

Subactivity: Information Technology and R&D
Line Item: High Performance

GOAL STATEMENT:

NOAA's Information Technology and R&D programs seek to make major improvements in NOAA's ability to forecast weather and climate and disseminate environmental information. They also seek to stimulate the modernization of NOAA's computationally intensive services through the use of evolving high-performance computing technologies (HPCC).

BASE DESCRIPTION:

High-Performance Computing and Communication: The purpose of the HPCC program is to make major improvements in NOAA's ability to forecast the Nation's weather and climate, to model ecosystems and the ocean, and to disseminate environmental information. Improvements in the accuracy and timeliness of NOAA's short-term weather warnings, seasonal forecasts, and regional and global climate predictions are heavily dependent on major advances in high-end computing power, advanced information technology, and the availability of environmental data and information.

Current funding supports software development for improved weather modeling, including hurricanes, tornadoes, aviation, and other severe weather forecasts. As a result, thirteen GPRA performance measures across all four NOAA Mission Goals, including hurricane forecast tracking, winter storm warning accuracy, regional climate forecasts, and the accuracy of wave heights and wind speed forecasts, will not be met as scheduled. NOAA is requesting a budget increase in FY 2007 to restore the HPCC funding to prevent further performance delays. Improvements to NOAA's services require continually evolving computer technology, high-speed networking, and communications technologies that cannot be met at the base budget level.

The HPCC supports objectives in NOAA's Strategic Plan through IT research. These critical investments allow NOAA to meet its Mission in delivering vital services and science education to the public. The program allows NOAA to participate as a "mission" agency in the Interagency Working Group on Information Technology Research and Development, assuring coordination with Federal initiatives. The HPCC primarily serves the Environmental Modeling objective of the NOAA Strategic Goal to: "Serve Society's Needs for Weather and Water Information."

Base activities support the objectives, "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs" and "Enhance the conservation and management of coastal and marine resources to meet America's economic, social, and environmental needs" under the Department of Commerce Strategic Goal of "Observe, protect, and manage the Earth's resources to promote environmental needs."

PROPOSED LEGISLATION:

None.

SUMMARIZED FINANCIAL DATA

(Dollars in thousands)

Subactivity: Information Technology and R&D	FY 2005 ACTUALS	FY 2006 CURRENTLY AVAILABLE	FY 2007 BASE PROGRAM	FY 2007 ESTIMATE	INCREASE / DECREASE
Line Item: High Performance					
High Performance (WW)	12,322	6,411	6,442	12,916	6,474
Educational Partnership Program/Minority Serving Institutions (EPPMSI)	16,757	-	-	-	-
TOTAL	29,079	6,411	6,442	12,916	6,474
FTE	27	13	13	13	-

Note: The dollars in this table represent budget authority.

PROGRAM CHANGES FOR FY 2007:

High Performance Computing and Communication: (+0 FTE and +\$6,474,000) – NOAA requests an increase of 0 FTE and \$6,474,000 for critical funding for High Performance Computing and Communication. These funds will be used to make major improvements in the NOAA’s ability to forecast the Nation’s weather and climate, to model ecosystems and the ocean, and to disseminate environmental information. Improvements in the accuracy and timeliness of NOAA’s short-term weather warnings, seasonal forecasts, and regional and global climate predictions are heavily dependent on major advances in high-end computing power, advanced information technology, and the availability of environmental data and information.

Statement of Need

Weather and climate models play a central role in improving NOAA’s information and service delivery, and research and development computing is the key to improving the models. A NOAA and national need of overriding importance is the improvement of hurricane track and intensity prediction. NOAA has recognized this need with ambitious goals for prediction of track out to five days, which are in the current GPRA goals. These relate to the need to evacuate millions of people (e.g. the Texas-Louisiana evacuation for Hurricane Rita) several days in advance of landfall. The research and development supercomputing funded from the HPCC program will be used to expedite the Hurricane Weather Research and Forecast (WRF) model (which relates directly to improving intensity) and the global weather model (which relates directly to improving track). Other needs such as improved temperature, air quality, and aviation prediction are needed and require WRF model research and development using HPCC computing resources. NOAA has been making rapid progress in seasonal to inter-annual prediction by the use of long range (out to nine months) ensembles of the global coupled atmosphere and ocean model, but this requires large computing resources that depend on the HPCC program increase.

Similarly, NOAA is working on new global models in the Earth System Modeling Framework that will improve forecasts from hours to centuries, which will require the full funding of the HPCC program.

