

## Coordination Meeting for the Unified Forecast System (UFS) Strategic Implementation Plan (SIP) Annual Update

Wednesday - 1 August 2018

### Introduction

Brian Gross welcomed the meeting participants, and made participants aware of the logistics and phone rules for the meeting.

### NGGPS/SIP

Ming Ji/Fred Toepfer presented an overview of UFS system, governance and planning approaches as well as SIP goals and objectives for UFS, SIP planning cycle, tentative timeline and working groups. The next steps for UFS and the SIP meeting objectives were briefed.

Q. Who does the Steering Committee answer to?

A. Right now the technical oversight board is Ming Ji and John Cortinas, will include others eventually.

Q. Will this involve other agencies?

Yes, Beside NOAA, NCAR, NASA and NAVY/NRL may be involved. There is a potential list ([slide 22](#)) of members that have made soft commitments but this has not been finalized as the charter hasn't been signed.

### OWAQ SIP

John Cortinas briefed on OAR Unified Forecast System Strategic Implementation Plan. Their program plans aligned with SIP. True, they are trying to make sure that alignment is in place. It takes a little while but they are getting there.

Q. Does JTTI have direct impact on SIP and modeling or different?

It was created to fund the transition of research to operations. It is a joint NWS and OAR project.

Q. Which priorities go forward?

A transition plan is required for every proposal in JTTI. They rejected proposals that were not aligned with operations. Technical readiness level may also be why some proposals were rejected.

Q. What mechanisms are there in OAR?

Those are inside discussions within OAR. The labs are to make those adjustments. They fund a number of RLs. They are trying to establish success early on by funding things that transition into operations early on. Brian Gross wants to improve the relationships between R&D.

### Hurricane Supplemental

Fred Toepfer gave an overview on the Hurricane Supplemental spend plans and project plan status as well as the planning status. The Hurricane Supplemental is aligned with the SIP very well.

Q. How much is planned for the community infrastructure?

\$3 million. This will allow us to achieve acceleration of what we already had in the works. It is in line with the NCAR/NOAA MOA.

Q. How long does this funding last?

It has to be obligated by FY19. Since most of the projects are 2-3 year projects, a waiver for 3-4 years has been requested to spend the money. This way it can be spend over 3-4 years even though it is received in one year.

### **R&D and Operational HPC Resources**

Frank Indiviglio gave an update on current NOAA HPC resources.

Q. What can be achieved in a 3 year SIP?

Operations will remain the same through FY19. R&D MSU will add a petaflop and NOAA projects will get 90%. They may add more add more later in the year possibly Q3/Q4 but the work will be focussed on accelerating that. There is 50 million in supplemental for HPC and 25 million for R&D. Access will be granted around Q3 of FY19 at Fairmount for the THEIA recap.

Q. At EC, an in house staff overlooks the software and make technical choices; in NOAA we have to go out to lowest bidder; is there a migration to a best practices like the EC?

A: We have to make the best trade off for the government moving forward with model benchmarks. The big challenge is scientist usability. They are trying to make it better with improving procurements. Make software stacks more similar so it is easier to use.

Q. There is a big overhead to hire foreign national; is MSU make it easier?

It is outside security perimeter; they will handle security; this is to aid foreign national process.

Data communications between here and MSU contrast to Boulder, there are Nwave connections to MSU and it is well positioned. It works with NOAA in Stennis to provide Nwave connection. Will not be as robust in the beginning.

Q. What about live data stream at MSU?

We can try. Need to have a discussion on that for the possibility of having real-time experiments running.

Q. What about cloud computing?

It is based on requirements; trade off between performance and cost. They are putting in things to get it outside of the perimeter.

Q. Is NOAA funding cloud computing?

They support what they can. (*no exact answer on who is funding what and how*). Brian is point of contact for information on MSU.

Q. What is the rough number on what they are going to buy in second year?  
It is really in the early stages, can't give a public answer.

### **NCAR/NOAA MOA**

Hendrik Tolman gave an overview of seven elements of common Infrastructure in NCAR/NOAA MOA. The MOA has not been signed however, work on all unification areas are already ongoing.

