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Draft: Governance Model for Unified Forecast System for NCEP's Production Suite

What is in this document? This document is the draft of a governance model for a NOAA-community partnership to provide a state-of-the-art modeling system for use in NCEP's Production Suite. The document defines the scope of the community modeling system. The initial governance model is simple, a Steering Committee and a set of Working Groups. The Steering Committee is charged by and Reports to an Executive Oversight Board. The Steering Committee is charged with filling out the governance structure based on what is needed to build a productive partnership of the research and operational modeling communities.

Functions, roles, and responsibilities are described. Possible additional governance bodies are listed. A set of discussion points are listed at the end.

The document was written by the SIP [Governance Working Group](#), and Version 0 was discussed at the August 2017 SIP Community Meeting. The Governance Working Group has included members from many organizations vested in the success of a partnership of the research and operational modeling communities. Additional members of the community have participated, and input was requested and received after the August 2017 Community Meeting. This input was incorporated into the document.

The Governance Working Group proposes that the document is now ready for consideration for implementation.

An outcome of the SIP Community Meeting was that a functioning interim governance be set up in the near term; the SIP community posed a set of issues that require deliberative attention of a community governance. Much has been gained with investment by NOAA's National Weather Service and the Office of Oceanic and Atmospheric Research. Nascent partnerships with, especially, the National Center for Atmospheric Research have been agreed upon. The Next Generation Global Prediction System's working groups and the Climate Programs Office's Model, Analysis, Predictions and Projections Task Forces have engaged multi-agency and the academic experts in science and software engineering. There is opportunity to be taken by making the Unified Forecast System - Steering Committee (defined below) functional in the near term.

What is Next? The governance needs to be chartered by the organizations and the sponsors that will be committed to a community-based approach with the goal of providing end-to-end modeling capacity bridging research and operations. This draft document now enters into a definition and approval phase with charterers and the Governance Working Group.

Scope: What is being governed?

What is being governed? A unified, coupled modeling system of Earth's environment that provides the foundation to meet the requirements of [NCEP's Production Suite](#).

The modeling system will require the use of components, services, and scientific capacity developed across Federal, multi-agency investments in research and development of Earth system simulation and prediction. This is a community of, primarily, federal (including, federally funded research and development centers and federal contractors) and academic experts who span the range of capabilities needed to support the end-to-end functionality of the NCEP Production Suite¹.

The governance functions at the interface of EMC, NCEP, NOAA laboratories and programs, and the broader research and development community, with the goal of providing end-to-end modeling capacity bridging research and operations.

Hence, what is being governed is: a community-based, unified, coupled modeling system suitable for application in NCEP's Production Suite. This will be called the **Unified Forecast System** (UFS).

¹ *Note, including private sector assets, here, is a complication probably best left to the future. From the beginning, the private sector is part of the end-user community. Engagement of the private sector for requirements, evaluation, outcomes, and effectiveness is an important charge to the UFS-SC*

