MODEL DEVELOPMENT AND ENHANCEMENT RESEARCH TEAM (#5)
TECHNICAL DIRECTION
FY 2007

General Instructions:

1. A detailed quarterly Progress Report will be submitted by the 15th of October 2006 and January, April, and July 2007 describing efforts performed in support of all Model Development & Enhancement Research Team (MDERT) tasked activities. A high level Monthly Progress Report will be submitted by the 15th of November and December 2006 and February, March, May, June, August, and September 2007 summarizing MDERT efforts towards goals and milestones, and include its financial status report.

Quarterly Progress Reports shall contain efforts **by activity** presented as follows:

a. Current Efforts (quarter just completed)
b. Planned Efforts (for next reporting period)
c. Problems/Issues/Schedule Changes Encountered or Anticipated
d. Interface with other organizations (other than Core RT member organizations)
e. Summary of funding status, planned versus actual expenditures

Monthly Progress Reports shall contain a high level summary (about one page in length) of **overall MDERT activities** presented as follows:

a. Current Efforts (month just completed)
b. Planned Efforts (for next reporting period)
c. Problems/Issues/Schedule Changes Encountered or Anticipated

2. The MDERT Plan shall be updated to include activity planning for the seven year period from FY 2008 through FY 2014 **no later** than April 1, 2007. It shall be sent to Gloria Kulesa by that date.

3. Program Reviews will be conducted per the agenda to be supplied by the Program Manager prior to the scheduled review.

4. All deliverables, technical reports, documentation to industry, press releases, and briefings shall be reviewed and approved by the Program Manager (PM), or designee, **prior** to **External** distribution. Approval shall be requested of the PM or designee **before** exhibiting at conferences, symposiums, etc. The following statement shall be included in all research papers, journal articles, documents, announcements, etc.:

"This research is in response to requirements and funding by the Federal Aviation Administration (FAA). The views expressed are those of the authors and do not necessarily represent the official policy or position of the FAA."

5. In taskings specifically stating "as authorized by the Program Office", authorization must be in writing from the Program Manager, or designee.

6. The MDERT shall not contact any FAA regional, headquarters, or air traffic control facility, in writing or orally, without first notifying the Program Office for approval.

7. Copies of all monthly and quarterly Progress Reports, technical papers, etc., shall be submitted electronically to Gloria Kulesa with copies to the MDERT and to the following: (see Attachment 1 for e-mail addresses) **(note: distribution list updated; ensure new addressees list is instituted)**

- FAA Operations Planning R&D (Warren Fellner, Jackie Queen)
- FAA Weather Policy and Standards (Rick Heuwinkel, Debi Bacon)
- FAA William J. Hughes Technical Center (Tom Carty, Starr McGettigan, Victor Passetti)
- FAA Operations Planning Systems Engineering (Cheryl Souders)
- NCAR (Bruce Carmichael, Marcia Politovich, Roy Rasmussen, Bob Sharman, Greg Meymaris)
- NOAA NSSL (Kim Elmore)
- NOAA ESRL (Mike Kraus, Lynn Sherretz, Stan Benjamin, Jennifer Mahoney)
- NRL (Ted Tsui)
- NWS HQ (Mark Andrews, Kevin Johnston, Celia Miner)
- NCEP AWC (Clinton Wallace)
- NCEP EMC (Geoff DiMego)
- MIT LL (Mark Weber, Marilyn Wolfson)
- OFCM (Mary Cairns)
- NASA (John Murray)
- CIMSS, Univ of Wisconsin (Wayne Feltz)
- WARP Program (Jim Stobie)
- ITWS Program (Thad Carpen)

8. Costs not to exceed **$1,070,000** (which are the cumulative amount of "old and new" funds allocated from Oct '06 – Sep '07) shall be expended in performance of the specific taskings of this Technical Direction.

9. Any funding identified as contingent funding may be funded if the indicated conditions are reached; as with all funding decisions, contingencies will be subject to Program Office consideration reflecting evolving priorities.

10. Although it is intended that funding allocated per fiscal year be expended within that specific fiscal year, consideration will be taken for taskings not completed due to unforeseen circumstances. Upon receipt of written notification from the Program Office, funding for uncompleted tasks shall be carried over to the next fiscal year.

