

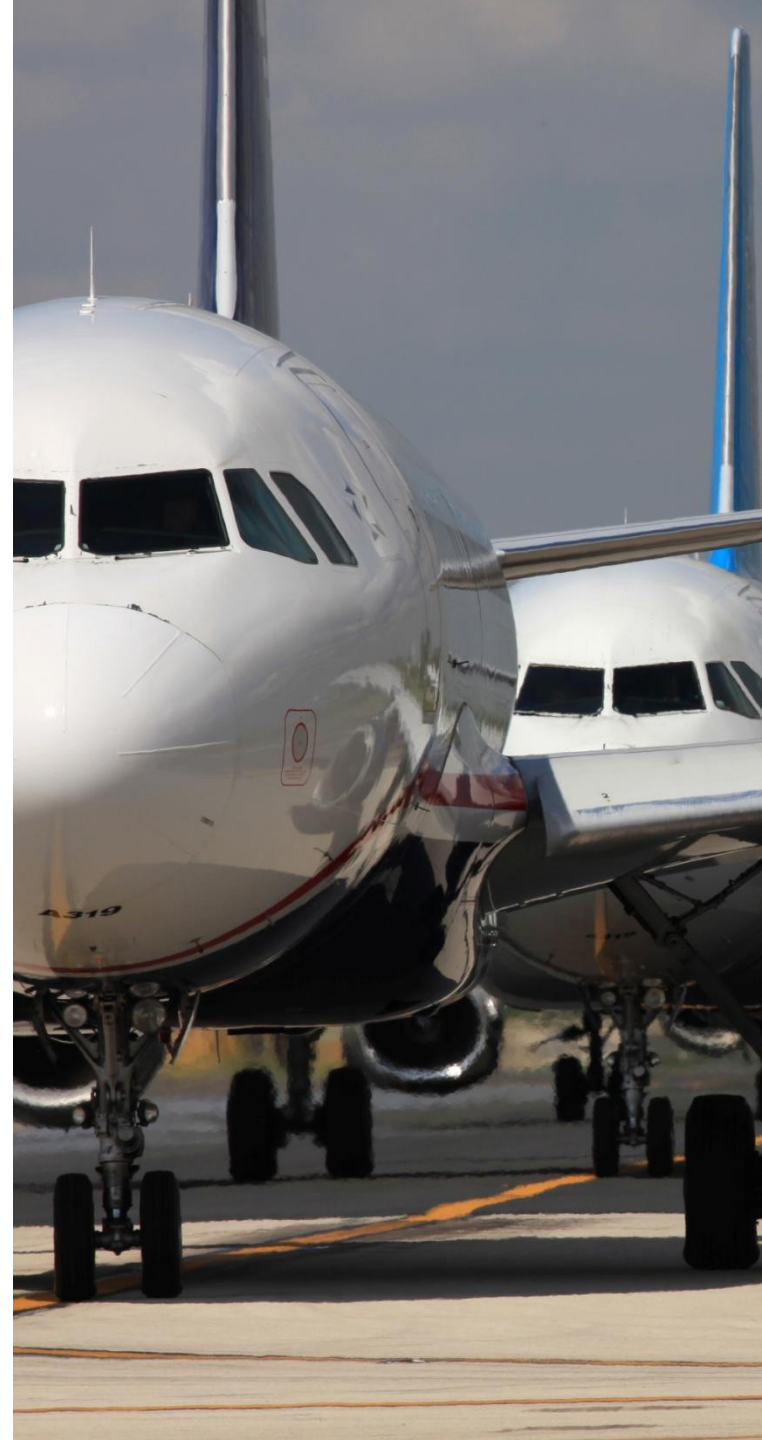
FAA NextGen Weather Systems

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

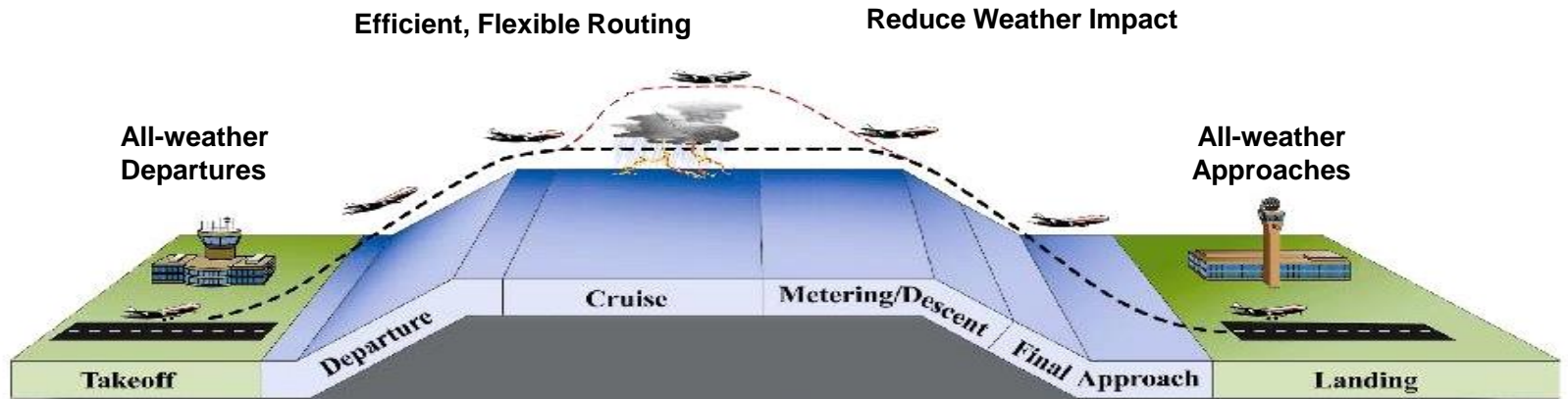
Presented to: FPAW

Presented by: William N. Brown, FAA

Date: August 2015



NextGen Weather Systems

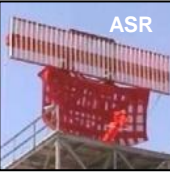


Current Wx Dissemination	<ul style="list-style-type: none"> ITWS NFU, ITWS VOLPE 	<ul style="list-style-type: none"> ITWS NFU, ITWS VOLPE WARP WINS, FBWTG 	<ul style="list-style-type: none"> CIWS CDDS WARP WINS, FBWTG 	<ul style="list-style-type: none"> ITWS NFU, ITWS VOLPE WARP WINS, FBWTG 	<ul style="list-style-type: none"> ITWS NFU, ITWS VOLPE
Future	CSS-Wx				

