

Unified Forecast System: Strategic Plan (UFS User's Workshop) July 28, 2020

for the UFS-Steering Committee

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Co-chairs

- Thanks to the Organizing Committee
- Introduce UFS Strategic Plan
- In the slide deck are some canonical UFS slides.

[UFS Community Portal](#)



Thanks to Organizing Committee

- Jeff Beck (DTC and CSU/CIRA at NOAA/GSL)
- Lisa Bengtsson (NOAA/PSL)
- Ligia Bernardet (DTC and NOAA/GSL)
- Cecelia DeLuca (CIRES)
- Jim Kinter (George Mason University)
- Weiwei Li (DTC and NCAR)
- Bin Liu (IMSG at NOAA/NCEP/EMC)
- Louisa Nance (DTC and NCAR)
- Kathryn Newman (DTC and NCAR)
- Yan Xue (NOAA/NWS/OSTI)

“The workshop is expected to improve communications, transparency, and mutual trust between operational centers and the broader community.”

Writing team:

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Four Sections:

1. Introduction
2. UFS Forecast Skill
Priorities, and Science
and Systems Goals
3. UFS Organizational and
Management Priorities
4. Schedule

For those new to UFS, this is a good document to introduce yourself to the community.

1. Introduction

Important points:

- The UFS Strategic Plan builds off of two previous Strategic Implementation Plans (SIP). Compared with the previous Strategic Implementation Plans, this document separates aspects of strategy from those of implementation.
- Introduces applications and how the UFS governances aligns with applications and products



2. UFS Forecast Skill Priorities, and Science and Systems Goals

Important points:

- Describes Forecast Skill Priorities for each application
- Describes UFS Science Goals (Six (6) major goals)

“The UFS is committed to achieving improved accuracy of numerical guidance through systematic strengthening of the scientific foundation of the applications guided by operational impact. Therefore, UFS Science Goals and Forecast Skill Priorities are coupled to each other. The UFS Science Goals represent the method and the Forecast Skill Priorities represent the verification and validation criteria that are the targeted outcomes of scientific development.”

- UFS Systems Goals
 - Improve community engagement
 - Simplify Short-Range Weather/Convection Allowing Model Suite
 - Improve workflow
 - Evolve Hierarchical Systems Development capability