11. ESRL, NCAR, NCEP, and OKU shall notify the FAA CO (Elisa Brown) and their respective COTR, via e-mail, whenever they each (individually) have reason to believe that the costs they expect to incur in the next 60 days, when added to all costs previously incurred in FY07, will

exceed 80 percent of the amount allocated to them for MDERT tasking. Each "lab" shall also indicate whether exceeding the 80 percent level is a positive or negative variance based on their budget plan.

12. Until further notice all travel must be approved in advance by the COTR, and funding to attend any conference, symposium, etc. will not be approved. Additionally, contractual travel vs. overhead travel shall be broken out on the monthly financial status report.

07.5.1: Infrastructure Support Related to Operational Running of the RUC and Meso-Eta Systems ($24,375 old, $40,250 new to NCEP; and $45,000 old, 75,000 new to ESRL)

Efforts in support of this task will ensure the reliable and timely running of the Rapid Update Cycle (RUC) modeling system in the NCEP Operational Suite and providing grid output (SAVs and AIVs) to aviation users., continued availability of model datasets at highest resolution and smooth incorporation of incremental enhancements to the systems (configuration management)

Efforts will also include the following:

07.5.1.1 Maintain hourly RUC runs and provide grids of SAV and AIV guidance products.

07.5.1.2 Provide vendors with gridded model data via Family of Services (FOS), and the FAA Bulk Weather Data Telecommunications Gateway (FBWDTG).

07.5.1.3 Provide full grids from RUC runs on NCEP and NWS/OPS servers.

07.5.1.4 Maintain access to model verification data.

Deliverables:

07.5.1E1 Oct '06 – Sep '07: Perform observation ingest, quality control, and preparation in support of the operational RUC runs. **(NCEP)**

07.5.1E2 Oct '06 – Sep '07: Perform configuration management for RUC, including thorough documentation, and respond promptly to any code malfunctions or performance issues. **(ESRL)**

07.5.1E3 Oct '06 – Sep '07: Monitor RUC performance, respond to any problems detected by ESRL, NCEP, or any RUC users, diagnose cause, develop solutions to RUC software problems, and coordinate with EMC and NCO on testing. **(ESRL)**

07.5.4 Develop, Test, and Implement the Rapid Refresh Configuration of the WRF Modeling System. ($13,500 old, $21,500 new to NCEP; $63,000 old, $107,000 new to ESRL)

Efforts will include final testing, both retrospective and real-time.

07.5.4.1 Begin real-time cycling of the RR model with GSI over RR domain at degraded resolution.

07.5.4.2 Build retrospective period capability including different seasons for testing of RR with cycling.

07.5.4.3 Build graphics and web viewing capability for display of ESRL RR real-time and retrospective runs.

07.5.4.4 Further enhancement of WRFpost version for Rapid Refresh application, including modifications to generation of RUC-specific fields.

07.5.4.5 Start to solicit input from other RTs and NWS forecasters in Alaska and Puerto Rico regarding how they wish to use RR and particular forecast challenges for which the RR might be able to provide guidance.

Deliverables:

07.5.4E1 15 Oct '06: Technical report describing the ESRL preliminary real-time and retrospective resting of the WRF Rapid Refresh System **(ESRL)**

07.5.5: Develop, Test and Implement Improvements to the Operational WRF 3DVARs for Rapid Refresh and North American Mesoscale Runs. ($45,000 old, $68,000 new to NCEP; $63,000 old, $107,000 new to ESRL; and $13,500 old, $26,500 new to OKU)

This task will provide the necessary continued development for 3DVAR analysis capability, the critical analysis component of data assimilation, for implementation and improvement in both the Rapid Refresh and North American Mesoscale components of the NCEP operational run suite.

