

FAA NextGen Weather Systems

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

To: FPAW – Fall Forum

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Date: October 22 , 2014



**Federal Aviation
Administration**



Benefits of CSS-Wx and NWP

**Reduce FAA
Operations Costs**



***Significant Cost Avoidance Over
Lifecycle FY14-40
Payback After 6 Years***

**Modernize National
Airspace System**



***Decommission Outdated Systems
Leveraging SWIM and FTI
Cloud Compatibility
Global Data Standardization***

Improve Efficiency



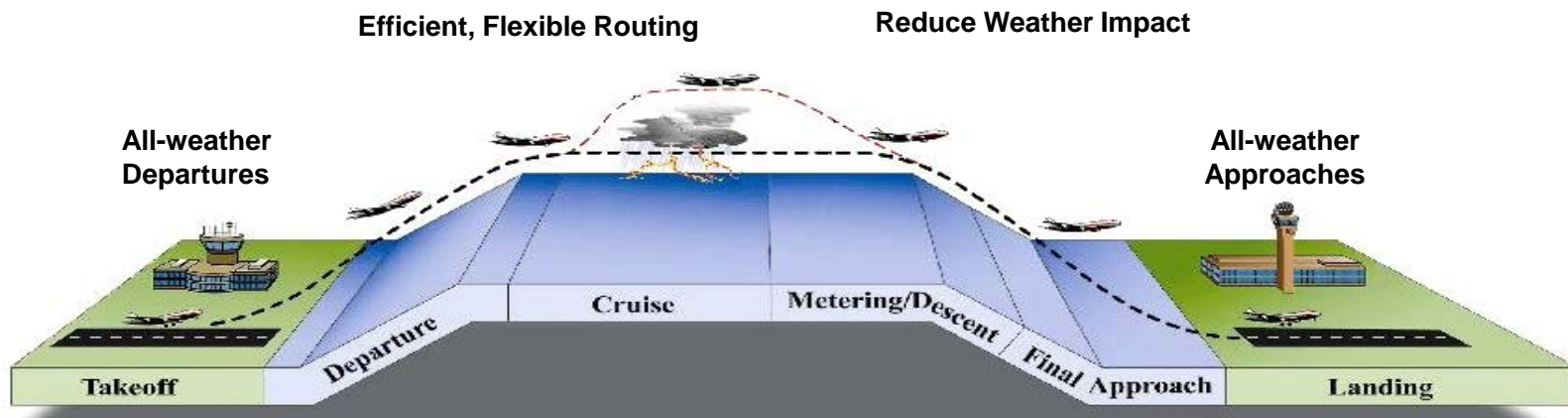
***Over \$2.9B of User Benefits
Reduce Flight Delays
Enable Collaborative
Decision-making***

