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Mobile Communication Network Architecture (MCNA)

Co-Funded by FAA and NASA GRC under the Boeing Global
Communication, Navigation and Surveillance System (GCNSS) Follow-on
Contract

Boeing team includes: Boeing, Avaliant, Honeywell & ITT

Karl Griep – Avaliant LLC/Boeing
8/16/2005



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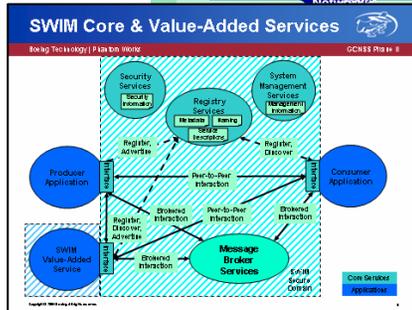
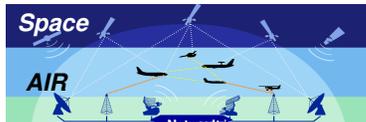
MCNA Relationship with Past, Present & Future NASA Research Activities



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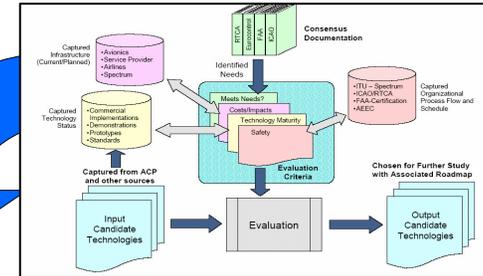
GCNSS Phase II

GCNSS- I
GCNSS- II

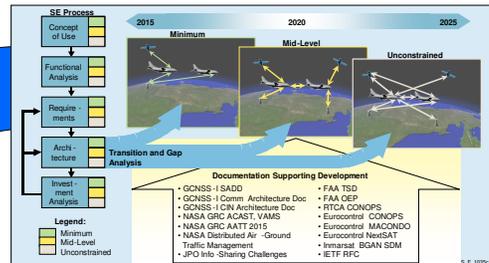
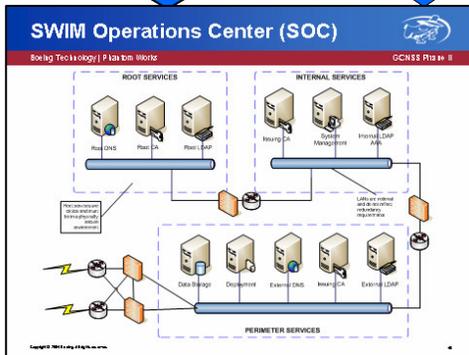


NASA/FAA
MCNA

FAA/NASA
Future Communications Study

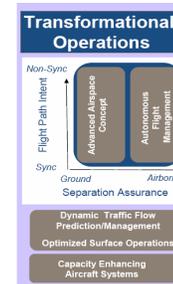
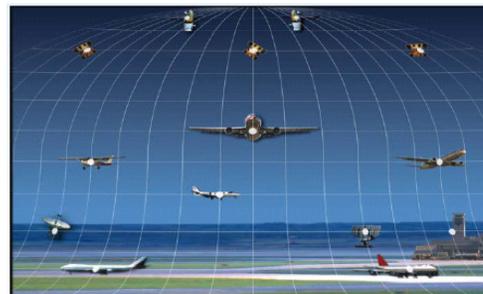


FAA
SWIM



NASA TNAS
2015-2025

NASA SBT
2007-2015



UAV Operations
University/Base Research

What is MCNA ?



