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*Computer Networks & Software Inc.*

**Industry Support Project**  
**ACAST/SBT Workshop Review**

**August 16, 2005**

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# *Agenda*

- **Project Scope**
  - **Industry Groups Supported**
- **Group Work Plan Summaries**
  - **Activity Highlights**
- **Summary**



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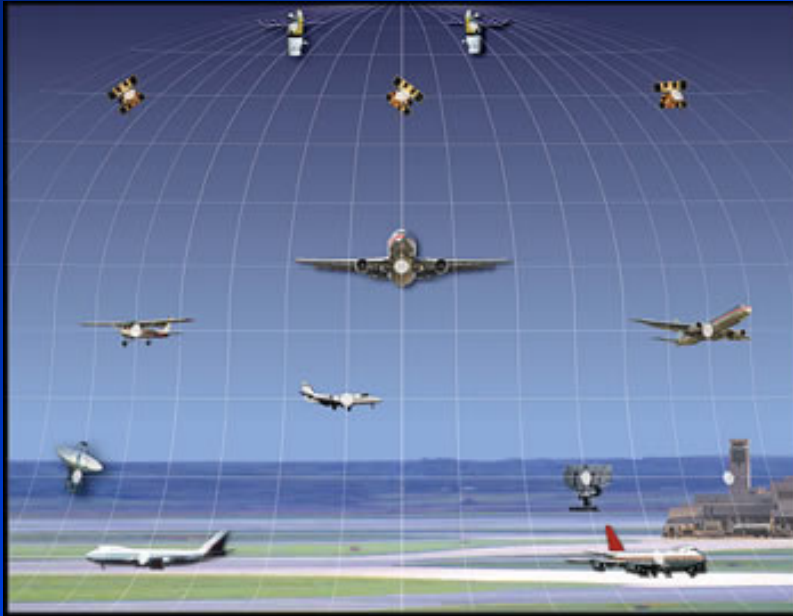
## *Project Scope*

- **Title**
  - Industry Support
- **Project**
  - Includes support for a selected set of AEEC Committees, AEEC User Forums, RTCA Committees, RTCA Forums and related Industry bodies
  - NASA GRC Leads: Israel Greenfeld and Jun Mao
- **Plan/Deliverable**
  - Industry forum participation
  - Working paper preparation
  - Meeting minutes
  - Quarterly review
- **Today's Focus**
  - Snapshot of key initiatives
  - RTCA Committees supported by Mulkerin Associates Inc.



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# Standards Body Participation



## Accomplishments:

- Provided inputs to NASA GRC regarding aviation industry Communications, Navigation & Surveillance (CNS) activities for guiding research to be consistent with FAA and aviation industry CNS trends.
- Provided ongoing, specialized NASA GRC representation in key aviation industry committees.
- Provided objective participation on behalf of NASA GRC in the development of aeronautical CNS operational requirements and standards.
- Maintained participation in aviation industry CNS architecture development.
- Based on committee participation, fostered ideas for solutions to specific aviation industry CNS issues and problems.
- Provided knowledge-based, informal liaison between/among committees.

## Committees & Working Groups Supported:

### **Airlines Electronic Engineering Committee (AEEC)**

- Aircraft Data Networks (ADN) Working Group
- Data Link Systems (DLK) Subcommittee
- Air Ground Communications System (AGCS) Subcommittee
- Aircraft Information Security (SEC) Working Group
- Data Link Users Forum
- AEEC General Session

### **RTCA**

- SC-186, Automatic Dependent Surveillance – Broadcast (ADS-B)
- SC-206, Aeronautical Information Services (AIS) Data Link
- RTCA Symposium
- RTCA Forum

### **International Civil Aviation Organization (ICAO)**

- Aeronautical Communications Panel (ACP) Working Group “N”



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# ACAST Sub Project Applicability Matrix - 1/3

Industry Group	Goals	Degree of Criticality to NASA				Related ACAST Sub Project(s)
		● High	⊙ Medium	○ Low		
Aircraft Data Networks (ADN) Working Group	▶ Design next generation aircraft networks		●			▶ Transitional CNS Architectures ▶ Global Air/Ground Networks ▶ Multimode/Multifunction Avionics ▶ CNS Technologies
	▶ Transition from ARINC 429 to ARINC 664		●			
	▶ Ethernet technology and avionics		●			
	▶ Use of IP in aviation community		●			
	▶ Transport of flight critical data over IP		●			
	▶ Example cabin architecture		⊙			
	▶ Example avionics architecture		●			
	▶ Adapt commercial protocols and services to ATN		●			
Data Link Systems (DLK) Subcommittee	▶ Maintain ACARS standards		○			▶ Global Air/Ground Networks ▶ Multimode/Multifunction Avionics ▶ VHF Systems Optimization ▶ CNS Technologies
	▶ Develop standards to support ATN		●			
	▶ Develop standards to support VDL Mode 2		●			
	▶ Data Link Security		●			
Air Ground Communications System (AGCS) Subcommittee	▶ Develop emerging and maintain Satcom standards. Includes Swift 64, Aero H, BGAN		●			▶ Transitional CNS Architectures ▶ Global Air/Ground Networks ▶ Multimode/Multifunction Avionics ▶ Oceanic/Remote Communications and Surveillance ▶ CNS Technologies
	▶ Develop HF DL and maintain legacy HF communication standards		○			
	▶ Develop VDL Mode 2 and maintain legacy VHF communication standards		●			
	▶ Forum to review FAA's VDL Mode 3 effort		●			
Aircraft Information Security (SEC) Working Group	▶ Develop a common security framework for aeronautical community		●			▶ Multimode/Multifunction Avionics ▶ CNS technologies
	▶ Develop a common security mechanism		●			
	▶ Provide a integrated international effort on future security equipments		●			
	▶ Minimal effect on current airline operations		⊙			