Current Wx Processing	<ul style="list-style-type: none"> ITWS 	<ul style="list-style-type: none"> ITWS WARP 	<ul style="list-style-type: none"> CIWS WARP 	<ul style="list-style-type: none"> ITWS WARP 	<ul style="list-style-type: none"> ITWS
Future	NWP				

Current Wx in Air Traffic Operations

Wx Sources



ATC/TMU/ATCSCC Users



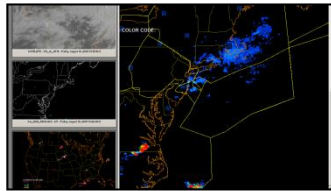
USER SYSTEMS
(ERAM, MICRO-EARTS, ATOP, DOTS+, FDP2K)



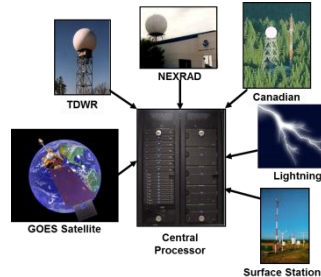
DECISION SUPPORT TOOLS
(TFMS, TBFM, TFDM)



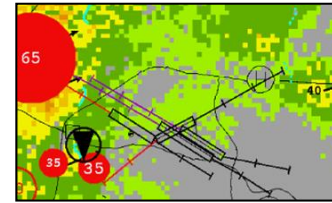
INTEGRATED DISPLAY SYSTEM (IDS)



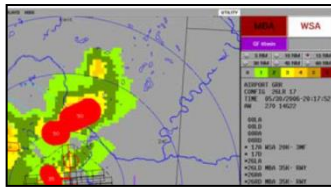
WEATHER AND RADAR PROCESSOR (WARP) BRIEFING TERMINAL (WARP BT)