Community Governance: Unified Forecast System

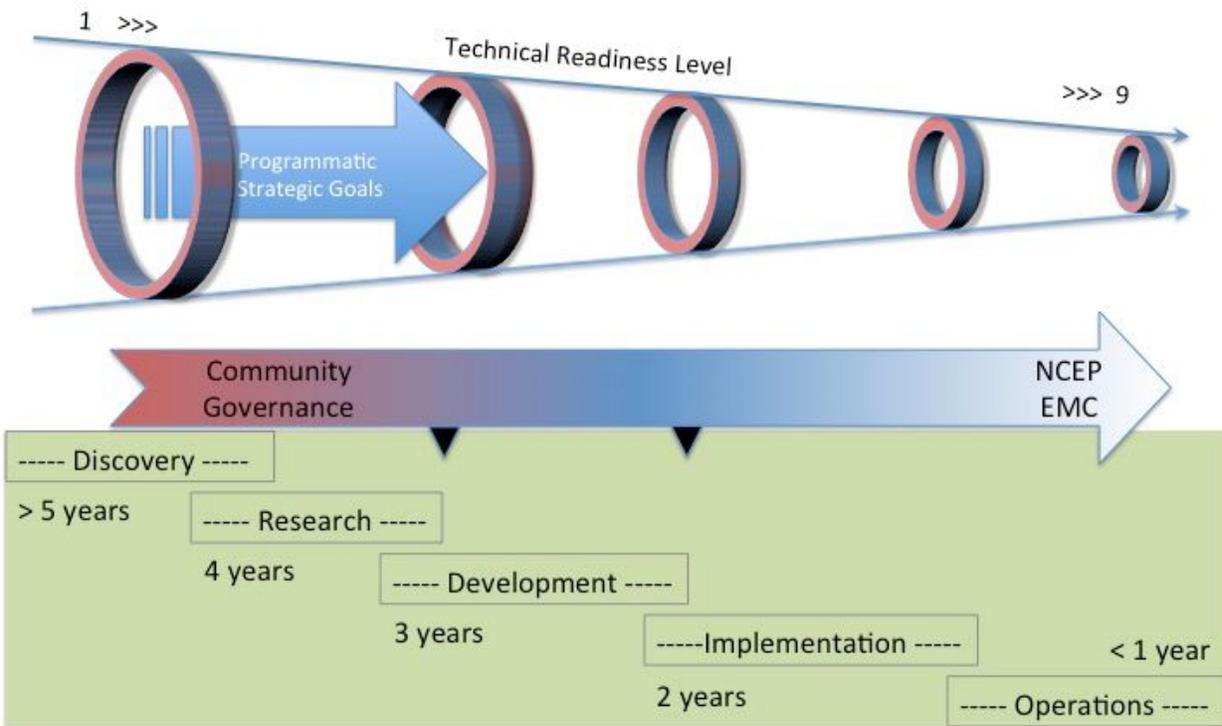


Figure 1, Caption: This figure represents the transition of research to operations. The progression is characterized by notional [technical readiness levels](#) for models from least (1) to most (9) ready for operational applications. The Community Governance acts to identify and steer capabilities from the research community towards the research-development interface. At the development-implementation interface there is a transition to NCEP management. The community governance has a strategic outlook beyond 5 years; however, focuses primarily on the 2 - 5 year time span. Handoff to the transition to operations occurs in the 2 - 3 year time span.

Initial Governance Bodies

The essential governance bodies are the Working Groups, Unified Forecast System (UFS) Steering Committee, and the Executive Oversight Board. These bodies will serve as the starting point.

It will be the job of the UFS Steering Committee to define other governmental bodies as a functioning governance evolves. Additional, **Likely governmental bodies** are listed in the Appendix.

Unified Forecast System (UFS) Steering Committee (UFS-SC)

The Unified Forecast System Steering Committee (UFS-SC) is the review, coordination, and decisionmaking body. It operates under the umbrella of the **Community Values** listed below.

Essential, long-term functions:

- **Define the organizational structure of the community governance of the unified forecast system (UFS)**
 - Given the initial inclusion of the Working Groups in the governance structure, the Steering Committee will assume the following charges:
 - oversight of activities of working groups
 - approving candidate capabilities and development strategies for implementation in the production suite
 - encouragement of external participation in the project
- **Set strategic direction and approve strategic plans for the UFS**
- **Approve the content and development path of the production suite²**

Working Groups (WGs)

Working Groups represent the essential science, technical, and design capacity of the Unified Forecast System (UFS). They span the community of expertise needed to support the UFS. Initial Working Groups are well defined by the existing NGGPS Working Groups. There are three types of working groups:

- Component/Discipline Working Groups (for example, Land, where focus might be on a component model, with scientific development a high priority.)

² This is a function that requires more attention. NOAA, often NCEP/EMC, holds the decision on the configuration of the operational system at the 1-2 year time span. The UFS-SC focuses on the candidate algorithms and system developments in the transition from research to development to implementation. Therefore, the UFS-SC focuses on the 2-5 year time span.

- Systems Working Groups (for example, Systems Architecture, Verification and Validation, Ensembles, Communications, End-user, Infrastructure, etc., where the focus is on the system as a whole, addressing a balance of scientific and technical research and development, cost, and end-user requirements)
- Applications Working Groups (for example, Medium-range Global, Seasonal, Space Weather, where the components are brought together as a configuration to address the requirements of a particular application)

Executive Oversight Board (EOB)

Proposed Charge: The Executive Oversight Board (EOB) charters the Unified Forecast System - Steering Committee (UFS-SC). Members include representation from NOAA (from the National Weather Service, the Office of Ocean and Atmospheric Research) and primary partners (e.g. NCAR, NASA, Navy, etc). Membership is at the program level (sponsors) and institution level (committing organizations to participation). The UFS-SC reports to the EOB, and the EOB assures the programmatic relevance of UFS-SC decisions. The EOB serves to adjudicate UFS-SC, if the UFS-SC cannot resolve decisions.