3. UFS Organizational and Management Priorities

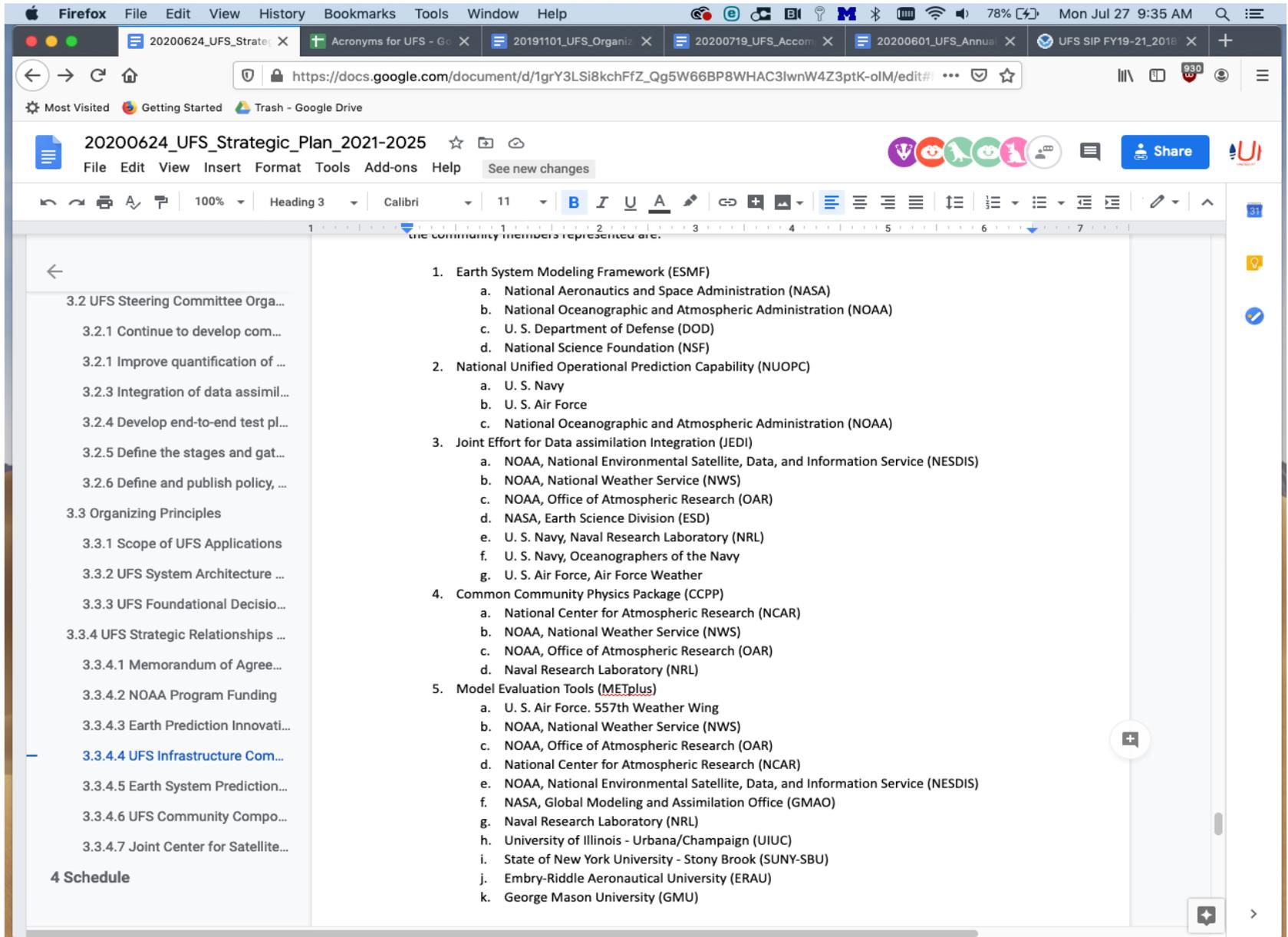
Important points:

- Describes the priorities of the Steering Committee
- Describes Organizing Principles of the UFS
 - Defines Applications
 - Introduces System Architecture
 - List UFS Foundational Decisions

“The UFS is a unified system because its applications share a set of agreed-upon scientific components and a set of agreed-upon infrastructures. The scientific components and infrastructures are integrated into a consistent system architecture.”

- Describes the Strategic Relationships of the UFS

Lists the organizations already contributing to the UFS through infrastructures and components. Expertise and software that that would not be available without the community.



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the community members represented are:

1. Earth System Modeling Framework (ESMF)
 - a. National Aeronautics and Space Administration (NASA)
 - b. National Oceanographic and Atmospheric Administration (NOAA)
 - c. U. S. Department of Defense (DOD)
 - d. National Science Foundation (NSF)
2. National Unified Operational Prediction Capability (NUOPC)
 - a. U. S. Navy
 - b. U. S. Air Force
 - c. National Oceanographic and Atmospheric Administration (NOAA)
3. Joint Effort for Data assimilation Integration (JEDI)
 - a. NOAA, National Environmental Satellite, Data, and Information Service (NESDIS)
 - b. NOAA, National Weather Service (NWS)
 - c. NOAA, Office of Atmospheric Research (OAR)
 - d. NASA, Earth Science Division (ESD)
 - e. U. S. Navy, Naval Research Laboratory (NRL)
 - f. U. S. Navy, Oceanographers of the Navy
 - g. U. S. Air Force, Air Force Weather
4. Common Community Physics Package (CCPP)
 - a. National Center for Atmospheric Research (NCAR)
 - b. NOAA, National Weather Service (NWS)
 - c. NOAA, Office of Atmospheric Research (OAR)
 - d. Naval Research Laboratory (NRL)
5. Model Evaluation Tools (METplus)
 - a. U. S. Air Force. 557th Weather Wing
 - b. NOAA, National Weather Service (NWS)
 - c. NOAA, Office of Atmospheric Research (OAR)
 - d. National Center for Atmospheric Research (NCAR)
 - e. NOAA, National Environmental Satellite, Data, and Information Service (NESDIS)
 - f. NASA, Global Modeling and Assimilation Office (GMAO)
 - g. Naval Research Laboratory (NRL)
 - h. University of Illinois - Urbana/Champaign (UIUC)
 - i. State of New York University - Stony Brook (SUNY-SBU)
 - j. Embry-Riddle Aeronautical University (ERAU)
 - k. George Mason University (GMU)