Q. Regarding the support and training issues, how does the MOA speak to that?  
MOA Identifies need and recognizes that we need to do that. Redirecting resources. Funding priorities, spending money on groundwork.

Q. How about system architecture group, grad student test, well documented workflow, is that workable, what is the timeline or next steps? Refer to next talk.

Q. How does this fit into the critical path in the agency? How does that play into what the SIP is trying to accomplish?  
Yes, this all needs to be in place for the grad test. It allows us to accelerate and identify need for building infrastructure and documentation. Funding is our high priority.

Q. What is the timeline for delivery?  
It will not delivered as one big thing but bits and pieces. Code delivery is a step but not endpoint. We can get a commitment once it is a full resource repository.

### **Community Participation through Common Repositories, Infrastructure, and Workflow**

Hendrik Tolman presented on key technical issues such as infrastructure, repositories, workflow, coupled modeling and governance to enable efficient community modeling.

Q. Training?  
7 elements of MOA are critical but training is important too. Need to get the training done too.

Workflow that connects R&D is critical. Use same workflow to facilitate transition. Important to have this discussion in an open forum.

Q. Is there a workflow working group, how do we approach that?  
We might have a working group, but maybe not at SIP level.

CROW, don't have resources at EMC, working group. CIME is the community workflow for the coupled model system.

## **CCPP/Community Physics Framework**

Lidia Bernardet presented on CCPP Framework and Physics schedule as well as added physics components and framework development.

Q. What's coming next?

CCPPv2 contains betaGFS in the current GFS operational suite. The code is fully integrated in FV3. All developers will be encouraged and eventually mandated to use CCPP if they are doing development on FV3.

CCPP will be used for FV3GFS v2 - 2020 implementation (this new physics incorporated are targeted for January 2020).

Navy will have a role, once others put physics in there it may be accessible to all, the goal is single parameterization that can be used jointly by being able to swap cores. Once fully developed it will be a huge asset.

Q. Are there issues with FACA requirements?

Don't think so.

Q. Who is funding?

NOAA pay for infrastructure but other groups pay for support/training. FAA funding.

## **Verification, Validation, and Testing for the UFS**

Tara Jensen presented on DTC community UFS Test Plan and Metrics.

**UFS SIP action WGs should map to test plans and metrics organization and vice-versa.** Draft report out in one month.

## **Communications and Outreach**

Tim talked about communication and outreach WG project milestones.

**There are no needed updates to the Comms and Outreach SIP plan.** The plan is holding up and Bhavana demonstrated UFS webpage prototype. Tim called for working group to add content to the UFS website to send their ideas to Tim/Bhavana by end of August.

## **UFS Steering Committee & Role of Steering Committee in Guiding the UFS**

Richard Rood and Hendrik Tolman gave an overview and update on UFS steering committee activities.

First meeting was on repositories; **major issue in SIP plans.** A repository sub-working group was formed and expect to see a report soon. Grad student test and presentation to describe the services/support needed for repository and code DBs.

Q. How about gatekeeper function? Need to get to O2R?

There is a placekeeper in the document and require programmatic commitments. Early focus on repositories and grad student test are driven by O2R part.

Q. What is connection to NOAA committee?

Unified Modeling Committee; **Hendrik to bring back to EMC.**

Q. What are the underlying principles in which you make decisions?

No oversight board, might be ESPC.

Q. How do we tie this all together in a streamlined decision making progress?

Making decisions by consensus model with working groups. Technical oversight board, maybe simplification of committees is needed.

Suggestion: Not enough science in the UFS-SC / I think the UFS SC is getting smart / the meeting should be more structured around the science problems.

If WGs are repetitive, suggestion to combine it.

### **Increasing Community Participation/Improve Experience**

This WG is not leveraging their time well every week. They need to meet with a purpose and would like content lined up (structured, focused, agenda).

UFS-SC (one group) is the decision making body for the SIP working groups ([slide 11](#))

If the WGs are not working, then change the leadership.

