Weather in the NextGen Era – Digital Aviation Services

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Agenda

- NextGen Background
- Program Alignment
- Current Status
- Challenges
- Digital Aviation Services
- Summary

The Next Generation Air Transportation System (NextGen)

NextGen is a **Congressionally mandated** initiative to modernize the U.S Air Transportation System in order to:

- Increase capacity and reliability
- Improve safety and security
- Minimize the environmental impact of aviation

Weather impacts today:

- Weather accounts for 70% of all air traffic delays within the U.S. National Airspace System (NAS)
- The Federal Aviation Administration (FAA) has determined two thirds of this is preventable with better weather information

*****The total cost of domestic air traffic delays to the U.S. economy was as much as $41 billion for 2007.*****

Aviation Weather Today	NextGen (new requirements)
Not integrated into aviation decision support systems (DSS)	Totally integrated into DSS
Today's requirements can lead to inconsistent info	Updated requirements/ Nationally consistent
Low temporal resolution (for aviation decision making purposes)	High temporal resolution
Disseminated in minutes	Disseminated in seconds
Updated by schedule	Updated by events
Fixed product formats (graphic or text)	Flexible formats
"Stovepipes"	The 4-D Cube!

NextGen

- **Improvements to the air transportation system will be achieved by applying:**
  - ***Space-based navigation and integrated surveillance***
  - ***Digital communications***
  - ***Layered adaptive security***
  - ***Weather integrated into decision-making***
  - ***Advanced automation of Air Traffic Management***
  - **Net-centric information access for operations**

NextGen 4-D Weather Data Cube

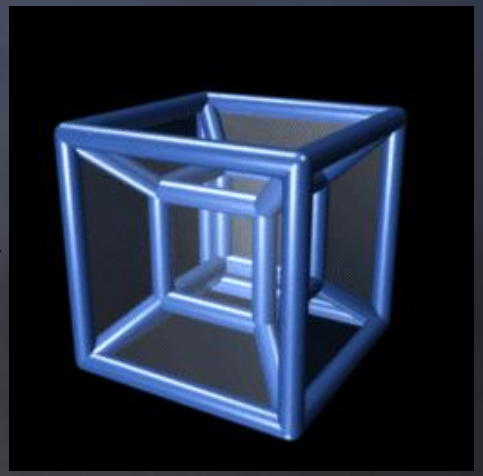
- **NextGen 4-D Weather Data Cube will access:**
  - ***Continuously updated weather observations (surface to low earth orbit, including space weather and ocean parameters)***
  - ***High resolution (space and time) analysis and forecast information (conventional weather parameters from numerical models)***
  - ***Aviation impact parameters for IOC (2013)***
- **NextGen 4-D Weather Data Cube will not be a big database, but a "system of systems" with metadata tagged, 4-dimensional, gridded weather information**
- **NextGen 4-D Weather Data Cube is a 'pathfinder' for other service areas, not just aviation**

Collaborations: 4-D Weather Data Cube

- NOAA collaborates with many different organizations to advance Cube capability
  - *National Weather Service (various divisions and centers)*
  - *FAA and other NextGen Partner agencies*
  - *NOAA Research*
  - *National Center for Atmospheric Research (NCAR)*
  - *Massachusetts Institute of Technology, Lincoln Labs (MIT/LL)*
  - *Open Geospatial Consortium (OGC)*
  - *European Meteorological Network*
- FY11 - expanding collaboration and data providers

Single Authoritative Source

- **The 4-D Weather Single Authoritative Source (SAS):**
  - ***Is only a portion of the 4-D Weather Data Cube***
  - ***Provides a common weather picture for National Air Space (NAS) participants (Airlines, Military, FAA, etc.)***
  - ***Is the basis for all aviation decisions by Air Traffic Management (ATM) in the FAA***
  - ***Is formed by merger of model data, automated gridded algorithms, climatology and observational data, and meteorologist input/data manipulation to ensure consistency and accuracy***



- **FAA and NWS collaboratively determine contents of SAS subject to FAA air traffic management needs**

Current NOAA NextGen Status

- Executed first formal year of program
- Completed successful multi-organization Capability Evaluation in Sep 2010
- Entering into acquisition in FY11 for IT infrastructure improvements
- Working R&D for:
  - *Single Authoritative Source*
  - *Verification techniques*
  - *Higher resolution modeling*
- Evaluating advanced forecast systems and techniques

Program Alignment

- **IT Services**
  - *Architecture and design*
  - *Prototype systems*
  - *Integrating existing systems*
  - *Production and deployment of systems*
  - *Enhancement of NWS infrastructure*
- **Contents**
  - *Forecaster tools and capabilities*
  - *Model improvement and development*
  - *Aviation weather parameter generation (e.g., thunderstorms, icing, turbulence, etc.)*
  - *Verification of 4-dimensional weather data*

