



# NGGPS Program Status Meeting

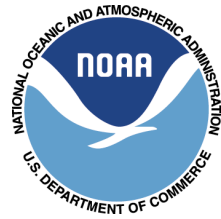
## NGGPS overview

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February 10, 2016



# NGGPS Objectives



## What is NGGPS:

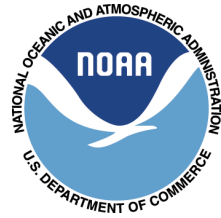
- The NGGPS Project is building the future NOAA operational coupled global prediction system supporting multiple applications
- The NGGPS Project is building the future NCEP Unified Coupled Global Model

## NGGPS Overarching Objectives:

- Re-establish US as the world leader in global weather prediction
  - Extend forecast skill beyond 8 to 10 days
  - Improve hurricane track and intensity forecast
- Extend weather forecast to 30 days
  - Implement a weather-scale, fully-coupled numerical weather prediction system
  - Support development of products for weeks 3 and 4
- Support unification of the NWS numerical weather prediction suite
- Position NWS to take advantage of advanced high performance computing architectures



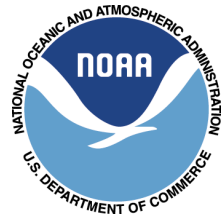
# NGGPS Strategy



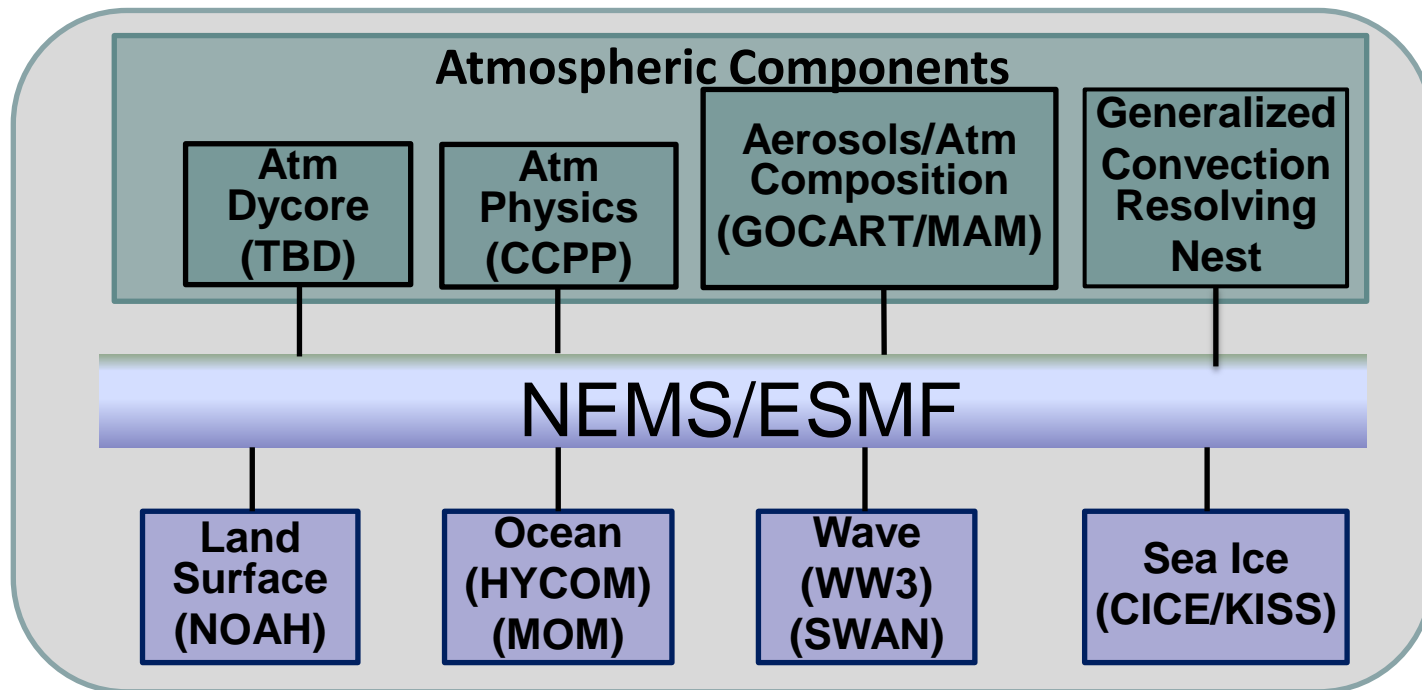
- Multi-year NWS-led community effort to build and implement future global weather prediction system supporting multiple forecast applications at NCEP using **community codes**
- Accelerate forecast performance improvement through community involvement and accelerated transition of research to operations
  - Funds supporting both R&D and operations
  - Implement a Global Modeling Test Bed
  - Grants
  - Coordination (e.g. HWIPP, MAPP, USWRP, R2X)
- Overall system designed (re-architected) to take advantage of evolving HPC architectures (CPU/GPU Hybrid or Massively Integrated Cores (MIC))
  - Highly scalable
  - Adapt to continued evolution of HPC
  - Support modeling suite migration to fine grain computing