Improve Safety



***Enhanced Weather Information
Greater Access
Common Situational Awareness***

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				



CSS-Wx
& NWP

Screening Information Requests (SIRs)
Release 1/2014

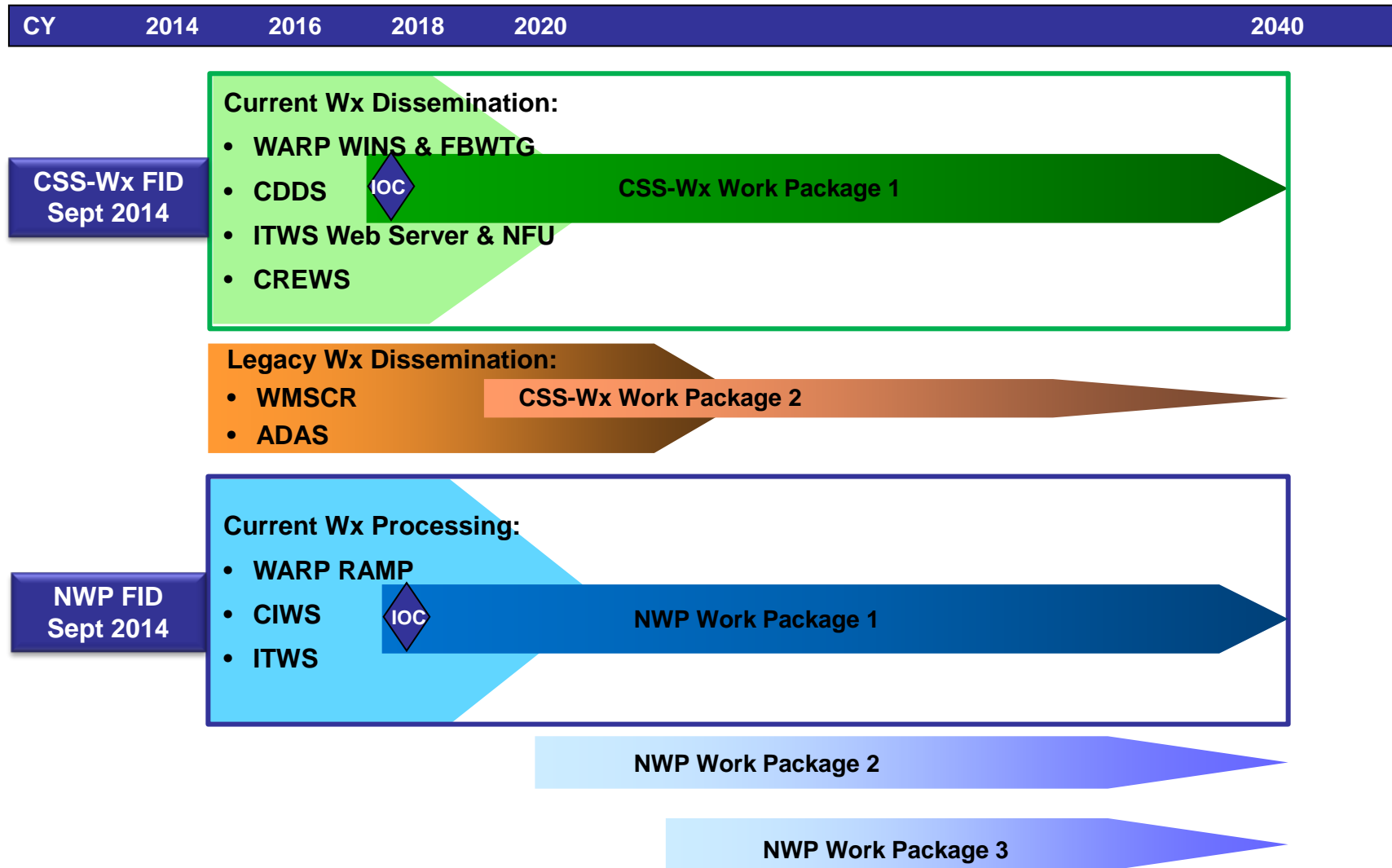
Final Investment
Decisions (FIDs) 2014

Contract Awards
2014

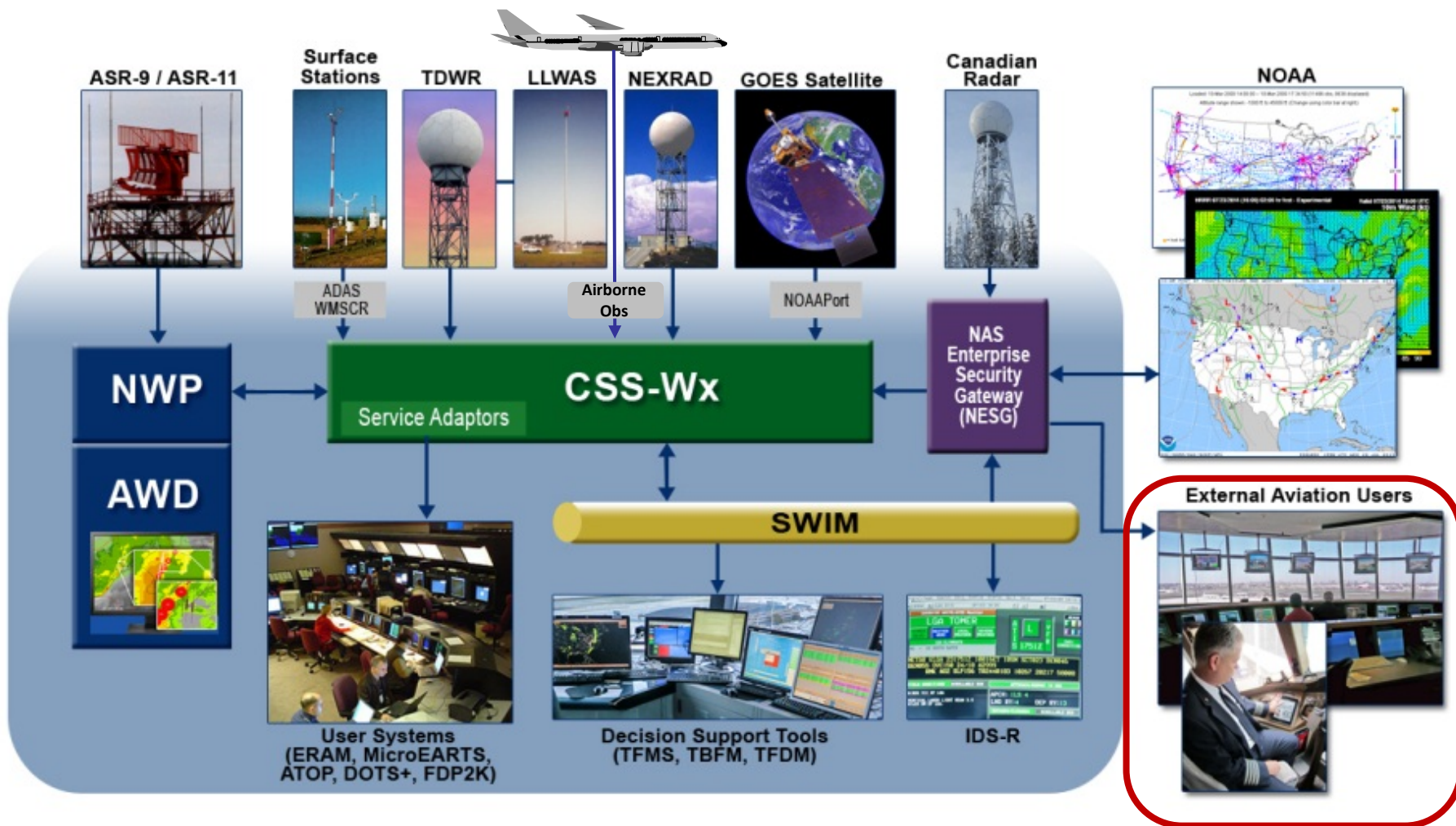
Last Site IOCs
2019



NextGen Weather Roadmap



NextGen Weather Architecture



NWP Program Scope