The following milestones will be met:

07.5.5.1 Report on testing of RUC-like cloud/hydrometeor assimilation (including GOES cloud-top data and METAR cloud/visibility/weather data) within WRF-GSI on the Rapid-Refresh domain. (15 OCT '06) (ESRL, OKU)

07.5.5.2 Based on parallel testing and refinement of the experimental code, deliver a "pre-implementation" version of WRF-GSI to replace Eta 3DVAR in NAM /NDAS (Oct '06) (NCEP)

07.5.5.3 Development efforts will produce a "research quality" Rapid Refresh-specific version of the WRF 3DVAR (likely WRF-GSI) modified for Rapid Refresh testing and comparing results to the RUC 3DVAR version. (15 Dec '06) (NCEP, ESRL)

07.5.5.4 Further refine the radial velocity analysis component of GSI in response to mode resolution changes. Consider issues on data quality, super-obbing, and optimal decorrelation scales. (15 Jan '07) (OKU, NCEP)

07.5.5.5 Development efforts will produce a "research quality" code for an upgrade package (improved covariance and use of WSR-88D satellite radiances and covariances) to the WRF-GSI. (15 May '07) (NCEP)

07.5.5.6 Based on case-study testing and refinement of the research quality code, deliver resulting an "experimental" code for an upgrade package (improved covariance and use of WSR-88D satellite radiances and covariances) to the WRF-GSI for the March 2008 change package to the NAM-WRF. (Jul '07) (NCEP)

07.5.5.7 Report on testing of RUC-like surface observation assimilation (including use of inferred planetary boundary layer (PBL) depth, terrain, and land mask constraints, and soil temperature/moisture adjustment) within WRF-GSI on the full Rapid-Refresh domain. (15 Dec'06) (ESRL)

07.5.5.8 Development efforts produce an "experimental" version of the GSI suitable for Rapid Refresh application (i.e., includes RR-specific modifications for cloud hydrometeor and surface observation assimilation) (15 Feb '07) (ESRL)

Deliverables

07.5.5E1 Mar '07: Subject to NCEP Director approval, implement WRF-GSI in NAM/NDAS **(NCEP)**

07.5.5E2 15 Jul '07: based on real-time parallel and retrospective testing and refinement of the experimental code, report to NCEP on progress toward a "pre-implementation" version of WRF-GSI suitable for Rapid-Refresh application (to replace 3DVAR in FY 2009). **(OKU, NCEP)**

07.5.6: Develop, Test, and Evaluate the Performance of the Nonhydrostatic Weather Research and Forecasting (WRF) Modeling System ($9,000 old, $16,000 new to NCAR)

The following milestones will be met:

07.5.6.2 Commit to WRF repository the changes embodied in operational WRF codes used in NAM upgrade package of March 2007. (1 Mar '07) (OKU, ESRL)

07.5.6.3 NCAR shall Deliver the following to ESRL: physics improvements; code parallelism

and computationally faster set of routines to reduce the wallclock times for rapid refresh runs; written description of version features. (31 Mar '07) (NCAR)

Deliverables:

07.5.6E1 Jun '07: Conduct a WRF Users' Workshop and a tutorial on the Advanced Research WRF (ARW) core (NCAR) for the user community. Include descriptions and testing of Rapid Refresh as part of the workshop.

07.5.8: Improve Model Physics in the WRF Model, Especially those that Affect Aircraft Icing. ($20,125 old, $39,875 new (including $20K for DTC) to NCAR; $7,000 old to NCEP; and $26,875 old, $53,125 new (including $20K for DTC) to ESRL)

The following milestones will be met:

07.5.8.1 Deliver "pre-implementation" code to NCO with WRF physics upgrades for March 2007 change package for WRF-NMM in the NAM/NDAS. (Oct '06) (NCEP) **(UNFUNDED)**

07.5.8.2 Development efforts produce a "research quality" code for physics upgrades for consideration in the WRF-NAM in the NAM/NDAS. (15 May '07) (NCEP) **(UNFUNDED)**

07.5.8.3 Based on case-study testing and refinement of the research quality code, deliver result in an "experimental" code of physics upgrades for the March 2008 change package for WRF-NMM in the NAM/NDAS. (Jul '07) (NCEP) **(UNFUNDED)**

07.5.8.4 Evaluate candidate convective schemes and their interaction with other physics for RR application. (Jan '07) (ESRL)

