NextGen Weather Systems

Common Support Services-Weather (CSS-Wx) and NextGen Weather Processor (NWP)

Presented to: FPAW

Presented by: Alfred Moosakhanian, FAA AJM-333

Date: August 2016
Purpose

• **Provide NextGen Weather Systems status**
  - Common Support Services- Weather (CSS-Wx)
  - NextGen Weather Processor (NWP), including Aviation Weather Display (AWD)

• **Announce upcoming event**
  - FAA PMO NextGen Weather Systems User Forum in October 2016
Delivering NextGen Improvements

Legacy System
- Radar
- Inefficient Routes
- Voice Communications
- Disparate Information
- Fragmented Weather Forecasting
- Weather Restricted Visibility
- Forensic Safety Systems
- Nationwide Focus

NextGen
- Satellite
- Performance Based Navigation (fuel savings)
- Voice & Digital Communications
- Automated Decision Support Tools
- Integrated Weather Information
- Improved Access in Low Visibility
- Prognostic Safety Systems
- Focus on Congested Metroplexes

https://www.faa.gov/nextgen/programs

Implementation
- TFDM
- PBN
- TBFM
- ASIAS
- AIM
- NWP

Transformational
- ADS-B
- CATM-T
- SWIM
- CSS-Wx
- NVS
- DataComm

Foundational
- Terminal Automation Modernization and Replacement
- En Route Automation Modernization
- Terminal Automation Modernization and Replacement

Aviation Data
Key Benefits of CSS-Wx and NWP

Reduce FAA Operations Costs
$2.0B Cost Avoidance Over 25 Year Lifecycle Including $350M Ops Cost Savings
Eliminates Need for Legacy System Tech Refreshes

Modernize National Airspace System
Decommission Outdated Systems
Leveraging SWIM and FTI
Cloud Compatibility
Global Data Standardization

Improve Efficiency
Over $2.8B of User Benefits
Reduce Flight Delays
Enable Collaborative Decision-making

Improve Safety
Enhanced Weather Information
Greater Access
Common Situational Awareness

NextGen Weather Systems
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NextGen Weather Systems Scope

Common Support Services – Weather (CSS-Wx)

- Provides a single source for FAA weather information and establishes enterprise level common support services using SWIM
- Focuses on weather information management, publishing to support users, and providing new interface standards and formats
  - Consistent with global standards (e.g., WXXM)
  - Provides geospatial data access services (WFS, WCS, WMS, WMTS)
- Enables decommissioning of legacy weather dissemination systems (e.g., WARP WINS, FBWTG, CDDS)

NextGen Weather Processor (NWP)

- Produces advanced aviation specific weather products
  - 0 to 8 hour aviation weather products
  - Real-time weather radar information (e.g., ERAM)
  - Convective Weather Avoidance Fields
  - Wind Shear alerts
- Translates weather information into weather avoidance areas for integration into decision support tools (e.g., TFMS, TBFM)
- Provides Aviation Weather Display (AWD) of NextGen weather information for ATC users
- Enables decommissioning of legacy weather processor systems (e.g., WARP, ITWS, CIWS)
NextGen Wx Systems Architecture

NextGen Weather Processor (NWP)

Common Support Services – Weather (CSS-Wx)

Stakeholders
NAS Web Users

ATCTs
TRACONs
CERAPs
ARTCCs

Central & Terminal Processors

CONUS+
Terminal Domains

ARTCC & Terminal Domains

Canadian Wx Radars

WMSCR/ADAS
Surface Obs Networks

LLWAS/TDWR

NEXRAD

MDCRS

Satellite

NOAA Data

Lightning Networks

Flight Services, Providers, Airlines

Legacy Weather Consumers

Modern Weather Consumers

External Weather Consumers

System Wide Information Management (SWIM)

Aeronautical Information Management Modernization (AIMM)

Stakeholders
NESG

ASR

LLWAS/TDWR

Flight Services, Providers, Airlines

Legacy Weather Consumers

Modern Weather Consumers

External Weather Consumers

System Wide Information Management (SWIM)

Aeronautical Information Management Modernization (AIMM)

Flight Services, Providers, Airlines

Legacy Weather Consumers

Modern Weather Consumers

External Weather Consumers

System Wide Information Management (SWIM)

Aeronautical Information Management Modernization (AIMM)

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Safety Improvements

• New architecture makes terminal safety products available domain-wide
• New processing enables rapid convective growth detection
• New products provide low-cost options for expanding terminal weather coverage
Efficiency Improvements

- Operational implementation of 0-8 hour “radar-forward” predictions
- Translation of weather products into pilot avoidance metrics
- Enables decision support tool development with tailored access via SWIM

Decision Support for Strategic Traffic Flow Management

4D Flow Constrained Areas

Efficient In-flight Reroutes

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NextGen Flexible Layer Mosaics

