

NOAA Strategic Approach to Uncrewed Systems

Moderator: Philip Hoffman,
NOAA Uncrewed Maritime Systems R&D Coordinator

**National Oceanic and
Atmospheric Administration**

March 8, 2022

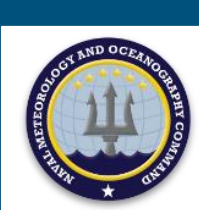
Panelists:

CAPT Philip Hall, Director, NOAA UxS Operations Center

Alex C. Ligon, Navigation Response Team – 1

Bill Lingsch, Integrated Ocean Observing System

Sharon Mesick, National Centers for Environmental Information



Drivers for Collaboration



Commercial Engagement Through Ocean Technology Act of 2018 (CENOTE Act of 2018, 33 USC §4102)

CENOTE directs Navy and NOAA to form a strategic partnership that advances the testing, training, and development of uncrewed systems.

- Directs NOAA to coordinate its development of uncrewed maritime systems with universities, the private sector, and the U.S. Navy and make the data accessible to the public.
- NOAA-Navy MOU Annex 24: Establishes a framework for coordination and collaboration between NOAA and US Navy on the assessment, acquisition, testing, and use of uncrewed maritime systems (UMS).



NOAA UxS Strategic Plan (2021-2025)



Goal 1: Coordinate and Support UxS. Operations at an Enterprise Level

Goal 2: Expand UxS Applications Across NOAA's Mission Portfolio

Goal 3: Accelerate Transition of UxS. Research to Applications

Goal 4: Strengthen and Expand UxS. Partnerships

Goal 5: Promote Workforce Proficiency in. UxS Use and Operations



UxS Operations Center

Office of Marine and Aviation Operations



UxS Transition to Operations

Panel: NOAA Strategic Approach to Uncrewed Systems March 8, 2022

NOAA's UxS Strategy Goals

- Maximize utilization of UxS for NOAA's requirements
- Provide opportunities to demonstrate UxS concepts to meet requirements
- Accelerate UxS research to operations

2021-2024 High Priority Projects

Project (Geographic Area)	Partner	Desired Final Operating Capability
High-Altitude AirCore Retrieval System for Atmospheric Greenhouse Gas Profiling (CO)	OAR	UAS stratospheric observations by OAR
Advancing UAS-based topo-bathymetric mapping operations along river corridors to inform management of endangered Pacific salmon (CA, OR, WA)	NMFS	UAS river mapping by West Coast NMFS Science Centers
Advancing remote marine mammal stock assessment with passive acoustic gliders (HI)	NMFS	Marine mammal surveys with gliders in HI
REFOCUS - Reimagining Ecosystem and Fisheries Observations by Combining two UxS fleets. (CA)	NMFS	Glider operations by UxSOC/NMFS
Uncrewed Surveys of Pinnipeds in the Aleutian Islands (USPAI) Project (AK)	NMFS	UAS operations by UxSOC
Transition of the Oculus glider into operations for Arctic ecosystem research (AK)	OAR	Glider operations by UxSOC
Use of uncrewed surface vehicles (USVs) in tandem with NOAA vessels to increase survey efficiency (East Coast, Great Lakes and AK)	NOS NMFS	USV Operations from NOAA Ships by UxSOC and Marine Operations
Uncrewed Underwater Vehicle (UUV) for Scallop Survey in Wind Farms Areas (New England)	NMFS	Routine scallop resource surveys
Transitioning the Tropical Cyclone Air-Deployed small UAS to Operations (FL)	OAR	OAR/AOC Operated from WP-3Ds