As the group grows larger, it gets harder to get things done. Anything bigger than 10 people gets difficult. They want clear marching orders for each WG. If there are no important issues then the group should be disbanded.

Each group needs a charge and deliverable; dedicated resources to do the work.

Keys: motivated chairs, the cost of collaboration; gap analysis (S2S science grp, storm surge model - these applications are part of the UFS??)

Who is going to do the work and meet deliverables?

## **Thursday - 2 August 2018: SIP WG Update and Briefings**

### **NGGPS Global Model Suites Planned for NCEP/EMC Operations**

Vijay Tallapragada updated on NGGPS global model suites planned for EMC operations. FV3GFS v1 on target for implementation in January 2019. Advanced version of FV3GFS v2 is targeted for Q2FY20. FV3-GFS delayed development because working on pre-implementation tests. Delayed implementation until FY21.

Arun Chawla updated on coupled model development for S2S scales.

Q. What is the resolution of the ensemble?

Operational is 39km and the other is 25km.

Q. What is the ideal number of ensemble members?

There are many tens of members, we continue to evaluate. EC resolution has bigger impact the first few months and ensemble members are longer.

Q. What is the computational expense?

Model take 2.5-3x more within 8 minutes per day. 64 nodes and new uses 129.

Q. How much resources are used for IO?

They are still doing optimization.

Q. Is CAM physics applied globally?

Yes.

Q. Are we on target to have coupled system FV3 - MOM6, CICE5, WW3 by FY18Q4?

How does this fit with the SIP?

Yes, application lies within UFS. Anonymous peer review suggested. 3 major working groups are in process of developing coupled systems eg: land-physics.

### **Convection Allowing Models (CAM)**

Jack Kain and Curtis Alexander presented on CAM, it's requirements and connection to global model suite.

Project milestone Accomplishments are: Standalone regional FV3 CAM development, evaluation of ensembles, NSSL FV3 verification, physics configuration with FV3, and CAM precipitation verification.

The three primary projects are:

CAM deterministic transition to FV3

CAM ensemble DA transition to FV3

CAM ensemble forecast transition to FV3.

To turn off SREF/NAM/RAP, several key criteria are outlined that needs to be met by the replacement system within regional FV3, CAM and global system.

Q. Global with the regional nest is not included, why?

Because of longer time scale, huge issue with the data run-time (as long as 6 hours).

Q. Have you looked at assimilating surface obs?

Yes they've looked at it but not ready to do it. First we need to address physics.

Q. What is missing?

Near surface systematic bias, PBL scheme issues, and land surface scheme issues. Fixed these for short range applications.

Q. How challenging is transition of WCOSS to HPC?

Brian: by 2022 WCOSS phase 2 will be in place. Might need 2 systems, as we may also have OCONUS.

In Coupled system, DA system is better than obs.

### **System Architecture**

Cecelia DeLuca updated on on system architecture working group accomplishments.

The CMEPS coupled prototypes are Hierarchical model Development (HMD), Graduate student Test (GST). The open issues lies in land and physics WGs, DA WG, infrastructure, UFS-SC.

Q. Regarding GST, what are the implications with partnering with academic community. System architecture and governance with how academia partners with NOAA?

### **Infrastructure**

Rusty Benson presented on infrastructure working group projects accomplishments.

A final report is available with recommendations and milestones for repositories, data portal and community workflow.

The main issues are - uncertainty in NOAA/UCAR MOA (dependency), obligations for data portal and repository management, and GST workflow requirement.

Q. Overlap between this and JEDI; What is the build mechanism followed?

Source code not identified yet,CEMS has the infrastructure that will be used as MOA gets agreed; Suggested to look at EC build system.

Infrastructure regarding the moving nest capability, will create branches and will merge back to NEMS (hierarchical code management).

Q. Why is there a separation in stochastic physics and GFS physics?  
Plan was to make it an independent component in the coupled system.

Q. Is it possible to have 6 applications on 1 database?  
Yes, we are already doing in VLAB.

### **Dynamics/Nesting**

Vijay Tallapragada presented on Dynamics and Nesting Working Group projects. The major accomplishments are fv3 dynamics, stand alone regional FV3, hurricane moving nests and DAD and WAM project.

