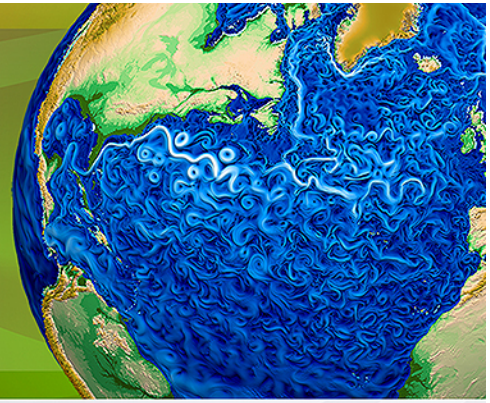
ACME
Accelerated Climate Modeling for Energy



# ACME Ambitions and Status
## *Vision, Goals and Reality*

Dave Bader

ACME Council Chair

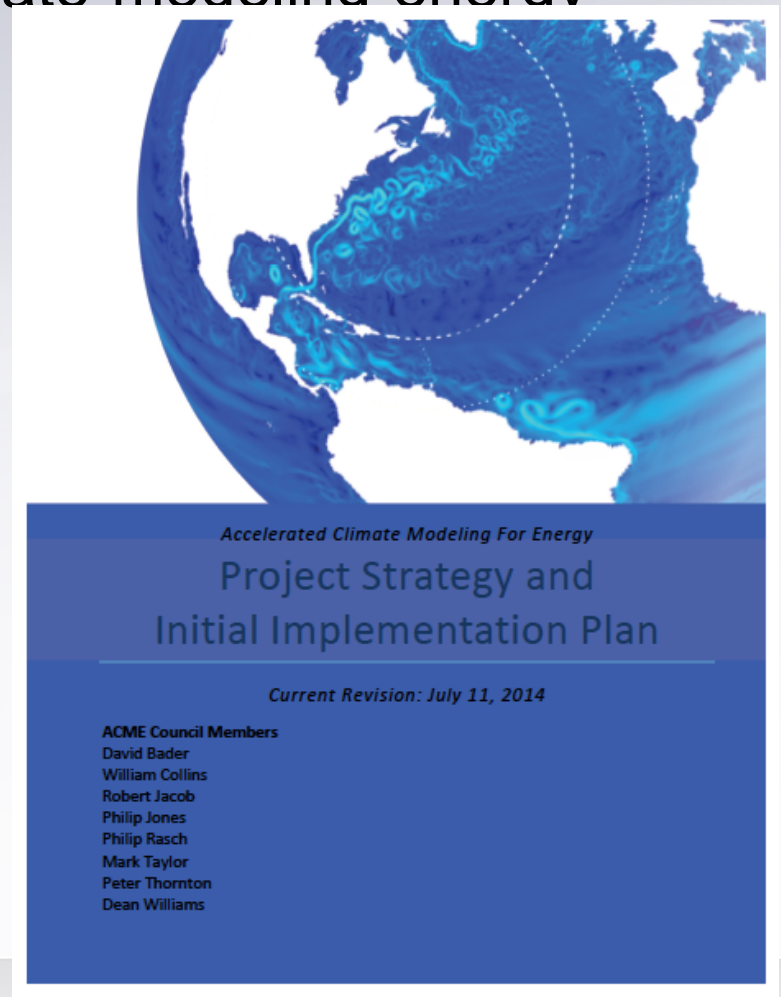
Dean Williams and Val Anantharaj,
ACME Workflow Group Leaders

December 8, 2015

U.S. DEPARTMENT OF ENERGY

# ACME Information

- http://climatemodeling.science.energy.gov/projects/accelerated-climate-modeling-energy



# Why ACME? A DOE Science Vision for Climate Simulation and Prediction

*The Accelerated Climate Modeling for Energy Project is an ongoing, state-of-the-science Earth system modeling, simulation, and prediction project that optimizes the use of DOE laboratory resources to meet the science needs of the nation and the mission needs of DOE.*

"A DOE Model on DOE Machines for the DOE Mission"

# Three-Year (2017) Deliverables

1. ACME v1 Model Experiments Completed
   1. Water Cycle – Coupled High Resolution Globally
   2. Cryosphere – Global Coupled Model with Refined Resolution Regions in Atmosphere, Ocean and New Ice Processes
   3. BGC – Global Coupled Model with New Terrestrial BGC and Ecological Processes
2. ACME v1 Model Documented and Released
3. All ACME v1 Experimental Data Available

