P1.16 TRANSFORMATION OF NAS TO NEXTGEN AND FAA 'S WEATHER ARCHITECTURE IMPACTS: AN UPDATE

Cheryl G. Souders*
FAA Air Traffic Organization, Operations Planning, Chief System Engineers' Group
Washington, DC

Robert C. Showalter
CSSI, Inc., Washington, DC

James W. Tauss
CSSI, Inc., Washington DC

1.0 Introduction

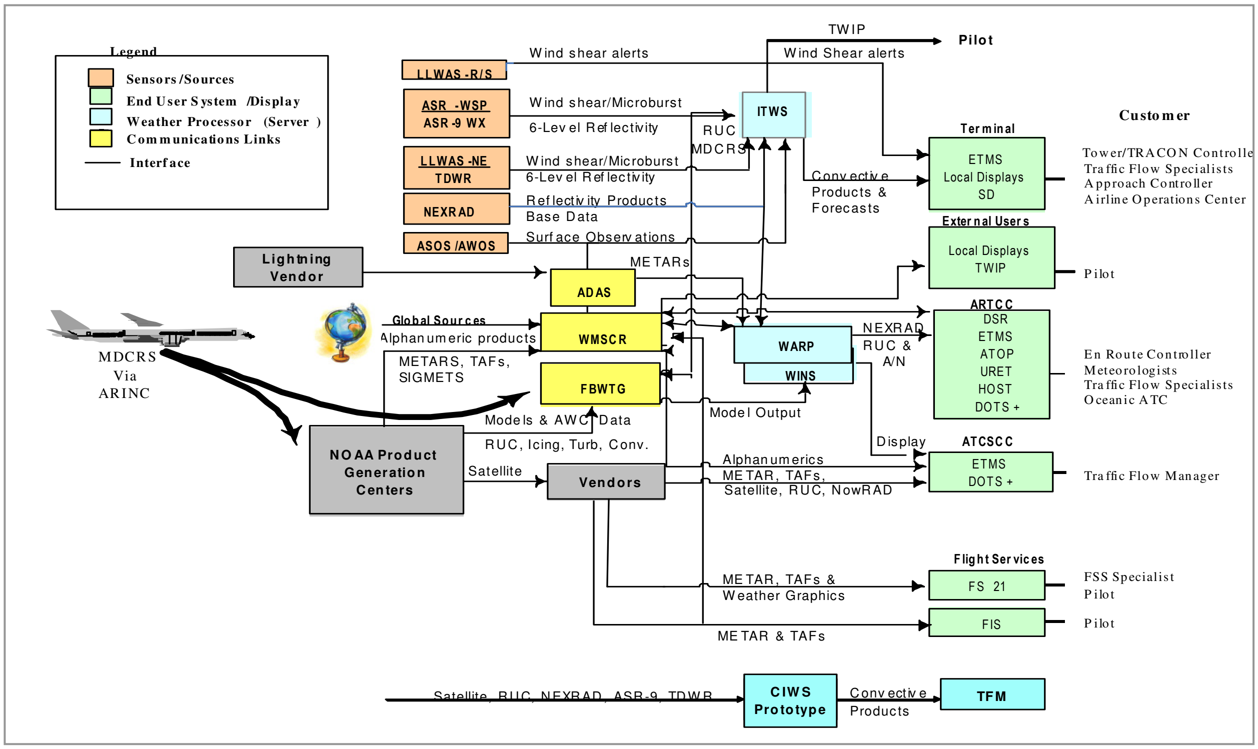
Because of the profound adverse impact that weather has on aviation, the Next Generation Air Transportation System (NextGen) is focusing on a new direction in aviation weather information emphasizing capabilities to help stakeholders at all levels make better decisions to mitigate the impact of weather. Safe and efficient NextGen operations will be dependent on enhanced weather capabilities based on three major tenets:

- A common picture of the weather for all transportation decisions makers and aviations system users
- Weather directly integrated into sophisticated decision support capabilities to assist decision makers
- Utilization of Internet-like information dissemination to realize flexible and cost-efficient access to all necessary weather information

Weather information services are crucial in supporting the safety, efficiency and capacity of the Nation Airspace System (NAS). Today, approximately one-fourth of all aircraft accidents and one-third of fatal aircraft accidents are weather-related and weather continues to be a major factor adversely affecting NAS capacity, contributing to approximately three-fourths of system delays greater than 15 minutes (OPSNET). To address the expectations of demand on capacity in 2025, weather impact mitigation becomes increasingly critical and current aviation weather capabilities must undergo major changes. The Federal Aviation Administration's (FAA) weather architecture fulfills an important role in enabling the FAA to meet this increasing demand of air traffic on the NAS capacity while maintaining existing high safety standards. The FAA must transform the existing NAS weather architecture to ensure the future NAS meets safety, security, mobility, and efficiency needs.