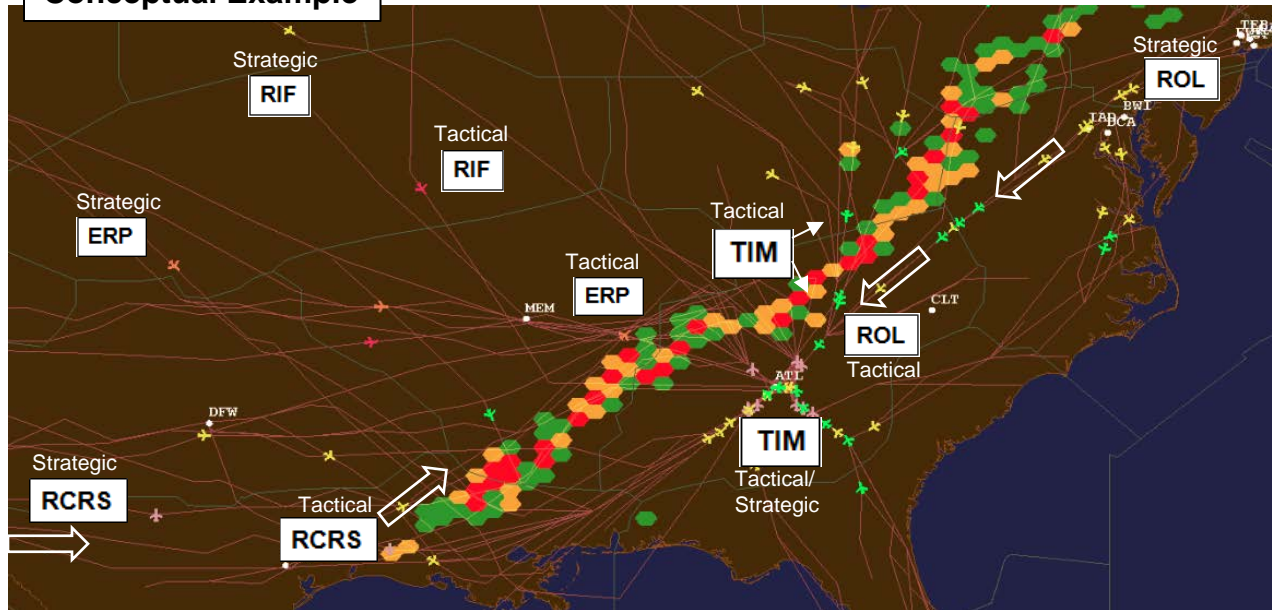
- Produces advanced aviation specific weather products
 - Translates weather information into weather avoidance areas for integration into decision support tools
 - Enables decommissioning of legacy weather processor systems (e.g., WARP, ITWS, CIWS)
-
- NWP collocated with CSS-Wx equipment at central, TRACONs and CERAPs
 - Aviation Weather Displays (AWDs) at ARTCCs, CERAPs, ATCSCC, and designated TRACONs/ATCTs

