NCAR’s Role
NCAR is a charter member of the Weather Working Group, a part of the Joint Planning and Development Office (JPDO), which has been given the responsibility to develop a modernized U.S. air transportation system. This multi-agency, long-term endeavor is called the Next Generation Air Transportation System, or NextGen. The FAA estimates that 70-75% of the 500,000+ /year air carrier delays are attributable to weather. The good news is that up to 60% of these delays can be avoided with better weather information and skillful application of that information to managing air traffic. NCAR’s R&D for NextGen covers the spectrum of future needs: development and operational transition of advanced aviation weather hazard information; dissemination to end-users; development of new decision support techniques; and the integration of advanced weather information into the full range of functional areas addressed by NextGen.

The primary Federal Agencies working together in NextGen are the Federal Aviation Administration (FAA), Department of Commerce (NOAA, National Weather Service), National Aeronautics and Space Administration (NASA), the Department of Defense, and the Department of Homeland Security (DHS). Additional participants include large and small corporations—airframe manufacturers, avionics suppliers, air traffic control suppliers, weather system vendors, systems engineering specialists, airlines—as well as academia.

What is NextGen?
The modernization of the air transportation system is a crucial national priority. Its planning time frame is through 2025, costs will be in the billions, and it will involve virtually every entity that foresees itself as a user, provider, or operator of the system. NextGen is as much a cultural change in doing business as it is a change in technology. In any case, “weather” is a keyword within any planned operational improvement. Functional areas specifically addressed in NextGen planning are:

- Airspace - oceanic, en route, airportal
- Aircraft - new technologies and operational capabilities
- Safety - exposure to risk, accident/incident reduction
- Security - exposure, response
- Environment - climate, noise and emission pollution
- Communications, navigation, surveillance
- Airport - operations
- Weather - what is, what will be, how will it be used

NextGen is comprehensive—curb-to-curb and everything in between. It will affect every aspect of air travel. NextGen's primary emphasis areas are informed support to automated decision support systems and tools that either assist, or where possible, eliminate manual air traffic management. Hybrid concepts will be explored that include human-over-the-loop decision-making, helping to assure the success of human intervention. Each proposed operational enhancement must demonstrate its worth in terms of enhancing the safety, efficiency and capacity of the national airspace system.

Weather Information is Critical
Few air traffic management-related decisions, whether by air traffic control, airline operations, or pilots, are made without careful consideration of the weather environment. Indeed, weather information permeates all functional areas of the national airspace system. That is why JPDO planning includes weather as a primary functional area, and weather integration is a key NextGen activity.
Weather R&D focuses on several impact areas:

- Turbulence: clear air, mountain wave, and convective
- Icing: in-flight and ground-based
- Storms: convective and winter
- Obstructions to vision
- Volcanic ash
- Space Weather
- Wake Vortices
- Environmental Impacts: noise, emissions

It is critical to accurately forecast these weather hazards because they close or reduce airspace capacity, thus affecting pilots from all aviation sectors. Timing and severity are both important to account for varying operational thresholds established by different user communities. With the introduction of decision support tools and concepts, probabilistic forecasting is another important dimension. And whether the decision maker is a machine or a human, the weather information cannot be data-centric, but rather must be readily understandable, unambiguous, and relevant to the decision at hand.

Helicopter Emergency Medical Service (HEMS) Tool

NextGen Net-enabled Weather (NNEW)

Fundamental to NextGen’s future success is the use of a common operating picture of the environment, including the weather situation, by every decision-maker involved with every decision. For weather, this means there must be a single authoritative source from which all users derive their weather information for decision support. The first step, then, is the creation of a multi-dimensional (time, space, uncertainty, severity) virtual data base, from which all users derive their unique weather information needs to form a common situational awareness and make decisions. And remember—the user can be a human or a machine, as in the case of machine-to-machine interactions.

NCAR’s historical focus on creating multi-dimensional weather impact data grids, that easily meet the needs for flight planning, is ideally suited to the NNEW application. The added probabilistic dimension for decision support applications is a current R&D enhancement.

NextGen and NCAR for the Future

All of the weather R&D and product development at NCAR supporting the NextGen capability will be sponsored by multiple Federal agencies and industry through the JPDO. The functional aspects of NextGen are contained in a NextGen Concept of Operations and are also translated into plans, programs, and operational enhancements in a series of highly-integrated documents, which represent consensus of all the participants. These are all living documents designed for flexibility. Weather is central to every functional area.

For More Information, Contact:
Dr. Bruce Carmichael
Director, Aviation Applications Program
National Center for Atmospheric Research
Research Applications Laboratory
PO Box 3000 Boulder, CO 80307-3000
303-497-8406
303-497-8401 fax
brucec@ucar.edu
www.ral.ucar.edu/aap