07.5.8.5 Improve handling of moist processes in candidate PBL scheme for use in the RR-WRF. (Jan '07) (ESRL)

07.5.8.6 Test and evaluate current stratocumulus parameterizations for the prediction of icing and if necessary develop a new parameterization for the formation of icing including freezing drizzle in stratocumulus clouds. (1 Aug '07) (NCAR)

07.5.8.8 In collaboration with NCAR, investigate potential for RR application of existing physics schemes that combine PBL processes with prediction of PBL-driven stratocumulus or shallow cumulus. (15 Aug '07) (ESRL, NCAR)

Deliverables:

07.5.8E1 Mar '07: Subject to NCEP Director approval, the physics upgrades become Operational at NCEP as part of the change package for WRF-NMM in the NAM/NDAS **(NCEP)**

07.5.8E2 15 Jun '07: Report to NCEP and AWRP on testing of revised versions of microphysics and other physical parameterizations into WRF Rapid Refresh model code package and include in Rapid Refresh package to NCEP **(ESRL)**

07.5.8E3 Jun '07: Report on overall performance of physics parameterizations in pre-implementation version of RR at annual WRF Workshop in Boulder, C. **(ESRL)**

07.5.8E4 Sep '07: Report on development of a predictive capability in the NCAR microphysics for aerosol concentration and mixing ratio that can be used to determine cloud condensation nuclei (CCN) and ice nuclei (IN) as a function of cloud updraft velocity, temperature, pressure, and background aerosol concentration. **(NCAR)**

07.5.12: Code Conversion/Optimization of NCEP Computer Upgrade (UNFUNDED)

07.5.15: Develop improved Methods of Cloud and Moisture Analysis for use in the WRF Modeling System ($11,250 old, $18,750 new to OKU; and $22,500 old, $37,500 new to ESRL)

This task will focus on improvements that will result in better moisture and cloud fields for initializing the WRF prediction model. It will be accomplished by working to improve the analysis algorithms and through continued efforts to improve the utilization of observations of clouds, hydrometeors and precipitation using satellite, surface, and radar observations.

07.5.15.2 Develop and evaluate the performance of diabatic digital filter initialization (DDFI) in the RR WRF model for initial cloud and hydrometeor fields. (15 Mar '07) (ESRL)

07.5.15.4 Develop a revised version of the gridpoint statistical interpolation (GSI) cloud assimilation treatment of satellite and METAR cloud data in its cloud analysis. (15 May '07) (ESRL, OKU)

07.5.15.5 Based on case-study testing and refinement of the research quality code, deliver 'experimental' WRF code with diabatic initialization upgrades (e.g. initial use of Level II reflectivity) for the March 2008 change package for NAM. (Jul '07) (NCEP) **(UNFUNDED)**

Deliverables:

07.5.15E2 15 Jul '07: Report on progress of GSI cloud analysis code to NCEP to be part of FY 2008 Rapid Refresh. **(ESRL)**

07.5.15E3 15 Sep '07: Complete further revisions and testing of the generalized cloud analysis package within GSI for stratiform cloud (using GOES cloud top and METAR cloud data) and

initial treatment for convective cloud at parameterized scale assimilating radar reflectivity. **(ESRL, OKU)**

07.5.17: Infrastructure Support for Running the Operational WRF Model in Rapid Refresh, North American Mesoscale and HiRes Window Modes at NCEP ($36,000 old, $59,000 new to NCEP)

This task will assure uninterrupted running of the models, continued availability of model datasets at highest resolution and smooth incorporation of incremental enhancements to the systems.