Proposed Actions

- Expedite the research and development of the Weather Research and Forecast model. The Hurricane WRF model can be developed significantly faster with the personnel and computing resources available if the program increase is supported. Specifically, improving interaction of the atmospheric model with the ocean model promises to improve intensity prediction, which has been very difficult with current research and development computing. Similarly, the program increase would support the testing (WRF Developmental Test Center) and technology transfer of new models for short range prediction (the “NMM” model) rapid refresh (essential to aviation prediction). The global weather prediction models would be improved by development of next generation of coupled models and advanced ensemble approaches. Coupled models and ensemble model development require the large computing resources that the program increase would support.
- Advance toward ecosystems-based management through the development of state-of-the-art Earth System models. The HPCC program supports high performance computing and software engineering for developing and implementing component models of atmospheric chemistry and ecology and biogeochemistry on land and in the ocean. These components, when coupled to physical climate models, capture the cycling of nutrients such as carbon and nitrogen that effect ocean and land ecosystems, and provide the tools to produce global atmospheric pollution forecasts. The Earth System Modeling Framework (ESMF) will commence implementation within these Earth System Models; the framework is required to couple world ocean models to models of coasts and estuaries, to better track the movement of nutrients and pollutants from streams and rivers all the way to the open ocean. ESMF is a key tool for integrating NOAA’s environmental modeling enterprise across the organization, including accelerating the transition of research models into operations.
- The HPCC program will continue to make investments into the access to and use of high speed research networks such as Lambda rail in order to more effectively and quickly receive data and distribute its vital data and products. The HPCC program also makes investments into the development of advanced software applications that permit access, study of, and distribution of NOAA data and products.

Benefits

- Improved hurricane track and intensity prediction help in two ways. First, the improved forecasts increase credibility with the public – surveys consistently reveal that many people do not evacuate because they have a perception the storm will not be as strong as forecast (fewer false alarms). Second, the ability to add lead time for the storms allows civil authorities adequate time to prepare (related to improving “probability of detection”). Improved short range forecasts have been shown to result in savings in all economic sectors. A very important sector that is directly benefited is transportation. Improved forecasts will lead directly to improved aviation and surface transportation safety. Similarly, NOAA is committed to significant improvements of its temperature forecasts, leading to a reduction of heat-wave deaths, and air quality prediction, which reduces deaths do to lung diseases.

- State-of-the-art Earth System models provide the basis for NOAA's capability to forecast nutrient and pollutant movement through the Earth System and their consequent impact on ecosystems, and for meeting the Administrations goals in the Climate Change Science Program. Through the use of ESMF, these Earth System models and the components of which they are comprised will be more easily transition from research to operations.
- The periodic refresh of HPC technology is required in order to implement the scientific advances and software improvements made by NOAA's scientists to the portfolio of environmental models that NOAA has developed and maintains. The technology that will be acquired enables the benefits of the preceding two bullets to be realized.
- Access to and use of advanced high speed networks such as Lambda rail allow for the transfer of large volumes of environmental data to and from NOAA research facilities. Research into the use of these networks may also lead to enabling both data and compute grids which would allow NOAA to better integrate and make use of its investments in information technology by more scientists, partners, and customers. Advanced applications that provide capabilities such as data visualization and data manipulation by scientist and decision makers would allow for improved research and more timely decision making.

Performance Goals and Measurement Data:

This increase will support the Department of Commerce Strategic Goal to “Serve Society’s Needs for Weather and Water Information.” Specifically, this increase improves NOAA’s ability to collect, process, and provide information. This increase also supports the NOAA Mission Support goal and is critical to achieving the following performance measures: (includes a list of the performance measures)

Performance Goal: Serve Society’s Needs for Weather and Water Information
Weather Research Forecasts
Improve 48-Hour Hurricane track forecasts.
U.S. temperature forecasts (cumulative skill score over the regions where predictions are made)
-Improve Lead-time for winter storm warnings.
Improve Accuracy for winter storm warnings.
Improve Accuracy of Day 1 Threat Precipitation Forecast from 29% in 2003 to 35% by 2008
Accuracy (%) of forecasts of ceiling and visibility (3 miles / 1000 ft.) (aviation forecasts)

False Alarm Rate (FAR) (%) of forecasts of ceiling and visibility (3 miles / 1000 ft.) (aviation forecasts)
Accuracy (%) of forecast for winds (marine forecasts)
Accuracy (%) of forecast for waves (marine forecasts)
Earth System Modeling
Reduced uncertainty in model simulations of the influence of aerosols on climate.
U.S. temperature forecasts (cumulative skill score over the regions where predictions are made)
Improved ability of society to plan and respond to climate variability and climate change using NOAA climate products and information.
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Reduced uncertainty in model simulations of the influence of aerosols on climate.