NCAR Strategic Plan
Status and Discussion

October 7, 2013
Status and Looking Ahead
Status

- First draft about to be posted for comment
- Discussion at members meeting (Wednesday)
- Next steps
  - 30-day comment period
  - Revision in response to comments
  - Refinement by Executive Committee
  - Discussion with NSF
  - Final Approval expected in early 2014
Top Level View
Need for Investment in NCAR

- Tremendous advances over last few decades
  - Demonstrated record of success

- But society still vulnerable to weather, space weather, climate change, air pollution...

- Sustained research, enabled by new computing, modeling, observing capabilities, can help
  - Enhanced understanding
  - Better characterization of vulnerability and risk
  - Better predictions
  - More focused and usable results
Our Argument

• Maintain strong support for a set of core activities: NCAR’s imperative areas

• Move ahead with a new Research Frontier to pull together, integrate and enhance key activities
A New Frontier for NCAR

• A Multi-scale Simulation System
  – New observations, data assimilation, process studies
  – Model development
  – Prediction studies
A New Frontier: More Detail

• Global models with a variety of uniform global horizontal resolutions, and variable-mesh grids for both regional downscaling and upscaling research

• Scale-adaptive physical parameterizations and numerical algorithms

• Closer integration of data assimilation with model development/verification, including analysis of model parameter sensitivity, uncertainty quantification, and incremental benefit of new observations

• Weather-chemistry-climate prediction system for “days to decades” forecasting; new approaches to evaluate model forecast skill on these time scales

• Exploit existing and new observations to test models at the process level and quantify the relative importance of different feedbacks
Four Imperatives – Equally Important

• Advance the Atmospheric and Related Sciences
• Provide Research Facilities and Services
• Impart Benefits to Society
• Promote Innovation and Creativity
Ten Goals – Equally Important

• Advance the Atmospheric and Related Sciences
  – Resolve fundamental uncertainties that inhibit understanding
  – Improve simulation and prediction of hazards & impacts

• Provide Research Facilities and Services
  – Develop, maintain, and support use of observing systems
  – Develop, provide, and support community models
  – Enhance supercomputing and information technology
  – Develop new capabilities for “Big Data”

• Impart Benefits to Society
  – Develop and transfer science that meets societal needs
  – Integrate research and education

• Promote Innovation and Creativity
  – Encourage exploration and new connections
  – Attract and retain talented people for our field
More Detail: Goals & Priorities
Goals & Priorities: Science

Resolve fundamental uncertainties that inhibit understanding

- Carry out *discovery-oriented* research into key components of the sun-earth-human system in order to understand *fundamental processes and mechanisms*

- Study *couplings and feedbacks* among the different components of the sun-earth-human system and integrate knowledge of processes and their interactions to understand and predict *system-scale behavior*
Goals & Priorities: Science

Improve simulation and prediction of hazards and impacts

• Improve capabilities for probabilistic prediction through predictability studies and advances in data assimilation and uncertainty quantification

• Develop innovative methods to diagnose causes for model weaknesses, and develop new modeling approaches (e.g., process parameterizations, numerical schemes) that substantially advance predictive skill

• Extend forecasting of short-term hazards (e.g. floods and solar eruptions) and impacts by integrating data assimilation, statistical methods, modeling, and social science.
Goals & Priorities: Facilities & Services

Develop, maintain and support use of observing systems

- Refine, maintain, and operate the existing facilities, conducting campaigns, producing and distributing freely available data sets, and performing critical research in support of instrumentation and facilities.

- New facilities and community efforts: the Airborne Phased Array Radar (APAR, on the C-130); the Coronal Solar Magnetic Observatory (COSMO); improved coordination and support atmospheric chemistry observations.

- Conducting observational and process research, developing new instrumentation and algorithms, and developing improved methodologies for data access, management and distribution.
Goals & Priorities: Facilities & Services

Develop, provide and support community models

• Accelerate advances in present community models, by incorporating improvements flowing from research at universities, government labs and NCAR and by enhancing their ability to couple models of different processes.

• Developing and releasing new high-resolution community modeling systems for weather-climate predictions/projections, spanning time scales from minutes to decades, with companion measures of uncertainty.

• Expand community access to community models through open and well-designed software along with infrastructure that supports effective utilization of the models and their results.
Goals & Priorities: Facilities & Services

Continue to enhance supercomputing and information services

• Preparing for next upgrade of NWSC computing and data systems, which will move into the trans-petascale regime and enable increasingly data-centric science

• Develop, maintain, and provide robust and portable cyberinfrastructure to support field campaign operations, acquisition and distribution of data from instruments and observing platforms, and near-real-time analysis.
Goals & Priorities: Facilities & Services

Develop new capabilities to deal with Big data

- Operate and maintain our existing suite of data services and tools while continuing to develop and distribute new data products and management and analysis tools to the science community.

- Accelerate development of new data-centric science workflows needed for multi-disciplinary research.

- Promote data publication and collaborate closely with external agencies and data archives to standardize metadata and enhance data discovery.
Goals & Priorities: Societal Benefits

Develop and transfer science that addresses societal needs

- Work with specific users in the development and implementation of advanced methods to observe, analyze and predict weather, air quality, and climate

- Transfer to the community state-of-the-art numerical models, data assimilation procedures, numerical techniques, and user-centric verification methods for atmospheric, climate, hydrological, and space weather forecasts

- Integrate the physical and social sciences to provide information on the societal impacts of and vulnerabilities to climate change, terrestrial and space weather, and improve the communication of risk and uncertainty to a diverse population.
Goals & Priorities: Societal Benefits

Integrate research and education

• Work with universities to understand their needs and identify opportunities for increasing the educational benefits from NCAR science

• Continue opportunities for collaboration among graduate students, their university advisors, and NCAR researchers and maintain strong engagement with UCAR K-undergraduate educational programs

• Increase the opportunities for involvement of NCAR scientists and engineers in teaching, including Web-based instruction, supervising students, and conducting other educational activities within the university community.
Goals & Priorities: Innovation

Encourage scientific exploration and new connections

• Encourage unfettered exploration across the scope of NCAR science by reserving at least 10% of scientific and engineering staff’s time for them to engage in self directed research on NCAR-relevant topics

• Develop and support interdisciplinary projects that join atmospheric science with ecological, hydrological, biogeochemical, health, and social science.
Goals & Priorities: Innovation

Attract and retain a talented & diverse group of people for our field

- Sustain a strong ASP Postdoctoral Fellowship program and other postdoctoral opportunities and experiment with new early-career term appointments for extraordinary performers

- Support the continued development of the UCAR SOARS program and similar efforts to aggressively reach and nurture a diverse range of candidates for all programs, visitor and employment opportunities.
Thank You

Questions and Comments?