
- Update transition plan & facilitate forecast R2O transition with results from working groups & testing
- Dissemination
- Evaluation



## DST Development



- Technical working groups to support co-design
- Alpha/beta testing
- Usability testing
- Update transition plan & facilitate decision support tool R2O transition with results from working groups & testing
- Dissemination
- Evaluation



# Thank you!

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Cooperative Institute for  
Great Lakes Research

**CIGLR**

*Great Lakes Science for Society*