07.5.17.1 Maintain four-per-day North American Mesoscale runs and provide SAV and AIV guidance. (NCEP)

07.5.17.2 Maintain four-per-day HiRes Window runs and provide SAV and AIV guidance. (NCEP)

07.5.17.3 Provide vendors with gridded model data via Family of Services and the FAA Bulk Weather Data Telecommunications Gateway. (NCEP)

07.5.17.4 Provide full grids from NAM, and the HiRes Window on NCEP and NWS/OPS servers. (NCEP)

07.5.17.5 Maintain access to model verification data. (NCEP)

07.5.17.6 Provide assistance to In-Flight Icing, Turbulence, Convective Weather, C&V and Oceanic Weather RTs when their algorithms and product generation systems are ready to transition into NCEP' operational production suite. (NCEP)

Deliverables:

07.5.17E1 Oct '06 - Sep '07: Perform observation ingest, quality control and preparation in support of the operational North American Mesoscale WRF runs. **(NCEP)**

07.5.17E2 Oct '06 – Sep '07: As requested by other RTs, incorporate new AIV calculations into Operational WRF Model post-processor and product generator (NCEP)

07.5.19: Develop Ability to Assimilate WSR-88D radial velocity and reflectivity data into the WRF modeling system. (UNFUNDED)

MDERT FY 07 funding ($)

Task	Description	NCAR	NCEP	ESRL	OKU	DTC	Total
07.5.1	Infrastructure support for operational running of RUC and Meso-Eta systems		65,000	120,000			185,000
07.5.4	Develop, test, and implement Rapid Refresh configuration of the WRF modeling system.		35,000	170,000			205,000
07.5.5	Develop, test, and implement to operational WRF 3DVARS for RR and NAM runs		113,000	170,000	40,000		323,000
07.5.6	Dèvelop the nonhydrostatic WRF modeling system.	25,000					25,000
07.5.8	Improve model physics that affects icing in the WRF, RUC, and Meso Eta models.	40,000	7,000	60,000		20,000 - NCAR 20,000- ESRL	147,000
07.5.12	Code conversion/ optimization of NCEP computer upgrade						
07.5.15	Develop Improved Methods for Clouds & Moisture Analysis for use in WRF			60,000	30,000		90,000
07.5.17	Infrastructure support running operational WRF model in RR NAM and HiRes window models at NCEP		95,000				95,000
07.5.19	Assimilation of WSR-88D radial velocity & reflectivity data for modeling at horizontal scales smaller than 4KM						
07.5.22	Develop, test and implement WRF modeling system in NCEP's North American Mesoscale runs.						
	Total	**65,000**	**315,000**	**580,000**	**70,000**	**40,000**	**1,070,000**

Attachment 1,

Email addresses

Andrews, Mark	mark.andrews@noaa.gov
Bacon, Debi	debi.bacon@faa.gov
Benjamin, Stan	stan.benjamin@noaa.gov
Cairns, Mary	mary.cairns.noaa.gov
Carmichael, Bruce	brucec@ucar.edu
Carpen, Thad	Thad.CTR.Carpen@faa.gov
Carty, Tom	thomas.carty@faa.gov
DiMego, Geoff	geoff.dimego@noaa.gov
Elmore, Kim	kim.elmore@noaa.gov
Fellner, Warren	warren.fellner@faa.gov
Feltz, Wayne	wayne.feltz@ssec.wisc.edu
Heuwinkel, Rick	richard.heuwinkel@faa.gov
Johnston, Kevin	kevin.l.johnston@noaa.gov
Kraus, Mike	kraus@fsl.noaa.gov
Kulesa, Gloria	gloria.kulesa@faa.gov
Mahoney, Jennifer	jennifer.mahoney@noaa.gov
McGettigan, Starr	starr.mcgettigan@faa.gov
Meymaris, Greg	meymaris@ucar.edu
Miner, Celia	cecilia.miner@noaa.gov
Murray, John	john.j.murray@nasa.gov
Passetti, Victor	victor.passetti@faa.gov
Politovich, Marcia	marcia@ucar.edu
Queen, Jackie	Jacquelyn.S-ctr.Queen@faa.gov
Rasmussen, Roy	rasmus@ucar.edu
Sharman, Bob	sharman@ucar.edu
Sherretz, Lynn	lynn.sherretz@noaa.gov
Souders, Cheryl	cheryl.souders@faa.gov
Stobie, Jim	james.stobie@auatac.com
Tsui, Ted	tsui@nrlmry.navy.mil
Wallace, Clinton	clinton.wallace@noaa.gov
Weber, Mark	markw@ll.mit.edu
Wolfson, Marilyn	mwolfson@ll.mit.edu