# NGGPS Unified Global Coupled Model Description



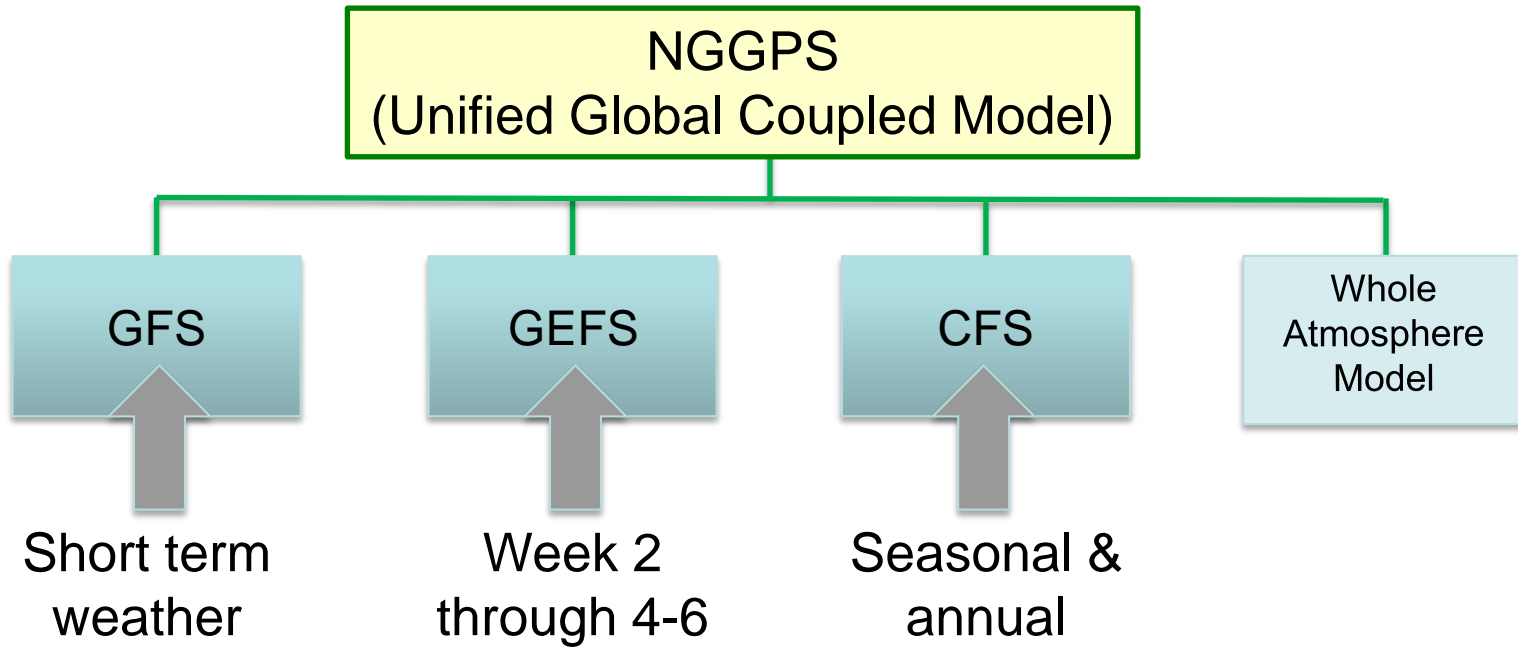
- Fully-coupled system with ocean, waves, sea ice, land surface, atmosphere, aerosols and atmospheric composition model components
- Built using NEMS/Earth System Modeling Framework
- Each component model will be community code