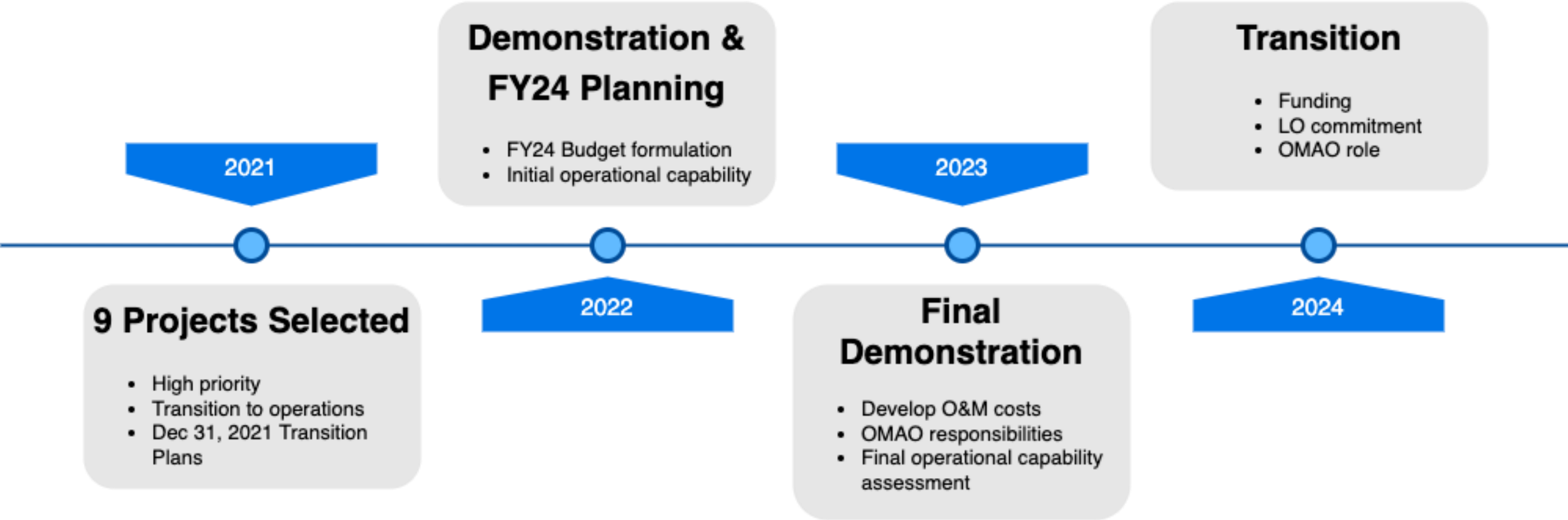


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FY24 Project Transition to Operations Strategy

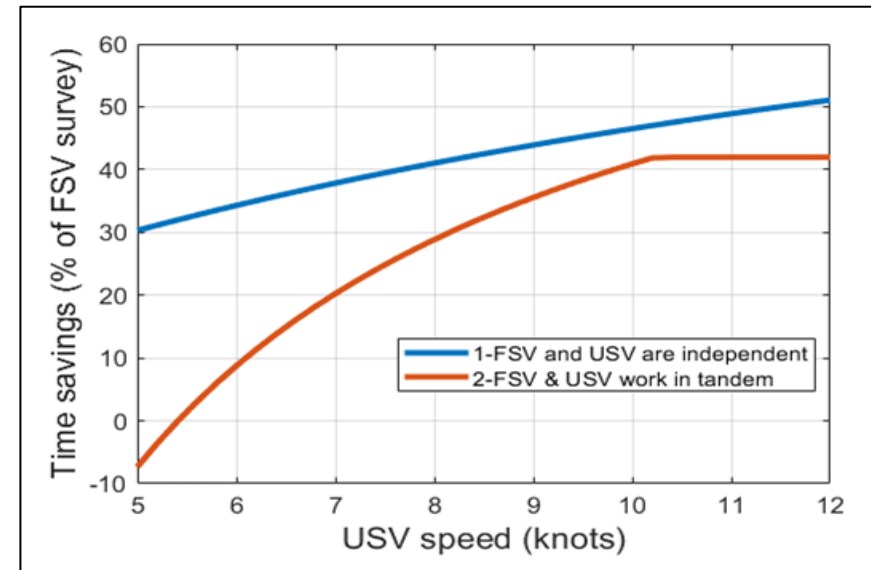


Use of Uncrewed Surface Vehicles (USVs) in Tandem with NOAA Vessels to Increase Survey Efficiency

Objective: operationalize the use of diesel-powered USVs working in tandem with NOAA ships as ‘force multipliers’ to reduce the cost of sonar measurements for fisheries surveys and hydrographic mapping.

Justification:

- USVs have recently progressed to a point that they can contribute to core OCS and NMFS data products (nautical charts and fisheries stock assessments)
- A single USV working in tandem with a NOAA ship has the potential to reduce ship time requirements for acoustic-trawl and ocean mapping surveys by ~1/3
 - ❖ Rob Downs, Damian Manda - Office of Coast Survey
 - ❖ Alex De Robertis, Michael Gallagher, Sandra Parker-Stetter - NOAA Fisheries
 - ❖ Don Jones - NOAA Marine Operations Center
 - ❖ Larry Mayer, Val Schmidt - University of New Hampshire



Planned Activities

Year 1 (FY 2021)

Specification and purchase of a suitable USV (iXblue DriX identified, procurement completed)



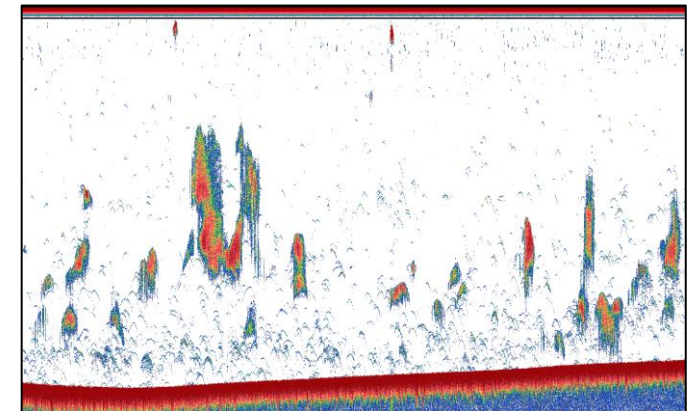
Year 2 (FY 2022)