Terms of Reference

Unified Forecast System (UFS) - Steering Committee (UFS-SC)

Charter: The UFS-SC is chartered by the Executive Oversight Board, with senior representation from NOAA (both from the National Weather Service, and the Office of Ocean and Atmospheric Research) and primary federal partners.

Scope: Unified Forecast System (UFS) - a community-based, unified, coupled modeling system suitable for the applications in NCEP's Product Suite.

Membership: The membership includes a Chair and representatives of the following groups:

- Research and Operational Laboratories/Centers: (Institutional Representatives) EMC Director, OAR Lab Directors (GFDL, ESRL, ...), NCAR Lab Directors, NASA/GMAO Chief, and other representative{s) (*Representation is based on the component models and system's services required on the 1 and 2 year delivery plan*)
- Program Offices: (Sponsor representatives) NWS (Office of Science and Technology Integration), OAR (Office of Weather and Air Quality and/or Climate Program Office), Other?

- Working Group (WG) Representatives: System's Technical Representatives (NEMS +), Component/Discipline WG Representatives, Systems WG Representatives (Architecture, Analysis, +), Applications WG Representatives³

The UFS-SC should be a balance of NOAA and non-NOAA members. In order to assure relevance to operations at EMC the following criteria are proposed

- 1) Major milestones and schedule of EMC applications are a foundational consideration of the UFS-SC.
- 2) Application WG and Science WG Co-Leads from EMC and NOAA labs should be balanced with Co-Leads from non-NOAA community,
- 3) EMC Director and other NWS and OAR Representatives assure the relevance of the UFS-SC deliberations and commitment of organizations to the UFS-SC decisions
- 4) UFS-SC has the task for defining the governance and its operations. The EMC and NOAA Reps assure the relevance and vestment of NOAA with the Community Governance
- 5) The UFS-SC will consider the paths that connect Research and Operations and define the transition of roles and responsibilities

Term: Chair: 2 years renewable at the discretion of the Executive Oversight Board; Permanent membership of EMC Director and institutional partners. Working Groups: Staggered based on schedule. Considered every year. Nominal 2 year terms. Renewable.

UFS-SC: Details: Essential, long-term functions:

Towards a Transitional Governance

Definition of organizational structure:

Definition of the organizational structure includes definition of governance bodies, how they interact, and how the membership is determined. This will include communications plan.

Set strategic direction and approve strategic plan

- Using input from SIP working groups the UFS-SC develops strategic plan for UFS
- The UFS-SC coordinates with NOAA & NCEP strategic planning activities.

³ For the Applications (and possibly for Component/Discipline) WGs a representative process is recommended. That is, the Application's lead select representation for the UFS-SC, and those leads are responsible for representing the needs of all the applications. Recommend terms be based upon the priority implementation goals.

- Take a five-year outlook, but focus on Research-Development and Development-Implementation interface.

Content and development path of production suite

Pose that we consider a Unified Forecast System (UFS) to provide the NCEP Production Suite (NPS). Consider planning the UFS transition to operations on fiscal year (FY) time horizons and plan ahead two fiscal years at a time; when combined with the current year of execution this would equate to a 3-year plan to be updated annually. At each fiscal year there is a matrix documenting the components that are configured for each of the applications in the NPS. The Steering Committee focuses on the UFS-FY

- Determines content of UFS-FY goals for NPS at the research-development and development-implementation interface (see Figure 1)
- Reviews design, progress, code, and requirements on a regular basis
- Recommends merging of applications
- Recommends sunseting systems

UFS-SC: Roles and Responsibilities

- Makes community-based decisions
- Provides oversight to governmental bodies (e.g. working groups / liaison)
- Assesses risk and benefit
- Documents what is achieved, what is deferred, what is ended
- Assures communication across the governmental organization
- Assures communication about system as a whole in decision making
- Identifies Strategic Assets (5 year) for transition to Development
- Reviews Research to Development transition
- Reviews Development to Implementation Transition
- Identifies and Promotes use of Operational Systems in Community Research