# NGGPS

## Planned Operational Applications

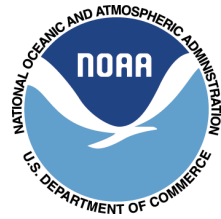


Application = Ensemble + Reanalysis + Reforecast

Research needs to fit into strategy



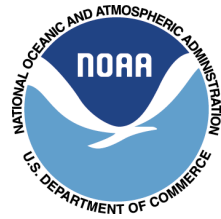
# NGGPS Activities



- NGGPS Implementation Plan and team/model component activities
  - Dynamic core testing advanced to second phase with 2 dycores
  - Implementation plans being revised
- Focus on accelerated development of model components
  - Coordinating proposal driven scientific development by universities, federal labs, and testbeds (integrated in team plans)
  - Meetings/workshops
    - Reanalysis/Reforecast Coordination Meeting
    - NGGPS funded PIs presented papers AMS Annual Meeting
    - NGGPS Post Processing Meeting
    - Sea Ice Forecasting Workshop



# Implementation Plan Development Teams



- Atmospheric Prediction – Dynamics/Nesting (Whitaker/Tallapragada)
- Atmospheric Prediction – Physics (Doyle/Moorthi/Kuo)
- Aerosols and Atmospheric Composition (Stajner/Hou)
- Atmospheric Data Assimilation (Derber)
- Ocean Prediction (including waves, sea ice, and data assimilation) (Mehra)
- Land Prediction (Ek)
- Post-Processing (Hamill/Zhu)
- Ensemble Development (Hamill/Zhu)
- Overarching System (architecture/integration incl NEMS/ESMF) (DeLuca/Iredell)
- Software Architecture and Engineering (Iredell)
- Verification and Validation (Stajner/White)
- Testbeds (Davidson/Ek)
- Infrastructure (Young)

Team participation across NOAA line offices/laboratories, Navy, NASA, UCAR and coordination with the High Impact Weather Prediction Project and the National Earth System Prediction Capability program



# NGGPS Modeling Priorities

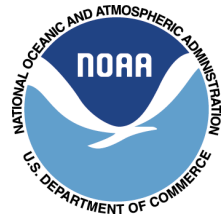


- **Data Assimilation:** Advance techniques for remotely sensed observations, coupled ocean forecasts, position errors of cyclones/hurricanes, and improved forward observation models (4d-Var)
- **Prediction:** Improve the representation of atmospheric model dynamics, and the representation of atmospheric model physical processes through coupling with land surface, ocean, waves, sea ice, and aerosols and atmospheric components
- **Ensemble Development:** Further methods for ensemble initiation and the treatment of model uncertainty in ensembles
- **Weeks 3 and 4 products:** Improve forecasts of precipitation, and near-surface air temperature over the US
- **Post-processing:** Extend techniques and the development of methods suited to the 15-30 day time range
- **Verification Methods:** Advance model forecast verification methods by identifying the uncertainties in methods comparing analyses and observational data sets





