NCEP GEFSv12 Upgrade Plan

Producing a useful global reanalysis for GEFS reforecast amidst major system changes: a proposed modification to GEFS implementation and reanalysis/reforecast timelines

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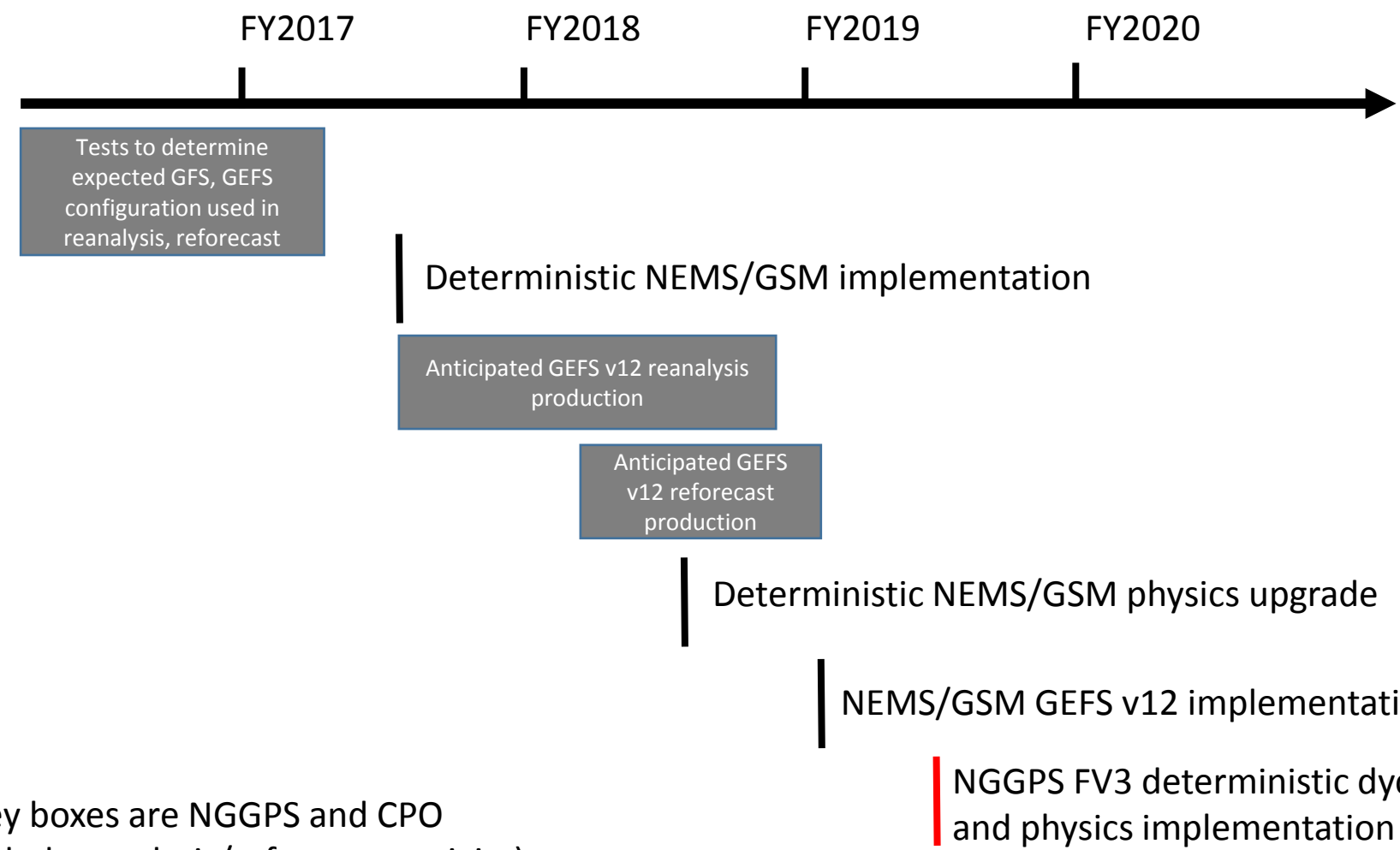
A review of the (estimated) implementation schedule for reanalysis, GEFS, and new dycore (Original Plan).