NWP Benefit Categories

•Improved NAS-wide routing/resource convective weather impact management

- Dynamic, flexible, and “opportunity-driven”
- More than one beneficial, tactical and/or strategic NWP beneficial resource impact management decision can be made at any given time

Conceptual Example



NWP Routing / Resource Impact Management Benefits Categories Include:

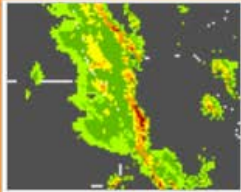
ERP	Enhanced Reroute Planning (Non-Playbook)
RIF	Reroute Assistance, Individual Flights of City-Pairs
ROL	Routes Open Longer
RCRS	Reopen Closed Routes Sooner
TIM	Enhanced Terminal Airspace Impact Management <ul style="list-style-type: none">- Airport- TRACON- Arrival / Departure Transition Areas (ATA / DTA)

NWP Benefit Categories (continued)

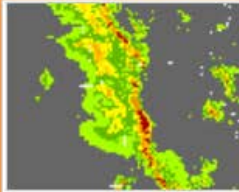
- **Improved Airspace Flow Program (AFP) execution/management**
 - NWP provides a higher-resolution, deterministic strategic convective weather forecast that allows ATM to implement more targeted and precise AFPs / FCAs in regards to convective weather
- **Enhanced Playbook reroute planning/execution**
 - NWP provides a higher-resolution, deterministic strategic convective weather forecast that allows ATM to implement more efficient coordinated (e.g., “Playbook”) reroutes
- **Improved utilization of available airport capacity through better anticipation of terminal area convective weather**
 - Earlier detection of convective weather impact on airport
 - More consistent, reliable predictions