4 Schedule

4. Schedule

Important points:

- A notional schedule posited by EMC (esp. Vijay Tallapragada) for transition to the UFS.
- A set of releases from NCEP & UFS in the next year

“The Short-range Weather release will be a research model for the community, and the first UFS release that is not linked to an operational release.”



Where is this available?

The plan is open for comment to the community.

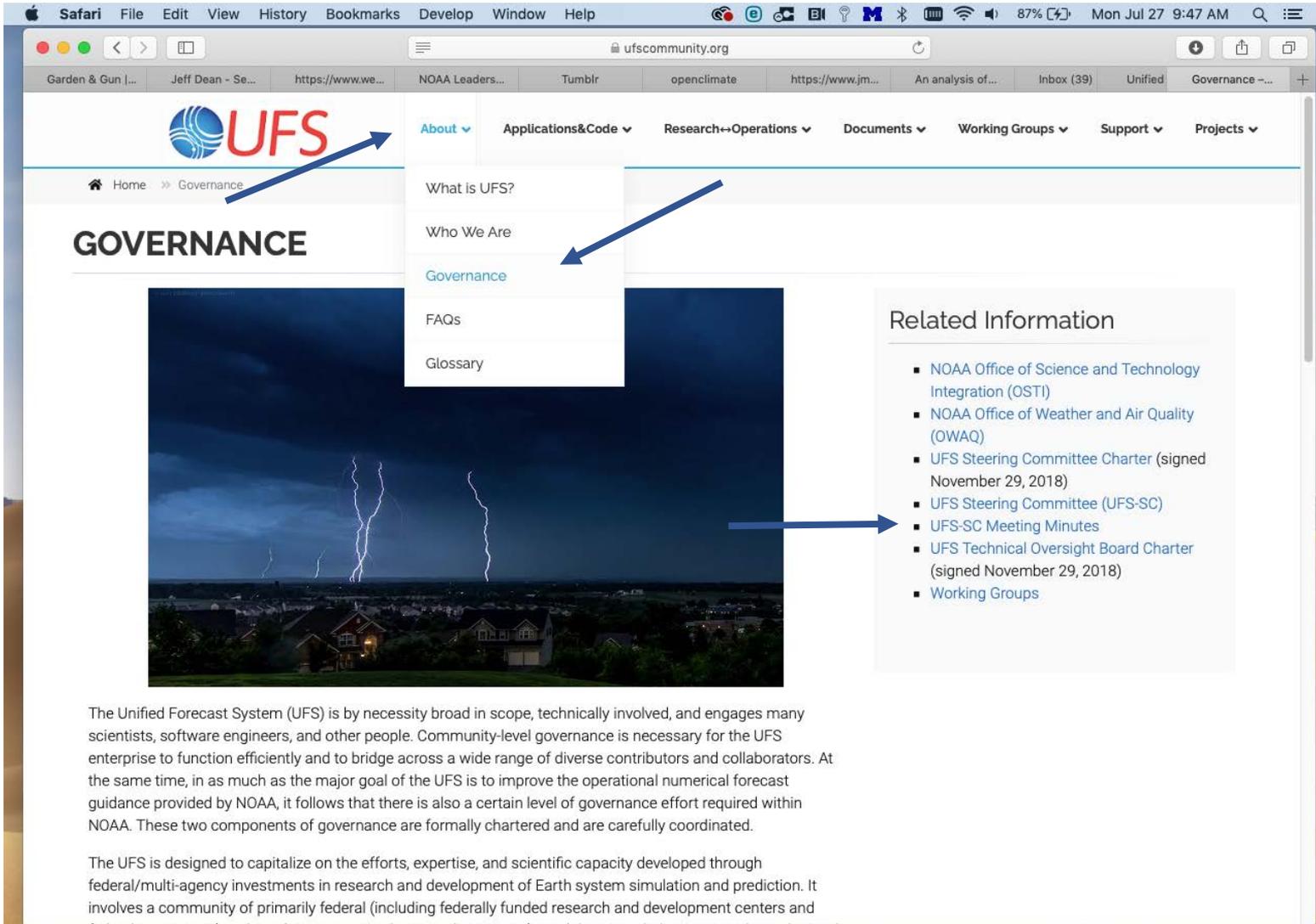
Link is

https://docs.google.com/document/d/1grY3LSi8kchFfZ_Qg5W66BP8WHAC3lwnW4Z3ptK-olM/

On the portal:

<https://ufsccommunity.org>

ABOUT >> GOVERNANCE >> UFS-SC MEETING MINUTES



The screenshot shows the website interface with the following elements:

- Navigation Bar:** Home » Governance
- UFS Logo:** UNIFIED FORECAST SYSTEM
- Menu Items:** About, Applications&Code, Research<=>Operations, Documents, Working Groups, Support, Projects
- Dropdown Menu (About):** What is UFS?, Who We Are, Governance, FAQs, Glossary
- Section Header:** GOVERNANCE
- Image:** A large image of a lightning storm over a residential area.
- Related Information Sidebar:**
 - NOAA Office of Science and Technology Integration (OSTI)
 - NOAA Office of Weather and Air Quality (OWAQ)
 - UFS Steering Committee Charter (signed November 29, 2018)
 - UFS Steering Committee (UFS-SC)
 - UFS-SC Meeting Minutes
 - UFS Technical Oversight Board Charter (signed November 29, 2018)
 - Working Groups