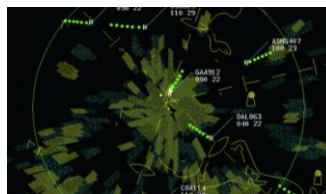
CORRIDOR INTEGRATED WEATHER SYSTEM (CIWS)



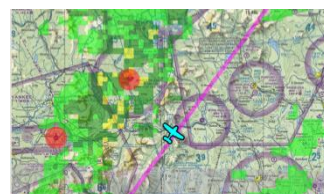
INTEGRATED TERMINAL WEATHER SYSTEM (ITWS)



AIR SURVEILLANCE RADAR - WEATHER SYSTEMS PROCESSOR (ASR-WSP)



STANDARD TERMINAL AUTOMATION REPLACEMENT SYSTEM (STARS)



FLIGHT INFORMATION SYSTEM - BROADCAST (FIS-B)



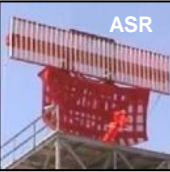
FLIGHT SERVICES (e.g., OASIS)

External Users, e.g. NOAA, Airlines



NextGen Wx in Air Traffic Operations

Wx Sources



ATC/TMU/ATCSCC Users



USER SYSTEMS
(ERAM, MICROEARTS, ATOP, DOTS+, FDP2K)



DECISION SUPPORT TOOLS
(TFMS, TBFM, TFDM)



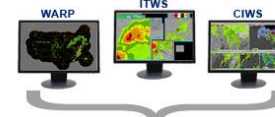
INTEGRATED DISPLAY SYSTEM (IDS)



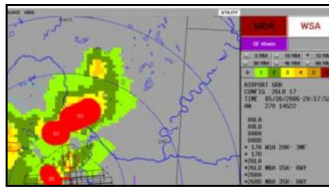
NextGen Weather Processor (NWP)



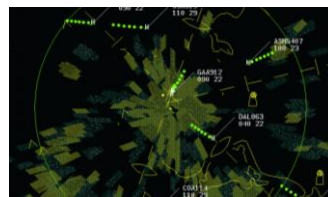
Common Support Services-Weather (CSS-Wx)



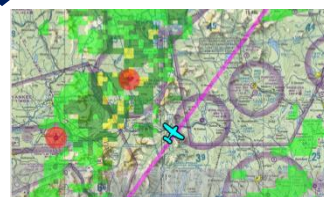
Aviation Weather Display (AWD)



AIR SURVEILLANCE RADAR - WEATHER SYSTEMS PROCESSOR (ASR-WSP)



STANDARD TERMINAL AUTOMATION REPLACEMENT SYSTEM (STARS)



FLIGHT INFORMATION SYSTEM - BROADCAST (FIS-B)