Notional NWP Products

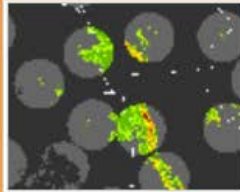
Mosaics



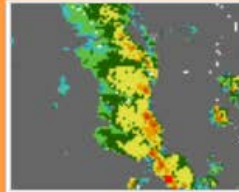
**Precipitation
(VIL) Mosaic**



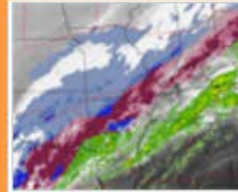
**Composite
Reflectivity
Mosaic**



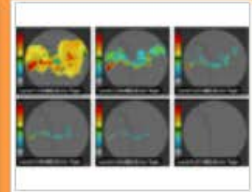
**Base
Reflectivity
Mosaic**



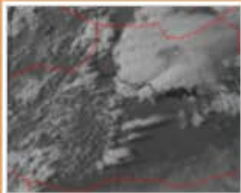
**Echo Tops
Mosaic**



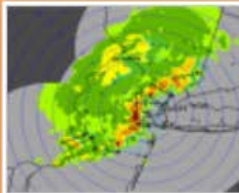
**Winter
Precipitation /
Phase Mosaic**



**Echo Tops
Mosaics (2-6)**

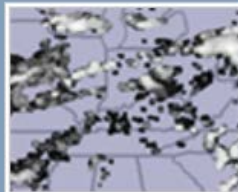


**Satellite
Mosaic**



ASR Mosaic

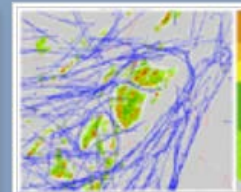
Translation Products



**Convective
WAF Mosaic
and Prediction**

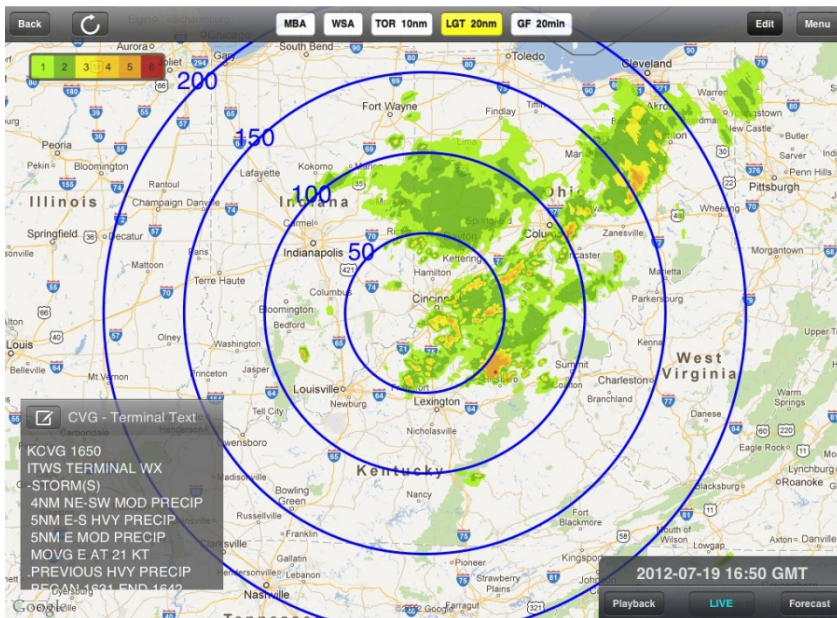


**RAPT
Convective
WAF and
Prediction**



**Convective
Weather
Avoidance
Polygons**

Support for Future Mobile Users



Mobile weather demonstrates terminal and en route weather information for users on iPad, iPhone, and other mobile devices

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)
-
- Commercial, off-the-shelf (COTS) hardware
 - Located at 2 NEMCs, 21 ARTCCs, 3 CERAPs, 33 TRACONs, ATCSCC, 1 Support System at WJHTC
 - Developmental and modified COTS software

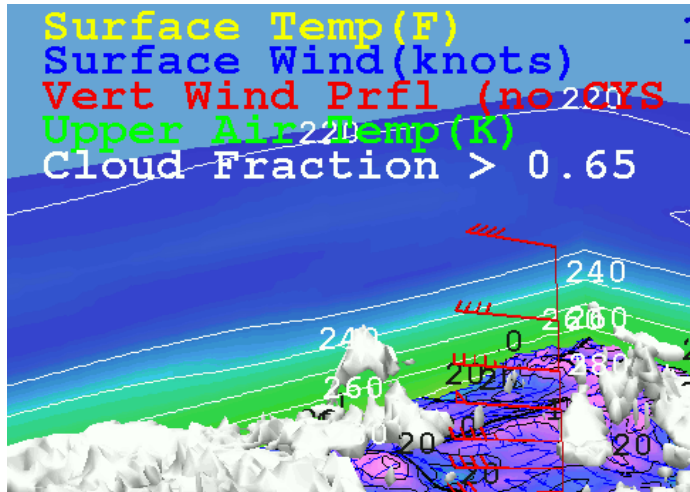
CSS-Wx Benefit Categories

- **Reduced costs to develop future custom weather interfaces**
 - Provides a single source for weather data (“one-stop shop”)
 - Provide common standards for systems to utilize, removing the need for custom interfaces
- **Reduced future infrastructure costs to support forecast data bandwidth needs**
 - Allows user to receive only the weather information needed
- **Increased weather access leading to reduced accidents**
 - CSS-Wx will improve the availability of aviation weather information and forecasts resulting in improved situational awareness