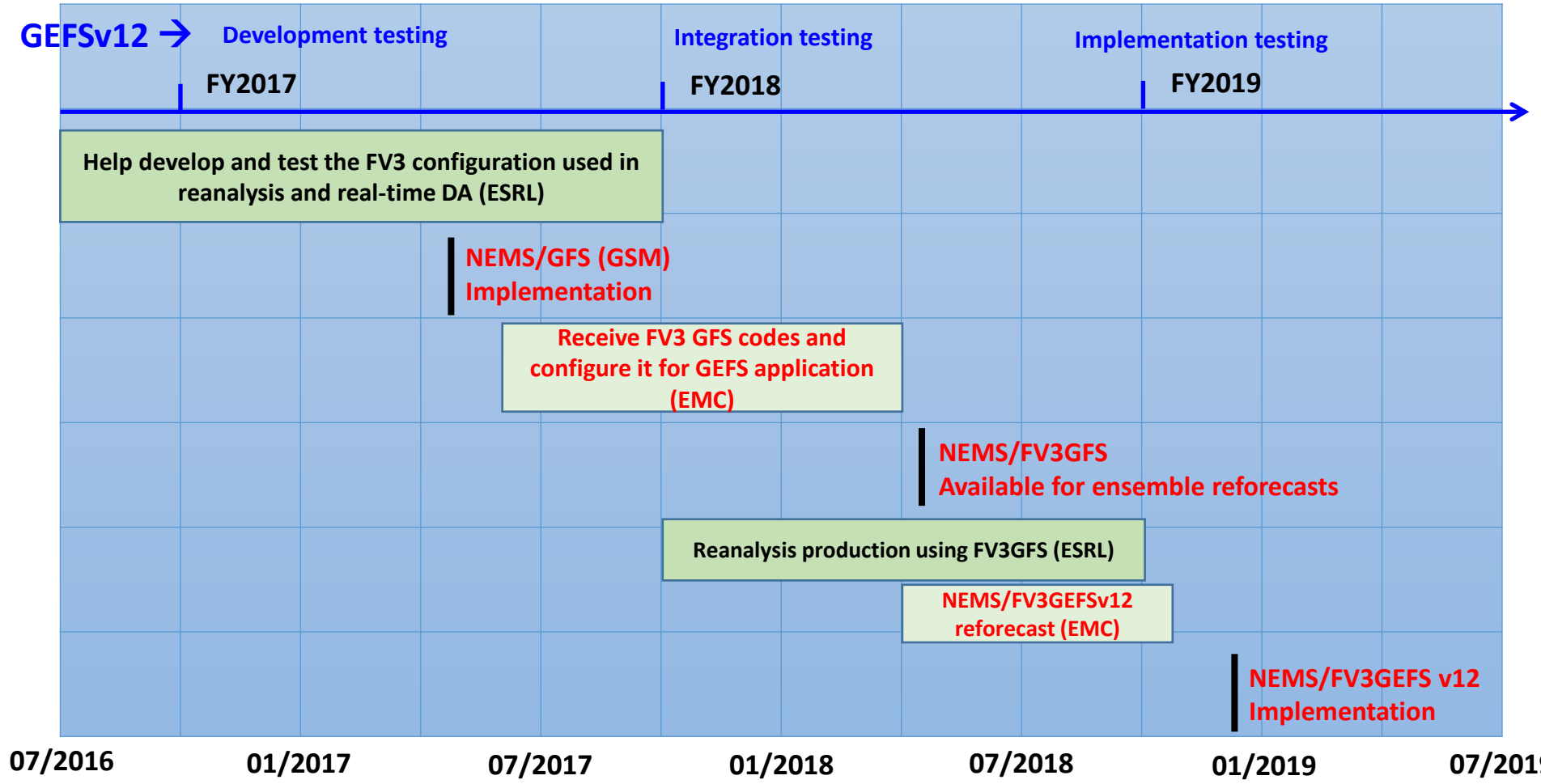
(grey boxes are NGGPS and CPO funded reanalysis/reforecast activity)