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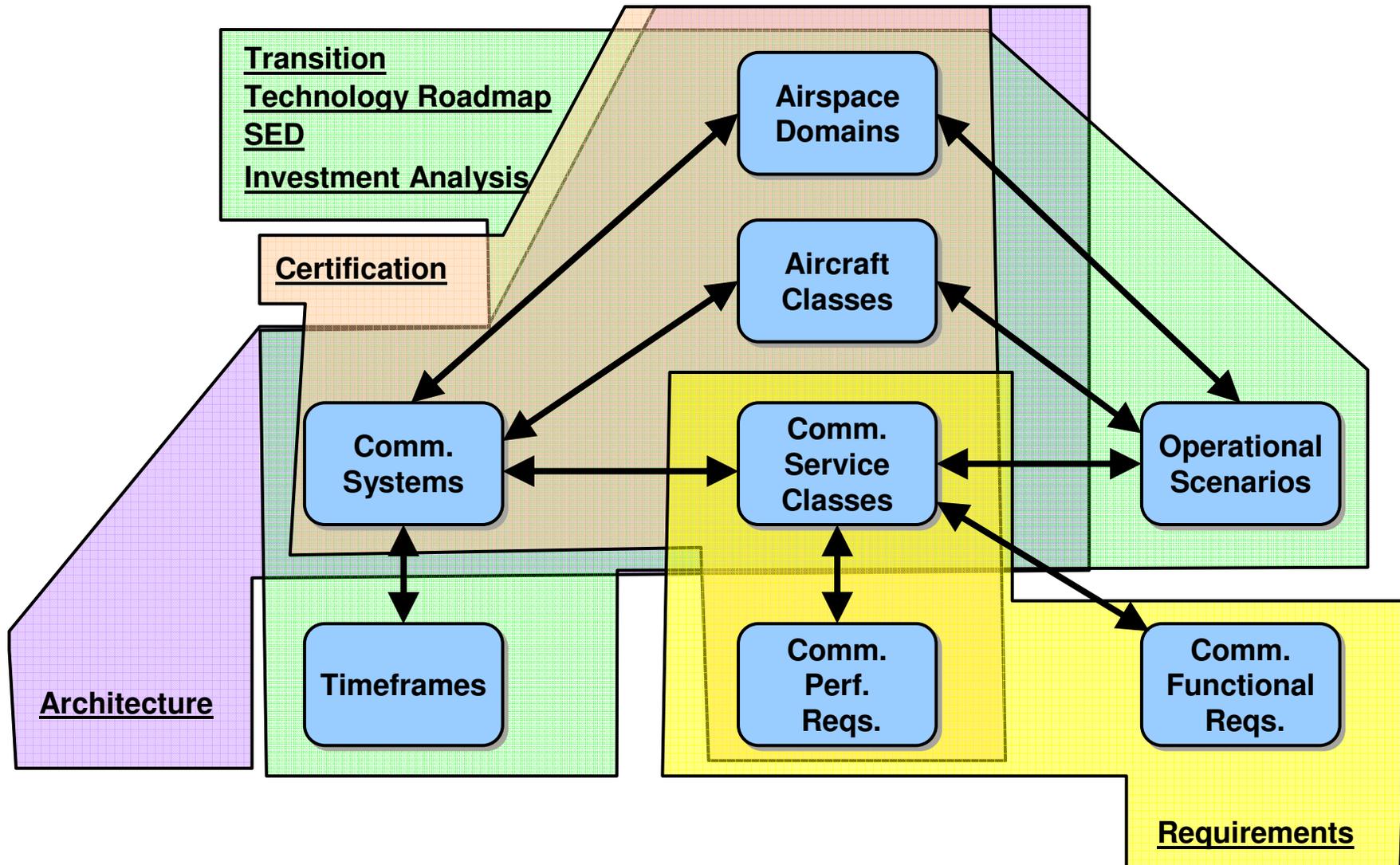
- **The aggregate of all A-G and A-A voice and data communications for CNS/ATM**
 - Includes physical and datalink aspects
 - Most concerned with internetworking considerations
- **MCNA is a Methodology for integrating disparate A-G & A-A communications links into a coherent communication networking solution**
 - Achieving aggressive service levels using two or more individual communication systems
 - Seamless service coverage across airspace domains and all aircraft classes
- **This effort has specifically focused on communication support for Network Centric Operations by enabling SWIM to the aircraft**