***Model Simulations Must Start by Summer 2016***

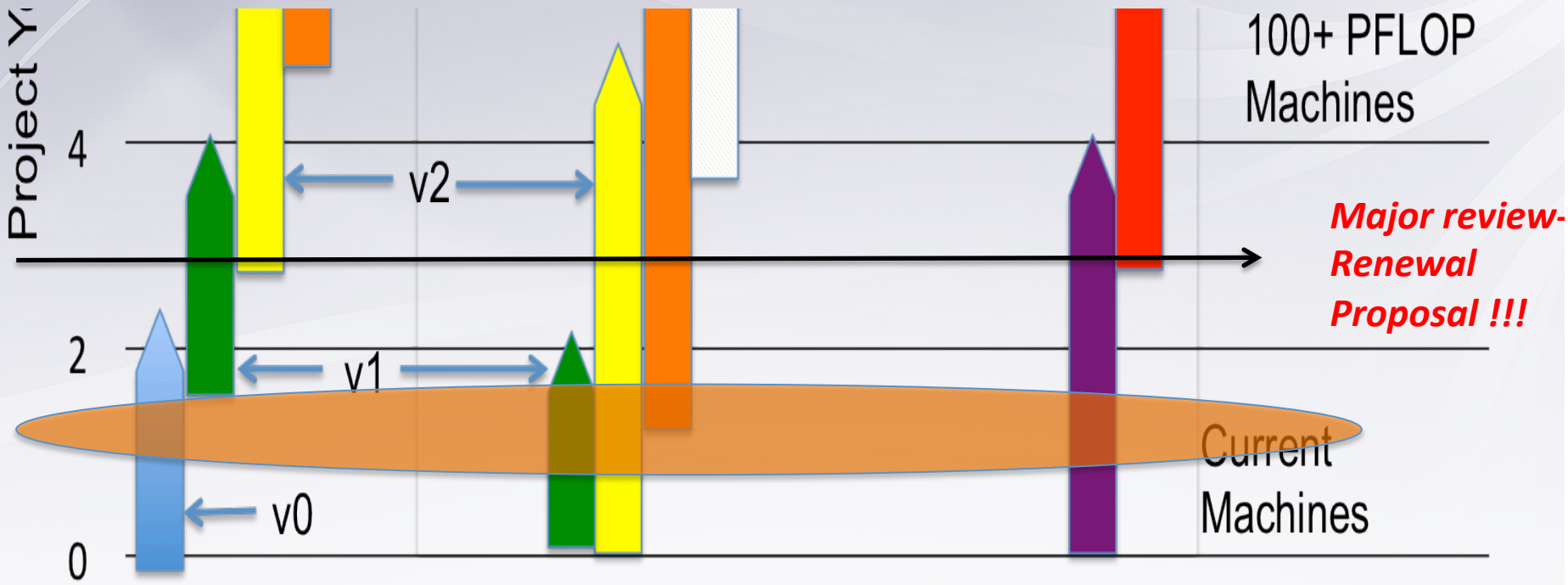
***ACME v1-alpha Completed by January 2016***

***ACME v1 Components Completed by November 2015***

# ACME Project Elements

- a series of **prediction and simulation experiments** addressing scientific questions and mission needs;
- a well documented and tested, continuously advancing, evolving, and improving **system of model codes that comprise the ACME Earth system model**; *formal code review process for each component; primary metrics for coupled system*
- the ability to use effectively **leading (and "bleeding") edge computational facilities** soon after their deployment at DOE national laboratories; and *NESAP, CAAR*
- **an infrastructure** to support code development, hypothesis testing, simulation execution, and analysis of results. Recently *Identified need for versioning of infrastructure, like model. Especially Workflow pieces and integration.*

