Future Aviation Network Technologies

Speakers

- Cary Spitzer, AvioniCon, Inc.
- Ralph Yost, Federal Aviation Administration
- Robert Crow, AirNav, Inc.
- George Couluris, Seagull Technology, Inc.
- Paul Cobb, Seagull Technology, Inc.
- Kevin Harnett, DOT/Volpe Center
- Kathleen Kearns, SITA
- Chris Wargo, Computer, Networks and Software, Inc.
- Steven Mainger, NASA Glenn Research Center

SPEAKERS...

ACAST
Architectures and Networks

Steven Mainger
NASA Glenn Research Center
Sub-project Manager
August 24, 2004

Architectures and Networks

- Identify the transformational CNS architectural concepts that will enable transition to a high-performance integrated CNS system.
  - Problem: The current NAS infrastructure is composed of functionally separate and independent CNS systems that do not allow for sharing of data, efficient use of spectrum resources, world-wide coverage, and long term capacity requirements.
- Define the global air/ground network architecture needed to support the transitional and transformational concepts.
  - Problem: The current NAS air/ground communications infrastructure is limited in its capabilities to deliver real-time information due to legacy, stove-piped architectures, limited bandwidth, and lack of system-wide interoperability and world-wide coverage.

Architecture Overview

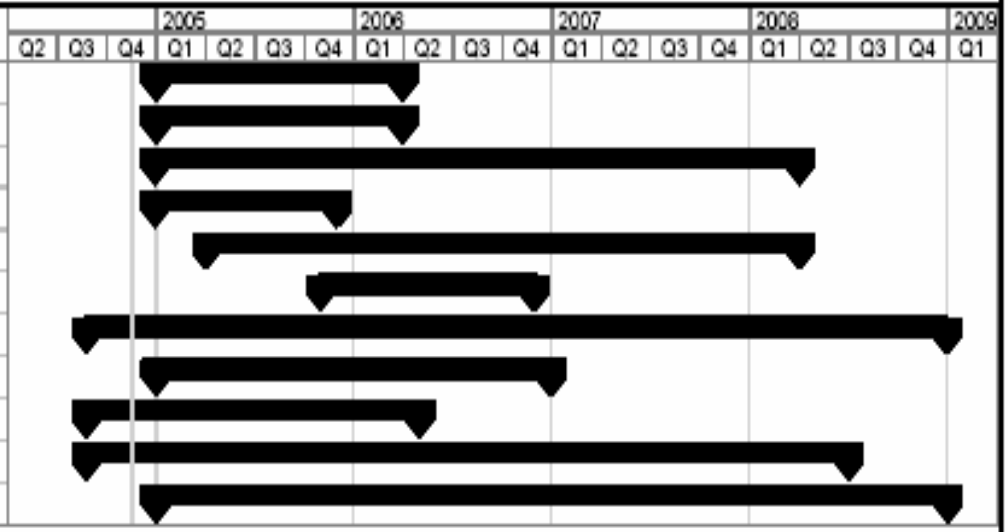
- Transitional CNS Architecture
  - Conduct transitional CNS requirements analysis
    - GCNSS-2, JPDO ConOps, ICAO, RTCA, EuroControl, Others
  - Coordination requirement exploration across other ACAST sub-projects
  - Define candidate transitional architectures
    - wireless, satellite-based, terrestrial and hybrid
  - Guide the development of Key enabling technologies
  - Influence design for technology demonstrations

Network Overview

- Global Air/Ground Network (GAN)
  - Conduct requirements and system analysis
    - Emphasizing performance, capacity, reliability, mobility and quality of service
    - Identify technology niches that NASA can turn into solutions
    - Coordination of requirements across sub-projects
  - Identification of network enablers to enhance:
    - NAS-wide interoperability and standardization;
    - Global operations.
  - Define SWIM network interface requirements (A/G, wireless)
  - Validate candidate technologies through demonstration

Architectures & Networks Sub-Project

ID	WBS	Task Name
1	I.1	Network-Centric Concepts
2	I.1.1	Operational Concepts Analysis
12	I.2	Transitional Architecture Concept Definition
13	I.2.1	Long-term CNS Requirements
18	I.2.2	Transitional CNS Architecture Definition
29	I.2.3	Analysis of SWIM Interface
34	I.3	Global Air/Ground Network Definition
35	I.3.1	Network Standards Requirements
48	I.3.2	Global Air/Ground Network Validation
61	I.3.3	Network Protocols Standardization
86	I.3.4	International Standards



Questions for Group Discussion

1. Is IPv6 the solution for future aviation networking? If so, What actions are required to make the transition happen?

- Network analysis – ultimately depends on Concept of Operations – How best to select a range of operational cases; loads and performance requirements; and get consensus on the operational scenario and depicted loads?
- What network security requirements to meet future net-centric architectures need to be explored?

Is IPv6 the solution for future aviation networking? What actions are required to make the transition happen?