The FAA has determined that the primary gaps in weather information services today are in detection, prediction, and dissemination (FAA Mission Need Statement (MNS) #339, June 2002). The FAA performed a weather functional analysis and developed a baseline set of weather functional and performance requirements. New sensors on the ground, on aircraft, and on satellites, as well as enhanced algorithms on current ground-based sensors will provide significantly improved detection of aviation impact weather. Aviation weather forecasting deficiencies must be resolved. For example, today an accurate 2-hour convective forecast is available, but an 8-hour forecast is necessary for efficient traffic management. Also, improved icing forecasts are necessary for general aviation safety, as well as quality ceiling and visibility products. Research and Development (R&D) is essential to develop a key weather component of NextGen: the seamless, consistent set of observations, analyses, forecasts and probabilities that are necessary to meet the needs of the envisioned NextGen Air Traffic Management (ATM) capabilities. Resolving these gaps will require continued funding for weather research, which is crucial to attaining NextGen. The transformation of the current point-to-point communications to the NextGen net-centric weather capability ensures service providers and users receive required weather information in real time.

* *Corresponding author address:* Cheryl Souders, FAA
800 Independence Ave., SW Washington, DC 20591
Cheryl.Souders@faa.gov (202) 385-7235



Meeting the needs of NextGen requires both eliminating these gaps and meeting the needs of emerging users.

So the question becomes - What are the implications of this transformation to the NAS Weather Architecture that is necessary to meet NextGen capabilities?

2.0 Transformation

The FAA has begun the transformation of the NAS in all services including weather. The current NAS weather architecture is shown in Figure 1. The NAS transformation occurs in incremental steps from now until NextGen is achieved. With the current FAA emphasis on reaching NextGen early, some capabilities will be implemented by 2012, but these capabilities have not been fully defined. Between now and 2017, direct connections to weather sensors will be minimized (except for local displays) as data and/or products are available to end-users via a net-centric capability and the four-dimensional (4-D) distributed database known as the 4-D Weather Cube. This reduction of connections between sensors, users, and processors enables real time dissemination throughout the NAS, as well as communications cost savings without any degradation of data/product availability. More aircraft will have weather sensors/algorithms to provide weather information to other users directly and/or via the NextGen 4-D Weather Cube.

For the FAA, the net-centric System-Wide Information Management (SWIM) capability subsumes the functionality of several NAS weather communications systems. These systems include the Weather Message Switching Center Replacement (WMSCR), two subsystems of the Weather and Radar Processor (WARP)—the FAA Bulk Weather Telecommunications Gateway (FBWTG) and the Weather Information Network Server (WINS), and the communications portion of the Automated Weather Observing System (AWOS) Data Acquisition System (ADAS). WMSCR is the primary NAS interface with the National Weather Service Telecommunications Gateway (NWSTG) for exchanging alphanumeric aviation weather products. WMSCR collects, processes, stores, and disseminates aviation weather products and information to various NAS systems, the airlines, commercial users, and international users. The FBWTG is the primary NAS interface with the NWSTG for receiving gridded forecast model data. It also receives in situ airborne observations from the

Meteorological Data Collection and Reporting System (MDCRS) and gridded aviation hazardous weather products (analysis and forecast) from the Aviation Weather Center. WARP disseminates weather products via WINS to NAS automation systems, including the User Request Evaluation Tool (URET) and Dynamic Ocean Track System (DOTS). URET uses three-dimensional wind and temperature forecasts to optimize trajectory algorithms for Conflict Probe to facilitate merging of air traffic by controllers, which increases airspace efficiency and capacity. DOTS uses 4-dimensional wind fields to create flight tracks across oceanic airspace. The ADAS at each Air Route Traffic Control Center (ARTCC) collects automated surface observations from AWOSs and Automated Surface Observing Systems (ASOS) within the ARTCC boundaries and distributes them locally and nationally.

By 2014 FAA weather processors (Figure 2), currently optimized by domain (e.g., En route, Terminal, and Traffic Management), begin convergence of their functionality into a single system, which may ultimately be transferred out of the FAA to the NextGen forecasting capability. The convergence of the weather processors, WARP, for En route, Integrated Terminal Weather System (ITWS), for Terminal and Corridor Integrated Weather System (CIWS), for Traffic Management, reduces duplicative functions, as well as operations and maintenance costs. Initially, the WARP functionality that must be sustained into NextGen will be transferred to the NextGen Weather Processor (NWP) along with new NextGen algorithms in Work Package (WP) 1. By 2018 the CIWS functionality will be added to the NWP with WP 2. By 2022 most ITWS functionality will be transferred to the NWP in WP 3. However, some local processing will remain within the FAA to ensure the required latency of information to controllers can be met. This includes detection and alerts of microburst/wind shear remain local in the near term until latency requirements to air traffic controllers can be assured, as well as the processing of Next Generation Weather Radar (NEXRAD) mosaics for display to en route controllers.