MCNA Task Data Organization



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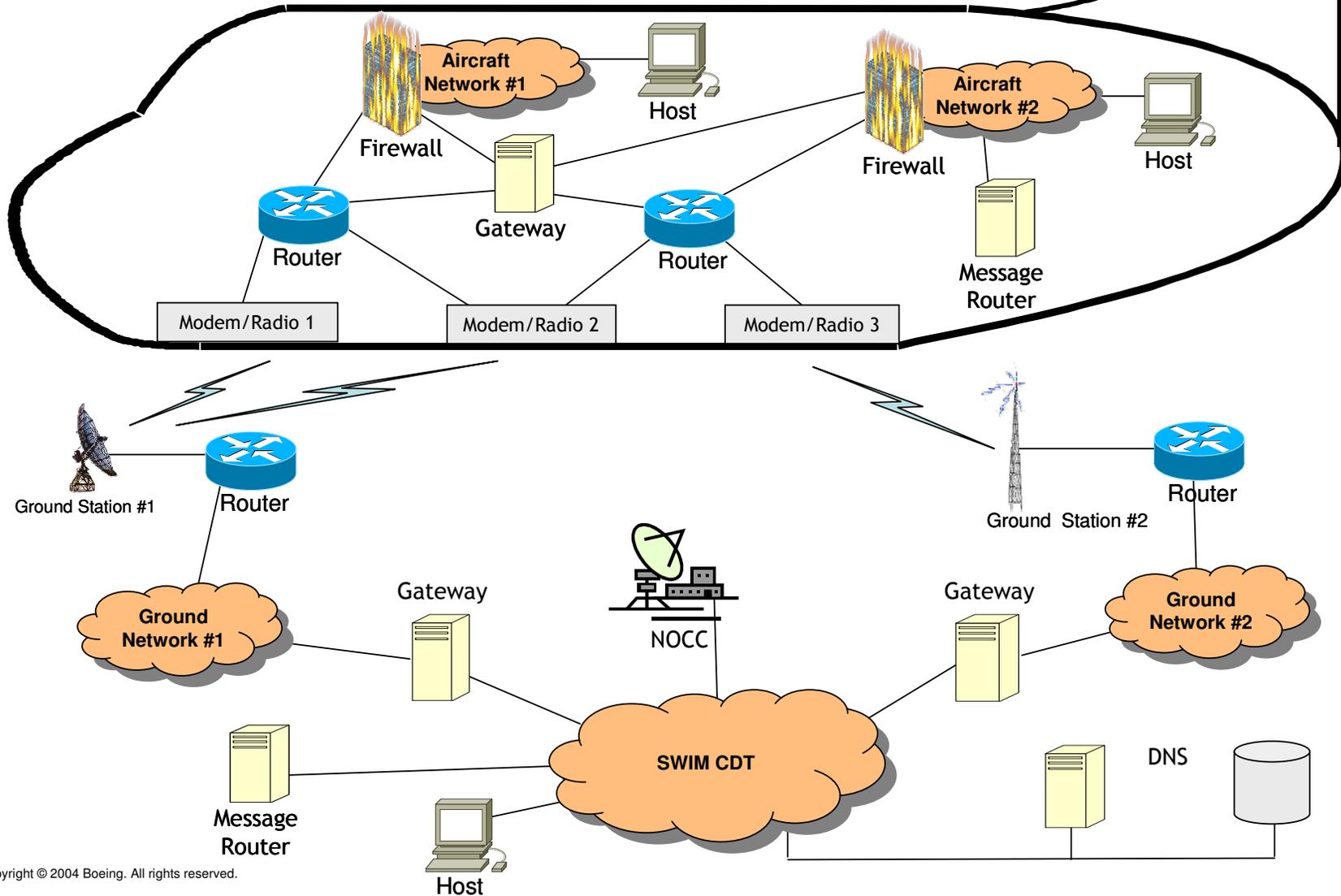


MCNA Physical Architecture



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- **Comparison of ATN and MCNA**
- **Required Communication Performance (RCP)**
- **Common Links for Safety of Life and Non-Safety of Life Traffic**
- **Certification Process Enhancements**
- **Initiate Near Term Deployment of IP**
- **MCNA is a Transformational Approach to A-G & A-A Communications**