Aligning with NWS Roadmap

- **NOAA NextGen Weather Program aligning with "Services Roadmap – Making the extraordinary…ordinary"**
- **Align with NextGen, including:**
  - ***Digital information***
    - Less emphasis on "grid editing"
    - More focus on end user of the information
  - ***Meteorological consistency***
    - Spatial in 3D
    - Temporal
  - ***User consistency***
    - Getting the same weather information from both our public and aviation forecasts
    - Getting the same answer no matter how you access the data

Challenges: International Harmonization

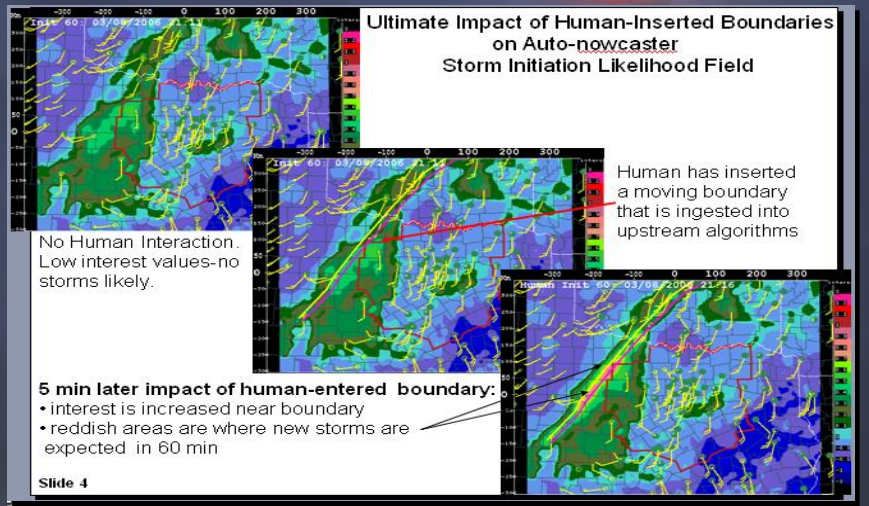
- Air travel is international
  - *Transition to more automated and integrated ATM systems requires harmonized, global scale weather and weather impacts*
- We need continuous international coordination to ensure seamless weather information for air transportation including:
  - *Harmonized data exchange*
  - *Agreed upon governance structure*

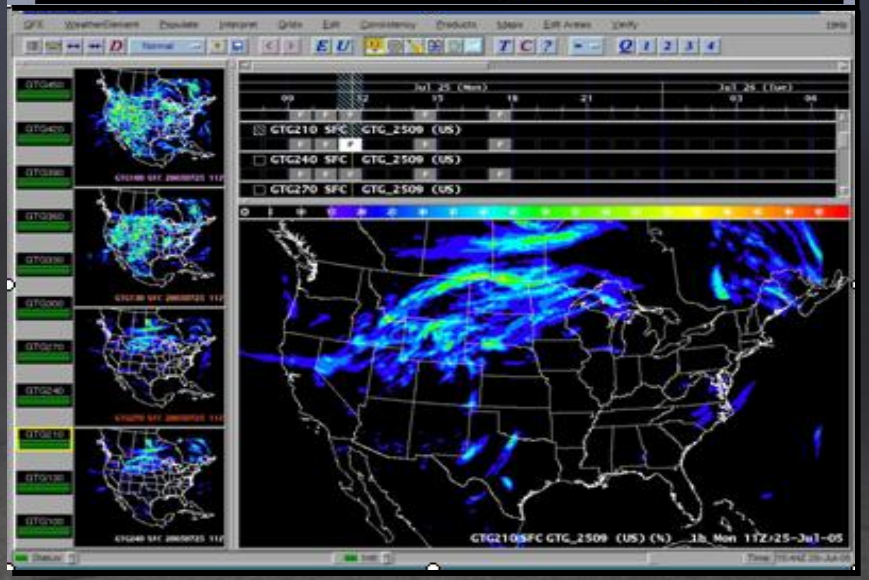
Challenges: Transition Research to Ops

- Need for basic research in fulfilling NextGen requirements is understood
- Need for applied research in delivering capabilities required for NextGen is paramount
- Balance of the two is key to success
  - *Must link operational requirements to basic and applied research and vice versa*