# Announcement of 2016 Federal Funding Opportunity

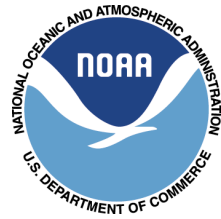


- Soliciting proposals for two-year projects involving data assimilation, prediction, ensemble development, post-processing, advances in verification methods, and weeks 3-4 products
- Eligibility – Institutions of higher education, federally funded educational institutions
- Letters of Intent were due January 19, 2016
- Applications due February 29, 2016
- Anticipated total announcement funding is \$3.2M annually
  - ~\$2.6M is restricted to non-governmental only
  - ~\$600K is for testbed related activities for public and private sector/ university partnership encouraged

Announcement is posted on <http://www.grants.gov>



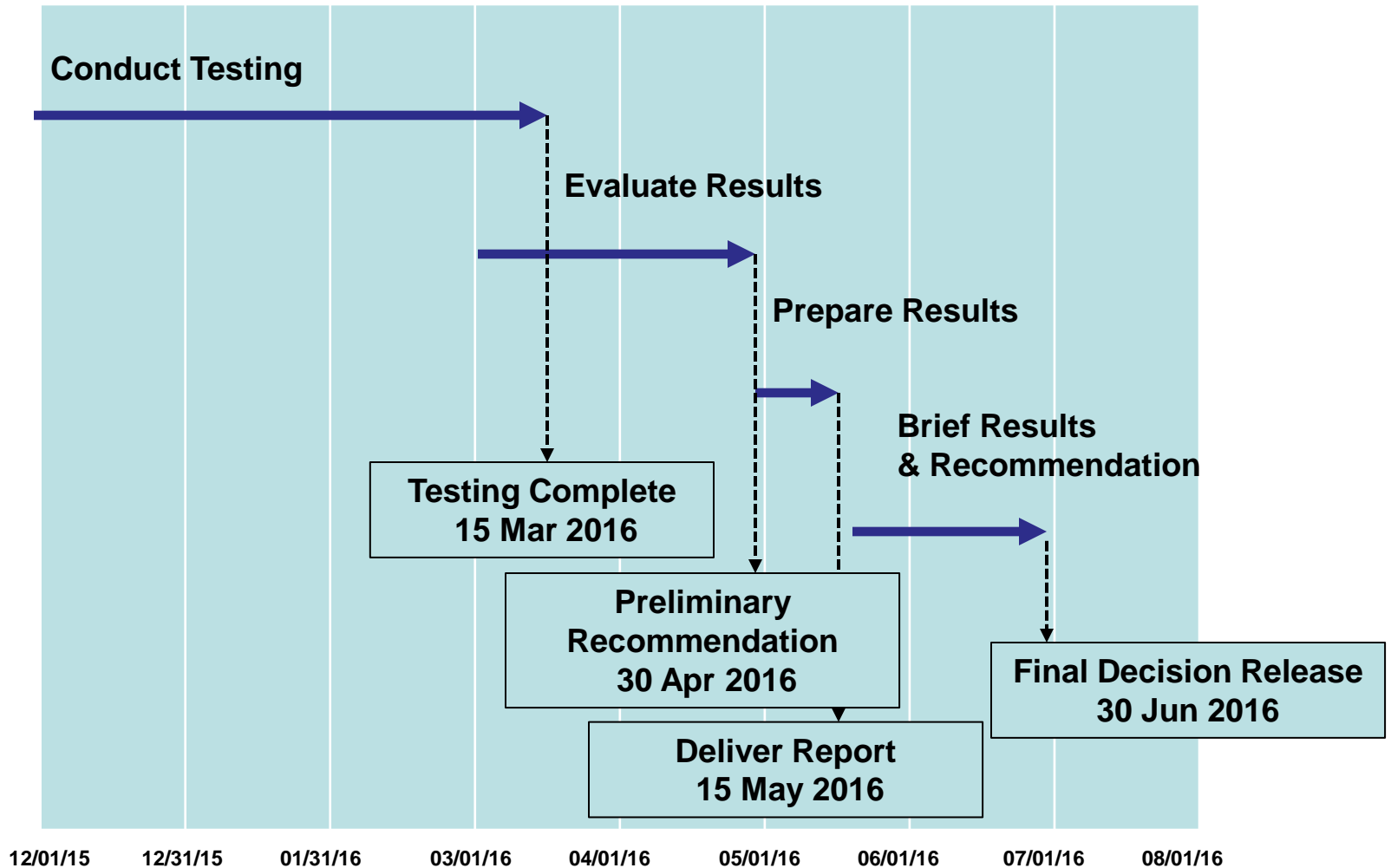
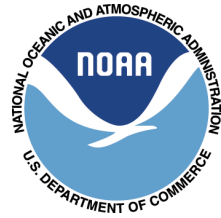
# NGGPS Testbed Priorities