USV acceptance testing and training
Integration on NOAA Ship Thomas Jefferson Operational hydrographic data collection



Year 3 (FY 2023)

Integration aboard NOAA ship Oscar Dyson
Over the horizon testing
USV testing during Alaska pollock survey



Long-term: Transfer USV operations to OMAO and UxS center.



NOAA UxS Strategic Goals



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Goal 5: Promote Workforce Proficiency in. UxS Use and Operations

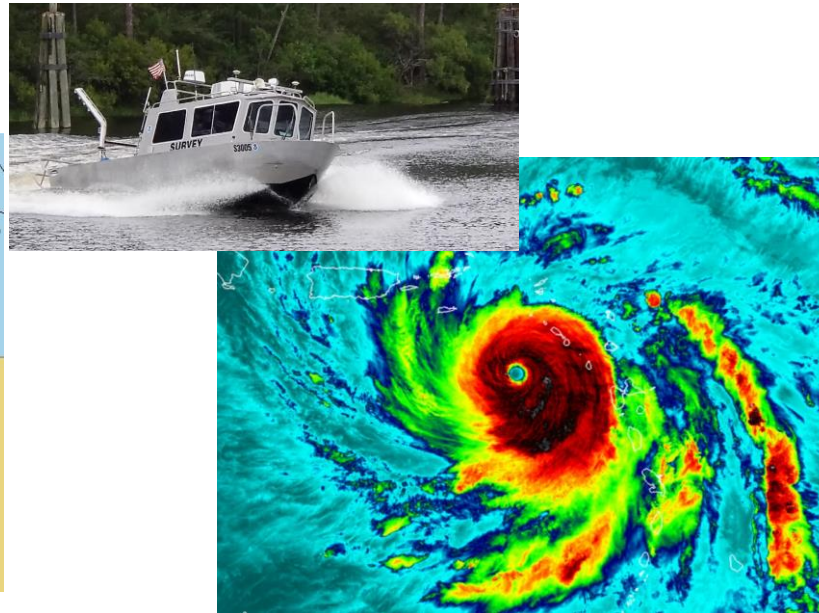
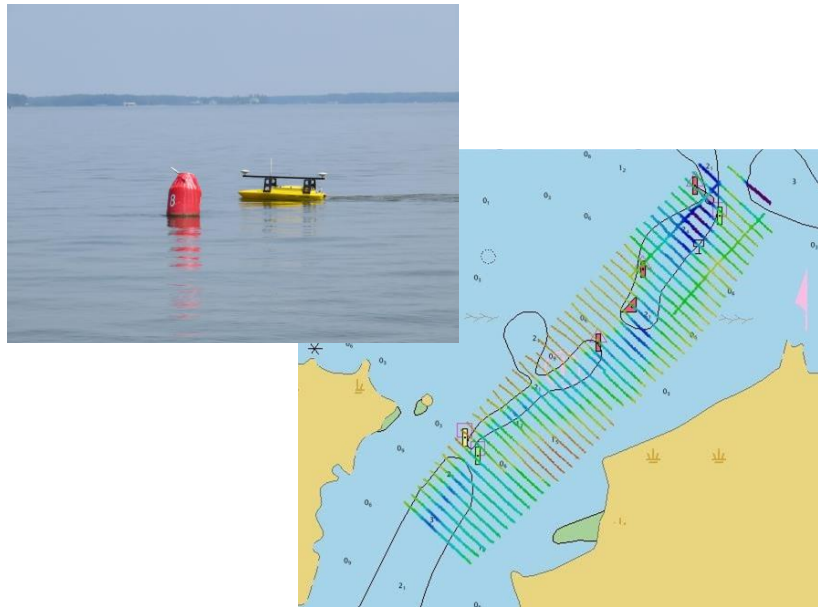
Alex C. Ligon

NOAA Office of Coast Survey / Navigation Response Team –1

Navigation Response Branch Operations

Emergency Response

Near Shore & Shallow Water



Ports, Harbors, & Channels





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Objective 4.1: Increasingly Leverage Interagency Integration.

Objective 4.2: Strengthen Collaboration with Academia.