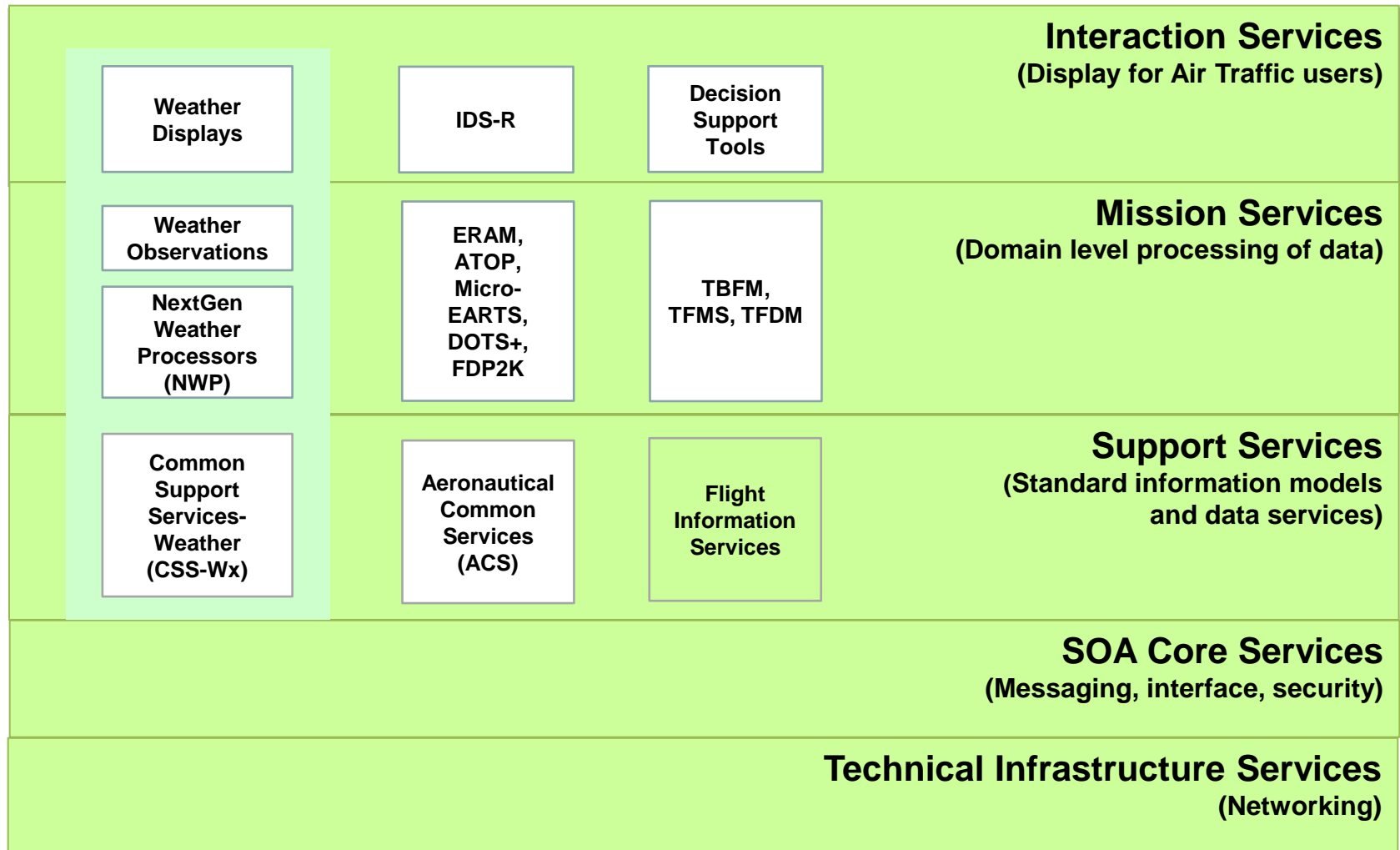


FLIGHT SERVICES

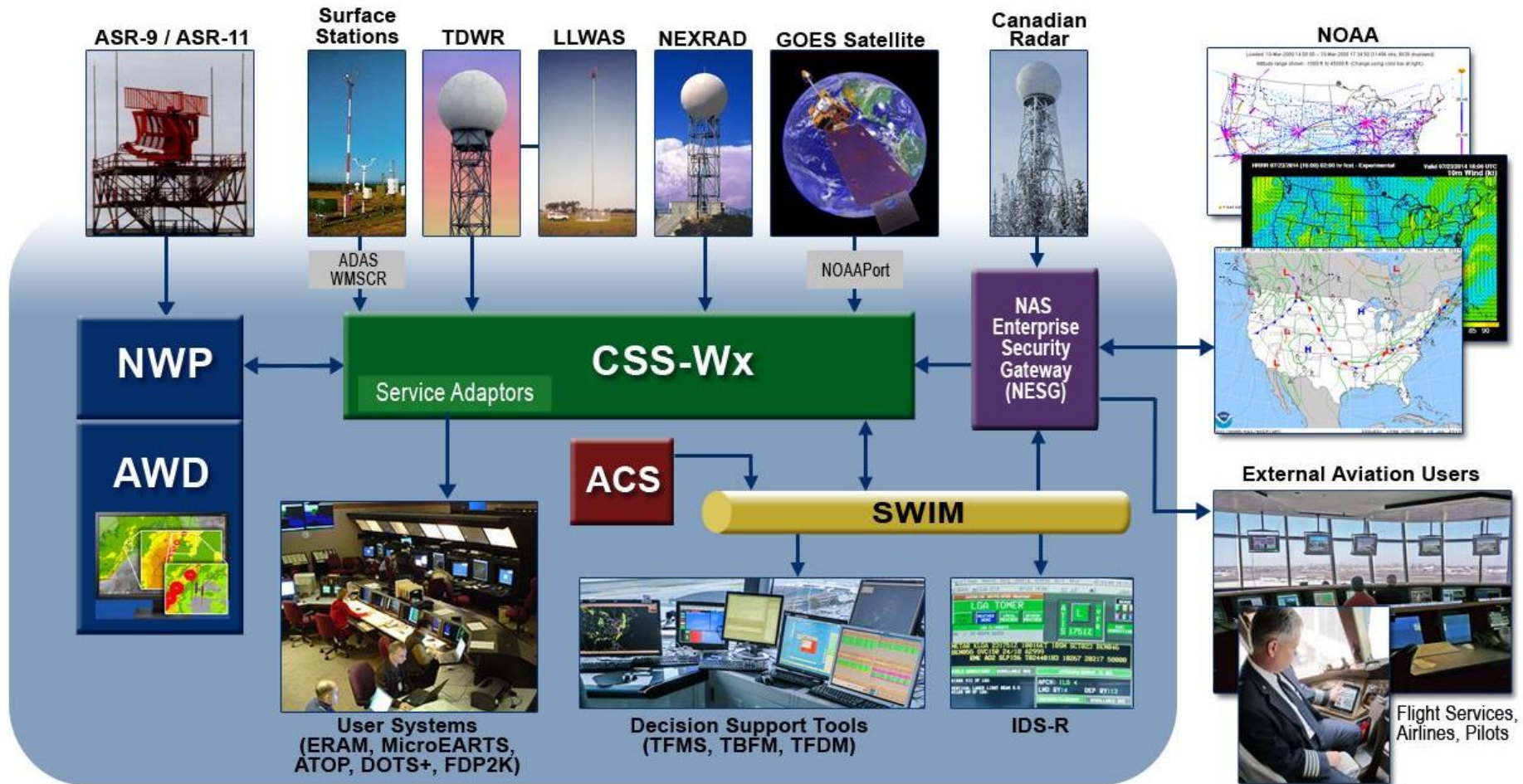
External Users, e.g. NOAA, Airlines



Weather in NAS Enterprise Architecture



NextGen Weather Architecture



CSS-Wx Program Scope



- Provides a single source for FAA weather information and establishes enterprise level common support services using SWIM
- Provides users with the right information at the right time
- 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)

NWP Program Scope



- Produces advanced aviation specific weather products
- Translates weather information into weather avoidance areas for integration into decision support tools
- Enables decommissioning of legacy weather processor systems (e.g., WARP, ITWS, CIWS)

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
Payback After 7 Years

**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

Interdependencies

<p>Data / Service Providers</p>	<ul style="list-style-type: none"> • Weather Radar and Sensors • FAA Telecommunications Infrastructure (FTI) • System Wide Information Management (SWIM) • National Oceanic and Atmospheric Administration (NOAA)