- Advance forecasts for days 6-10, in collaboration with the Hydrometeorology Testbed (HMT)
- Develop forecast tools and applications to reduce hurricane intensity errors, and provide improvements of observation data assimilation in the hurricane and tropical storm prediction subsystem, leveraging the Joint Hurricane Testbed (JHT)
- Support advances in forecasts for weeks 3-4, partnering with the Climate Test Bed (CTB)
- Develop advances in forecasts for high-impact weather focusing on days 0-3, in cooperation with Hazardous Weather Testbed (HWT) and Aviation Weather Testbed (AWT )

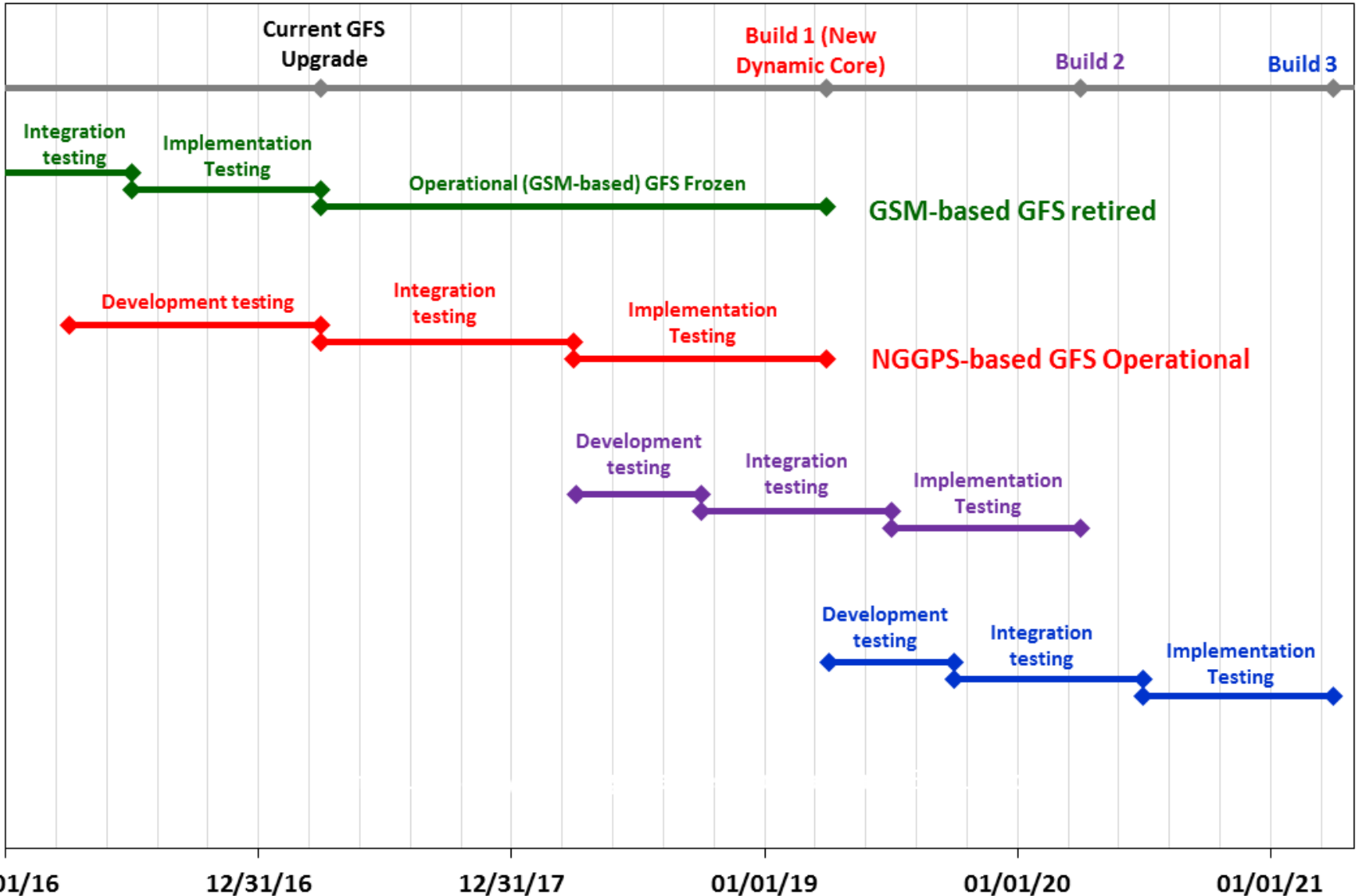
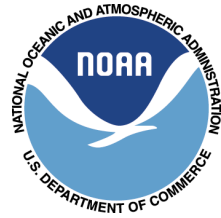