- Is this the right question? Define an architecture before selecting the protocol. Is an independent architecture possible with ties to technology choices?
- Yes, the world is heading (considering moving) towards IPv6 – needed for interoperability. ISO picked for trendy reasons
- What is lost by going toward IPv6?
- What are the certification hurdles – can certification keep pace with the technology (NO)?
- Concern about maintaining 24-bit ICAO address standard.
- Mobility issues to match defined ATN standards
- Policy-based routing, dual-homing, simultaneous dual connection and (refer to morning speaker) needs more research
- IPv6 has inherent security features – needs further research.
- Commercial service provider
- TCA compliance?
- Maintainability and supportability more cost effective.

Is IPv6 the solution for future aviation networking? What actions are required to make the transition happen? (2)

- FTI is IPv4 – what are interface issues?
- Availability of certified/certifiable components
- Interoperability – need to understand transition technologies (NAS and global)
- Consider full end-to-end internetworking (A/G + G/G + G/A + A/A)
- Strategic, Tactical views
- Should all application types share the same bandwidth? Yes, one time equipage is important to airlines.
- Consider the safety ramifications of shared bandwidth (FCC currently restricts this use).
- Quality of Service must support the message content??? Does this target your messages importance? Bigger the pipe - the C&C message is hidden.

How best to select a range of operational cases; loads and performance requirements; and get consensus on the operational scenario and depicted loads?

- Examine other Airspace System Programs as sources for this CNS data (VAMS)
- Define necessary the network-centric communication parameters
- Considering survivability of networks may render the need for communication parameters obsolete
- Promote business case that promote incentives to equip – design for mixed equipage (who does this?). Build this into the design.
- Benchmarking data to assess current/future operations.
- How do the needs filter back to the right organizations (e.g., spectrum)?
- What value is this process without consensus on the services to be provide/performed.

What network security requirements to meet future net-centric architectures need to be explored?

- Exportable technology
- Assessment of security Threats and Vulnerabilities (w/eye on more open dissemination environment) sensitivity on this item
- IETF protocols incorporate T&V in standards
- High-level Vulnerability Assessment using NIST 80037
- Global application of secure technologies
- Authentication, Confidentiality, Integrity, Non-repudiation
- Affordable based upon aviation industry business case
- Reference AEEC adhoc mtg report on Security (June 2003)
- Built-in, not bolted on!
- Consider the impact of using gateways in architecture
- Scalability
- Design to LCD of communication bandwidth and availability
- Desktop bandwidth solutions don't automatically equate to aviation use

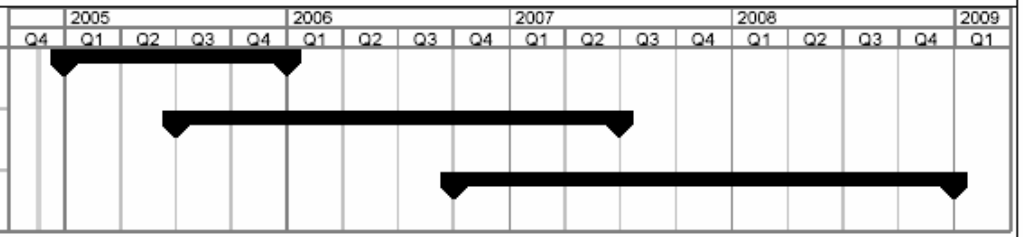
Other questions

- What service requirements flow from T-NAS?
- More near-term results are needed from this research (NASA vs FAA focus?).
- Airline business-case: What do they want from this?
- Capitalize on forums that airlines are active – out reach to NAS stakeholders.
- Understand FTI transition schedule – sync to it.
- Should contingency of operations issues be addressed?
- Interoperability across domains be considered.

BACKUP SLIDES

Spectrum Sub-Project

ID	WBS	Task Name
1	H.1	MLS-band Use Concept
6	H.2	WRC-7 Technical Inputs
11	H.3	Long Term Aviation Spectrum Roadmap



Project:
Date: Wed 8/18/04

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Progress
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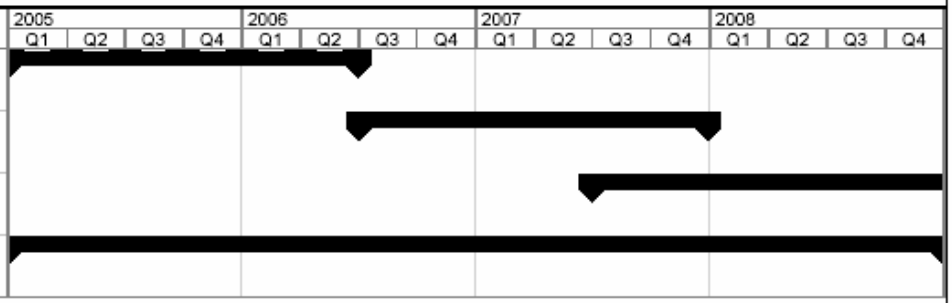
MMDA

ID	WBS	Task Name
1	C.1	MMDA Architecture Definition
14	C.2	MMDA prototype Development
25	C.3	Demonstration and Validation
40	C.4	Certification



Project: MMDA Task Schedule - Draft
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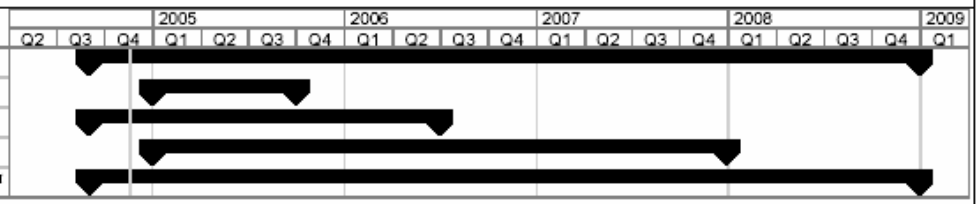
Surface ICNS Sub-Project

ID	WBS	Task Name
1	A	SURFACE ICNS NETWORK
2	A.1	MLS Band Characterization
12	A.2	Surface ICNS Concept of Use
35	A.3	Surface ICNS Network Demonstration
60	A.4	Prototype Surface ICNS Network Demonstra



Project: Surface_Terminal Schedule -
Date: Wed 8/18/04

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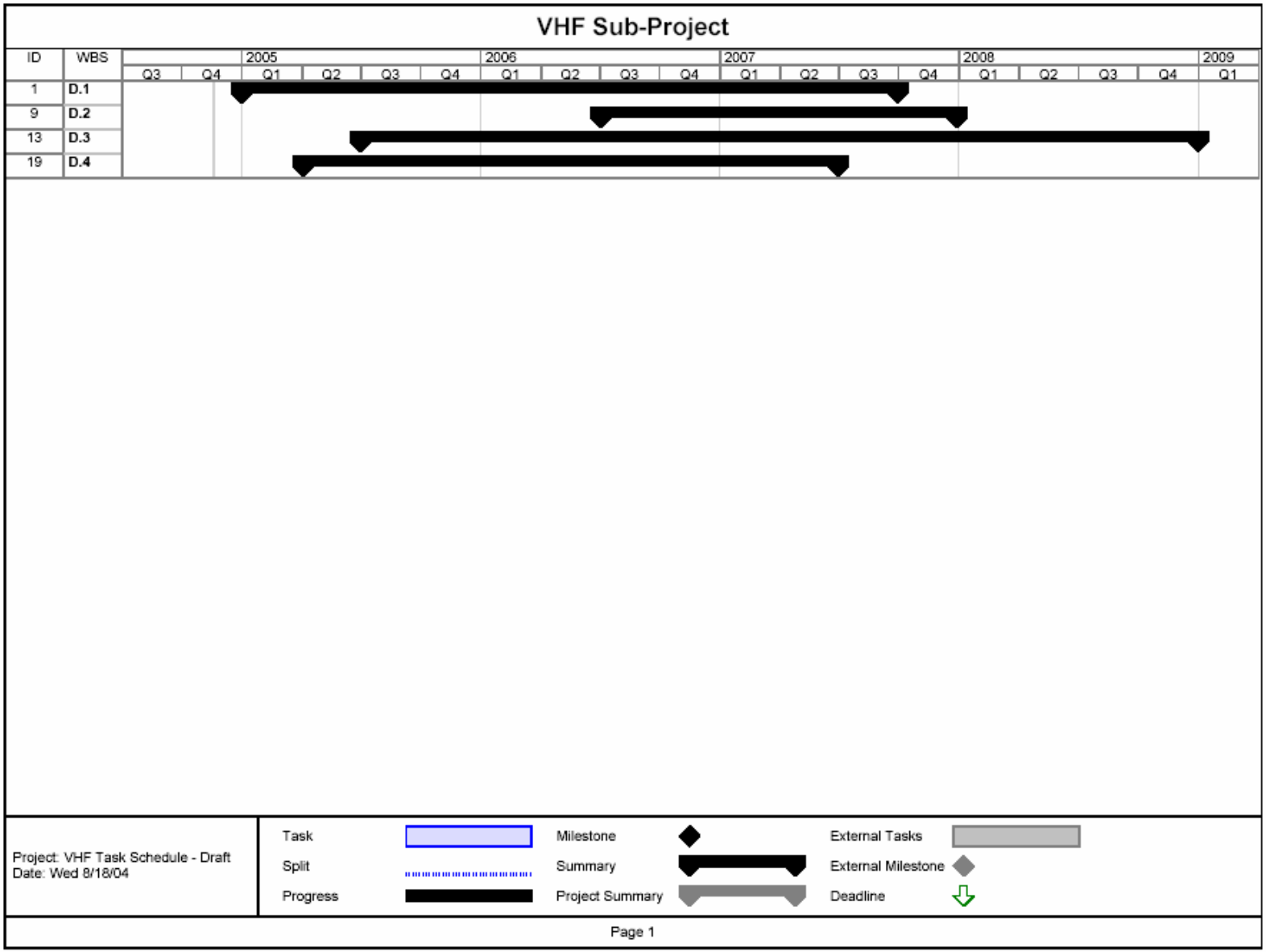
Oceanic Sub-Project


VHF Sub-Project
ID
WBS
2005
2006
2007
2008
2009
Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1
1 D.1
9 D.2
13 D.3
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