



NASA Surface CNS Network Requirements Summary

Agenda

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 - 3 Airport Operations Communication Systems
 - 4 Tenant Communications Systems
 - 5 Existing Systems Assessment
 - 6 Services Description and Criticality Evaluation
 - 7 Current Wireless Systems
 - Limitations/Concerns/Recommendations
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- ▶ Conclusions

DFW Airport Overview

- ▶ Level 12 Airport
- ▶ 3rd Busiest Airport in the US
- ▶ Largest Hub for American Airlines
- ▶ Significant Package Processing Hub for UPS and FedEx
- ▶ One of FAA's Largest TRACONs and ATCT Operations
- ▶ Four terminals for passenger traffic, fifth in operation in 7/05
- ▶ Has multiple mobile radio systems with approximately ~4800 frequency assignment available for users
 - Users include airlines, caterers, fuelers, cargo handlers, ramp handlers and baggage handlers
 - Systems are fully loaded with users
 - Systems operate at 800 MHz and 460 MHz range

Task 1 American Airlines Communications Avionics



Courtesy of American Airlines

Task 5 Existing Systems Analysis

► FAA Communication Spectrum Analysis

User	Power Levels	Frequency Range Used	# of Channels / Frequencies	Use
FAA NAVAIDS	2.5 W	75 MHz	1	FAA RadioNavigation - ILS Marker Beacon
FAA NAVAIDS	15 - 150 W	108.1 -117 MHz	10	FAA RadioNavigation - LOC, VOR
FAA ATC Voice Comm	~ 10 W	118.1 - 128.425 MHz	38	FAA VHF Comm Radio Comm
FAA ATC Voice Comm	~ 10 W	132.5 - 136.525 MHz	13	FAA VHF Comm Radio Comm
FAA ATC Voice Comm	10 - 25 W	219 - 323.05 MHz	25	FAA UHF Comm Radio Comm
FAA NAVAIDS	2 - 3 W	329.45 - 335 MHz	7	FAA RadioNavigation - Glide Slope etc
FAA ATC Voice Comm	10 W	338.2 - 397.85 MHz	12	FAA UHF Comm
FAA	2 - 4 W	409.55 - 418.575 MHz	6	FAA Land Mobiles
FAA	1 - 5 W	2.5875 - 941.5875 MHz	3	FAA Land Mobiles
FAA NAVAIDS	1.5W - 3.5 kW	978 - 1191 MHz	10	FAA RadioNavigation UAT, ADS-B, Mode-A, Mode-C
FAA NAVAIDS	~ 1.3 MW	2755 - 2895 MHz	4	FAA RadioNavigation
FAA	0.5 - 1.3 W	7128 - 8480 MHz	16	FAA Fixed
FAA	1.5W , 3kW	14.51625 - 15.7 GHz	4	FAA - RadioLocation

Task 6 Services Description and Criticality Evaluation

► Functions and operations critical to airline operations

- Host outages – Creates significant delays
- Dispatch – Flight plans/releases
- Fueling – Fuel loads come from dispatch
- Passenger Services
- ACARS- close out activity, connecting passengers, maintenance items
- Mobile/Portable Radios – Impact ramp and passenger operations
- Aircraft Maintenance
- Inventory Control – Affects maintenance capability
- Company Tower – Terminal area control, taxi in/out, gate assignment
- FAA Tower – Local ground movement, departure control
- FIDS – Passenger originating and connecting at airports
- Weather
- TSA Security Checkpoints
- INS Customs
- DPS – Police, Fire, Emergency

Task 6 Services Description and Criticality Evaluation (cont.)

▶ FAA Terminal Systems

- ATCT ground voice & data communications lines
- ATC Radios (VHF & UHF)
- Radar (ASR-9 & ASDE-3)
- Marker Beacons (Nav/Landing)
- Lighting Systems (Nav/Landing)
- ILS (Nav/Landing)
- VOR (Nav)
- TDWR (Hazardous Weather)
- LLWAS (Hazardous Weather)
- TDLS for PDC & ATIS (Voice & Data)
- ITWS (Weather)
- RVR (Weather)
- ACE-IDS (Weather & NOTAMS)
- AWOS/ASOS (Weather)

Proposed Requirements for AWSN



- ▶ Proposed requirements are categorized as follows:
 - Technical
 - Performance
 - Security
 - Safety
 - Policy

Proposed Requirements for AWSN

▶ Technical requirements

- **The AWSN shall be a shared network supporting ATC, Airspace users, Airport Operators, and passengers.**
- The AWSN shall have the capability to establish separate, independent domains for each network segment provider and gateways across those domains, as required.
- The AWSN shall be capable of operating with a single RF operator and/or multiple providers.
- The AWSN shall operate in a multi-RF provider environment.
- **The AWSN shall support Circuit Switched, Packet Switched, and Broadcast modes for voice, data, and video traffic.**
- The AWSN shall be capable being interoperable with copper, fiber, and other wireless networks present on the airport surface.
- The AWSN shall be able to transmit and receive air-mobile and ground-mobile voice, data, and video communications.

Proposed Requirements for AWSN

► Technical Requirements (cont.)

- Placement of AWSN antennas shall not create an obstacle to air traffic and surface vehicle operations.
- AWSN mobile transceiver equipment shall fit on the selected platform
- The AWSN shall not degrade other aviation systems below their minimum performance requirements.
- **The AWSN shall be capable of keeping network traffic separate based upon priority, i.e. critical, essential, and routine traffic shall be isolated from each other.**
- The AWSN shall be capable of prioritizing service based upon network traffic class (e.g., criticality of message type) in accordance with ICAO Annex 10 priorities.
- **The AWSN shall have “ruthless” pre-emption of lower priority traffic in favor of higher priority traffic.**
- **The AWSN shall have standard EIA, ITU-T, IEEE, and IETF telecommunications interfaces that can accommodate voice, data, and video.**

Proposed Requirements for AWSN

► Technical Requirements (cont.)