[Slide from Hamill and Whitaker]

Discussion about existing timeline

- FV3 GFS implementation is the most important implementation on EMC's priority list.
- Significant resources are being allocated to a reanalysis using the existing and soon-to-be-obsolete spectral GFS.
- A FV3-based ensemble will be needed in the ensemble-based 4DEnVar assimilation system associated with the FV3 GFS implementation.
- FV3-based analyses may differ significantly in their error characteristics from the GSM based reanalyses - reforecast product quality may suffer.
- This may be an opportune time to rethink GEFS v12 implementations and reanalysis/reforecast so they:
  - Sync up with the major FV3 implementation, and presumably implementations thereafter.
  - Reduce the risk of delaying the implementation of FV3 (in both the GFS for GEFS).

FV3 GFS based GEFS v12 plan (proposed) with reanalysis and reforecast



Proposed changes: 1) No reanalysis and/or reforecasts with GSM based GEFS; 2) Start producing FV3-based reanalysis for GEFS v12 in ~Q1 FY18, using the configuration of FV3GFS. 3) Reforecasts will commence soon after starting the reanalysis, uncoupled*, with 2-tier SST approach, and will include extension to 35 days

Implications of these changes

- GEFS v12 implementation will use FV3 dycore, occur in close coordination with the FV3 deterministic GFS development

- GEFS v12 implementation will be consistent with EMC's global modeling strategies of unified system
  - National Water Center and customers (New York City) will get full quality reanalysis/reforecasts before upgrade (**still need to determine 20-yr reanalysis plan vs. 30-yr requirement**).

- Reanalysis production is performed with FV3 system, not the obsolete spectral dycore.

- ESRL reanalysis team participates in bringing FV3-based assimilation system online more quickly and testing an FV3-based GEFS, reducing risk of any delays with FV3GFS implementation.

Reanalysis and Reforecast Planning

- For reanalysis (ESRL)
  - Dec. 1st 2017 – decision of GEFSv12 configuration
  - Start reanalysis much earlier with deterministic FV3GFS/GDAS configuration (no need to wait for final GEFSv12 configuration)

- For reforecast (EMC)
  - April 1st 2018 – frozen codes for GEFSv12
  - Start GEFSv12 reforecast (6 months)

- Issues
  - HPC resources
  - ESRL reanalysis plan does not cover NWC's 30 years reforecast requirement

Coupling with Ocean and Sea-ice

- Coupling with ocean and sea-ice model will add <u>significant risk</u> for reforecasts and GEFS v12 implementation
  - UGCS Seasonal is ***NOT READY*** for testing extended range predictions for weather
  - Will continue investigating the impact of coupling on GEFS forecast skill
  - **Use 2-Tier SST (e.g., bias corrected CFS predicted SST)**
- Issues
  - Functions of ensemble capabilities in NEMS
  - Ocean and sea-ice components are not finalized yet
  - Coupled DA is still not ready for scientific evaluation
  - Degradation and bias from coupling – need to retune the system
  - Revisit strategies for UGCS (moving target for Ocean and Sea Ice Models)

Intermediate options for GEFS extension to 35 days

- EMC will provide real-time 35 days forecast to support CTB “SubX” project – not operational
  - Start from July 1st 2017
  - Extension of GEFSv11, un-coupled, but plan for 2-tier SST approach
  - Once per week in real-time; 20-y reforecast – every 7 days, 5 members
  - Support CPC sub-seasonal MME Project
  - Understand impacts of tropical SST using 2-tier approach
  - Just one FTE effort (funding already in place at EMC)