Located at the FAA Command Center and each of the FAA regional ARTCCs, WARP serves as the common source for weather information in the En Route domain. WARP provides timely

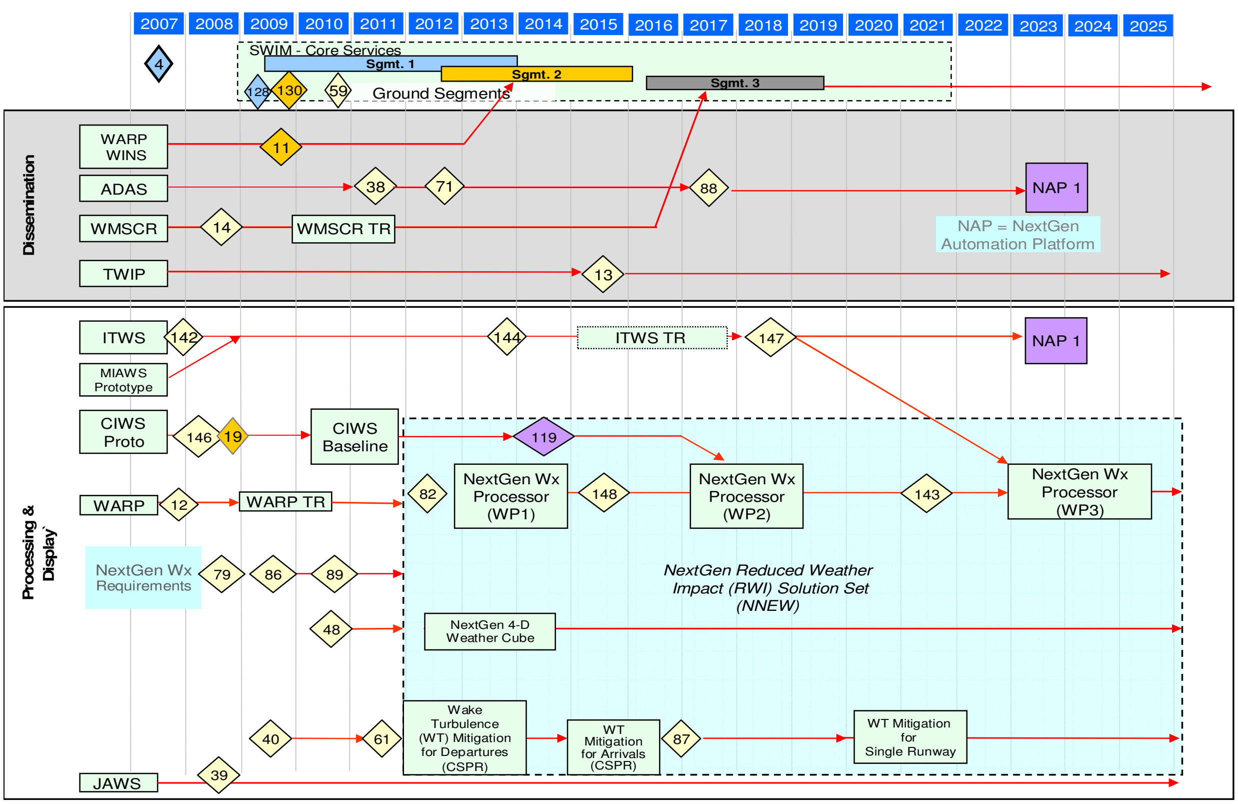


Figure 2 NAS Weather Roadmap to NextGen – Processors

weather information tailored to different users. At the FAA Command Center traffic management specialists receive products to support strategic decisions. At each ARTCC the WARP provides En Route air traffic controllers more tactical information with NEXRAD radar mosaics that depict sector weather hazards for individual sector usage. The Center Weather Service Unit (CWSU) meteorologists' use WARP mosaics to advise traffic managers of current and potential route blockages to support air traffic routing/rerouting decisions, enabling increased efficiency and capacity of the NAS. This shared situational awareness of impacting weather facilitates the efficiency of traffic flow and enables traffic managers to minimize delays.