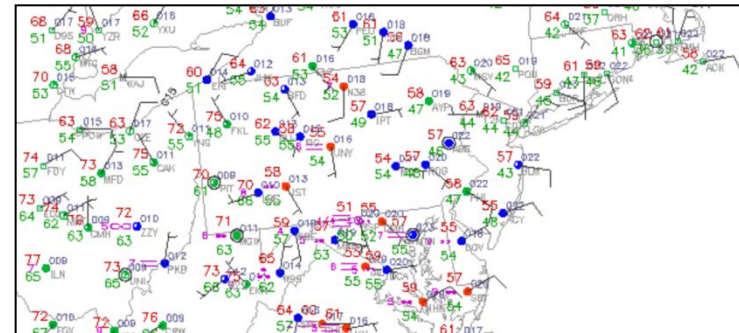
CSS-Wx Products from NOAA



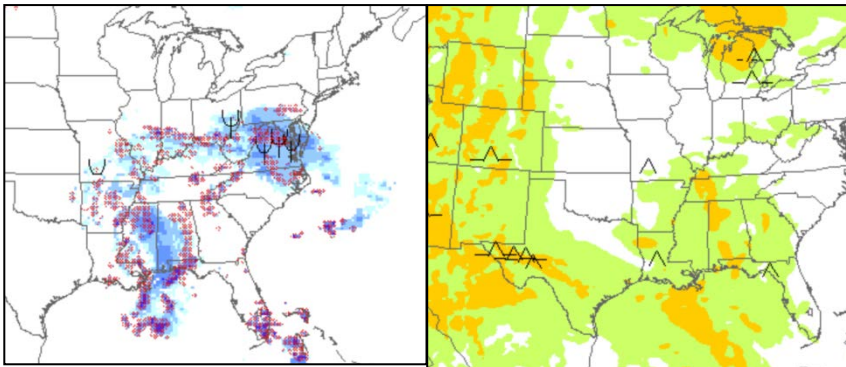
Numerical Forecast Model Data



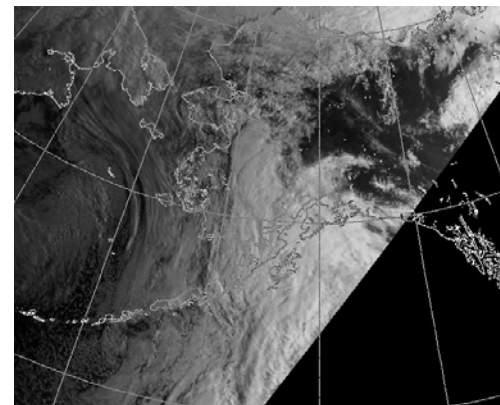
METARS, TAFS and other alphanumeric



Icing and Turbulence Forecasts



Satellite Images



CSS-Wx Interdependencies

Data / Service Providers	<ul style="list-style-type: none"> • Weather Radar; Sensor Systems; and Aircraft Observations • FAA Telecommunications Infrastructure (FTI) • System Wide Information Management (SWIM) • National Oceanic and Atmospheric Administration (NOAA)
FAA Data / Service Consumers	<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 Metering (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)
External to FAA Data / Service Consumers	<ul style="list-style-type: none"> • NOAA • Department of Defense (DoD) • Department of Homeland Security (DHS) • Airline Operations Centers (AOCs) • Weather Vendors / Other Authorized Users
International	<ul style="list-style-type: none"> • Global harmonization with EUROCONTROL and ICAO through the use of standards

NextGen Weather Programs Support FAA Strategic Initiatives

Once implemented, CSS-Wx and NWP will:

- **Make aviation safer and smarter**
 - Improve standardization and data access
 - Enhance decision-making process
- **Deliver benefits through technology and infrastructure**
 - Achieve benefits of NextGen
 - Right-size the NAS
- **Enhance global leadership**
 - Transform our internal structure (e.g. stakeholder collaboration)
 - Ensure global Interoperability of NextGen

CSS-Wx Geospatial Data Access Services

- **Web Feature Service (WFS):**
 - Filtered access to non-gridded data formatted as XML (WXXM GML)
 - Provides Common Geospatial constructs for other NAS data (aeronautical, air traffic)
- **Web Coverage Service (WCS):**
 - Filtered access to gridded data formatted as NetCDF4
 - Uses OGC Reference Model
- **Web Map Service (WMS):**
 - Image of Weather data formatted as gif, png, jpeg, etc.
- **Web Map Tile Service (WMTS):**
 - Image of Weather data as set of tiles formatted as gif, png, jpeg, etc.



CSS-Wx Sample Weather Products

- **WCS (gridded data):**
 - NOAA model data, e.g. RAP, GFS, UKMET, NAM
 - AWC data, e.g. CIP, NCWD
 - NWP products, e.g. VIL, ET
- **WFS (alphanumeric data):**
 - AWC data, e.g. NCWF
 - Observations, e.g. MDCRS, METAR
 - NWP products, e.g. storm motion
- **WMS:**
 - NWP products, e.g. weather radar mosaics
 - Satellite image
 - Lightning data
 - NWS data
- **WMTS:**
 - Weather Radar/Satellite Imagery – Set of Tiles

Integrated Web Services Benefits

- **OGC Web services provide standardized methods for filtered weather data transfer using modern standards**
- **Weather data transferred in standardized formats**
 - netCDF-4 for gridded data
 - Weather Information Exchange Model (WXXM) and North American Weather (NAWX) for alphanumeric products
- **Publish/Subscribe message pattern for continuous data transfer for automated systems**
- **SWIM interface provides a unified interface for NAS consumers weather access**
- **Reduced bandwidth utilizations by only transferring filtered coverage areas and one-to-many tiered design**