The Unified Forecast System (UFS) is by necessity broad in scope, technically involved, and engages many scientists, software engineers, and other people. Community-level governance is necessary for the UFS enterprise to function efficiently and to bridge across a wide range of diverse contributors and collaborators. At the same time, in as much as the major goal of the UFS is to improve the operational numerical forecast guidance provided by NOAA, it follows that there is also a certain level of governance effort required within NOAA. These two components of governance are formally chartered and are carefully coordinated.

The UFS is designed to capitalize on the efforts, expertise, and scientific capacity developed through federal/multi-agency investments in research and development of Earth system simulation and prediction. It involves a community of primarily federal (including federally funded research and development centers and federal contractors) and academic universities across the range of capabilities needed to support the end-to-end



Backup & Informational Slides



About the UFS

Purpose The Unified Forecast System (UFS) is a comprehensive, community-developed Earth modeling system, designed as both a research tool and as the basis for NOAA's operational forecasts.

Governance Planning and evidence-based decision-making support improving research and operations transitions and community engagement.

Scope UFS is configurable into multiple applications that span local to global domains and predictive time scales from less than an hour to more than a year.

Design UFS is a *unified* system because the applications within it share science components and software infrastructure

Impact UFS is a **paradigm shift** that will enable NOAA to simplify the NCEP Production Suite, to accelerate use of leading research, and to produce more accurate forecasts for the U.S. and its partners.