For the Terminal domain, ITWS ingests and 'fuses' numerous sources of data into products that require no meteorological training for interpretation for both safety and capacity decisions, which are provided to various users. Products include wind shear, microburst, and gust-front alphanumeric and graphic forecast products; storm-cell (location and movement) forecasts, tornado and lightning information; and high-resolution terminal-area wind data. ITWS improves safety, as well as capacity at pacing airports, those with high impact on NAS capacity, by providing the wind shear and microburst prediction. Its high-resolution, rapid updates of terminal wind product provides rapidly updated 3-dimensional wind speed/direction fields over ATC terminal waypoints improves merging and sequencing of aircraft. In addition, ITWS displays the impact of convective storms and gust front passage on runway usage to terminal controllers. This enables them to optimize runway usage during wind shifts associated with storm passage and assist aircraft in avoiding hazardous weather in the approach and departure corridors, thereby increasing airport efficiency. By providing a common picture of weather impacts between controllers, traffic managers and dispatchers, ITWS facilitates coordination necessary to mitigate those impacts and enhance overall NAS capacity.

The CIWS enhances the capacity of the NAS by providing traffic managers high accuracy weather products for the air traffic dense Midwest-Northeast corridors from Chicago to Indianapolis to Washington to New York to Boston. This capability enables them to exploit gaps in the convective activity for aircraft routing/rerouting. As this area is most susceptible to delays and reductions in capacity during periods of convective weather, CIWS generates weather products depicting the current and forecast locations of storms. CIWS currently operates displays at eight ARTCCs, the FAA Command Center, and six TRACONs. The resultant common situational awareness of convection among these facilities aids collaboration to implement effective mitigation strategies. Unique products include storm predictions out to 2 hours and the highest level of accuracy for storm tops (enabling over-the-top routing) and storm intensity growth or decay, as well as an indication of its own predictive performance. To enhance capacity, CIWS also covers important Playbook routes in Canada. By 2012 CIWS will provide convective products for the entire CONUS via the network-centric capability SWIM.

The FAA will determine the functionality (sensor, processor, and dissemination) that must be sustained, modified or replaced to meet the NextGen vision. The FAA's sensor roadmap, shown in Figure 3, depicts the planned transition to NextGen. To reduce operations cost, the FAA is moving toward convergence of as much sensor functionality as possible.

The FAA will also determine if the existing ground-based wind shear/microburst detection systems need to be replaced or if this functionality can be met through a combination of airborne systems, improved NEXRAD (or NEXRAD follow-on system) algorithms, and/or enhanced training. If it is determined that the wind shear/microburst functionality must remain ground-based, the FAA will sustain these systems until convergence the functionality has been completed. The FAA currently has three wind shear/microburst detection systems, the TDWR, the ASR-9 Weather System Processor (ASR-WSP), and the LLWAS, which will be sustained until at least 2020. While these systems each operate differently in how they detect wind shear, they all provide alerts to terminal controllers, who pass them onto pilots of approaching and departing aircraft.

The TDWR and ASR-WSP are radar-based systems that provide wind shear and microburst coverage, gust-front prediction, and storm location and movement at 84 of the busiest NAS airports. Factoring in the stand-alone LLWAS-RS network, extended coverage of wind shear