Objective 4.3: Reinforce NOAA's Growing Partnerships with the
Private Sector

Bill Lingsch

NOAA Integrated Ocean Observing System



Drivers for Collaboration



Commercial Engagement Through Ocean Technology Act of 2018 (CENOTE Act of 2018, 33 USC §4102)

- CENOTE directs Navy and NOAA to **form a strategic partnership** that advances the testing, training, and development of uncrewed systems.
 - Directs NOAA to coordinate its development of uncrewed maritime systems with universities, the private sector, and the U.S. Navy and make the data accessible to the public.
 - Annex 24: Establishes a framework for coordination and collaboration between NOAA and US Navy on the assessment, acquisition, testing, and use of uncrewed maritime systems (UMS).
- **NOAA seeks to strengthen this partnership by coordinating efforts to improve global ocean forecasts with targeted and sustained glider data. These advancements improve downstream NOAA models used to forecast hurricane intensity.**

Partnerships Make it Possible (force multiplier)



Region	Tropical Atlantic & Caribbean	Mid-Atlantic Bight	Gulf of Mexico	South Atlantic Bight
Operator	CARICOOS CIMAS UNIVERSITY OF MARYLAND SYSTEM ANAMAR	MARACOOS Ocean Information for a Changing World Mid-Atlantic Regional Association Coastal Ocean Observing System RUTGERS UNIVERSITY OF NEW JERSEY UNIVERSITY OF DELAWARE UMass VIMS WILLIAM & MARY VIRGINIA INSTITUTE OF MARINE SCIENCE Stony Brook University WOODS HOLE OCEANOGRAPHIC INSTITUTION 1930 	GCOOS GULF OF MEXICO COASTAL OCEAN OBSERVING SYSTEM THE UNIVERSITY OF SOUTHERN MISSISSIPPI ATM 	SECOORA Southeast Coastal Ocean Observing Regional Association Skidaway Institute of Oceanography UNIVERSITY OF GEORGIA WOODS HOLE OCEANOGRAPHIC INSTITUTION 1930
Support	University of the Virgin Islands IOCARIBE OCOVI supporting CARICOOS in the Virgin Islands Cape Eleuthera Institute DEPARTMENT OF COMMERCE (DOC) - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) OFFICE of MARINE & AVIATION OPERATIONS	MONMOUTH UNIVERSITY NOAA OCEAN ACIDIFICATION PROGRAM Global Ocean Monitoring and Observing NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION DEPARTMENT OF COMMERCE (DOC) - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) OFFICE of MARINE & AVIATION OPERATIONS	SHELL DEPARTMENT OF COMMERCE (DOC) - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) OFFICE of MARINE & AVIATION OPERATIONS	THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL Global Ocean Monitoring and Observing NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION DEPARTMENT OF COMMERCE (DOC) - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) OFFICE of MARINE & AVIATION OPERATIONS
Leveraged	THE G. UNGER VETLESEN FOUNDATION	UNIVERSITY OF NEW JERSEY HELMHOLTZ BIOS HELMHOLTZ RESEARCH FOR GRAND CHALLENGES OQI OCEAN OBSERVATORIES INITIATIVE Ocean Wind An Orsted Initiative UNIVERSITY OF NEW YORK STATE	USF UNIVERSITY OF SOUTH FLORIDA MOTE MARINE LABORATORY	USF UNIVERSITY OF SOUTH FLORIDA

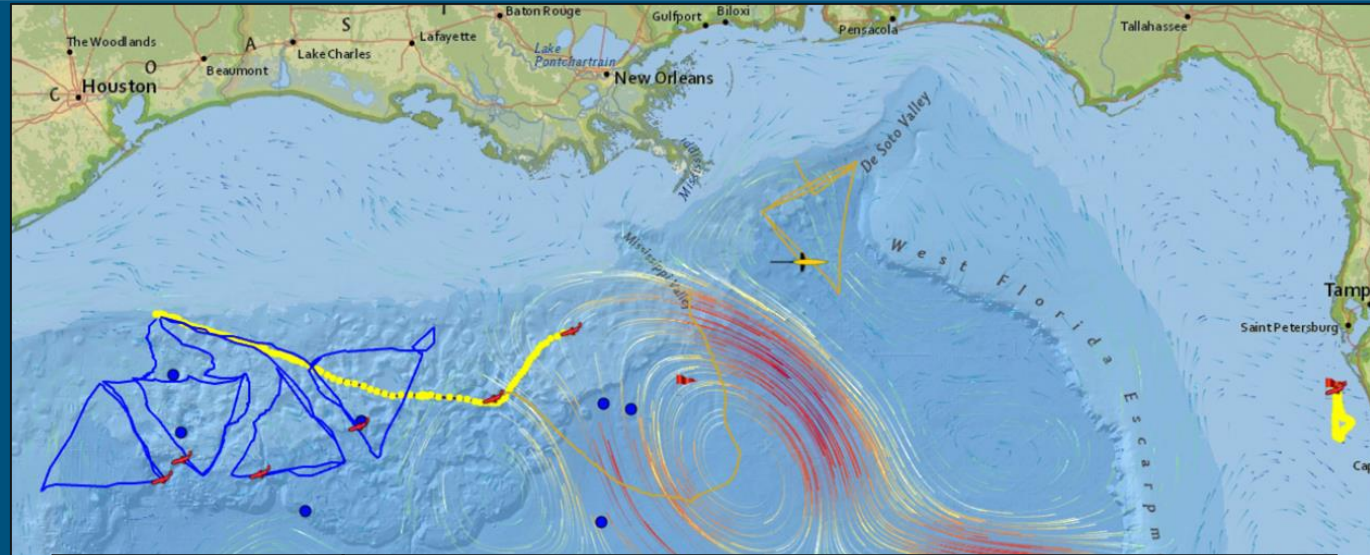
Lead by:

 IOOS Integrated Ocean Observing System

Improving Hurricane Intensity Forecasts



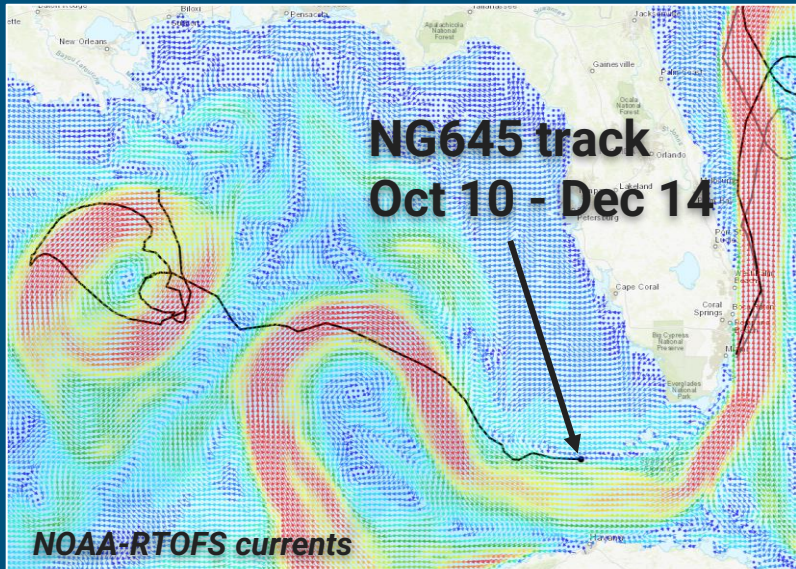
- 8 storms made landfall in the U.S. during the 2021 hurricane season
 - 6 in a Gulf state
 - 1 Major Hurricane (**Ida – Cat. 4**)
 - 2 Cat. 1 (Elsa & Nicolas)
 - 3 Tropical Storms
 - Hurricane Grace (Cat. 3) made landfall near Veracruz, Mexico after traversing Gulf
- **Temporary increased cycling of ARGO (2 day)**
- 14 gliders deployed in the GoM during the 2021 hurricane season for 539 glider days
 - **Shell - 2 (USM & TAMU)**
 - 47 days USM
 - 36 days TAMU
 - **Navy - 6**
 - NG645 (Mission1: 104; Mission2: 43+)
 - 367 Total Days (as of November 22)
 - Leveraged Partner Datasets (not hurricane focused) - 89 total days (as of November 22)
 - **USF - 4 missions**
 - **Mote - 2 missions**



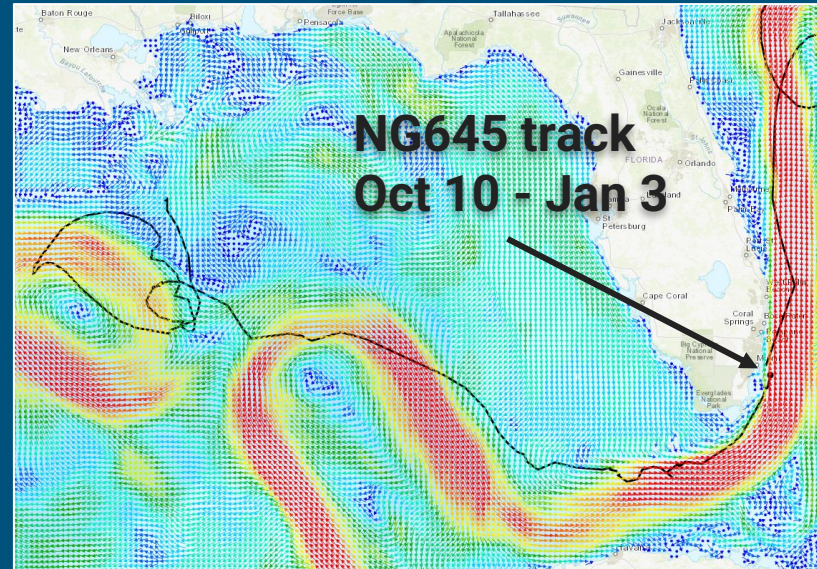
Navy Glider NG645: Loop Current - Gulf Stream Track