<p>FAA Data / Service Consumers</p>	<ul style="list-style-type: none"> • NAS consumer systems, including: <ul style="list-style-type: none"> – En Route Automation Modernization (ERAM) – Advanced Technologies and Oceanic Procedures (ATOP) – Time Based Flow Management (TBFM) – Traffic Flow Management System (TFMS) – Micro En Route Automated Radar Tracking System (Micro-EARTS) – Information Display System Replacement (IDS-R) • NAS Users, e.g. Collaborative Decision Makers, Traffic Management Unit (TMU)
<p>External to FAA Data / Service Consumers</p>	<ul style="list-style-type: none"> • NOAA • Department of Defense (DoD) • Department of Homeland Security (DHS) • Airline Operations Centers (AOCs)
<p>International</p>	<ul style="list-style-type: none"> • Global harmonization with EUROCONTROL and ICAO through the use of standards



Contract Awards

- **Both CSS-Wx and NWP contracts were awarded in April 2015**
 - Periods of Performance: April 2015 – March 2023 (including 4 year options)
 - CSS-Wx Program Prime contractor: Harris
 - NWP Program Prime contractor: Raytheon
- **Begin solution implementation of CSS-Wx and NWP systems**
 - Key Site Initial Operational Capability (IOC): 2019 (CSS-Wx) / 2020 (NWP)