UFS: Started from a set of important foundational decisions

- Dycore: Selection of the FV3 dynamical core for the GFS (Global Forecast System)
- Modular, community-based systems architecture for the coupled model
- Infrastructure:
 - Coupling (ESMF, NUOPC)
 - Data Assimilation (JEDI)
 - CCPP Framework (Atmospheric Physics)
 - METplus
- Strategic Implementation Plan (SIP)
- NCAR-NOAA Memorandum of Agreement
 - ~50 % shared code in models and infrastructure
- EPIC
 - Opportunity: Success of SIP and UFS is essential for EPIC.
 - SIP and UFS are part of the foundation for EPIC

UFS applications include:

- Medium-Range Weather (Weather) - Atmospheric behavior out to about two weeks
- Subseasonal-to-Seasonal (S2S) - Atmospheric and ocean behavior from about two weeks to about one year
- Hurricane - Hurricane track, intensity, and related effects out to about one week
- Short-Range Weather/Convection Allowing - Atmospheric behavior from less than an hour to several days
- Space Weather - Upper atmosphere geophysical activity and solar behavior out to about one month
- Marine and Cryosphere - Ocean and ice behavior out to about ten days
- Coastal - Storm surge and other coastal phenomena out to about one week
- Air Quality - Aerosol and atmospheric composition out to several days



UFS Community Portal

Portal: <https://ufsccommunity.org/>

Unified Forecast System

Building better forecasts through community partnerships

Quick links for this presentation:

- [Applications](#)
- [Documents](#)



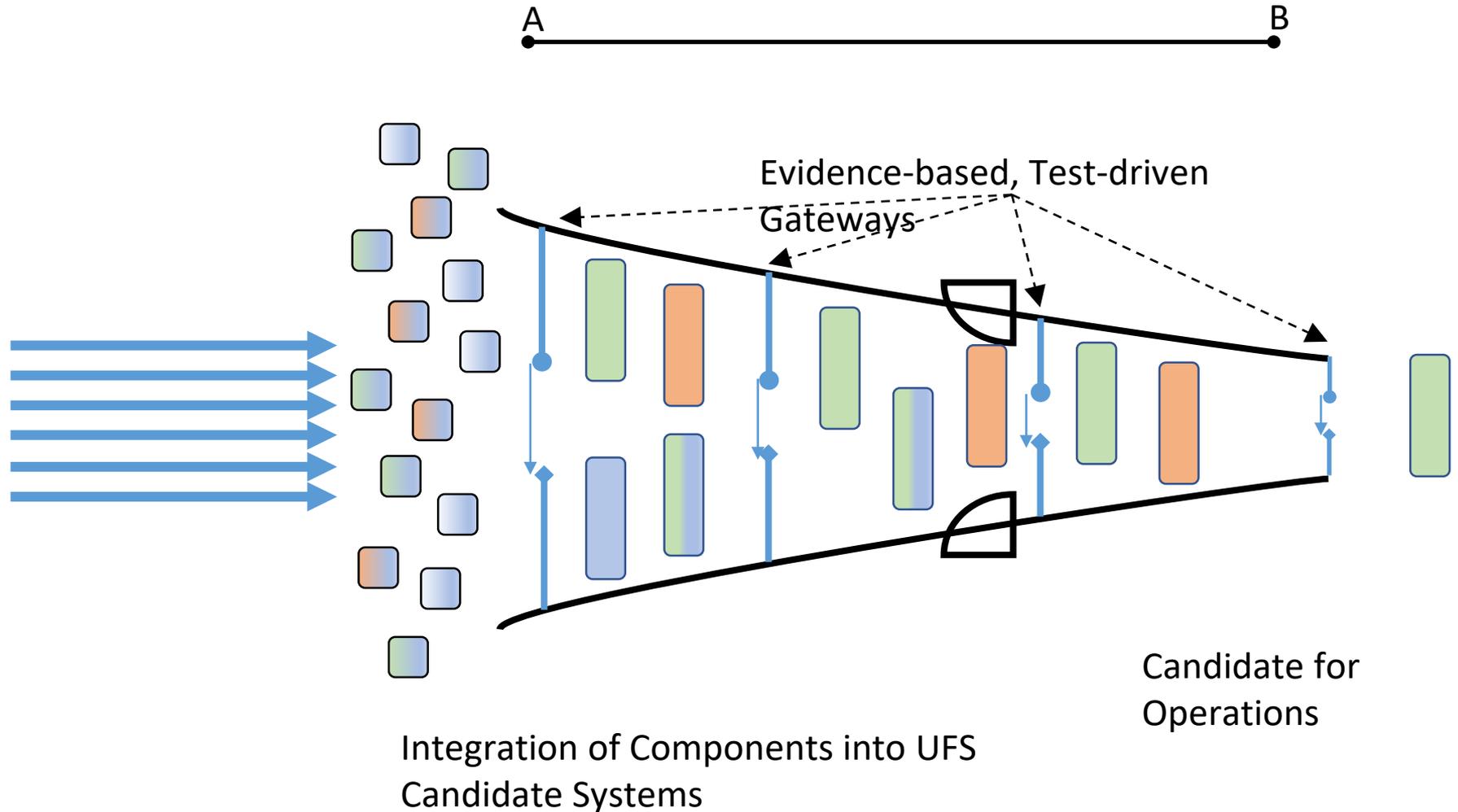
- Organizing Research to Operations Transition
- Describe and analyze the R2O process in order to improve it
 - Transitions between research and operations are widely considered what we need to improve.
- We need to know what we are doing to be able to target resources for improvement.
 - Describe the end-to-end process
 - What are the key functions?
 - What are the barriers?
 - How does it all fit together?
- Improved O2R is interwoven with R2O