Unified Forecast System (UFS) - Working Groups (WG) (UFS-WG)

Charter: The Unified Forecast System Working Groups (UFS-WGs) are chartered by the Unified Forecast System Steering Committee (UFS-SC)

Scope: Unified Forecast System Working Groups are expertise based. They are formed around Unified Forecast System (UFS) systems-wide functions, end-use applications, and discipline-specific model components. They span the community of expertise needed to support the UFS. UFS-WGs have the responsibility to identify and prioritize needs of their particular subject-area expertise against a set of objectives of the UFS. UFS-WG co-leads coordinate

their efforts with other WGs and represent WGs to the UFS-SC. WGs design, provide evaluation metrics, and coordinate activities to support evidence-based decisionmaking for transition to operations.

Membership: Working Group membership is open to all members of the NOAA and non-NOAA modeling community. Members should be credentialed in the expertise category of the WG and vested in the success of the Unified Forecast System. There are two co-leads with the co-Leads determined by the WG (*with concurrence of the UFS-SC?*). One co-lead represents the operational requirements, and expected to be from EMC or the organization holding the operational requirement. One co-lead is from the non-operational research and development community.

Term: Co-leads serve 2-year, renewable terms (*with 6 month overlap for continuity?*).

Working Group Details:

[\(List of WG Leads and Members\)](#)

Systems Working Groups

- System Architecture
- Infrastructure
- Ensembles
- Post-processing
- Verification and Validation
 - System wide
 - Verification and Validation required in UFS-WGs
- User Experience and Requirements (*Needs to be formed.*)
- Data (*Needs to be formed.*)

Applications Working Groups

- [Link to Application Leads](#)

Component/Discipline Working Groups

In many cases, the discipline-specific model components are community assets. They have their own governance. In this case, the UFS-WGs, described here, are charged with organizing the interface of the community to operations. The UFS-WG's influence on these community resources is as members of the community. There is no explicit or line-management authority given to the UFS-WGs.

- Dynamics And Nesting
- Model Physics
- Data Assimilation

- Land Surface Models (LSM) And Hydrology
- Aerosols And Atmospheric Composition
- Convection Allowing Models (CAM)
- Marine Models

Working Group Roles and Responsibilities:

- Communication
 - Within working group
 - With other working groups
 - With UFS-SC
 - Community
- Identify and prioritize development needs
- Gap analysis, where are resources needed?
- Define standard diagnostics
- Define evaluation and validation metrics
- Define (*and execute*) verification and validation plan
- Identify and adopt successful practices

Community Values

- Promotes environment for individuals to succeed
 - Recognizes talent in diverse communities
 - Assures efforts are credited and rewarded
 - Has transparent and documented processes for career advancement
 - Provides incentives to make decisions in context of community and system requirements (collaborative rather than individual decisionmaking)
- Evidence-based Decision Making
- Requirements Driven
- Considers the balance of cost, requirements, scientific credibility, user experience
- Supports a Scientific Organization (Rather than an Organization of Scientists)
- Committed to Process Improvement
 - Accuracy (Testing, Checking)
 - Documentation
 - Reduce redundant systems
 - Optimization of resources
 - Human
 - Computational

- Trust
- Transparency

Communications Plan

The Communications and Outreach Working Group is a committee of the Governance Group and is conceived as a standing committee after the UFS-SC is realized. Communication requirements were identified by the Governance Work Group and are incorporated into the Communications Plan.

Link to [Working Communications Plan](#)

References:

We have two examples of governance models that have the approximate scope needed for our proposed NOAA community. Neither of these models simply “transfer” to the NOAA community, and neither of them addresses all that need to be addressed. They are very good starts and should be analyzed and, likely, used as starting point for NOAA Community Governance

Community Earth System Model ([Main link](#))

- CESM “Administration” ([Main link](#))
- CESM Advisory Board ([Main link](#)), Terms of Reference ([link](#))
- CESM Scientific Steering Committee ([Main link](#)), Terms of Reference ([link](#))
- CESM Working Groups ([Main link](#)), General Terms of Reference ([link](#))
- CESM Governance Values ([link](#))
- CESM Plans ([Main link](#))

Earth System Modeling Framework

This is a [link to the PDF of the Project Plan](#) 2010-2015. This plan defines the governing bodies, their roles, their interactions, and in each subsection of the document their terms of reference.