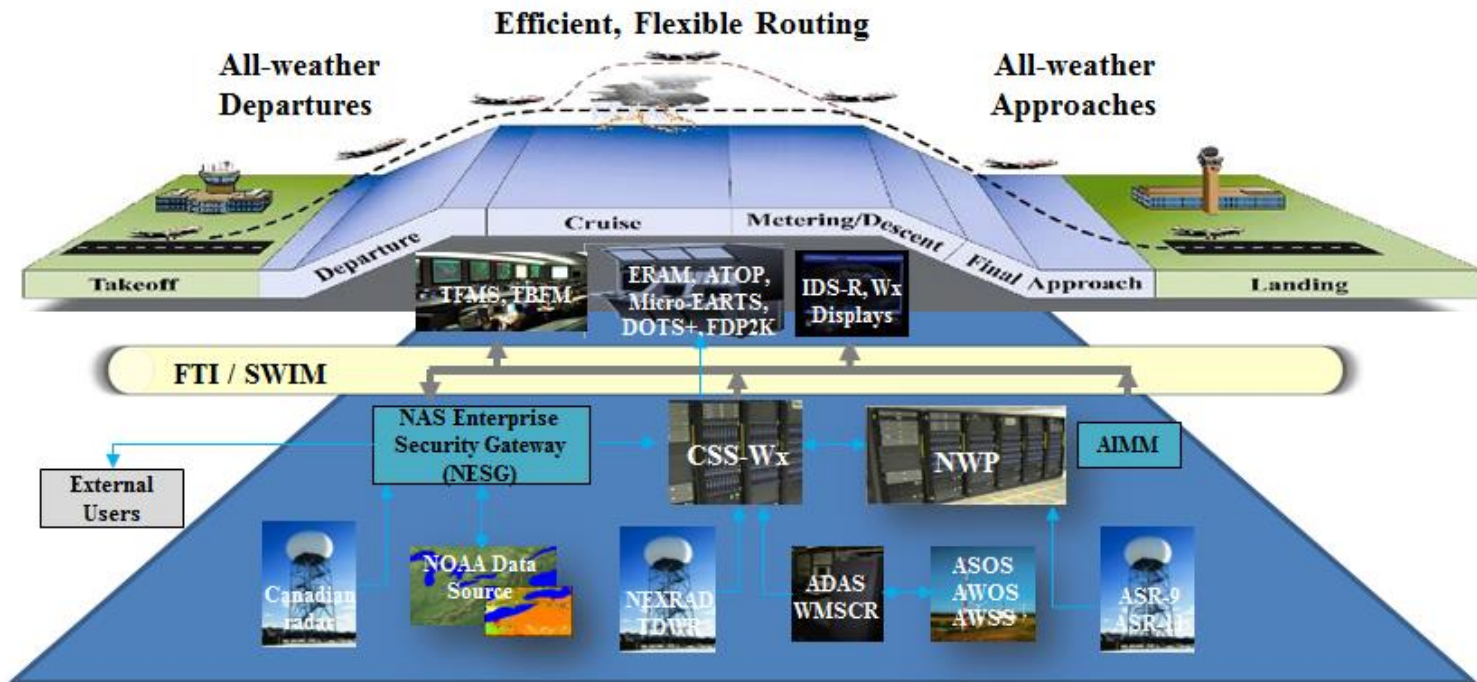
NextGen Weather Summary

As-Is Weather

- Aviation Weather information limitations: inconsistencies across domains, unique data types, fixed time, space resolution, range, and latencies
- User must mentally process multiple information sources to assess the potential impact to their operations

To Be Weather

- Consistent weather information across domains and externally by the implementation of a common weather exchange model (i.e., WXXM)
- Improved aviation weather information
- Reduce avoidable air traffic delays and maximize available runway and airspace usage



CSS-Wx / NWP

Initial Investment Decisions (IIDs)
2013

Screening Info. Requests (SIRs)
Release January 2014

Final Investment Decisions (FIDs)
2015

Contract Award
2015

Key Site IOCs
2019 / 2020

Backup



Contact Information

Alfred Moosakhanian, FAA
NextGen Weather Systems Manager
alfred.moosakhanian@faa.gov