# Dynamic Core Decision Schedule





# NGGPS Upgrade Cycle

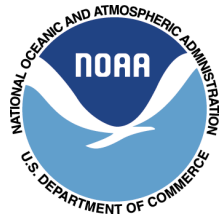




# Summary



- NGGPS plans being refined and development in progress
- Dynamic core testing in progress with final decision anticipated in summer 2016
  - Phase 1 testing complete / selected 2 of 5 dynamic cores evaluated, leveraged HIWPP testing
  - Phase 2 testing underway
  - Further dynamic core development and parallel testing will be required after final dycore selection
- Coordinating proposal driven scientific development by universities, federal labs, and testbeds
- Accelerated development of model components
- Global Modeling Testbed

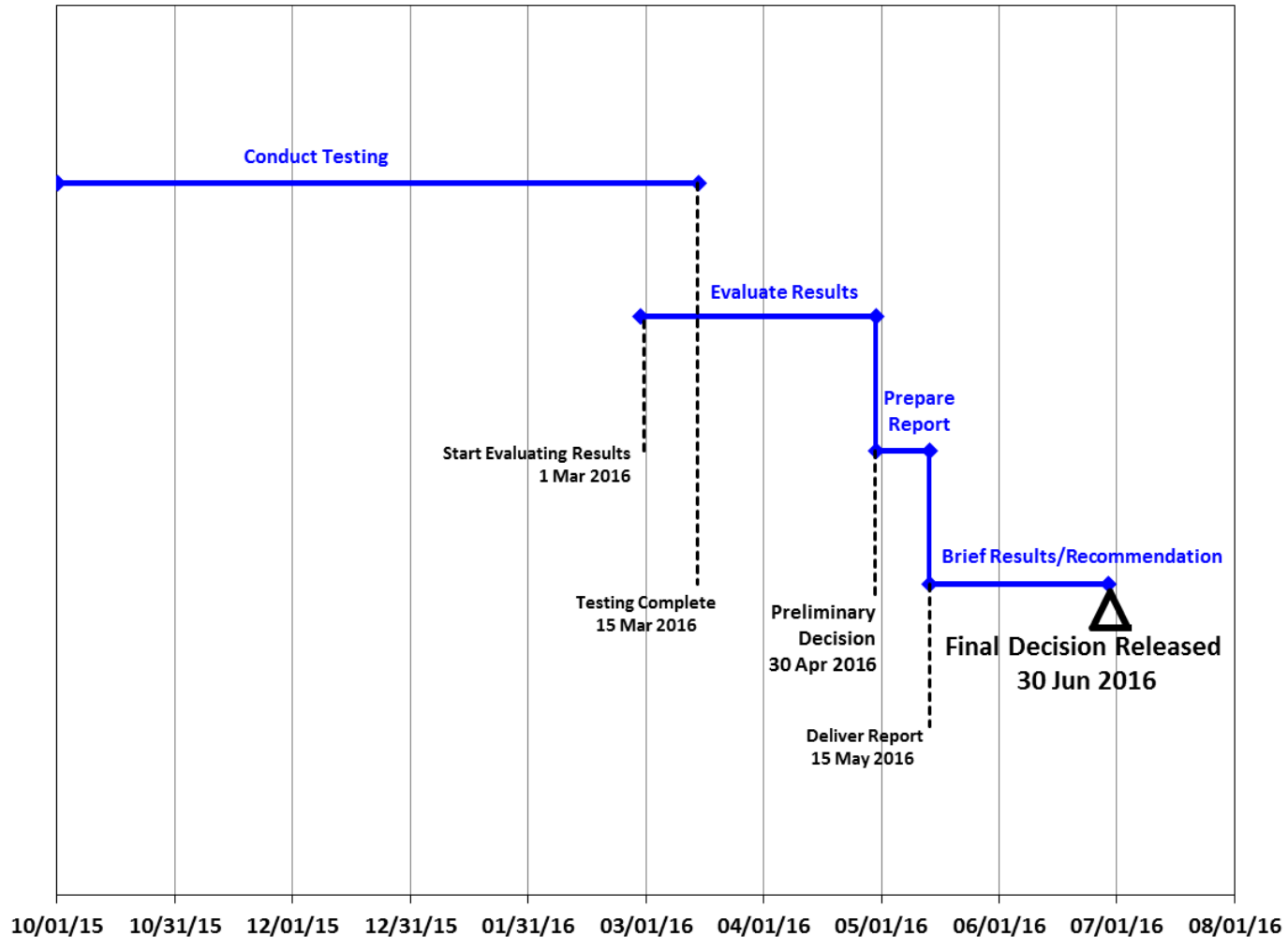
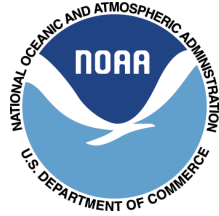


NGGPS Website:

<http://www.nws.noaa.gov/ost/nggps>

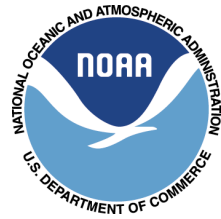


# Dynamic Core Selection Schedule





# R2O Initiative Objectives

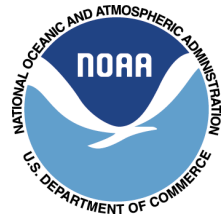


- The NWS R2O Initiative will expand and accelerate critical weather forecasting research to operation to address growing service demands, and increase the accuracy of weather forecasts through accelerated development and implementation of current global weather prediction models, improved data assimilation techniques, and improved software architecture and system engineering.
- The overarching initiative objective is to build a Next Generation Global Prediction System (NGGPS) that will be the foundation for the operating forecast guidance system for the next several decades.