This plan is explicitly multi-agency.

There is a similar, older view of ESMF Governance ([link](#))

- Bodies ([link](#))

SIP Community Governance Web Page ([link](#))

- [Comparative Analysis](#) of Community Governance Models
- [Annotated Bibliography](#) of Some Academic Papers
- [Resources](#) Presented During Discussions

Appendix

Important acronyms

EMC = Environmental Modeling Center
 NCEP = National Centers for Environmental Prediction
 NEMS = NOAA Environmental Modeling System
 NGGPS = Next Generation Global Prediction System
 NOAA = National Oceanographic and Atmospheric Administration
 NPS = NCEP Production Suite
 NWS = National Weather Service
 OAR = (Office of) Oceanic and Atmospheric Research
 OSTI = Office of Science and Technology Integration
 SIP = Strategic Implementation Plan
 UFS = Unified Forecast System
 UFS-SC = Unified Forecast System-Steering Committee
 WG = Working Group

Likely Governance Bodies

This is a list of potential governance bodies. Pose that at the outset governance bodies should be those needed to get things started:

- UFS Steering Committee (UFS-SC)
- Working Groups.

Then the UFS-SC defines and evolves the governance as needs arise and constituencies change.

External Review/Advisory Panel (This is one governance body which might be stood up at the beginning, or to have the UMAC (or subset, reformed) serve in this role.)

Sponsor Board: (Charters, Program Managers, and Senior Managers who are investor stakeholders in UFS) (*This is likely captured in the Executive Oversight Board.*)

Validation Board(s): Validation is the primary function that assures scientific credibility, system performance, and end-user experience. Validation boards will be needed for each application. Testing, verification, and validation will be needed throughout. A Validation Board for the system as a whole is needed. Perhaps, formulated on a 1 - 2 year term to align with the fiscal year plans.

Interagency Guidance / Steering / Collaboration: A way to stay in contact with cross-agency requirements, community activities on, for example, standards, protocols, services, requirements.

Configuration Review Board: As defined the UFS-SC has some of the attributes of a Configuration Review Board. However more technical review boards may be made. Such boards might function as parts of Working Groups.

Community as a Whole: A way to engage community, including end users, as a whole.

- End-users Community
- Implementation Partners
- Cross Agency Interests

Items for deliberation and reconciliation as the governance is chartered and deployed.

- Who or what institution charters the Steering Committee, the Community Governance?
 - See Executive Oversight Board above
- What is the relationship between the community governance and funding?
 - One possibility is for sponsoring (i.e., funding) agencies form the voting membership of the Executive Board and Steering Committees, with other community reps serving as non-voting but still active members of both groups.
- Can some working groups be combined or simplified? Or, alternatively, can a subset of working group leads represent the totality of the work groups in the steering committee.
 - The uses of “liaisons” as interfaces with working groups has proven successful in other community efforts.
 - Because of the complexity of the NCEP Production Suite, are all working group leads part of the UFS-SC, or is there some sort of representative governance?
- "Balance" and membership as a discussion point. EMC/NOAA needs to be present to work, but it cannot seem to be "NOAA." Should membership in the working groups be defined in some way?
 - What is “non-operational” community? Application, research, non-NOAA. Refer back to “balance.”
 - How are decisions made in Working Groups?
- The steering-committee's decision-making process needs to be spelled out, especially in cases where there is not a clear consensus. Given that some of the responsibilities of this body (e.g., sunseting systems) may be controversial, a clearly articulated and agreed-upon process is essential.
 - Chair (*initially appointed? Charterers? Elected? Not NOAA?*)
 - Are decisions taken by a simple majority vote of all members?
 - Is there scope for minority recommendations in contested cases?
 - Does this body simply make recommendations to some other person or body (e.g., the EMC director) or are its decisions binding?
- Define the details of membership, terms of service, etc.
- Engagement of private sector and commercial interests needs to be spelled out.
- Need to check: The handbook (http://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_216/Handbook_NAO216-105B_03-21-17.pdf) providing more detail on governance, and roles and responsibilities that could be used as a guide for developing transition governance and timelines for the UFS.