# ACAST Sub Project Applicability Matrix - 2/3

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Data Link Systems (DLK) Users Forum	▶ Establish and maintain interoperability between airborne users and ground communication service providers	◎	▶ Transitional CNS Architectures ▶ Global Air/Ground Networks ▶ Spectrum Research ▶ Multimode/Multifunction Avionics ▶ VHF Systems Optimization ▶ Terminal Area Communications ▶ Surface Integrated CNS Network ▶ CNS technologies
	▶ Ensure efficient use of limited frequency spectrum	◎	
	▶ Promote the progression from legacy to next generation technologies	●	
	▶ Forum for airspace users and ATS service providers to coordinate datalink applications	●	
	▶ Establish and maintain consistency among the services offered by ATS service providers	◎	
AEEC General Session	▶ Provides an overview of important technical developments in air transport avionics and aircraft electronics	●	▶ All ACAST Sub Projects
	▶ New standards are discussed and approved	●	
	▶ Initiates work program for following year	◎	
	▶ Marks the culmination of the year's standards development work	○	
RTCA SC 186 Automatic Dependent Surveillance - Broadcast (ADS-B)	▶ Develop Revision A to DO-286, TIS-B MASPS	●	▶ Global Air/Ground Networks ▶ Oceanic/Remote Communications and Surveillance ▶ Space based Surveillance ▶ CNS technologies ▶ Transitional CNS Architectures ▶ Terminal Area Communications ▶ Surface Integrated CNS Network
	▶ Developing standards for the Surveillance Transmit Processing (STP), Airborne Surveillance & Assurance Processing (ASSAP) and CDTI subsystems of ASAS	●	
	▶ Develop with EUROCAE harmonized operational concepts, SPR, and Interop specification for aircraft and ground surveillance applications	●	



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# ACAST Sub Project Applicability Matrix - 3/3

RTCASC-206 Aeronautical Information Services (AIS) Data Link	▶ Identify FIS & AIS communications system performance requirements for all airspace domains and ground operations	●	▶ Global Air/Ground Networks ▶ Multimode/Multifunction Avionics ▶ Surface Integrated CNS Network ▶ Terminal Area Communications ▶ Oceanic/Remote Communications and Surveillance ▶ CNS technologies
	▶ Define message content attributes and protocols for FIS/AIS data communications	●	
	▶ Change 1 to DO-252, Minimum interoperability specification for Automated Meteorological Transmission (AUTOMET)	●	
	▶ Change 1 to DO-267A, FIS-B MASPS; Provide guidelines for "lossy" compression for more efficient use of data link bandwidth	●	
	▶ Define MASPS for tactical (vs. advisory) use of FIS/AIS applications	●	
RTCA Symposium / Forum	▶ Provides a briefing of Industry activity, Industry focus and future work plans	●	▶ Transitional CNS Architectures ▶ Oceanic/Remote Communications and Surveillance ▶ Global Air/Ground Networks ▶ Multimode/Multifunction Avionics ▶ Surface Integrated CNS Network ▶ Terminal Area Communications ▶ CNS technologies
	▶ Insight into FAA and Industry programs	⊙	
	▶ Provides a program status review	⊙	
Aeronautical Communications Panel (ACP) Working Group N	▶ Develop ATN technical provisions	⊙	▶ Transitional CNS Architectures ▶ Global Air/Ground Networks ▶ Surface Integrated CNS Network ▶ CNS Technologies
	▶ Monitor operational requirements	⊙	
	▶ Develop new standards and/or guidance material as required	⊙	
	▶ Work on addressing IP mobility issues	●	