Dec 14, 2021



Jan 3, 2022



Goals

- Piloting exercise with the Navy GOC using GHOST
- Capture gradients
- Identify different water masses

Planned
Oct - Dec 2021




- Underwater Glider... ▾
- Threads
- Slack Connect
- More
- Channels
- bestpractices
- general
- piloting**
- webinar
- news-events
- publications
- training
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- website
- Add channels
- Direct messages
- Slackbot
- piloting


Search Underwater Glider User Group (UG2)


piloting ▾


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 **Hank Statscewich** 10:00 PM
 Hi Piloting Slack Channel. I have a question with regards to Monday, February 21st ▾ if my autoballast has converged into a solution, what's the best way to reset the autoballast settings without exiting the mission? I was thinking of entering a ">!set autoballast 0" during an iridium transfer, but I'm not 100% on this and I don't want the pitch and buoyancy motors burning through a bunch of battery power while they find their happy spot... I'm in 250 m deep water with a 1000 m pump. Thoughts? (edited)

Yesterday ▾







 **Nicolai** 5:59 AM
 Hi Hank, why are you trying to reset the state? If you change the total amount of ballast in your yo file the glider will re-calculate the dive/climb ballast. You could do an incremental increase/decrease in your yo file. (edited)

 **Hank Statscewich** 10:55 AM
 Hi Nicolai, thank you for the suggestion. I want to reset the auto ballast because I don't think it's doing a great job. Long back story to go along with this statement, but we are now in much deeper water and the water is composed of a very different density range as compared to when the autoballast solution converged. (edited)

 **Nicolai** 11:03 AM
 @Hank Statscewich - What is glider dive/climb speed look like right now? If you think the autoballast is stuck I would try to play with the total ballast amount. Maybe increase it to 450 cc and then go back down to 400 or 375. What are the minimum climb/dive speeds? What is the glider currently using

B I      

Send a message to #piloting

Activate Windows
Go to Settings to activate Windows



Underwater Glider User Group

Underwater Glider User Group

a community-based coalition aimed at bolstering scientific collaboration, information, and resource sharing for gliders

Join UG2



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Objective 1.3 : Implement an Innovative, Robust, and Encompassing Data Enterprise Strategy

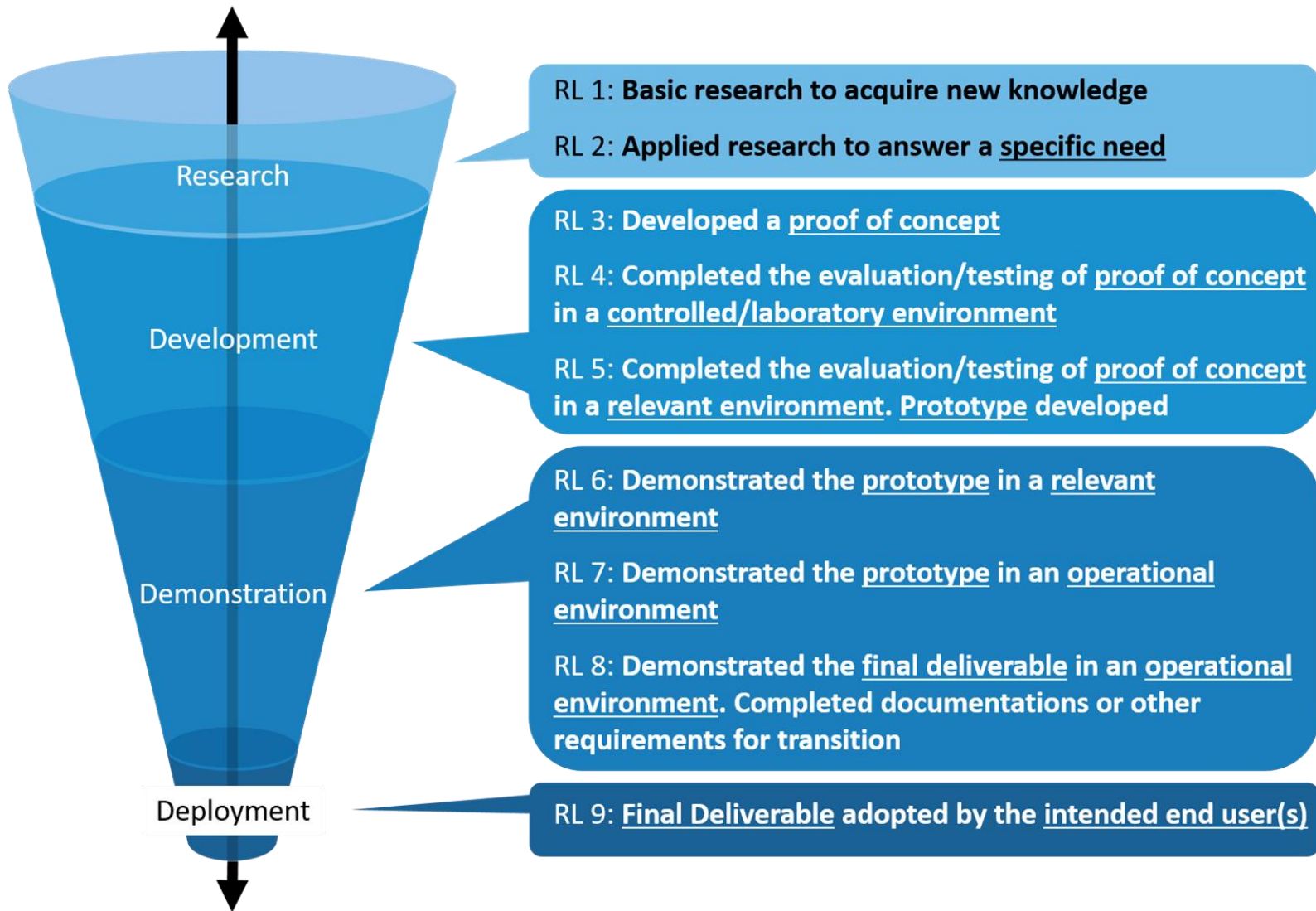
Objective 3.2: Develop Transition Plans with Operational Partners