Challenges: NWS Forecast Process

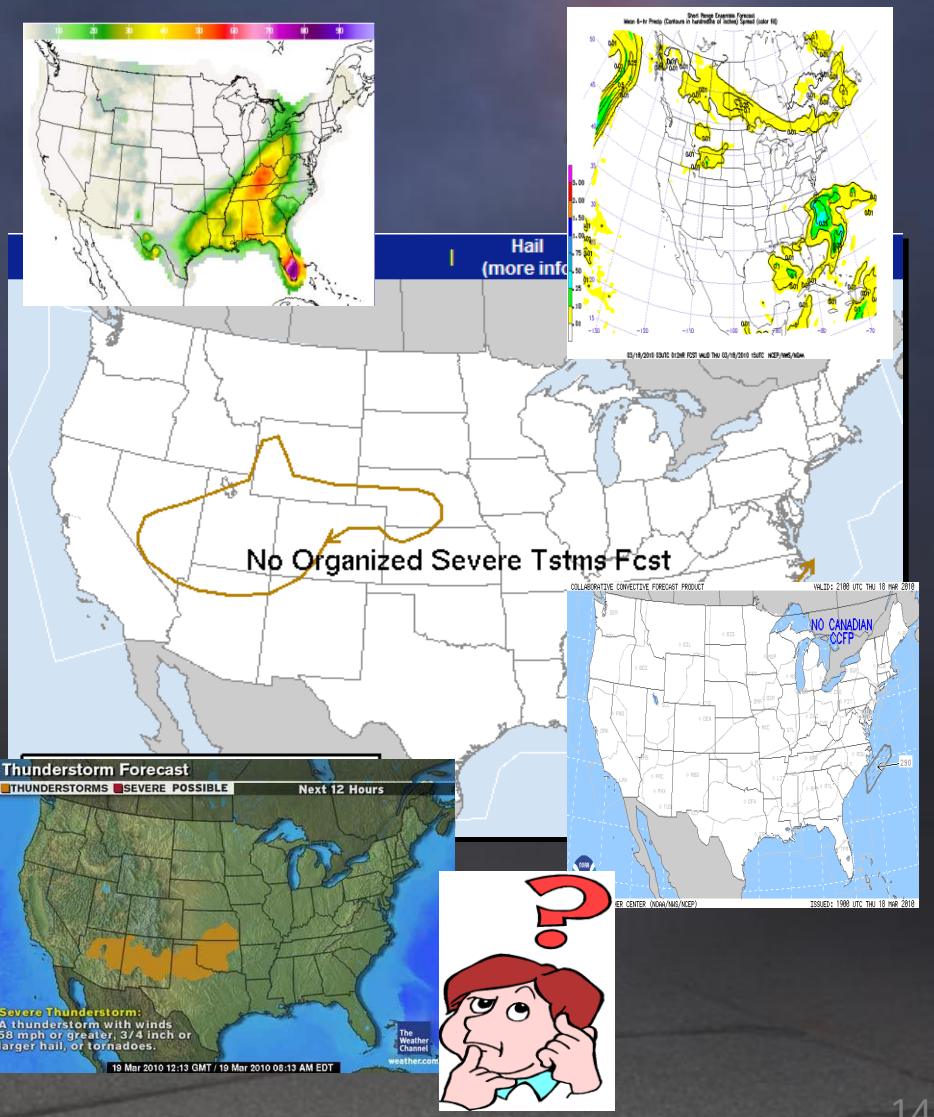
- In the era of high resolution, rapidly updating models, NWS forecaster responsibilities will change
- Some current initiatives under evaluation:
  - *Autonowcaster – convective initiation*
  - *Interactive Calibration of Aviation Grids in 4 Dimensions or (IC4D) – nudging model output*
- Real progress in the last few years is the realization that change is no longer a goal, but a necessity!