Q. Having a moving nest with variable resolution?  
Make a decision early on telescoping nests; 3-step development process will be included in hurricane supplemental.

Q. What is the timeline?  
Plan to continue for 3 years.

### **Physics**

Jack Kain presented on Model Physics working group projects. The major accomplishments are FV3-GFSv1 scheduled for implementation in Q2FY19 and development of CCPP and HTF.

Q. Is CCPP available with Noah-MP, want to look at S2S?  
No Noah-MP in CCPP, yet to include. Need to develop a plan or project to tackle that. NUOPC cap for LIS has a lot of pieces that are already there.

Q. Can we put LIS in CCPP to compare inline and offline system?  
Discussion has started with CESM team and Ligia's team.

Suggested talking to CAM group, getting global model physics, more resources for later.

### **Marine**

Avichal Mehra presented on Marine Modeling Working group projects.

Q. Are there issues with ROMS?  
Model for regional; they have a NUOPC cap working with that; re-engineered to bring into framework.

Data is provided for 25 yr water model on AWS, OCC.

### **Land/Hydrology**

Helin Wei presented on the Land/Hydrology working group.

Q. If we code it in-line will we continue to do that?  
Need options in the model.

Q. What's the expense of fast physics?  
NUOPC interface could be an option to efficiently couple. 250m grid for LSM so the water community wants inline coupling for baseline purposes.

### **Aerosols/Atmospheric Composition**

Ivanka Stajner presented on the Aerosols and Atmospheric Composition working group.

They created the NUOPC cap for the global model. Near real-time for chemistry component for the FV3. They need to separate the EPA physics from the CMAQ and integrate the FV3 physics.

Project issues:

- regional FV3-CMAQ delayed due to not having the SAR CAM
- collaboration between DA WG on aerosol DA plan (AOD)
- dependency on EPA chemistry be removed to replace with FV3 physics
- computing resources for complex chemistry
- funding uncertainty

FV3GFS-GOCART is in real time.

Physics routines themselves should transport the chemistry.

### **Ensembles**

Tom Hamill presented on the Ensembles working group.

Q. How can we better include stochastic parameterization?  
Working together with subject matter experts and the ensemble group. It was suggested to hold joint telecons.

Q. Is HR-GEFS still a priority?  
Currently written in the SIP Annex and Roadmap, but there needs to be a decision. Hendriks states that the GFS will be used as a native resolution run as an ensemble, but we need to answer this critical science question to tell NWS if it can be done in ops. Ensembles illustrate uncertainty which is good for IDSS.

Q. How to address uncertainty in ocean model (MOM6) ensembles: how many mbrs?  
Need a Land-atm tiger team on this.

### **Post Processing**

Jeff Craven presented on the Post Processing working group.

The groups may be too big; decisions are made very slowly. They need advice on where to go wrt PP. Cliff Mass is on the group and has some criticisms.

MDL completed GFS MOS using FV3 results - awaiting LAMP group evaluations using FV3 and will present to leadership. PP reported that MOS won't need to completely redevelop MOS before the Jan 2019 FV3GFS implementation (transparent transition) for ops.

Improve Stat PP needs funding to ensure we're not just doing the same PP methods but better science.

Q: Is UPP barrier to community participation for their group?  
Re-engineer entire code base using hurricane supplemental funding.

### **Verification and Validation**

Tara Jensen presented on the Verification and Validation working group.

They can't get account access to WCOSS.

Q. How much users for MET+ outside UFS community?  
Uptake in core component within small pockets in NOAA, python wrapped MET+ may be available in about half a year.

Python in workflow: working on getting python 3 on the older machines.

Recommend someone from NOS/OCS/CO-OPS? For WG.

### **Data Assimilation**

A panel was held for the Data Assimilation discussion including Ivanka Stajner, Tom Auligné, Daryl Kleist, Jeff Whitaker, and Ron Gelaro.