Resources

- **NextGen Weather:**
 - <https://www.faa.gov/nextgen/programs/>



CSS-Wx and NWP Brochures

NextGEN WEATHER
Improving Safety and Efficiency in the National Airspace System

AWD AVIATION WEATHER DISPLAY
Decision makers in the National Airspace System require a clear, consistent presentation of weather information to ensure efficient and safe air traffic operations in the current environment. Multiple weather displays from the Weather and Radar Processor (WARP) and the Combined Integrated Weather System (CIWS) are integrated into the Weather System (WWS) and the Common Integrated Weather System (CWS) to provide different information. While some weather products are effectively integrated with other weather products, some require a separate, stand-alone, dedicated weather display. Part of the NextGen Weather Processor (NWP), the Aviation Weather Overlay (AWO) consolidates both stand-alone, dedicated weather displays and weather products from both WARP and NOAA.

NWP NEXTGEN WEATHER PROCESSOR
The fully automated NextGen Weather Processor identifies terminal and enroute weather hazards and provides translated safety information needed to predict route blockage and airspace capacity constraints up to eight hours in advance. For all: Example of a route blockage as seen by pilot/air traffic controller. This can be identified by enhanced algorithmic sensing of key FAA forecasts.

AWD Architecture
The AWD is designed as a Geographical Information System (GIS) - Weather CSS-Wx. Digital weather data is processed and converted to a format that can be displayed on both ground and non-ground standardized hardware during heavy weather.

NextGen Weather harnesses massive computing power, unprecedented advances in numerical weather forecasting, translation of weather information into airspace constraints, and modernized information management services.

Improvements with AWD

- Consolidates legacy weather display
- Establishes new stand-alone weather display
- Designs for Geographical Information System (GIS) integration
- Includes dedicated and web browser access
- Supports Long Range and TRACON use
- Alerts from all TRACON available data
- Long & Turbulence products integrated
- Provides display for new traditional WWS

NextGen Weather can provide enhanced weather products when the weather products within the AWD, helping controllers and operators develop reliable flight plans, make better decisions, and improve on-time performance.

NextGen Weather is accomplished through collaboration between FAA, NOAA, and NASA.

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TRANSLATION PRODUCTS

- 0.5 hour
 - Convective Weather Avoidance Fields (CWAF)
 - Convective Weather Avoidance Parcels (CWAP)
- 0.2 hour
 - CWAF for Route Availability Planning (RAP)
 - Terminal Winds (TW)
 - Terminal Winds (TW)

ANALYSIS PRODUCTS

- Storm Cell Information
 - Storm Cell Information
 - Storm Cell Information
 - Storm Cell Information
- Wind Shear Safety
 - Microbursts, Gust Fronts
 - Terminal Winds
 - Terminal Winds

MOIAC PRODUCTS

- Vertical TWS and Convective Forecasting
 - Vertical TWS and Convective Forecasting
 - Vertical TWS and Convective Forecasting
- Air Surveillance Radar
 - Case Terminal Radar
 - Case Terminal Radar

DOES Satellite

- Confined Volume
- Confined Volume

FAA | CSS-WX | WWP | AWD
NOAA | RAP | HRRR | LAPS
NASA | CIWP | CIPI/FIP | OTG
NASA | CWAM | SATCAST | DWR

NextGEN WEATHER
Improving Safety and Efficiency in the National Airspace System

REDUCE WEATHER IMPACT
COMMON SUPPORT SERVICES - WEATHER

CSS-Wx COMMON SUPPORT SERVICES

NextGen Weather is a critical part of the NextGen Air Transportation System, designed to transform the management and operation of how we fly. It helps reduce weather impact, resulting in safer, more efficient and predictable day-to-day NAS operations.

NextGen Weather harnesses massive computing power, unprecedented advances in numerical weather forecasting, translation of weather information into airspace constraints, and modernized information management services.

With this powerful combination, NextGen Weather can provide tailored aviation weather products within the NAS, helping controllers and operators develop reliable flight plans, make better decisions, and improve on-time performance.

NextGen Weather is accomplished through collaboration between FAA, NOAA, and NASA.