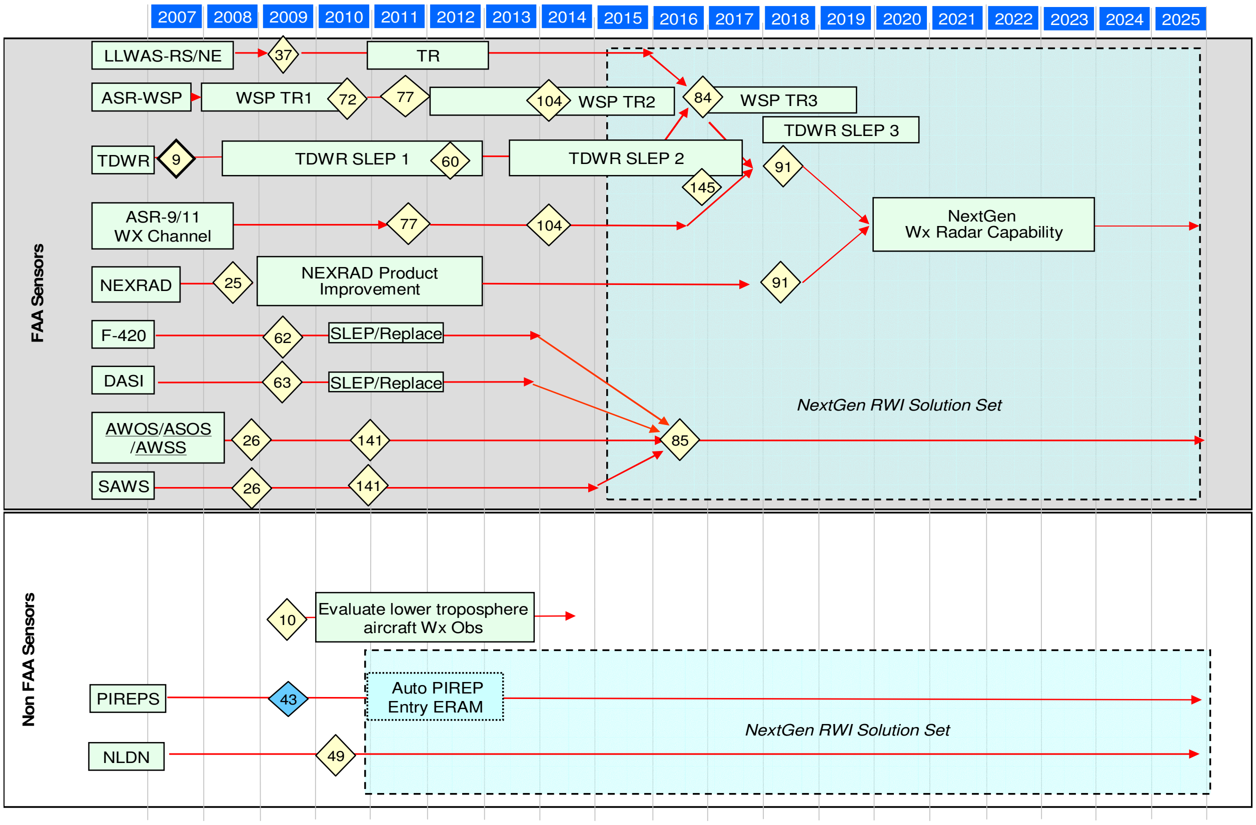


Figure 3 NAS Weather Roadmap to NextGen – Sensors

and microburst hazards is provided at over 120 airports, which enhances situational awareness between Terminal controllers and pilots.

The FAA also uses NEXRAD and the weather channels of the ASR-9 and ASR-11 for convection weather information. NEXRAD provide FAA specific products for several FAA systems. At this time the FAA plans in coordination with NWS and DOD to converge the functionally of all wind shear/microburst and convective sensors into one or no more than two NextGen systems.

Likewise, the FAA's surface observing systems will be sustained until their functionality is also converged into a single system. The F-420, which provides controllers instantaneous winds, and the Digital Altimeter Setting Indicator (DASI) are nearing the end of their life cycle and a decision will be made on whether a service life extension (SLE) is required before replacement. The functionality of the three current surface observing systems (Automated Weather Observing System (AWOS), Automated Surface Observing System (ASOS) and Automated Weather Sensor System (AWSS)) along with the backup system, Surface Automated Weather Sensor (SAWS), will be combined by 2020. Of course, the FAA will work with NWS and DOD on the requirements for the NextGen Surface Observing System.

3.0 4-D Weather Cube and 4-D Weather Single Authoritative Source

The 4-D Wx Data Cube, which is defined as containing all unclassified weather information used directly and indirectly for making aviation decisions, contains all relevant aviation weather information (e.g., observations, automated gridded products, models, climatological data, and human produced forecasts in the form of text, graphical and machine readable products). It also contains proprietary products and those in the public domain, as well as domestic and foreign weather information. The production of the 4-D Wx Data Cube and its utilization by NAS users' applications in an operational manner is the essence of NextGen weather capabilities.

However, a means is needed to arbitrate or merge 4-D Wx Data Cube information into a common weather picture upon which NextGen users, especially air traffic managers can rely.

That common weather picture is the 4-D Wx SAS, which:

- Fuses multiple weather observations and forecasts into a four-dimensional common weather picture available to all users.
- Facilitates decision making by a diverse set of stakeholders making coordinated air traffic management decisions using a variety of applications, decision tools, and displays.

The purpose of the SAS is to provide a standardized source of aviation weather elements (e.g., turbulence and icing) and element probabilities for use in making air transportation management decisions. Because the SAS comes from the 4-D Wx Data Cube, the weather information is integrated (or as the NextGen ConOps cites it, “fused” or “merged”) to obtain internal consistency before it becomes part of the SAS. Creating integrated information means that many information sets in the SAS are unique and may not reflect any one of the Cube sources that were used for merging.

The SAS represents the machine-readable, network-enabled, geo- and time-referenced weather information available via network-enabled communications and has the following characteristics:

- Includes current observations, interpolated current conditions (e.g., analyses), and predictions of future conditions
- Supports probabilistic decision aids
- Provides a seamless, consistent common weather picture for integration into operational decision support tools available to all ATM decision makers

4.0 Assumptions

The following constitutes the assumptions for transitioning the NAS weather architecture to that of NextGen:

- Ongoing NextGen Weather Functional Analysis may result in new and emerging requirements that create perturbations in the FAA’s NextGen Weather Architecture
- Sustainment for weather communications systems (WMSCR, WARP-FBWTG & WARP-WINS, and ADAS communications) until transition to NextGen net-enabled weather capability
- Current weather sensors are sustained until replaced by NextGen capability
- FAA funds its portion of the 4-D Weather SAS
- Migrate weather information to common network-enabled operations
- SWIM subsumes functionality of weather communications systems and subsystems and connects to all sensors by 2018.
- WARP End of Service - WARP technical refresh is needed to sustain functionality until it is subsumed by the NextGen Wx Processor WP1 (2012-2014)
- CIWS functionality is transferred to the NextGen Weather Processor by 2018
- NextGen Weather Processor WP 3 may be implemented on a non-FAA system
- Wake vortex sensors are installed and prediction capability becomes available
- In situ weather sensors are mandated on fully performance capable aircraft (Part 121 & 135), as well as UAVs by 2028
- Cockpit decision support tools use weather information to aid pilot in decision making; tailored weather can also be displayed
- In 2025, all aviation weather data is obtained from NextGen 4-D Wx Cube and all ATM aviation weather from the 4-D Wx SAS
- FAA continues to run some aviation weather algorithms (e.g., microburst and wake vortex) based on latency needs
- Weather research works toward specific requirements (e.g., icing accuracy and capability to create the 4-D Wx SAS)

5.0 NextGen Issues Impacting Weather Architecture

The FAA created the Enterprise Architecture roadmaps depicting the transformation from today to NextGen as an executive view of the NAS enterprise architecture. The latest weather roadmaps for “Dissemination, Processing and Display” and “Sensors” are depicted in Figures 2 and 3. The primary issues for determining the appropriate transition strategy are discussed in the following paragraphs.

To transition to NextGen, the end-state must be defined. The JPDO has developed several versions of the NextGen Concept of Operations (ConOps) with each successive version adding more detail. The current NextGen ConOps is version 2.0 dated 13 June 2007. A JPDO sponsored study team performed a weather functional analysis by extracting the operational functions requiring weather information to support decision making from this version of the ConOps. The weather functions required to support users' needs for weather information were then decomposed to the lowest level (i.e., highest level of detail). These functions were then transformed into functional requirements. The study team also developed performance requirements that define the temporal and spatial resolution requirements of the 4-D Weather SAS, including refresh rates, reliability and availability. The next task is to develop the performance requirements for each NextGen weather function, have them validated by operational users and then incorporate any changes resulting from that validation for a final, complete set of NextGen weather requirements. Then a gap analysis between today's NAS and NextGen will be performed. Once the gaps are understood and the requirements are allocated to the infrastructure [systems], the Enterprise Architecture weather roadmap will be updated. At that time, the FAA will support the JPDO refinement of the NextGen Integrated Work Plan.

As NextGen aircraft must have specified capabilities to operate in high-density airspace, the NextGen Weather ConOps envisions that weather sensors and/or algorithms will be mandated on fully capable aircraft in order to provide weather information to other users directly or indirectly via the NextGen 4-D Wx SAS. There will be two standardized sets of data required from aircraft in situ observations, one for jetliners and one for other aircraft. At a minimum, the jetliners will provide winds, temperature, relative humidity, turbulence, and icing information. To capture airborne in situ observations from the mid- and lower-levels of the troposphere, regional jets and some high-end general aviation aircraft will have a sensor set similar to airliners. To meet the vision of NextGen and the required mitigation of weather hazards on the NAS, the NextGen critical path may require mandatory equipage of a similar, more advanced sensor suite on smaller aircraft that wish to fly in highly congested airspace.

Another issue entails conducting Super Density Operations (SDO) at the nation's busiest airports. Today, in the most densely populated areas of the U.S., the air traffic system is barely keeping pace with demand. By 2025, even more major airports will become significantly congested as demand on the NAS approaches three times that of today. Conducting SDO entails matching land and airside throughput of an airport to meet NAS demand and requires reduced separation standards and less restrictive runway operations. A major factor impacting airport throughput is wake vortex (WV) considerations, which result in increased separation standards that lower airport acceptance rates. To ameliorate this reduction in airport capacity, the ability to provide wake vortex detection, and the predicted location and strength of WV is needed. Both these capabilities have been in research and development for some time. NASA and FAA have data from an airport experiment using a commercial LIDAR to detect and characterize WV, which may lead to modifications to current procedures for aircraft separation standards at airports with closely spaced parallel runways (CSPR). The FAA expects to have a wake vortex for departure capability implemented by 2015. Additional capability will be implemented through 2021, while further research on aircraft wake vortex mitigation systems is conducted.

However, a key question for the FAA is whether the convergence of its weather processing capability [depicted in Figure 2] should be a FAA system or integrated into a NextGen forecasting capability. This decision depends on several factors including the timeframe this capability is expected to emerge and to what extent it will be decentralized. The FAA still expects to extract model data from the NextGen 4-D Weather SAS and run aviation-unique applications, e.g., wind shear and microburst algorithms. This forecasting capability should be capable of incorporating all the current and planned functionality of WARP (except NEXRAD mosaics for DSR), CIWS, and ITWS (except for microburst, wind shear and possibly wake vortex detection).

One continuing issue for users is the small number of PIREPs that are captured for transmission and assimilation into models. The FAA plans the addition of a nearly automated capability for controllers to easily enter PIREPs in WP 3 or 4 of its En Route Automation Modernization (ERAM) system. At a minimum, this capability will be a part of the replacement NextGen Automation Processor (NAP).

On the surveillance roadmap, the Terminal Service unit has determined the need for replacement terminal radars for aircraft and weather surveillance to begin in the 2020 timeframe. With the transition to automatic dependent surveillance – broadcast (ADS-B) and satellite-based global positioning system (GPS), multi-lateration, and beacons; aircraft surveillance will no longer be ground based. However, it has been determine that a ground-based backup is necessary to maintain safety standards. The surveillance roadmap specifies a SLE for the ASR-9 to maintain a terminal weather radar capability. TDWR will also have a SLE. If it is determined that ground-based, low-level wind shear systems are no longer needed, the TDWR will be replaced with less expensive weather radar after 2020.

The JPDO will prioritize weather research and development (R&D) based on the selected NextGen critical path, which will be determined by the requirements. Once the weather requirements have been developed, the JPDO will update their R&D plan and the FAA will aligns its sponsored aviation weather R&D efforts to attain envisioned improvements. Weather R&D provides improved safety with the emergence of new forecast products such as enhanced in-flight icing and turbulence gridded products that include a severity parameter. In terms of capacity, as thunderstorms contribute the most to NAS weather-related delays, aviation weather research continues to develop more accurate, longer-range thunderstorm forecasts to enable the FAA to meet traffic management needs for forecasts out to eight hours.

Initially, new weather R&D products are displayed on weather processors and are accessible to some users. However, after 2016, many of these products are integrated into decision support tools of both FAA service providers and users to optimize algorithm performance for trajectory calculations, capacity determination, etc. Subsequently, probabilistic forecasts are fully integrated into decision support tools to incorporate the uncertainty in weather forecasts and that of traffic demand to provide traffic managers with enhanced capacity forecasts that minimize the loss of usable airspace.

6.0 Summary

Mitigation of weather impacts on the NAS is crucial to meeting the NextGen vision and must be fully integrated into the weather architecture to support the transition to NextGen. However, before the FAA can finalize the critical path of the Air Traffic System from today to 2025, the development of all NextGen requirements, not just weather requirements, is needed to perform a gap analysis. In many cases, the functionality will not change, but the entity performing the function will. Even when the gap analysis is completed, a number of studies are required to determine the critical path.

The FAA supported the NextGen weather functional analysis and the development of 4-D Weather SAS functional and performance requirements. It will continue to support the development of the rest of the NextGen performance requirements for the various weather parameters (e.g., accuracy of icing and turbulence forecasts), which will be completed in 2008. Operational users will validate these requirements through modeling and simulations. Then the best way to integrate weather into DSTs must be evaluated using operational metrics that improve NAS safety, efficiency and capacity.

Continued funding for weather R&D is absolutely essential to attaining NextGen capabilities and the weather performance characteristics that support them. NextGen essential R&D act ivies include:

- Reducing the number of weather-related accidents
- Supporting the reclamation of some of the usable airspace that is lost as traffic managers react to insufficiently reliable forecasts
- Develop the advanced modeling capability to create the 4-D Weather SAS and appropriate probability forecasts
- Investigate the possibility of mitigating weather impacts via airframe modifications
- Addressing techniques to integrate weather information into DST's including the use of probabilistic quantifications

The FAA has on-going efforts to deploy SWIM for the real-time net-centric dissemination of weather information. SWIM converts the multitude of direct connections between data sources, sensors, processors and user systems to nodes on the network. SWIM will subsume the functionally of weather communications systems.

The FAA is conducing system engineering efforts to determine the best way to consolidate weather system functionality to reduce implementation and operations costs. The goal is to combine wind shear/microburst and radar that provide convective information. Surface observing systems will likewise be consolidated, as will weather processors.

In order for weather to obtain the necessary funding to implement NextGen weather solutions, data-driven business cases must be developed. The studies that must be performed to provide the information for weather business cases include (1) available benefits, (2) integration of weather into decision support tools (DST), and (3) how does weather really impact the NAS. More importantly, these studies must to be conducted to determine what portions of available benefits can be allocated to weather systems. With the emphasis on improving NAS capacity to meet a demand three times that of today, caution must be exercised to not attribute capacity benefits to weather that may not be realistic. For example, what portion of the airspace that is currently 'lost' due to inadequate convective forecasts can actually be 'used' in the future with a accurate weather product that enables capabilities such as over-the-top routing or depicts high-resolution convection spacing that enables safe passage or has an accurate 8-hour forecast? Also, full integration of weather into DSTs is a must for the improved trajectory-based operations to become a reality.

In the final analysis, benefits must be based on metrics that improve NAS safety, efficiency and capacity. For example, if for the same amount of money research can improve in-flight icing forecast accuracy by 12% or turbulence forecasts by 8%, it must be determined which one has the greatest positive impact on the NAS!

The FAA's NAS enterprise architecture roadmaps will be updated annually, incorporating changes based on maturing R&D and operational studies, as well as any updates to the NextGen Concept of Operations. While these changes may be considered revolutionary by some, they are absolutely essential to meet the challenges of mitigating weather impact to NextGen. The real challenge for the FAA – ensure that sound system engineering principles are adhered to in transforming the NAS weather architecture to the NextGen vision.

7.0 Acronyms

4-D = Four dimensional (space and time)

ADAS = AWOS Data Acquisition System

ADS-B = Automatic Dependent Surveillance - Broadcast

ARTCC = Air Route Traffic Control Center

ASOS = Automated Surface Observing System

ASR-9 = Airport Surveillance Radar, Model 9

ASR-11 = Airport Surveillance Radar, Model 11

ATC = Air Traffic Control

ATCSCC = Air Traffic Control System Command Center

ATO = Air Traffic Organization

ATOP = Advanced Technologies and Oceanic Procedures

AWOS = Automated Weather Observing System

AWSS = Automated Weather Sensor System

BLM = Bureau Land Management

CIWS = Corridor Integrated Weather System

ConOps = Concept of Operations

CSPR = Closely Spaced Parallel Runways

CWSU = Center Weather Service Unit

DASI = Digital Altimeter Setting Indicator

DOD = Department of Defense

DOTS = Dynamic Ocean Track System

DSR = Display System Replacement

DST = Decision Support Tool

ERAM = En Route Automation Modernization

ETMS = Enhanced Traffic Management System

FBWTG = FAA Bulk Weather Telecommunications Gateway

FIS = Flight Information System

FAA = Federal Aviation Administration

GA = General Aviation

GPS = Global Positioning Satellite

HOST = Host Computer System

ITWS = Integrated Terminal Weather System

JAWS = Juneau (Alaska) Airport Wind System

JPDO = Joint Program and Development Office

LIDAR = Light Detection and Ranging

LLWAS = Low-Level Wind-Shear Alert System

LLWAS-NE = Low-Level Wind-shear Alert System-Network Expansion

LLWAS-RS = LLWAS Replace/Sustainment

M1FC = Model 1 Full Capacity

MDCRS = Meteorological Data Collection and Reporting System

MIAWS = Medium Intensity Airport Weather System

MNS = Mission Need Statement

NAP = NextGen Automation Processor

NAS = National Airspace System

NASA = National Aeronautics and Space Administration

NCWF = National Convective Weather Forecast

NEXRAD = Next Generation Weather Radar

NextGen = Next Generation Air Transportation System

NLDN = National Lightning Detection Network

NNEW = NextGen Network-Enabled Weather

NWS = National Weather Service

NWSTG = NWS Telecommunications Gateway

OASIS = Operational and Suitability Implementation System

PIREP = Pilot Report

R&D = Research and Development

RWI = Reduce Weather Impact

SAS = Single Authorative Source

SDO = Super Density Operations

SLE = Service Life Extension

SWIM = System Wide Information Management

TDWR = Terminal Doppler Weather Radar

TRACON = Terminal Approach Control

TWIP = Terminal Weather Information for Pilots

UAS = Unmanned Aircraft System

UAV = Unmanned Aerial Vehicle

URET = User Request Evaluation Tool

WARP = Weather and Radar Processor

WINS = Weather Information Network Server

WMSCR = Weather Message Switching Center Replacement

WP = Work Package

WS = Wind shear

WSP = Weather System Processor

WT = Wake Turbulence

WV = Wake Vortex (or Wake Vortices)

Wx = Weather

8.0 References

Joint Planning and Development Office (JPDO) NextGen Concept of Operations for the Next Generation Air Transportation System v2.0, Joint Planning and Development Office, 13 June 2007.

JPDO Weather Policy Study Team NextGen Weather Policy: Findings and Recommendations version 0.1, October 31, 2007.

JPDO Weather Functional Requirements Study Team Draft Report on Four-Dimensional Weather Functional Requirements For NextGen Air Traffic Management, January 2008.

The FAA's Aviation Weather Mission Need Statement (MNS) #339, June 2002.

The FAA's Operations Network (OPSNET) Database (2001-2006).

NOTE: The views expressed herein reflect the personal views of the author(s) and do not purport the views or position of the Federal Aviation Administration or any other component of the Federal Government.