Implementation of a Developmental Testbed Center (DTC)

Bob Gall
National Center for Atmospheric Research
Boulder, Colorado

The U.S. Weather Research Program (USWRP) includes plans for the rapid and direct transfer of new research results into the operational forecasting process of the National Weather Service (NWS) and other operational forecasting centers. The Weather Research and Forecasting (WRF) program is an important component of this USWRP technology transfer plan. The WRF effort embodies the concept of the operational and research communities working jointly toward development of next generation Numerical Weather Prediction (NWP) capabilities that will allow, as new techniques are developed in the research community, the most promising results to be rapidly and efficiently transferred to operations. For the WRF process to succeed, it is crucial that a comprehensive NWP Developmental TestBed Center (DTC) be created with appropriate staffing and resources to enable this process to flourish. This presentation will describe implementation of a developmental Testbed Center initially funded jointly by NOAA and NCAR/UCAR.

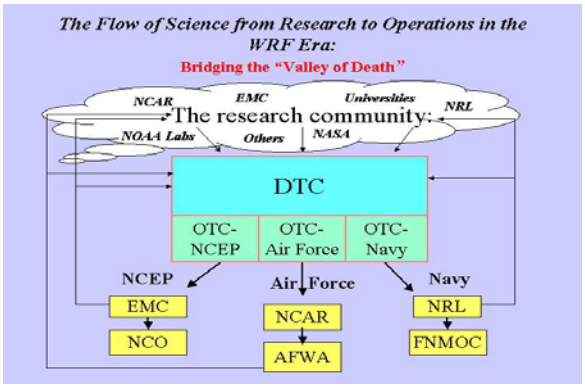

Figure 1. Bridging the "Valley of Death"

The role of the DTC is to provide a bridge between the NWP research and operational communities. It will be the place where the two communities will interact directly and is intended to facilitate the transfer of new NWP techniques, and ideas into operational forecasting. The transfer from research to operations has long been recognized as inefficient at best, and the gulf between the two communities has been referred to as the "Valley of Death", Figure 1. The purpose of the DTC is to provide part of the bridge over this valley by providing a facility where the research scientists can test out NWP ideas in a quasi-operational environment and where they can work together with scientists from operations.

Expressed in Figure 1 is the need for components within each of the operational centers, called Operational TestBed Centers (OTCs) where final testing is accomplished prior to operational implementation. Final testing requirements are likely to remain unique to each of these centers and hence it is not practical to combine the OTCs with the DTC. There will be a regular exchange of visits between personnel of the DTC and the OTCs so that testing activities can be coordinated and needs and requirements can be communicated. An exchange of information on needs and requirements between the research and operational communities will also occur through other components of the WRF program. Together, the DTC and the OTCs complete the bridge over the Valley of Death.

The WRF system will be the initial focus of the DTC, but the vision is ultimately to accommodate other developing modeling systems, such as a unified (mesoscale to global) capability. Consistent with the WRF goals, the DTC goals include facilitating the transition of new NWP and data assimilation research capabilities into an efficient and

effective weather forecasting process. A key objective of the DTC is to offer to the research community a *functionally equivalent* operational environment to test and evaluate new NWP methods, without interfering with day-to-day operational forecasting. The DTC will be a key component in the WRF process of testing new model code and numerical forecasting techniques such that promising enhancements can be considered for implementation at the operational forecast

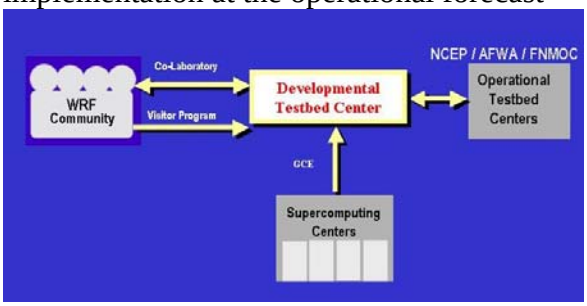

Figure 2. Basic Architecture of the DTC

centers. The DTC will allow researchers to run post-analyses of poor weather forecasts with complete operational NWP initialization data sets, and to perform extended periods of "retrospective" and real-time numerical weather forecasts with new NWP configurations in a fully cycled manner – neither of which is practical for the research community to do currently. The DTC will also facilitate the development of advanced tools for data access, quality control, verification, and high-performance computing supportive of the WRF program, as well as sophisticated user support services in the application of these tools.

The proposed DTC facility will be located in Boulder, Colorado, at the National Center for Atmospheric Research (NCAR), but operated jointly by NCAR and NOAA where it will take advantage of existing modeling, data assimilation, high-performance computing, and data management expertise and facilities within the Boulder area. The center in Boulder will form a close collaborative relationship with NRL in Monterey where similar developmental testing will take place. At the same time, the DTC will reach out to the broader research community for additional expertise, participation, and computational resources. See Figure 2. During the WRF development and evaluation process, researchers will be invited, through a peer-review proposal process, to work directly with DTC scientific and technical personnel, including on-site representation by members of the operational NWP community.

The DTC is not expected to own its own supercomputers but will take advantage of super computer resources around the country. This will include the computers located at NCAR and FSL and the NCEP backup computer. It could include the NAVO computer in Mississippi, the backup computers at AFWA and FNMCO and perhaps one or more of the super computer centers. These resources are to be eventually accessed by participants in DTC research through a Grid Computing Environment (GCE). It is also anticipated that many of the visitors with the DTC will continue their work from their home institutions after an initial stay at the physical location of the DTC. The DTC plans to maintain a system for easy access to DTC resources for these visitors.

The initial activities of the DTC took place in FY03-04 in the form of the WRF Test Plan that will culminate in the first operational implementation of WRF as a limited ensemble at NCEP in October 2004. In FY 04-05, the plans are to begin a limited visitor program where members of the NWP community are invited to Boulder to participate if further testing of the WRF system motivated by questions raised during the WRF Testing in FY03-04. This will include testing of new verification techniques, ensemble techniques and configuration of the physics packages. Both of the current cores of WRF, NMM and EM will be made available to the broad WRF user community.