- **NWP reflectivity mosaics update every 25 sec**
  - New volumes are created with each new radar tilt
  - All tilts are time-aligned in each new volume
  - Trends are computed between ‘like’ volumes
  - All volume products are time-aligned in making multi-radar mosaics

- **Example shows** Composite Reflectivity from “floor” to 60 Kft
  - Layer bottom (“floor”) and layer top (“ceiling”) selectable in 1 Kft increments
  - NextGen Weather radar mosaics contain fine-scale vertical storm structure
NextGen Storm Information

NWP Growth Trend shows danger 10 min before aircraft entered storms

Delta hail encounter August 8, 2015 around 2:00 UTC

NWP WXXM 2.0 Products Shown
- Aggregated Tornado Detections
- Storm Information Echo Tops
- Storm Information Hazard Texts
- Storm Information Leading Edges
- Storm Information Motion Vectors
- Growth Trends

Safety Benefits of NextGen Weather

Storm Info Hazard Text

Tornado Icon

Growth Trends 25 sec update

NWP Growth Trend shows danger 10 min before aircraft entered storms
AWD Integrated Icing and Turbulence

Example Mock-Up: Icing Contours overlaid on NWP radar mosaics
AWD NAS and External Users

External Users Top 10

NAS Users

En Route Displays
Terminal Displays
NWP Current and Future Products

Convective Weather Avoidance Polygons
Forecast Confidence
Offshore Precipitation
4D Trajectory Weather

Per-Radar Processing
Mosaic
Analysis
0-8 hour Prediction
Weather Avoidance
Scoring
Post Processing

NWP Product Generation Platform
CSS-Wx/NWP Implementation

Current Wx Dissemination:
- WARP WINS
- CDDS
- ITWS Web Server
- CREWS

Legacy Wx Dissemination:
- WMSCR
- ADAS
- ALDARS
- WIFS

Current Wx Processing:
- WARP RAMP
- CIWS
- ITWS

Contract Award: April 2015

CSS-Wx Work Package 1

NWP Work Package 1

CSS-Wx Work Package 2

NWP Work Package 2

NWP Work Package 3

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Upcoming User Forum

• To be hosted by FAA AJM-333 in October 2016
  – During ATCA conference in Washington DC

• Internal and external weather providers and consumers are welcome to participate
  – Contact alfred.moosakhanian@faa.gov
  – Register at http://nextgenweathersystems.com/

• Agenda
  – Program schedule
  – Weather products
  – Data format and access
  – Interface and documentation
Backup
Key Acronyms

- ACS: Aeronautical Common Services
- ADAS: Automated Weather Observing System (AWOS) Data Acquisition System
- AIMM: Aeronautical Information Management Modernization
- ARTCC: Air Route Traffic Control Center
- ASR: Airport Surveillance Radar
- ATCSCC: Air Traffic Control System Command Center
- ATCT: Airport Traffic Control Tower
- ATOP: Advanced Technologies and Oceanic Procedures
- AWD: Aviation Weather Display
- BT: Briefing Terminal (WARP)
- CARS: Common Air Route Surveillance Radar
- CDDS: CIWS Data Distribution Service
- CERAP: Combined Center Radar Approach Control
- CIWS: Corridor Integrated Weather System
- CREWS: CTAS Remote Weather System
- CSS-Wx: Common Support Services for Weather
- DOTS+: Dynamic Oceanic Tracking System Plus
- ERAM: En Route Automation Modernization
- FBWTG: FAA Bulk Weather Telecommunications Gateway
- FDP2K: Flight Data Processing 2000 System
- FTI: Telecommunications Infrastructure
- ITWS: Integrated Terminal Weather System
- LLWAS: Low-Level Windshear Alert System
- MDCRS: Meteorological Data Collection and Reporting System
- Micro-EARTS: Microprocessor En Route Automated Radar Tracking System
- NAS: National Airspace System
- NESG: NAS Enterprise Security Gateway
- NEXRAD: Next Generation Weather Radar (WSR-88D)
- NFU: NWS Filtering Unit
- NOAA: National Oceanic and Atmospheric Administration
- NWP: NextGen Weather Processor
- OGC: Open Geospatial Consortium
- RAMP: Radar Acquisition and Mosaic Processor
- SD: Situation Display
- STARS: Standard Terminal Automation Replacement System
- SWIM: System Wide Information Management
- TBFM: Time Based Flow Management
- TDWR: Terminal Doppler Weather Radar
- TFMS: Traffic Flow Management System
- TMAR: Terminal Automation Modernization and Replacement
- TRACON: Terminal Radar Approach Control
- WARP: Weather and Radar Processor
- WCS: Web Coverage Service
- WFS: Web Feature Service
- WINS: Weather Information Network Server
- WMS: Web Map Service
- WMSCR: Weather Message Switching Center Replacement
- WMTS: Web Map Tile Service
- WSP: Windshear Subsystem Processor
- WXXM: Weather Information Exchange Model