# ACME Roadmap



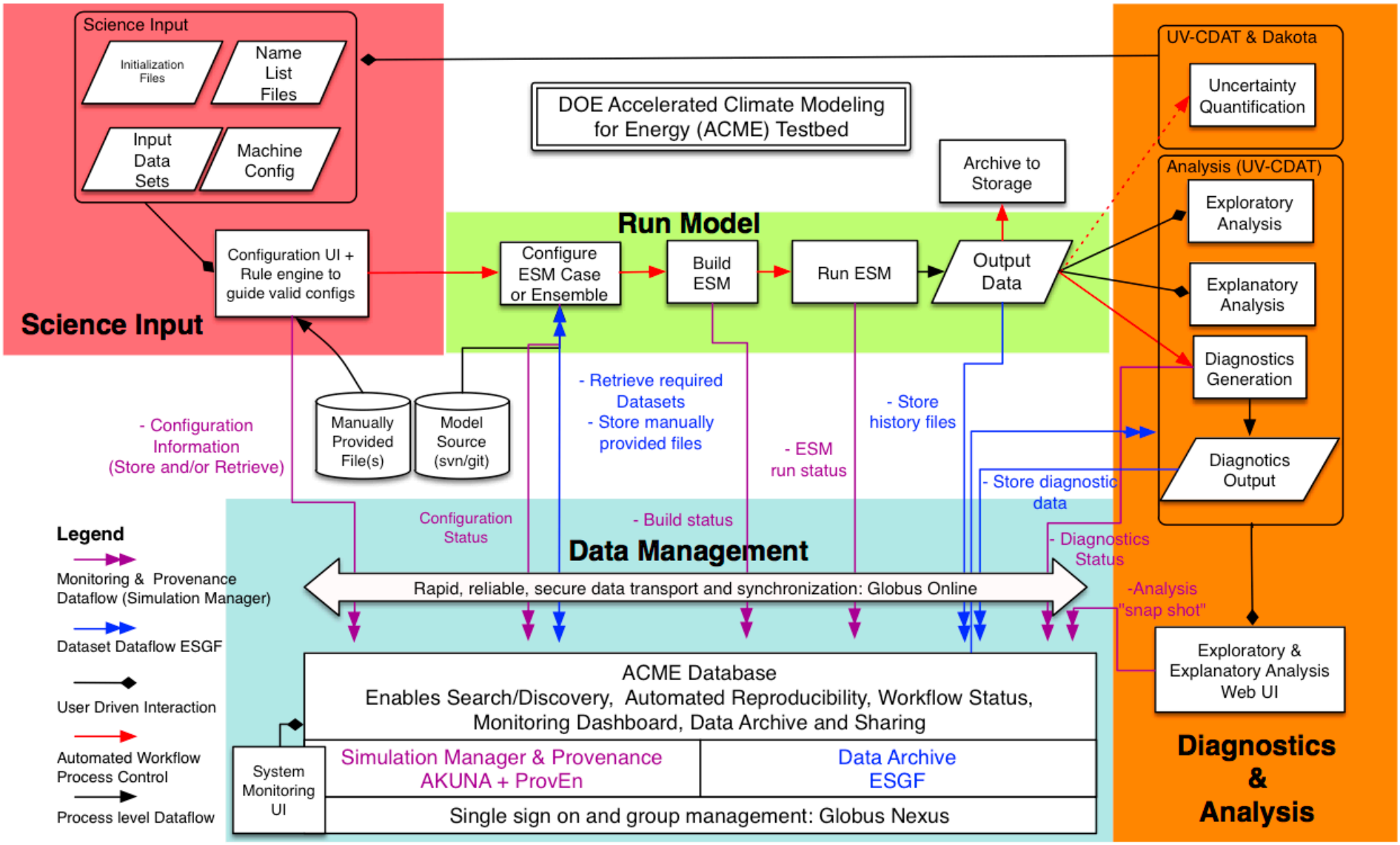

Major Simulations

Model Development

Leadership Architectures

# CRUNCH TIME!!!!

- Code freeze in November 2015
- Coupled model ready for tuning January 1, 2016
- Experimental Simulation Campaigns start July 1, 2016!!!!


Science Input
Initialization Files
Name List Files
Input Data Sets
Machine Config
Configuration UI + Rule engine to guide valid configs
Science Input
DOE Accelerated Climate Modeling for Energy (ACME) Testbed
Archive to Storage
Run Model
Configure ESM Case or Ensemble
Build ESM
Run ESM
Output Data
UV-CDAT & Dakota
Uncertainty Quantification
Analysis (UV-CDAT)
Exploratory Analysis
Explanatory Analysis
Diagnostics Generation
Diagnotics Output
- Configuration Information (Store and/or Retrieve)
Manually Provided File(s)
Model Source (svn/git)
- Retrieve required Datasets
- Store manually provided files
- ESM run status
- Store history files
- Store diagnostic data
Configuration Status
- Build status
Data Management
- Diagnostics Status
-Analysis "snap shot"
Rapid, reliable, secure data transport and synchronization: Globus Online
Exploratory & Explanatory Analysis Web UI
Legend
Monitoring & Provenance Dataflow (Simulation Manager)
Dataset Dataflow ESGF
User Driven Interaction
Automated Workflow Process Control
Process level Dataflow
ACME Database
Enables Search/Discovery, Automated Reproducibility, Workflow Status, Monitoring Dashboard, Data Archive and Sharing
System Monitoring UI
Simulation Manager & Provenance AKUNA + ProvEn
Data Archive ESGF
Single sign on and group management: Globus Nexus
Diagnostics & Analysis

# Some Current Workflow Challenges

- Lots of details – standardizing regridders, merging disparate data analysis packages and scripts, obtaining observational data sets, etc
- Infrastructure at Leadership Centers
  - Implicit assumption that most tasks will be done on their resources, and only small amount of data will be moved.
  - Diverse software stacks are diverse on data and infrastructure computers
  - Hard to get dedicated ACME resources that can be customized for ACME use cases.
- ESGF and data that are cataloged, but physically unavailable – e.g. HPSS