R2O: Process (Our behavior)

- Building usable complex information systems and software requires:
 - Systems engineering approach
 - Iterative design and testing
 - Iterations with developers, scientific experts, and application specialists (teaming and re-teaming)
 - Communications
 - Continuity
 - Definition (Developing common language)
 - Incremental Planning
 - Strategic goals
 - Integration into end-to-end systems to address application goals
 - Objective testing, verification, and validation at all steps

R2O: As a repeated, narrowing stage and gate process [\(see backup slides\)](#)



Community Components for Inclusion in UFS Repositories

Function	UFS-SC Analysis	Status Evaluation
Management and Decision Making	yes	some existing capacity
Workflow	yes	some existing capacity
Code Management	yes	some existing capacity
System Integration	no	major gap
Developer and User Support	no	major gap
Testing, Verification, and Validation	yes	some existing capacity

Computational Resources	no	some existing capacity
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- Schedule to be anchored in a series of releases of validated applications
 - Major releases
 - Incremental releases of increased capacity
- Forecast and scientific priorities defined in Application Teams through a community partnership
- Increased focus on transitions at research - operations interfaces
- Forecast, scientific, and systems development is captured in the strategic implementation plan (SIP)
 - SIP based on coordinated work of Working Groups and Application Teams
 - Carried out through Applications Teams and Working Groups through a set of proposals under program office guidance

Take away

- We are in a much different and improved place than two years ago
 - Implemented new medium range system, with improved forecast metrics and improved science foundation
 - Exercised and analyzed a systematic, evidence-driven transition from research to operations
- Changes in approach to programmatic and line management
 - Commitment of NWS and OAR leadership to fund UFS activities in a strategic, systematic and integrated (NOAA with community) approach
 - Use of SIP planning process to guide a managed, project-based approach to UFS activities.
- Importance of alliances with federal, academic, and private-sector partners, the community, is recognized through
 - NCAR-NOAA Memo of Agreement
 - Use of community infrastructure
 - Use of Federal Funding Opportunities to engage community through Working Groups (e.g. SIP)