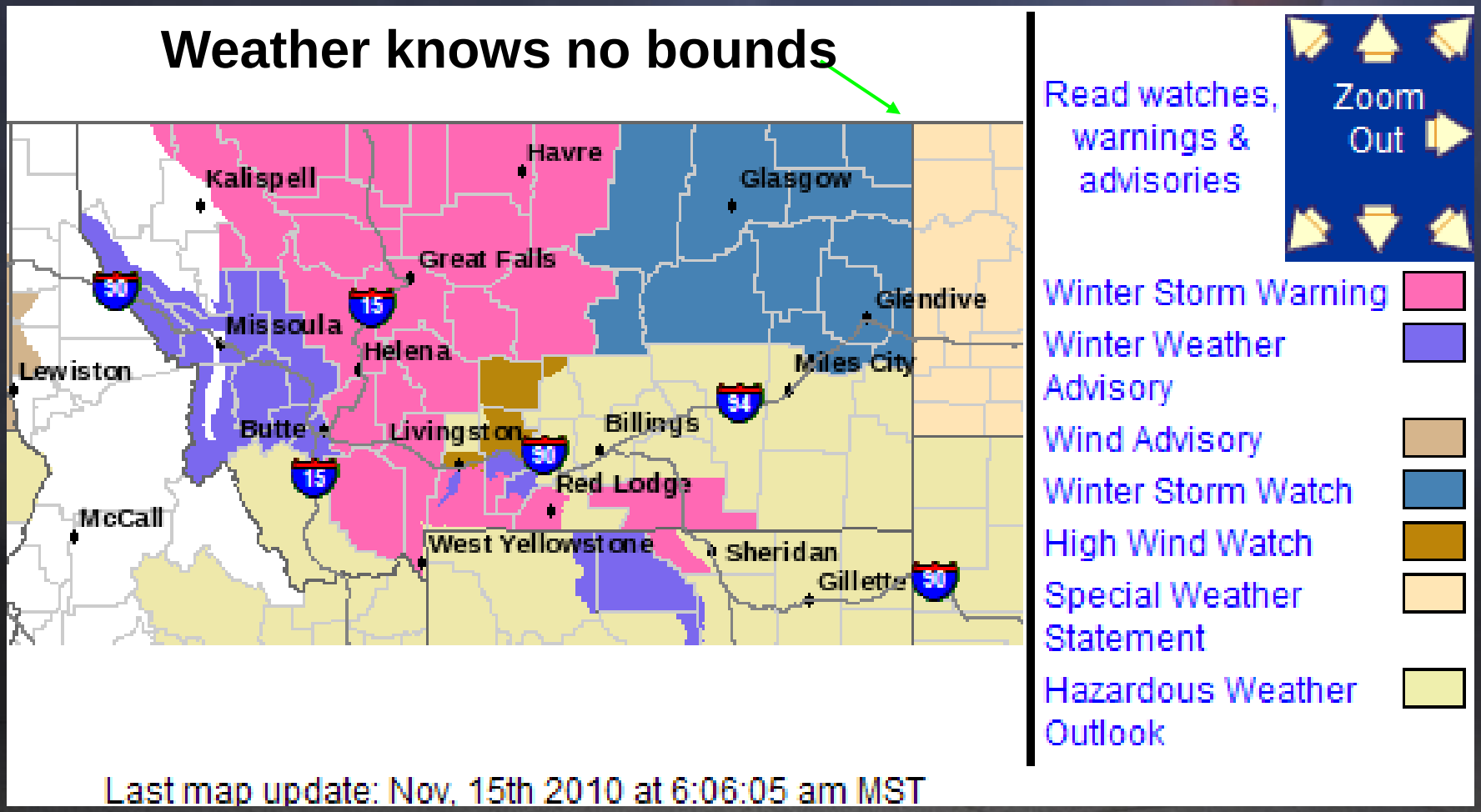


Challenges: Product Consistency

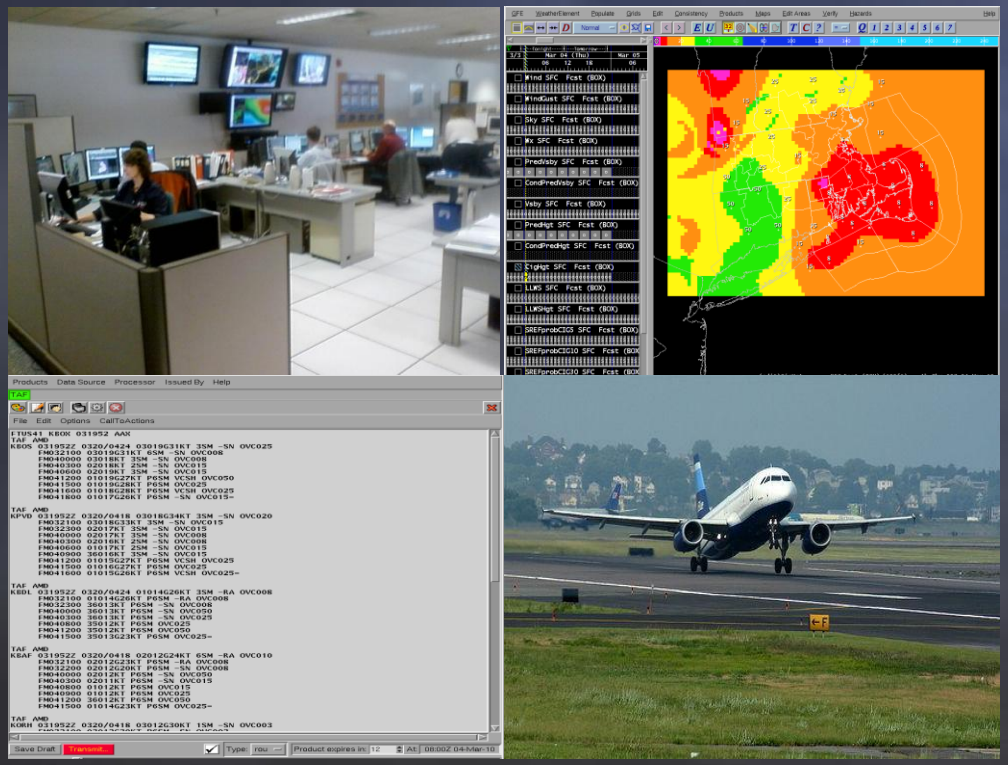
- A huge challenge for NWS (and the Private Sector) as they serve many customer needs
- Weather consumers are barraged by weather data… the easy answer is to plan for the worse
- Artificial "boundaries" on products



The "Consistency" Issue

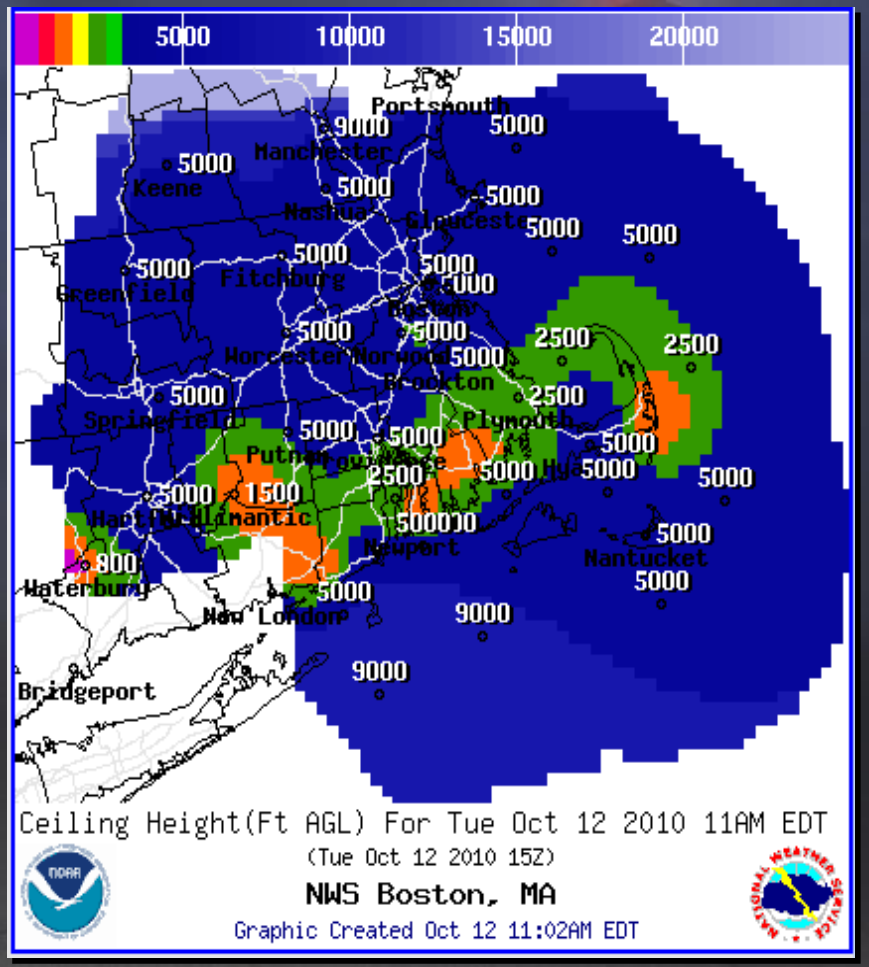


Digital Aviation Services



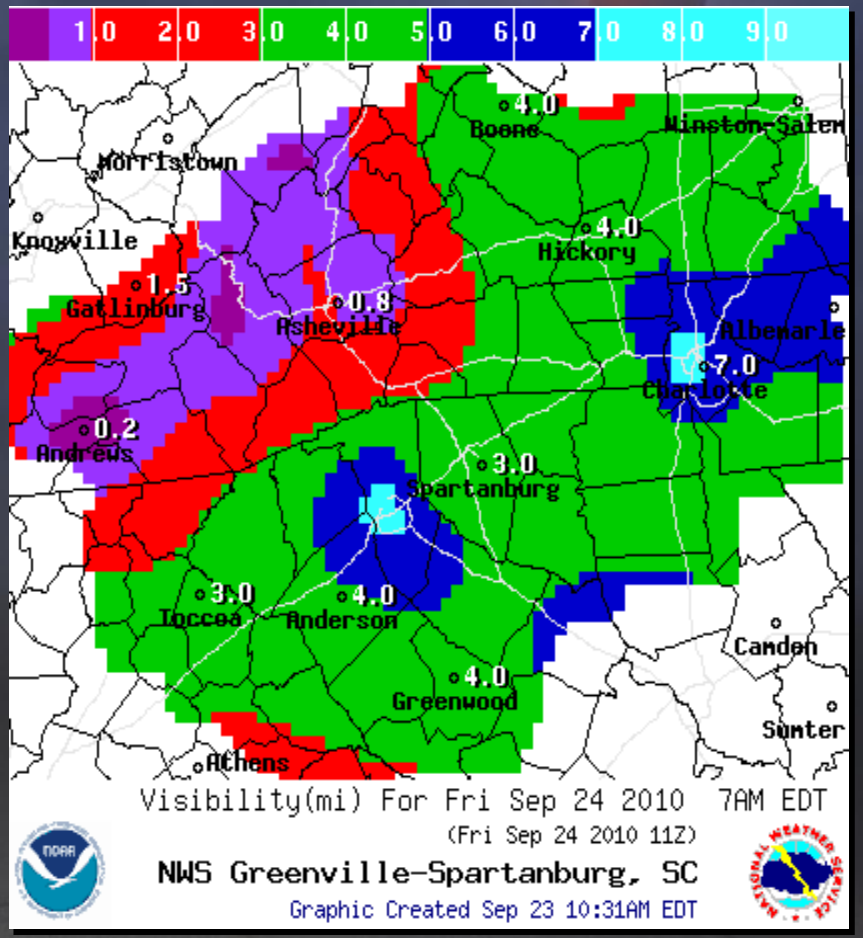
What are Digital Aviation Services

- Adding aviation elements to the National Digital Forecast Database (NDFD)
  - *Provide hourly graphical forecasts of ceiling and visibility out to 30 hours*
- Allows TAFs to fall out of the database with little or no post-editing



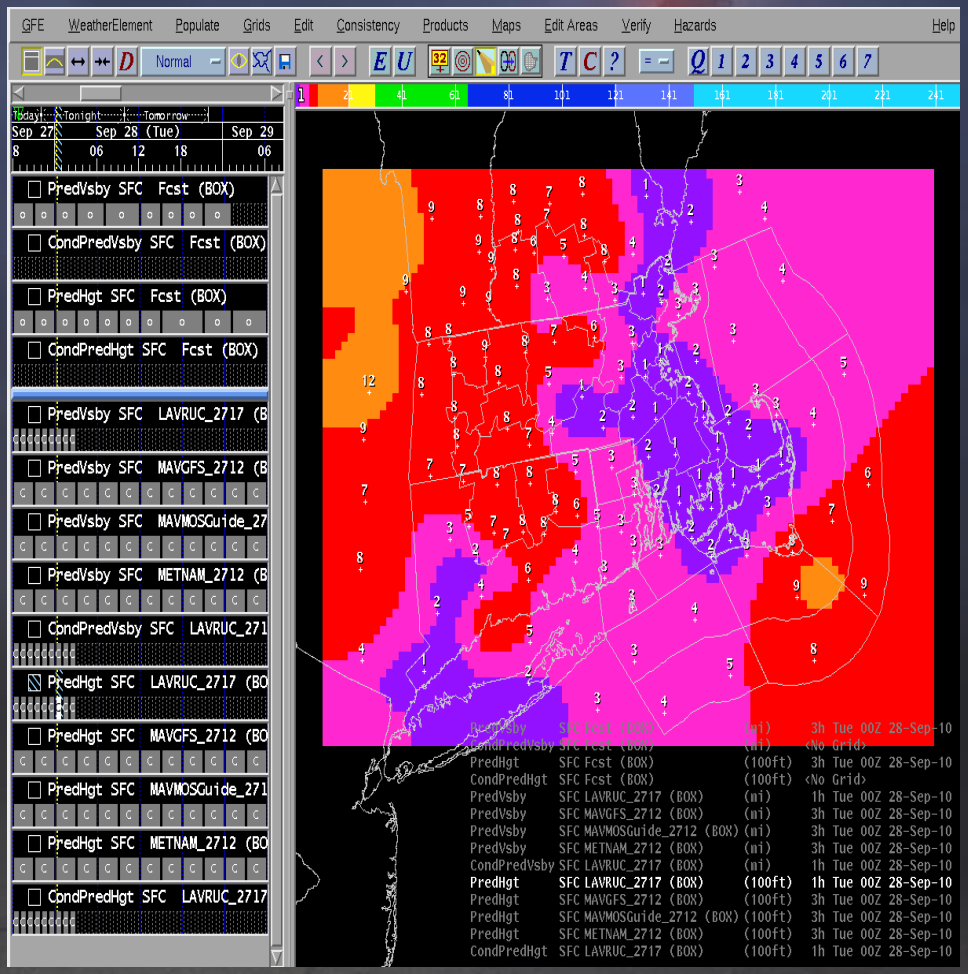
Why Digital Aviation Services

- Moves toward the NextGen requirements:
  - *Digital ceiling and visibility*
    - Build a national ceiling and visibility grid to be used by AWC
  - *Consistent aviation forecasts, the Single Authoritative Source (SAS) for C&V*
- Important guidance tool for medical services, search and rescue, and GA
- Improves NWS forecast consistency with aviation forecasts and beyond



Who is Producing Aviation Grids

- Participating NWS Forecast Offices are producing experimental digital forecasts of ceiling and visibility
  - *Boston, MA*
  - *Jackson, KY*
  - *Caribou, ME*
  - *Charleston, WV*
  - *Greenville-Spartanburg, SC*
- TAFs fall directly out of these grids



Operations Assessment

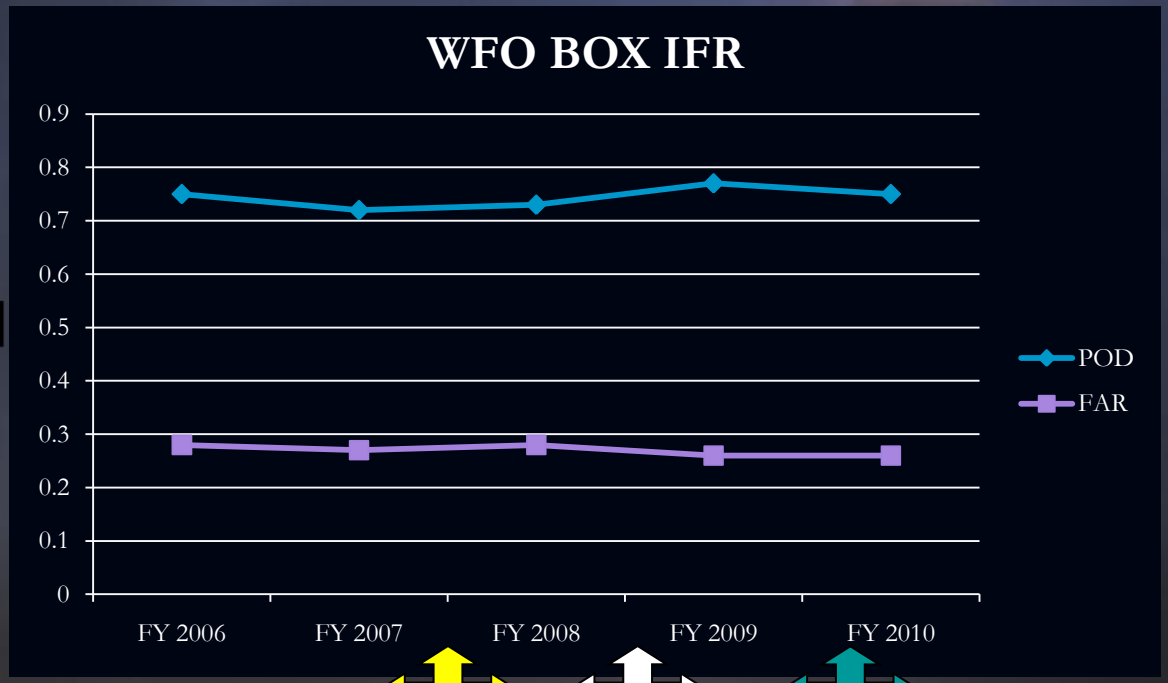
- **NWS Forecaster feedback has been very positive**
  - ***Prefer "keeping it simple" – all WFO products produced from one database***
  - ***Much easier to compose TAFs***
  - ***More efficient operations***
    - **Short-term forecaster no longer removed from grids to compose TAFs**
  - ***Improved product consistency***
  - ***Learning model biases to improve forecasts***

Operations Assessment

- **Customers noticing a difference:**
  - ***Increased consistency between TAFs and other products***
  - ***More frequent and proactive updates***
  - ***Forecast information available for any point in forecast domain***
  - ***Users can take the gridded database and create their own forecast products and displays***
  - ***"We have clearly noticed improved TAF performance and improved consistency in all public forecast products in the Boston area since NWS has been producing TAFs from the ceiling and visibility grids." - Rick Curtis, Chief Meteorologist, Southwest Airlines***

NWS Boston Verification

- No notable decrease in scores since beginning digital aviation services...some have improved



Began 3-h TAF Updates

Began Enhanced Short Term

Began Digital Aviation Services

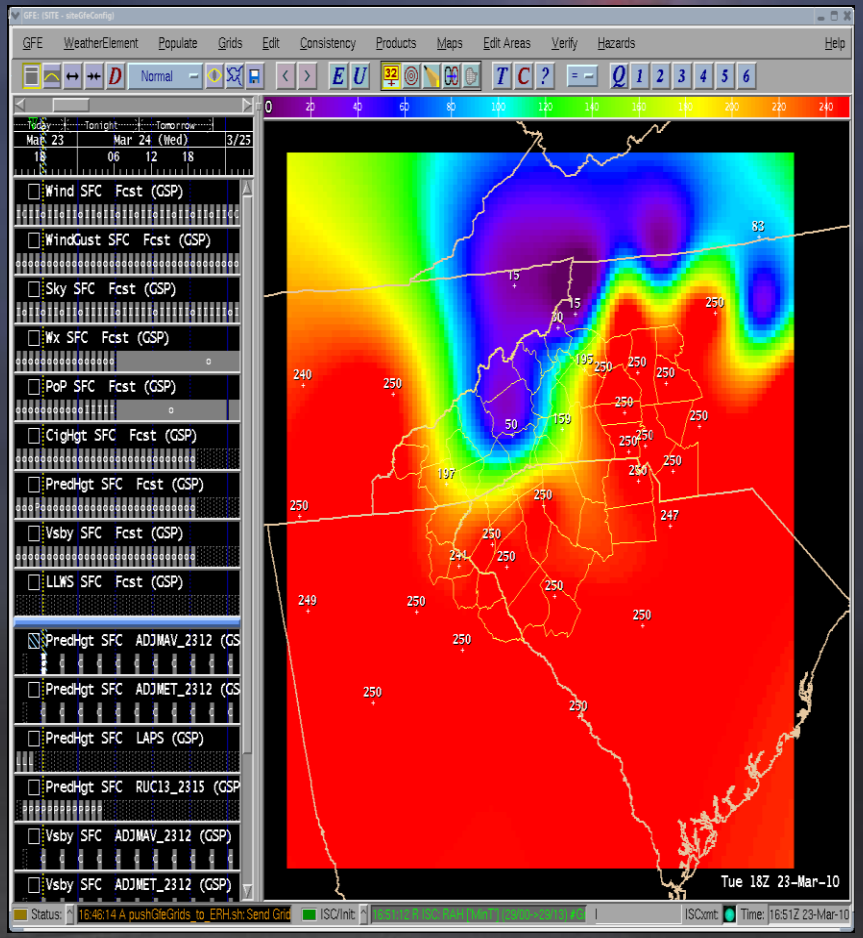
NWS Charleston Verification

	FY06	FY07	FY08	FY09	FY10
Probability of Detection (POD)	.578	.534	.573	.592	.611
False Alarm Ratio (FAR)	.385	.398	.408	.406	.407
CSI (Critical Skill Index)	.424	.395	.411	.421	.430
% CSI improvement over MAV	26.4%	34.5%	29.9%	25.5%	32.0%

- Aviation grids began at NWS Charleston in 2006
- Overall - fairly steady and in the right direction
  - No significant decrease in quality
- Best scores in last 5 years were in 2010

Current and Future Initiatives

- Coordinate the national requirements
- C&V transition between forecast offices
- Verification of forecasts at non-TAF sites
- Enhance verification for the future
- Assess new guidance tools e.g. - Gridded LAMP, and high resolution numerical model output
- A national C&V grid used by AWC to produce the Area Forecast



Current and Future Initiatives

- **Interagency Collaboration**
  - ***NWS working with FAA and Private Industry on FAA led C&V Research Transition Team. Team is tasked to:***
    - **Assess multiple C&V products**
    - **Build a coherent roadmap toward NextGen requirements**
    - **Help facilitate process to transition into operations**
  - ***Team is now well aware of NWS goal to build gridded national ceiling and visibility products - and the critical role this product will have in the SAS***

Summary

- **Foundation established for NOAA participation in NextGen**
  - ***Developing IT architecture and design for IOC***
  - ***Maturing program and management processes***
- **Establishing R&D initiatives for MOC and FOC**
- **The Future of Digital Aviation**

NextGen Weather State of the Union

The wording used in this cartoon strip is the original wording as printed on 06/26/2010, and was not modified in any way for the purposes of this briefing.