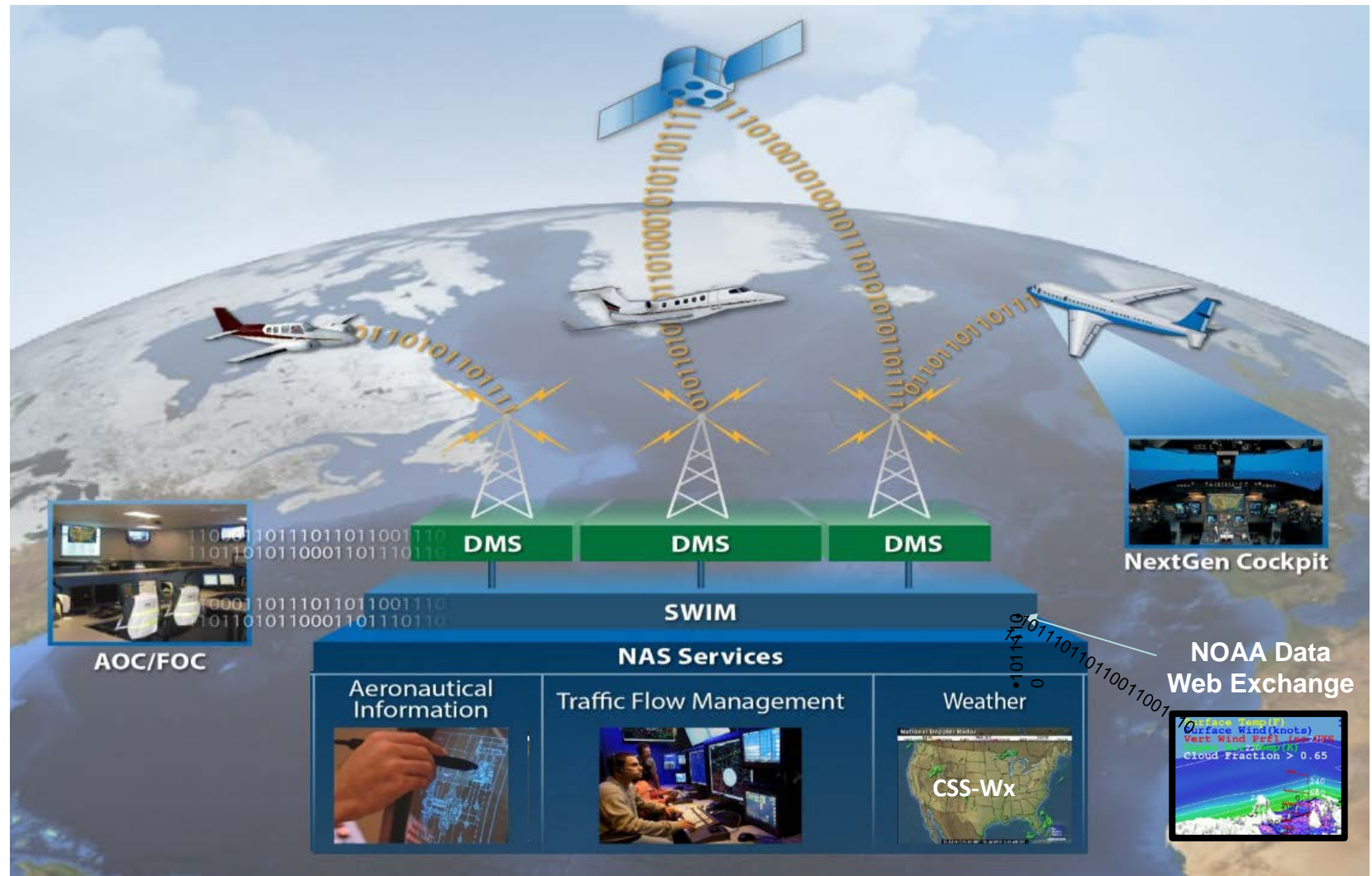
CSS-Wx and NWP Accomplishments

- **CSS-Wx early success demonstrating viability of new technology**
 - Joint Capability Evaluations between multiple agencies
 - SOA Interface for limited set of weather Information
- **NWP planned extended convective weather capability demonstrated**
 - Utilized at operational facilities
 - Collected feedback from multiple agencies
- **Developed Government Furnished Information (GFI) Packages**

Joint Capability Evaluation (CE)

- **Demonstrated capability for data exchange:**
 - Ground-Ground between NOAA and FAA
 - Air-Ground between FAA and Aircraft
 - FAA CSS-Wx published weather data to Aircraft:
 - NOAA Web Services
 - WTIC turbulence research
 - Aircraft accessed via AAtS Data Management Service (DMS)
- **Demonstrated NextGen Weather Capabilities**
 - Providing common weather picture to aircraft as well as ground users
 - Enabling more proactive Pilot-ATC interaction

FAA/NOAA Joint Concept Demo



CSS-Wx: R&D Environment

- **Weather for users in NextGen Prototype Network**
- **CSS-Wx Data Products**
 - METARs (Routine Aviation Meteorological Report)
 - TAFs (Terminal Aerodrome Forecast)
 - NEXRAD (Doppler Radar)
 - PIREP (Pilot Reports)
 - AIRMET/SIGMET
 - Terminal Wind Forecast
 - Terminal Icing Probability and Severity Forecast
 - GTG (Graphical Turbulence Guidance)

CSS-Wx & NWP Procurements

- **Procurements are in progress**
 - Screening Information Requests (SIRs) released in January 2014
 - Contract awards after approval at Final Investment Decisions (FIDs)
- **Government Furnished Information (GFI) software packages are ready**
 - Developed CSS-Wx Web Services standards and corresponding software
 - Modified research algorithms into validated, reusable software modules for NWP

NextGen Weather Summary

- **CSS-Wx and NWP programs are ready for implementation**
 - NWP will generate advanced aviation weather products for NAS operations
 - CSS-Wx will provide NWP and NOAA products along with other weather data to FAA users via SWIM
 - Early risk reduction activities have taken place using SWIM
- **NextGen Weather Systems will bring \$2.9B user benefits with significant cost avoidance/savings**