- **MCNA is very similar and complementary to ATN**
 - **ATN network protocol selection was best at the time**
 - **Commercial networking selected an alternate course - IP**
 - **IP incorporates 15 years of continuous process improvement**
 - Fueled by a thriving, multi-billion dollar IT industry
 - Much has been learned about structure networking protocols
- **MCNA only proposes to extend Layers-3&4 of ATN**
 - **CLNP becomes IPv6 and TP4 become TCP**
 - **ATN upper layer protocols and applications remain unchanged**
 - **IP-based ATN provides “best-of-breed” protocol stack**
- **ICAO is already moving towards TCP/IP**
 - **Already recognized the merits for G-G**
 - **Investigating the potential for A-G**



- **Tightly coupled with MCNA**
- **MCNA must influence RCP process**
 - **Must assure that RCP can be met using multiple links**
 - **Justification through operational analysis**
 - **Re-evaluated requirements for multihoming and PBR**
- **RCP Complexity**
 - **More complex than RNP (wider range of applications)**
 - **Removing barriers to entry for new communication services**
 - **Decouples communications systems from the applications**
- **Interoperability**
 - **May introduce even greater barriers to entry**
 - **Backward compatibility must be maintained!**



- **Equipage cost is a barrier to MCNA**
 - Shared links maximize the benefits while sharing cost
- **MCNA should enabled shared links**
 - Maximize cost/benefit
 - Expedite equipage adoption
- **Requires QoS assurance**
 - Over-provisioning
 - Fixed allocations
 - Priority, pre-emption and precedence (PPP)
- **IPv6 is the logical choice for shared A-G links**
 - Airlines will not transition to ATN for AOC, AAC or APC
 - Airlines are increasingly demanding IP
 - reduce cost and increase interoperability
 - OMB mandate for IPv6 vs. IPv4



- **No process to certify commercial comm. systems**
 - Open ended, thus too risky for most service providers
 - Build upon RTCA DO-270
- **Certification through demonstrated performance**
 - Use new links for APC/AAC services but monitor to demonstrate/establish performance
 - Use monitored data to justify use of commercial service for AOC and eventually ATS services
- **Application layer integrity mechanisms could allow relaxed software certification for comm. avionics**
 - Only integrity failures require Level-C
 - Protected Mode (PM) – CDPLC, PM-ADS, PM-FIS
 - Note - PM provides no security just data integrity
 - DO-290 (ATS), DO-296 (AOC)

Initiate Near Term Deployment of IP



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- **IPv6 selected for SWIM and MCNA**
- **IPv6 does not support certain ATN requirements**
 - **Mobility with multihoming & policy based routing**
- **Current and planned datalink services are based upon message transfer**
- **COTS IP-based message transfer services (MTS)**
 - **Overcome IPv6 shortcomings in the near term**
 - **Same technology selected for SWIM**
 - **Opportunity to introduce security**
 - **Early SWIM services to the aircraft**
- **Common IP link also supports APC, AAC and AOC**
 - **ARINC 633 – Common AOC message format (ACARS & XML)**

MCNA is a Transformational Approach to A-G & A-A Communications



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- **Similar Investment Analysis issues as SWIM and FTI**
 - **Enabling technologies based on common networking infrastructure**
- **MCNA is not a data link technology or a FAA program**
 - **Design approach/methodology to extend SWIM benefits and NCO capabilities to the aircraft**
 - **A Network Architecture for Mobile Nodes in the NAS**
- **Enables certain benefits stand-alone**
 - **e.g. CPDLC reduction of pilot and controller workload**
- **Mostly enables operational enhancements in conjunction with revised procedures and new automation**
 - **e.g. JPDO's Agile NAS**
- **Up front investment to provide long-term rewards**

Questions and Contact Information



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- All deliverables will be available on the ACAST website
- Email Comments:
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 - david.c.morse2@boeing.com
- Questions:

