Aviation Weather Testbed Overview

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Techniques Development Meteorologist
AWC

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Outline

- AWC Mission and Overview
- Testbed Objectives
  - NextGen Activities
  - Product Evaluation
  - GOES-R Training
  - AWIPS-II Migration
- AWT Experiments
  - Past and Future
AWC Vision
To be the trusted authority and leading innovator for aviation weather information.

AWC Mission
The AWC delivers consistent, timely and accurate weather information for the world airspace system. We are a team of highly skilled people dedicated to working with customers and partners to enhance safe and efficient flight.
Aviation Weather Center Staff

**Director:** Bob Maxson

**Deputy Director:** Clinton Wallace

**WCM:** Pat Murphy

**Executive Officer:** Cmdr. Joe Bishop

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**WCM:** Pat Murphy

**Executive Officer:** Cmdr. Joe Bishop

**International Chief:** Matt Strahan

**Global Forecasters:** Doug Behne, Steve Burbach, Hugh Crowther, Richard Douglass, Nolan Duke, Ted Hoffman, Ed Holicky, James Joynes, Marissa Sette, Jonathan Slemmer, Jesse Sparks, Adam Stout, Dan Zacharias

**Support Branch Chief:** David Bright

**SOO:** Bruce Entwistle

**TDM:** Steve Lack, Ryan Solomon, **VACANT**

**R&D:** Steve Silberberg, Amy Harless, Tim Mahoney

**IT Specialists:** Steve Chance, Larry Hinson

**CIRA IT Specialists:** Dan Vietor, Adrian Noland, Larry Greenwood, Mick Ohrberg, Chad Hill, Lee Powell

**CIRA NextGen Met:** Ben Schwedler

**CIRA AWRP Met:** Brian Pettigrew

**CIMSS GOES-R Met:** Amanda Terborg

**Jamison Sys. Engineer:** Jim McDuffie

**Summary:**
52 Federal Employees  
7 Vacancies  
11 Contractors
AWC’s Partners/ Stakeholders

- FAA
  - Command Center
  - Flight Service Stations
  - Research and Development (AWRP)
  - Policy and Requirements
- NWS
  - CWSUs
  - AAWU
  - WFOs
  - NCEP Centers
    - SPC, SWPC, TPC, HPC, NCO
- USAF
  - Weather Agency (AFWA)
  - 15 OWS, Scott AFB
  - Airline Met Services
  - United Kingdom’s Meteorological Office
  - Meteorological Service of Canada (MSC)
Domestic Operations Branch

- Five Operational Desks
  - FA East, Central, West
  - CCFP (Collaborative Convective Forecast Product)
  - Convective SIGMET

- Domestic Products
  - SIGMETs – Aviation Warnings
  - AIRMETs – Aviation Advisories
  - FA – Aviation Area Forecast
  - CCFP – NAS Convective Planning Forecast
  - SIGWX Low – Significant Low-Level Aviation Graphic
International Operations Branch

- **Three Operational Desks**
  - SGWX Northern Hemisphere
  - SGWX Southern Hemisphere
  - Tropical Desk

- **International Products**
  - Significant Weather High
    - Global 24-hour High-Level Forecasts
  - Oceanic SIGMETs
    - Aviation Warnings for Atlantic and Pacific
  - FACA and FAGX
    - Area forecasts for the Caribbean and Gulf of Mexico
AWC’s Area of Responsibility for Aviation Warnings (SIGMETs)
World Area Forecast Center

- World Area Forecast System (WAFS)
  - Formulated by ICAO and the WMO
  - Improve the quality and consistency of enroute guidance provided for international aircraft operations
- World Area Forecast Centers (WAFC)
  - WAFC – Washington
    - AWC provides Significant Weather Forecasts
    - NCEP Central Operations Provides Wind and Temperature Grids Charts
  - NWS Telecommunications Gateway supports satellite data broadcasts
  - WAFC – London
    - Met Office – Exeter
# AWC Product Issuances

<table>
<thead>
<tr>
<th>Product</th>
<th>#/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convective SIGMET</td>
<td>30,000</td>
</tr>
<tr>
<td>Non-Convective SIGMET</td>
<td>500</td>
</tr>
<tr>
<td>Collaborative Convective Forecast Product (CCFP)</td>
<td>25,000</td>
</tr>
<tr>
<td>AIRMETs</td>
<td>26,280</td>
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<tr>
<td>Area Forecasts (FA)</td>
<td>6,570</td>
</tr>
<tr>
<td>Significant Weather Low</td>
<td>1,460</td>
</tr>
<tr>
<td>Significant Weather High</td>
<td>18,890</td>
</tr>
</tbody>
</table>
Aviation Weather Testbed Mission

- Focus on support and enhancement of AWC’s mission and its customers and partners.
- Explore and develop science and technology innovations
- Assesses results relative to existing operations
- Accelerates transition of promising technologies into NWS operations
- Key player in developing aviation weather services for NextGen
R ↔ O

- **Research to Operations:**
  - Traditionally the focus of testbeds
  - A lot of aviation research going on across the board
    - NWS -> (MDL, ASB, NextGen, AWC, SPC)
    - NOAA OAR -> (GSD, NSSL)
    - FAA (AWRP, CDM WET)
    - NCAR/MIT LL
    - MITRE/AvMet
  - Many products are tested and transitioned in some way through the AWT

- **Operations to Research:**
  - Cannot be ignored
    - HITL/HOTL considerations
  - Is this product useful for the AWC forecaster?
    - Scope of the product (time and space)
    - Verification compared to other operational tools
    - Efficiency of job-related tasks
    - Training considerations
GTG and FIP

Current and Forecast Icing Product (CIP & FIP) and Graphical Turbulence Guidance (GTG) are operational through aviationweather.gov as a supplementary guidance product.

CIP, FIP and GTG are available for use by the forecasters through NMAP. Forecasters had little interaction with this product through the testbed during product development. Example of weak O -> R.
New Web Design

- Use of open layers for displaying features, SIGMET, AIRMET.
- Compatible with new NextGen data formats and requirements
- Compatible for tablets/mobile devices for easier use for the aviation community
- Retains classic views that will slowly be deprecated
- Tested and vetted through the AWT
NextGen at AWC

- NextGen effort has two primary parts
  - Content: New/Enhanced data and products
  - Information Technology: Dissemination methods

- Content
  - Fusion of weather and air-traffic information
  - New additions are largely probabilistic
  - Blending of forecast information from multiple sources
NextGen Data Dissemination

- Open Geospatial Consortium (OGC) Web Services
- Machine-to-machine data formats
  - Meta-data included for better product information
  - Searchable registries for users to locate data
- NextGen IT Web Services
  - NWS effort to provide NextGen data formats to the FAA
  - Allows subscriptions based on hazard, time, location, and other relevant parameters
NextGen Data Formats

- Gridded data provided in NetCDF
  - Follows CF conventions for variable and meta-data
  - Meta-data included within the data file
- Non-Gridded data disseminated in XML
  - Weather Exchange Model (WXXM)
  - AWC is a contributing developer for the XML schema used to describe aviation forecast products
AWRP Product Testing

- Aviation Weather Research Program
  - FAA NextGen weather focus within FAA
- New convective product examples:
  - Large-scale Convective Probability
    - HRRR and AFWA versions for large-scale convection forecasting including convective initiation
  - Ensemble Prediction of Oceanic Convective Hazards (EPOCH)
- Turbulence product examples
  - GTG3 (unknown status for AWT activities)

*There is no support for AWRP products in official AWT activities, but this collaboration is necessary to support the AWC users. A formal FAA-NWS testbed relationship should be considered.
NCAR’s EPOCH over N Pacific used in 2013 AWT Summer Experiment

NCAR’s Large Scale Cl and Convective Likelihood fields used in the 2013 AWT Summer Experiment
NOAA Product Testing

• Model upgrade evaluations
  – Ceiling and Visibility Improvements
    • SREF primarily
  – LAMP Evaluation
  – HIRES Window Evaluation

• New aviation forecast tools
  – HRRR Convective Probability Forecasts
  – NARRE Aviation Variables
  – NSSL WRF Aviation Variables
  – INSITE (NE US Convective Guidance based on Impact)
Flight Rules (Ceiling & Visibility) Improvements

SREF Parallel vs.
Operational – Flight Rule Distribution
February 1-28, 2014

West Coast (Western OR/WA/CA)

Northeast (NJ/Ern NY to Ern ME)

- Overall, much improved distribution of C&V flight categories
  - Ceiling in particular very much improved (not shown)
  - Snow: High LIFR much improved; introduced a small, high VFR bias in snow
  - Rain: Generally improved all categories
  - None: LIFR improved NE and West; High VFR bias WC slightly increased
MDL’s ANC convective likelihood field used for situational awareness available during the 2013 AWT Summer Experiment

TL HRRR Convective Probability Forecast available during the 2013 AWT Summer Experiment
See the INSITE Poster!
AWC Product Development

- Dashboards
  - Winter and Summer
- ECFP (Extended Convective Forecast Product)
- First Guess CCFP
- FA (Area Forecast) Guidance
- Timeliness Dashboard
  - Allows forecasters to address AWC issuance problems and efficiency
- Ensemble Processor
- Forecast Evolution
  - New National Aviation Meteorologist at FAA Command Center
Ensemble Processor: Joint work with CIRA, Customizable functions, output to GRIB2, NAWIPS formats, etc.
# 2014 GOES-R Evaluations

## 2014 Demonstrations for the Aviation Weather Center – CIMSS products

| Evaluation Period I | 1 March – 19 May | • Longer term demonstration periods, by-in-large one on one with forecasters  
| | | • Products vary by desk (i.e. C&V, icing, and turb tools at the FA desk, CI and lightning tools at CSIG and CCFP, etc.)  
| | | • Feedback collected via verbal discussion  
| Evaluation Period II (including a trip to the ATCSCC in DC) | 19 May – 19 September | • A one week, dedicated demonstration period in the AWT including both internal and external participants  
| | | • Feedback collected verbally and via surveys  
| Summer Experiment (C&V and convection focused) | 11 – 15 August |  

GOES-R Training

- **Seminars**... three ~30 minute, formal training seminars to introduce a new product
- **Quick guides**... short, one page overviews of each product; a brief summary, advantages and disadvantages, ways to use the tool in operations, links to additional material, and an example (sample on the left)
- **2-minute case studies**... short, ~5-8 slide cases of a product being used for aviation forecasting operations. Sample on the next slide...
2-minute Case Study sample: August 13th, 2013... 1645 – 1945 UTC Convective Initiation and 1755 and 1855 UTC 2-hour CSIG outlooks

- 2-hour experimental CSIG outlooks
- Note the increasing trend in probabilities
- Outlook indicating tops to FL400 and increasing along the sea breeze front within the next two hours
- Outlook indicating tops greater than FL400 within the next two hours

% probability of CI that will result in a 35 dBZ radar echo
AWIPS-II and GOES-R

- **Step 1**: AWC operational satellite imagery
  - Ingestion
    - GOES-E and GOES-W data currently being pulled in via dbnet
    - Mosaic imagery to follow shortly
  - Configuration and display

- **Step 2**: GOES-R experimental imagery from the AWT
  - Non-SBN data flow
  - Configuration and display

- **Step 3**: GOES-R operational imagery (post-launch)
  - SBN and non-SBN data flow using the expected netcdf4 format
  - Configuration and display
AWIPS-II Testing

• AWIPS-II team has been developed at AWC
  – Forecasters, IT Specialists, SOO
• Begin testing of AWIPS-II capability to issue the domestic Convective SIGMET
  – Currently done in NMAP toolsets
• Begin to migrate other operational desks to AWIPS-II testing
• Eventually simulate full forecast operations in the testbed with full forecaster training
  – 8 operational desks will run live parallel tests using AWIPS-II instead of NMAP
AWT Layout

Example of the AWT Layout for the 2013 Summer Experiment, one more AWT workstation will need to be added for full simulation of the operational environment.
AWT Experiment History

• Inaugural Summer Experiment 2011
  – Convective product focus:
    • CoSPA, Ensemble forecasts
    • GOES-R Products

• 2\textsuperscript{nd} Summer Experiment 2012
  – Aviation Weather Statement development for the NE US
  – Convective model performance

• 1\textsuperscript{st} Winter Experiment 2013
  – Experimental Icing and Turbulence Guidance
    • Global and International Focus, Ensemble vs Deterministic

• 3\textsuperscript{rd} Summer Experiment 2013
  – Convective desk evolution, what can we provide differently
  – NAM desk, N Hemisphere Convection, GOES-R and new lightning datasets
2013 Summer Experiment Participants
2014 Summer Experiment

• One week 11-15 August 2014:
  – Staff shortage
  – Will have internal mini-experiments throughout summer as time and forecaster availability permits

• 2 main goals:
  – Ceiling and Visibility Improvement
    • Evaluate high resolution forecasts and ensemble forecasts for best practices and best displays
    • Experiment with longer lead time forecasts
    • GOES-R ceiling and visibility products
  – Scope an Operational CONUS Aviation Weather Statement (convection)
    • Work with the CDM WET to jointly develop an official AWS ConUse/ConOps
    • Experiment with the real-time issuance of this event-drive product as a supplement to CCFP
Upgrades to AWT

• Additional workstations, some computing upgrades to support AWIPS-II migration
• Allow for ‘friendlier’ remote participation in testbed activities
  – Set up webex clients on all workstations, allow for sharing seminars and experiment post mortems on any testbed computer
  – Each workstation will have mic/speakers for audio
  – All sessions will be recorded via webex for archival purposes
    • Q&A better recorded
Questions/Comments

Testbed and Support Branch Questions:
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AWT Experiment Questions:
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