- The AWSN shall not diminish the quality of ICAO Annex 10 high priority voice or data communications by interfacing to public or private networks.
- **The AWSN shall have the capability for each network segment provider for centralized management to monitor and control faults, either locally or remotely, configuration, accounting (i.e., billing for services), performance, and security across the AWSN domain.**
- **The AWSN shall provide capability for cross-domain monitoring (query only) for coordination between network segment providers at the discretion of each provider.**
- The AWSN shall have equipment certified to the environmental, input power and harmonic distortion requirements specified in FAA-G-2100G.
- **The AWSN shall use the ICAO accepted voice encoder decoder specified in ICAO Annex 10, Vol. III, Part 1, Chapter 6.**
- **The AWSN shall support voice service extensions (e.g., Anti-Blocking, Controller Override, etc.) identified in RTCA DO-284 and DO-284 Change 1.**

Proposed Requirements for AWSN

▶ Performance Requirements

- The AWSN, for Aircraft to Ground, communication shall meet the Required Communication Technical Performance of 770 ms 95% of the time and the continuity, availability and integrity numbers as specified in, Appendix C1, section 5, RTCA DO-284 and DO-284 change 1, Table 5-2.1.
- The AWSN latency, when used as a wireline replacement to an ATC voice & data communication site, shall not exceed 25 ms in one direction.
- The AWSN shall meet the ICAO Annex 10 data integrity requirements for ATN Subnetworks.
- The AWSN shall have the following minimum data rates for each segment of the user community:
 - FAA: ~30 Mbps (TRACON to Tower), ~12 Mbps (TRACON or ATCT to RTRs, NAVAIDS, ASR-9 Radar, DBRITE, Weather Sensors, etc.). Does not include ASDE-3.
 - Airlines: ~ 65Mbps
 - Airport: 7 Mbps for data
 - Passenger comm.: 54 Mbps data only.

Proposed Requirements for AWSN

▶ Performance Requirements(Cont.)

- The AWSN shall be expandable, at a minimum, to 200% of its minimum data and voice capacity requirements to support growth.
- The AWSN shall be scalable to support additional growth.
- For discretely addressable services, the AWSN shall support the ICAO 24 bit address range and addressing for other non-aircraft fixed and mobile entities.
- The AWSN shall be capable of supporting end-to-end services that have 0.99999 availability with a six second mean-time-to-restore in accordance with FAA Order 6000.36 and the NAS-SR-1000.

Proposed Requirements for AWSN

▶ Security Requirements

- **The AWSN shall meet the security requirements documented in Homeland Security Presidential Directive 7: Critical Infrastructure Identification, Prioritization, and Protection.**
- The AWSN implementation shall support functionality that enables meeting the requirements of FAA Order 1200.22C.
- **The AWSN shall have the capability to provide secure communications (e.g., authentication, integrity, encryption, etc.) for all types of traffic transmitted using any of the modes.**
- The AWSN shall include the capability to secure assets within its domain from internal and external security violations and intrusions (e.g., virus protection, unauthorized access, protection against Denial of Service attacks).

Proposed Requirements for AWSN

▶ System Safety Requirements

- Each AWSN element shall meet FAA Aircraft Certification, Flight Standards, and ATO Safety requirements including all affected aircraft types.
- **The AWSN shall be subject to FAA ground system and airborne safety assessment in accordance RTCA DO-264 and FAA Order 8040.4.**
- The AWSN safety assessment shall incorporate all aspects of the airborne and ground components so that design assurance levels for DO-178B and DO-278 are properly identified.
- The AWSN shall incorporate the required enhancements resulting from the identified design assurance level in the safety assessment.

Proposed Requirements for AWSN

► Policy

- **The AWSN shall be standardized by ICAO and the ITU-T for worldwide acceptance.**
- **The AWSN for non-governmental users shall meet the requirements of the FAA Order 6050.19E Radio Spectrum Planning Process.**
- The AWSN shall be capable of providing diversity and avoidance in accordance with FAA Order 6000.36 and the NAS-SR-1000.
- The AWSN digital services shall comply with requirements specified in FAA Order 6000.47 (Maintenance of Digital Transmission Lines).

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- ▶ **The FAA's Aircraft Certification and Flight Standards Services should be engaged as soon as possible concerning AWSN development issues.**
 - ▶ ASDE-3 radar data rate (400 Mbps) is well beyond the capabilities current digital RF technology, therefore it was not included in the bandwidth.
 - ▶ Based on FAA requirements, do not combine the radar, ADS-B, and NAV/Landing systems in with the communications functions. No load is assumed in this analysis.
 - ▶ To meet the 200% growth in communications needs, new technology may be required.
 - ▶ Communications requirements for the AWSN will need re-assessment as concepts and resulting systems evolve.
 - ▶ To facilitate #1, the most likely uses of the AWSN should be selected as soon as possible.

Conclusion

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- ▶ **Communications load growth can be expected to parallel growth in the number of aircraft operations. The growth percentage in the requirements area should accommodate new projected systems.**
 - ▶ Assumptions about the growth in the number of surface aircraft operation will drive communications requirements.
 - ▶ Data rate performance numbers should be adequate to accommodate this growth based on current understanding of future requirements.
 - ▶ A thorough analysis of Airport Communications needs has been completed.
 - ▶ A set of top-level requirements has been generated.
 - ▶ The current needs, systems being delivered, and 0-3 years communications needs are very well understood.
 - ▶ Future communications needs beyond 3 years have been factored in based on FAA forecast numbers that indicate aircraft operations will double by 2014.