Sharon Mesick

NOAA National Centers for Environmental Information

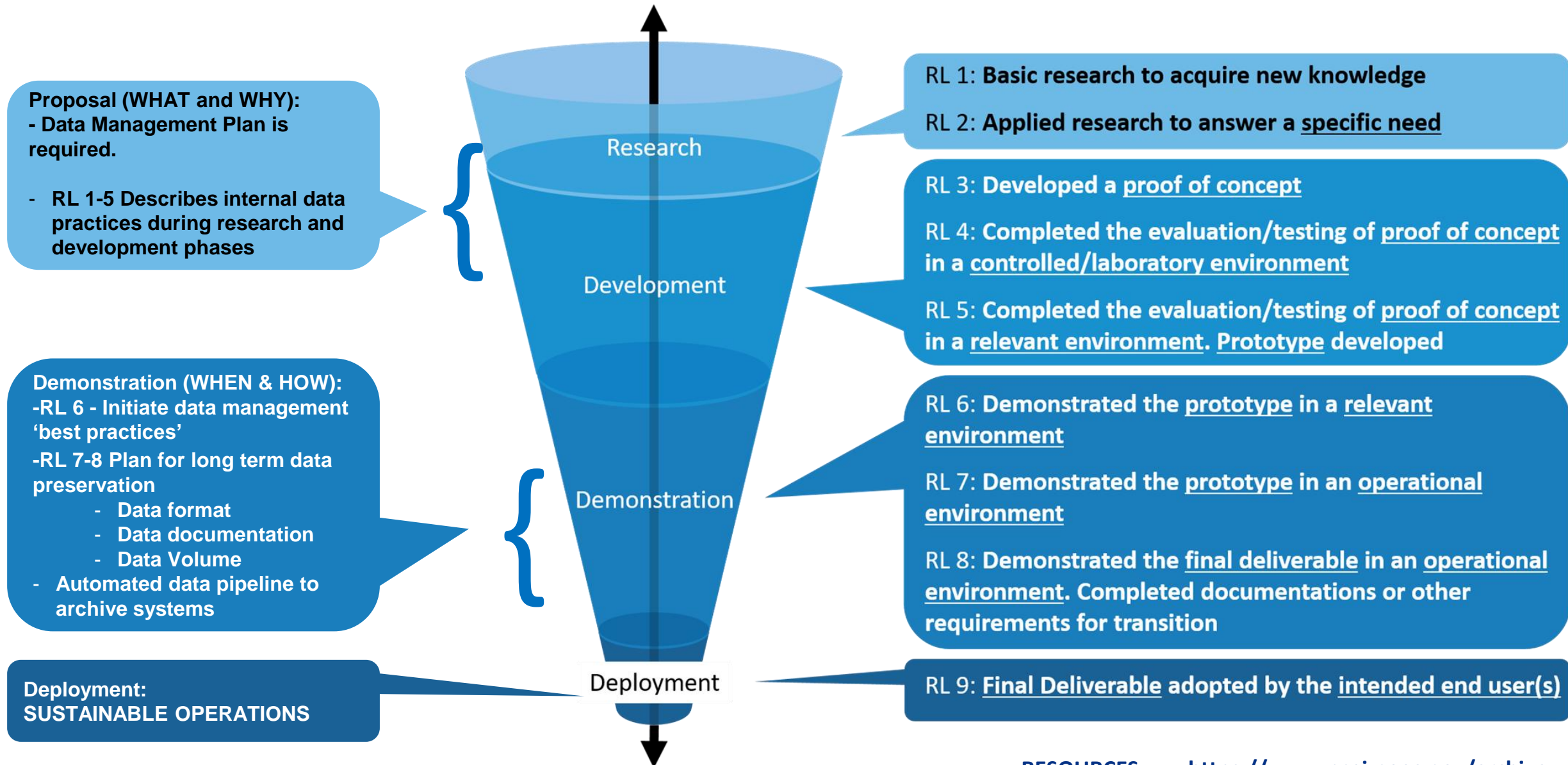
Making Data Operational: Office of Research, Transition, and Application

NOAA R&D Readiness Levels (RL) define R2O transition requirements



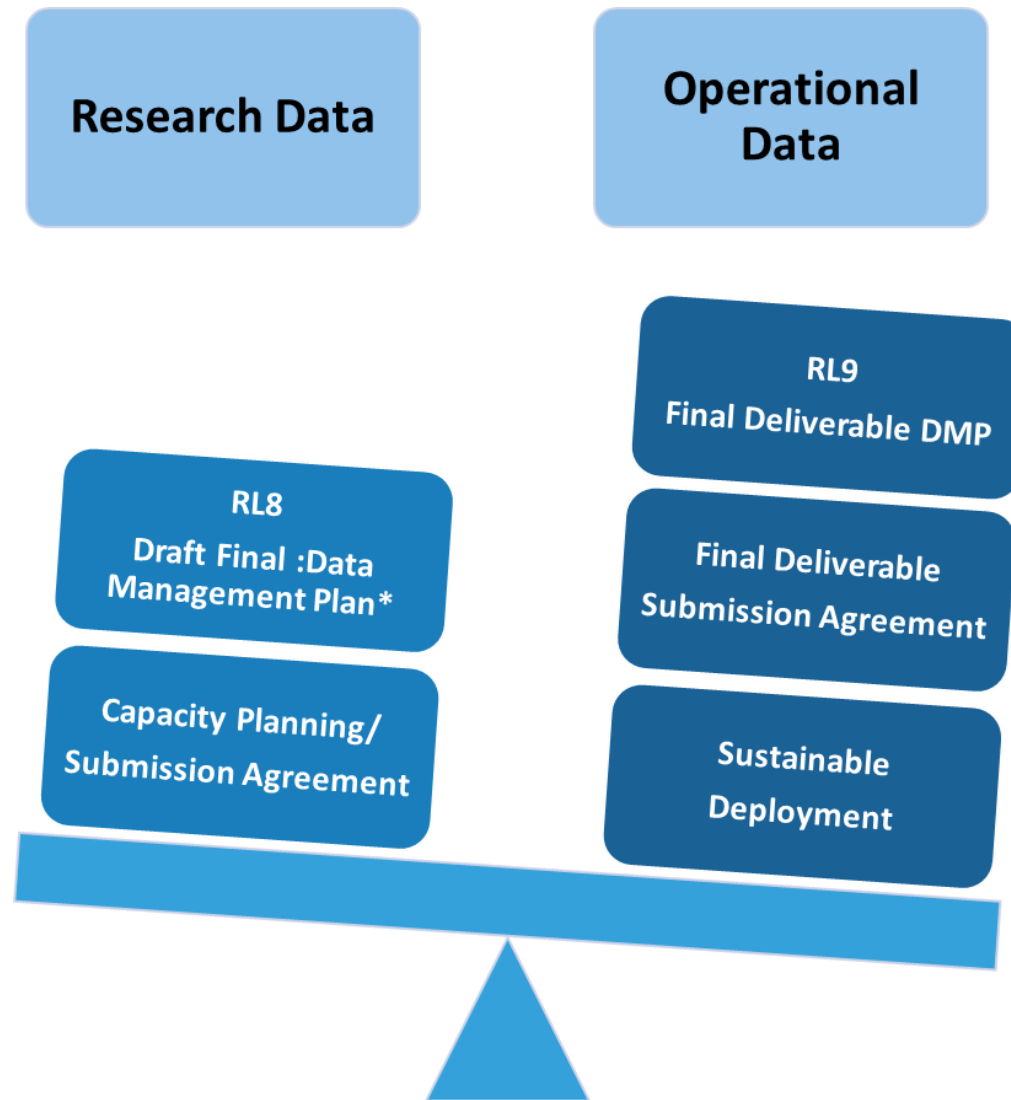
Making Data Operational: ORTA and NCEI

Aligning NOAA R&D Readiness Levels and Data Management Planning



Making Data Operational: NOAA RL 8 ⇔ RL 9

The key transition point for Data Management Implementation



Moderated Discussion, Philip Hoffman, Moderator