High level view of NextGen Weather architecture, showing the relationship between CSS-Wx, the NextGen Weather Processor (NWP) and the Aviation Weather Display (AWD). Weather sensor inputs are shown across the top, where "Satellite Stations" includes ASCAT, AWOS, AWSS and Lightning. Contents of weather information within the NAS are shown along the bottom. Incoming weather products from NOAA pass through the NWS, as do outgoing products for all external consumers.

CSS-Wx Weather Product Categories

NOAA	Numerical Forecast Models	Aviation Forecasts	Alphanumeric Products	Imagery
	RAP, HRRR, LAMP, ERF, NAM, etc.	Turbulence, long, etc.	METARs, Fronts, TAFs, PIREPs, etc.	Asaska and Guam Satellite, etc.
NWP	Mosaic Products	Analysis Products	Predictive Products	Translation Products
	Precipitation, Echo Tops, Gallette, etc.	Microbursts, Terminal Winds, Gust Fronts, etc.	8-hour Precipitation, Phase, Confidence, 2-hour Fronts, etc.	8-hour Convective Weather Avoidance Fields, etc.

CSS-Wx Web Services

The CSS-Wx system makes access and format standards (OGC). The services provided:

- WCS (Web Coverage Service)**
 - Disseminates gridded weather products in NetCDF4 format
 - Filters and transforms large gridded data sets such as weather radar and satellite mosaics, upper wind levels, and turbulence forecasts, etc.
- WFS (Web Feature Service)**
 - Disseminates non-gridded weather products in WXMML format
 - Filters and transforms non-gridded data sets such as wind shear alerts, storm cell information, terminal aerodrome forecasts, etc.
- WMS (Web Map Service)**
 - Disseminates weather product imagery in variety of formats (e.g., JPEG, PNG, GIF, KML)
 - Renders digital weather data as single large image or as sets of tiled images
 - Enables weather product consumption by modernized displays and mobile applications
 - Permits geographical overlay of information from multiple domains

FAA | CSS-WX | WWP | AWD
NOAA | RAP | HRRR | LAPS
NASA | CIWP | CIPI/FIP | OTG
NASA | CWAM | SATCAST | DWR

Key Acronyms

- ADAS: Automated Weather Observing System (AWOS) Data Acquisition System
- ARTCC: Air Route Traffic Control Center
- ASOS: Automated Surface Observing System
- ASR: Airport Surveillance Radar
- ATOP: Advanced Technologies and Oceanic Procedures
- AWD: Aviation Weather Display
- AWOS: Automated Weather Observing System
- AWSS: Automated Weather Sensor System
- CDDS: CIWS Data Distribution Service
- CIWS: Corridor Integrated Weather System
- CREWS: CTAS Remote Weather System
- CSS-Wx: Common Support Services for Weather
- DHS: Department of Homeland Security
- DoD: Department of Defense
- DOTs+: Dynamic Oceanic Tracking System Plus
- DST: Decision Support Tools
- ERAM: En Route Automation Modernization
- EWD: Enhanced WINS Dissemination (WARP)
- FBWTG: FAA Bulk Weather Telecommunications Gateway
- FDP2K: Flight Data Processing 2000 System
- FTI: FAA Telecommunications Infrastructure
- IDS-R: Information Display System Replacement
- IOC: Initial Operational Capability
- ITWS: Integrated Terminal Weather System
- LLWAS: Low-Level Windshear Alert System
- MEARTS: 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
- NEMC: National Enterprise Management Center
- NWP: NextGen Weather Processor
- OGC: Open Geospatial Consortium
- RAMP: Radar Acquisition and Mosaic Processor
- SWIM: System Wide Information Management
- TBFM: Time Based Flow Metering
- TDWR: Terminal Doppler Weather Radar
- TFDM: Terminal Flight Data Manager
- TFMS: Traffic Flow Management System
- TMU: Traffic Management Unit
- TRACON: Terminal Radar Approach Control
- VOLPE: National Transportation Systems Center (ITWS Web Services Provider)
- WARP: Weather and Radar Processor
- WCS: Web Coverage Service
- WFS: Web Feature Service
- WMS: Web Mapping Service
- WMTS: Web Mapping Tile Service
- WINS: Weather Information Network Server
- WMSCR: Weather Message Switching Center Replacement
- WXXM: Weather Information Exchange Model