# Welcome

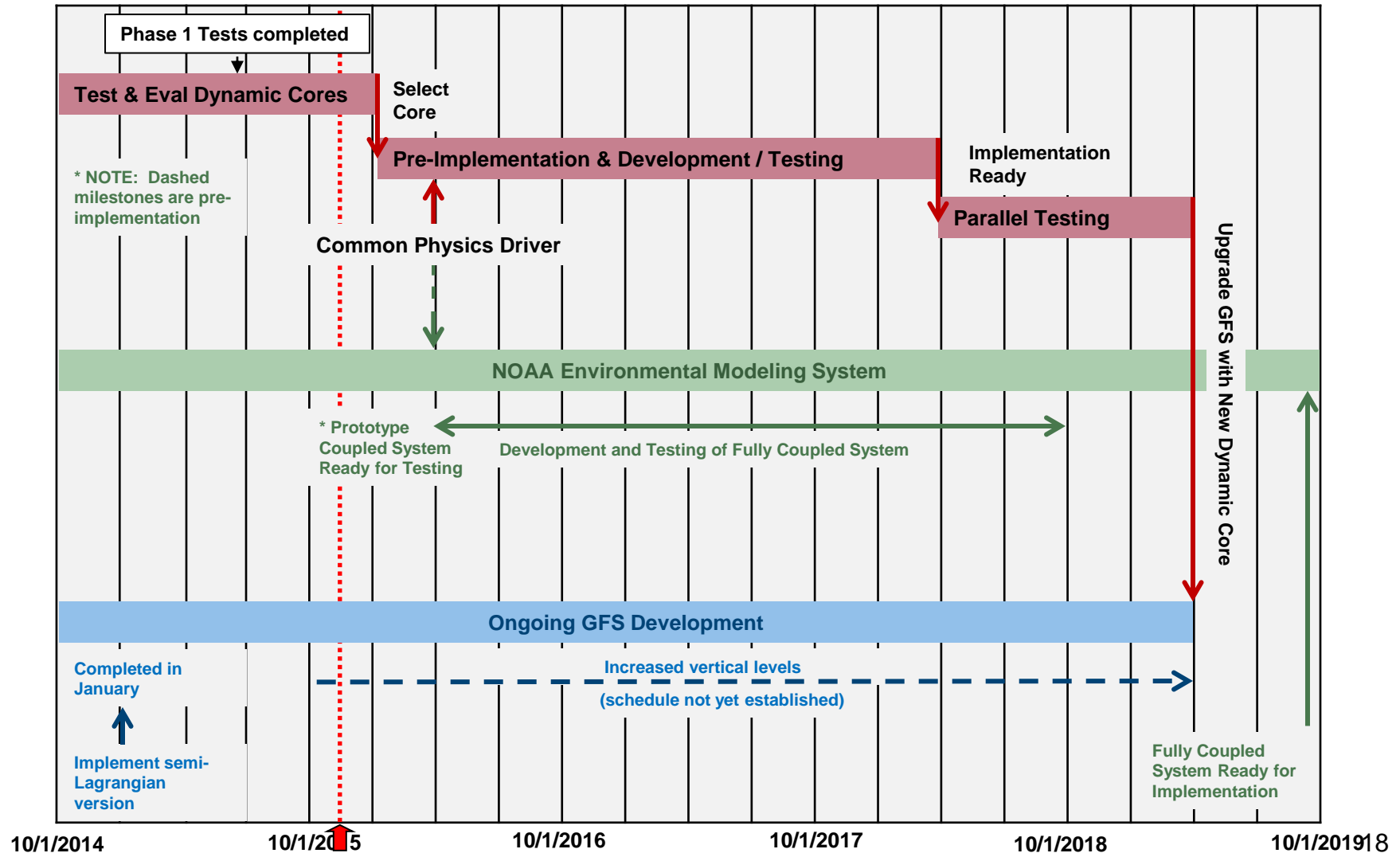


## Overall Meeting Objective

- Provide a status update of the R2O Initiative for the development of a Next Generation Global Prediction System (NGGPS).
  - Review status of team activities (accomplishments, goals, needs)
  - Facilitate cross-team awareness and interaction
  - Seek to identify opportunities to accelerate team progress in achieving goals



# NGGPS Implementation





# Grants