- A major accomplishment was getting the FV3 DA system developed and run at EMC to prepare for implementation.
- There is a JEDI academy, which is a week long training course (another course will be held in Nov).

The next JEDI training will be in College Park - Nov/Dev and the code release will be around the same time.

OOPS is open source EC code and the JEDI team is looking into another open source code call BUMP (there is risk in these because its unsupported).

Q: How will IODA gonna look like in terms of format?

Doesn't matter as API is the same. Utility that converts the buffer in NetCDF.

Q. Funded in S2S, how are you interfacing with Coupled DA? What is your timeline on decisions?

When the infrastructure is completed by FY20-21, experiments can be done, suggestion for need of prototype.

Q. Other pieces that can be separated and transitioned?

UFO is but others would need to be discussed and identified.

Q. Why CAM is not included here?

Will build ENKF in JEDI to let the CAM group start using.

Q. Where is QC in JEDI?

IODA; QC becomes even more important as some of the upstream codes are very old to reproduce functionality and develop upon.

Q. Plans for transition?

It is depending on funding availability, use JEDI for research questions for the next 5-10 yrs. What additional help? They need time; all 3 plans are in progress.

This is beneficial for the global model.

Issue of disc being very slow; suggestion to use small parts at a time is not representative.

Q. Is OOPS being used operationally? What are the concerns?

- ECMWF, Meteo France, no operational center
- Not ready now, need to test for NOAA applications

Q. With HS coming, how will these projects be leveraged at GMAO and EMC?

- Already a lot of contribution from GMAO in terms of expertise, EMC to leverage for connection to JEDI project

Q. How to best use the resources? What is the optimal way of distributing resources in terms of ingesting data?

- Can we be more efficient so we can free up things.
- NESDIS is looking at requirements based to provide data; clear case needs to be provided
- Requirements document needs to be nailed down early; need milestones and documentation; needs to satisfy operational requirements; there is a collection of requirements from the design phase workshop

Q. What are the plans in DA to provide forecasters DA for forecasting for high quality?

- All aspects equally responsible.

- Plans in place for funding from HS

Discussion on the current business model:

- implementation of JEDI is a risk not the development of JEDI
- Development model scales well; not as much overhead as in the past

Friday - 3 August 2018

## **Discussion/Wrap-Up**

### Action Items

- Complete building the UFS Technical Oversight Board
  - OSTI/OWAQ, Q1 FY19
- Align WGs, test plans, and metrics from workshop
  - WGs, September 2018
- Establish code managers for the repositories
  - WGs, Q1 FY19
  - Give guidance/mandate to move forward; implement repository; SC recommends to Fred;
- Add content to the UFS website and send their ideas to Communications WG
  - WGs, by end of September 2018
- Suggest new WG, eliminate unneeded WGs
  - WGs, Q1 FY19
- Suggest additional changes to WGs membership, size, scope
  - WGs, Q1 FY19
- Suggest improvements to SIP annual process, communications
  - WGs, SC. Q4 FY18
- Complete Annex drafts
  - WGs, 8/31/18
  - September for review; final drafts by end of August

Consolidate meetings in Dec/Jan time frame with SIP planning meeting. It was brought up if it has to be in Dec. Also, timing with the NCEP production suite review.

There needs to be more careful management of the data; input and obs for verification and DA. Put this forth to the SC for a separate WG or tiger team. We need to deal with the requirements questions. They put together a charge - first step is to create a requirements doc for the data WG (Melinda Marquis volunteered).

- Infrastructure 3.3.3; they can host obs data portal to make that available to the community
- Who might populate WG? Infrastructure (JEDI); components and needs, data (general); NESDIS, other institutions; Melinda to help coordinate this effort

Ensembles - what is going to replace the SREF? Can "PBL" and other parameters be quantified?

Post-processing testbed? How would this differ from the Testbeds at the Centers already; maybe WPC and SPC testbed? Russ Schneider and Dave Novak...

Chris Bretherton(Univ of Washington) and Jason Otkin (UWisc) and very involved co-chairs that aren't being funded. Greg Thompson has a white paper...physics team wants to look into this.