# *Aircraft Data Network (ADN) Subcommittee*

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- **Objective**
  - Design next generation aircraft networks
  - Transition from ARINC 429 to ARINC 664
  - Adapt commercial protocols and services to the ADN (IPv4 and IPv6)
- **Standard - ARINC Specification 664 Aircraft Data Network**
  - Part 1 Systems Concepts and Overview
  - Part 2 Ethernet Physical and Data Link Layer Specifications
  - Part 3 Internet based Protocols and Services
  - Part 4 Internet based Address Structures and Assigned Numbers
  - Part 5 Network Interconnection Services and Functional Elements
  - Part 6 Reserved
  - Part 7 Deterministic Networks
  - Part 8 Interconnection with Non-IP Protocols and Service
- **Interest to NASA**
  - Foster next generation aircraft data networks based upon IP
  - Use of IPv6 in Aviation community
  - Transport of flight essential information over IP data links
  - Mobile IP approaches and security



### ■ ARINC 664 Part 8

#### – Objective

- » Interoperation with Non-IP Protocols and Services
- » Provides guidance for development of aeronautical applications and services that can be transported over the TCP/IP network
- » Definition of a secure, acceptable path for transition from ATN to TCP/IP environment

#### – Status

- » Developed and discussed approximately 12 different models of connectivity
- » Working consensus developed on depiction of transition model and approach
- » Work to be considered as input to ICAO ACP WG “N” current study
- » Completed three draft iterations
- » AEEC has adopted Part 8 as of 28 March 2005



## *Data Link Systems (DLK) Subcommittee*

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- **Objective**
  - Develop and maintain standards for data transfer between aircraft and ground stations
  - Standards cover existing ACARS and the emerging ATN
- **Standards**
  - ARINC Specification 618 Air/Ground Character Oriented Protocol
  - ARINC Specification 619 ACARS Protocols for Avionics End Systems
  - ARINC Specification 620 Data Link Ground System Standard and Interface
  - ARINC Specification 623 Character Oriented ATS Applications
  - ARINC Specification 631 VDL Implementation Provisions
  - ARINC Specification 637 ATN Implementation, Provisions, Protocols & Services
  - ARINC Characteristic 758 Communications Management Unit (CMU) Mark 2
- **Interest to NASA**
  - Principle committee for the C component of CNS
  - Continuous monitoring of technical changes for aviation data links
  - Relates to transition of future ACAST mobile communication architecture and networks



# *Air Ground Communications System (AGCS) Subcommittee*

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- **Objective**
  - Develop and maintain standards for Air/Ground communications using SATCOM, HF, VDL Mode 2, or VDL Mode 3
  - Standards cover existing ACARS and the emerging ATN
  - VDL Modes 2, 3 activities fused into AGCS
- **Standards**
  - ARINC Characteristic 741 Part 1 Aviation Satellite Communications System Aircraft Installation Provisions
  - ARINC Characteristic 741 Part 2 Aviation Satellite Communications Systems Design & Equipment Functional Description
  - ARINC Characteristic 761 Second Generation Aviation Satellite Communications System Aircraft Installation Provisions
  - ARINC Characteristic 781 Mark 3 Aviation Satellite Communications System Aircraft Installation Provisions
  - ARINC Characteristic 750-2 VHF Digital Mode 2 Data Radio
  - ARINC 750-X VHF Digital Mode 3 Data Radio
- **Interest to NASA**
  - ACAST Sub Projects covering En Route, Terminal and MMDA activities
  - Oceanic/ Remote Airspace flight data
  - Aero H; Swift 64;
  - Characteristic 781: BGAN (or SwiftBroadband) services using Inmarsat 4



## *Aircraft Information Security (SEC) Working Group*

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### ■ Objective

- Develop a Concept of Operation (ConOps) for a common security framework, and a common set of security mechanisms
- Other industry groups will follow recommendations as provided by the Security ConOps
- Security perspective for today and tomorrow

### ■ Standards

- Draft 1 of ARINC Project Paper 811: *Commercial Aircraft Information Security Concepts of Operation and Process Framework* will be circulated in 2<sup>nd</sup> half 2005

### ■ Interest to NASA

- SEC to share its results with other AEEC committees
- The subcommittee endorsed the creation of an Aircraft Information Security Forum. An APIM will be prepared for consideration by AEEC.
- Open aviation industry forum to deliberate a common security infrastructure
- Aviation security developments will influence ACAST sub projects
- Integrated international effort on future security requirements



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# *Data Link Users Forum (DLUF)*

## – Objective

- » Improve system performance
- » Maximize air/ground data link communications services
- » Coordinate activity among aviation industry players leading to the identification and resolution of common problems.

## – Standards

- » None

## – Interest to NASA

- » Industry forum to deliberate data link issues, new developments
- » FAA-Eurocontrol Future Communications Study
- » Possible participation in the Link 2000+ program
- » Update industry about ACAST program



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# *AEEC General Session*

## ■ Objective

- Provide an overview of the important technical developments in air transport avionics and other aircraft electronics
- Provide an overview of the year's standards development efforts by all sub committees and working groups
- Formal meetings of AEEC
  - » New standards are proposed, discussed and voted for approval to begin work

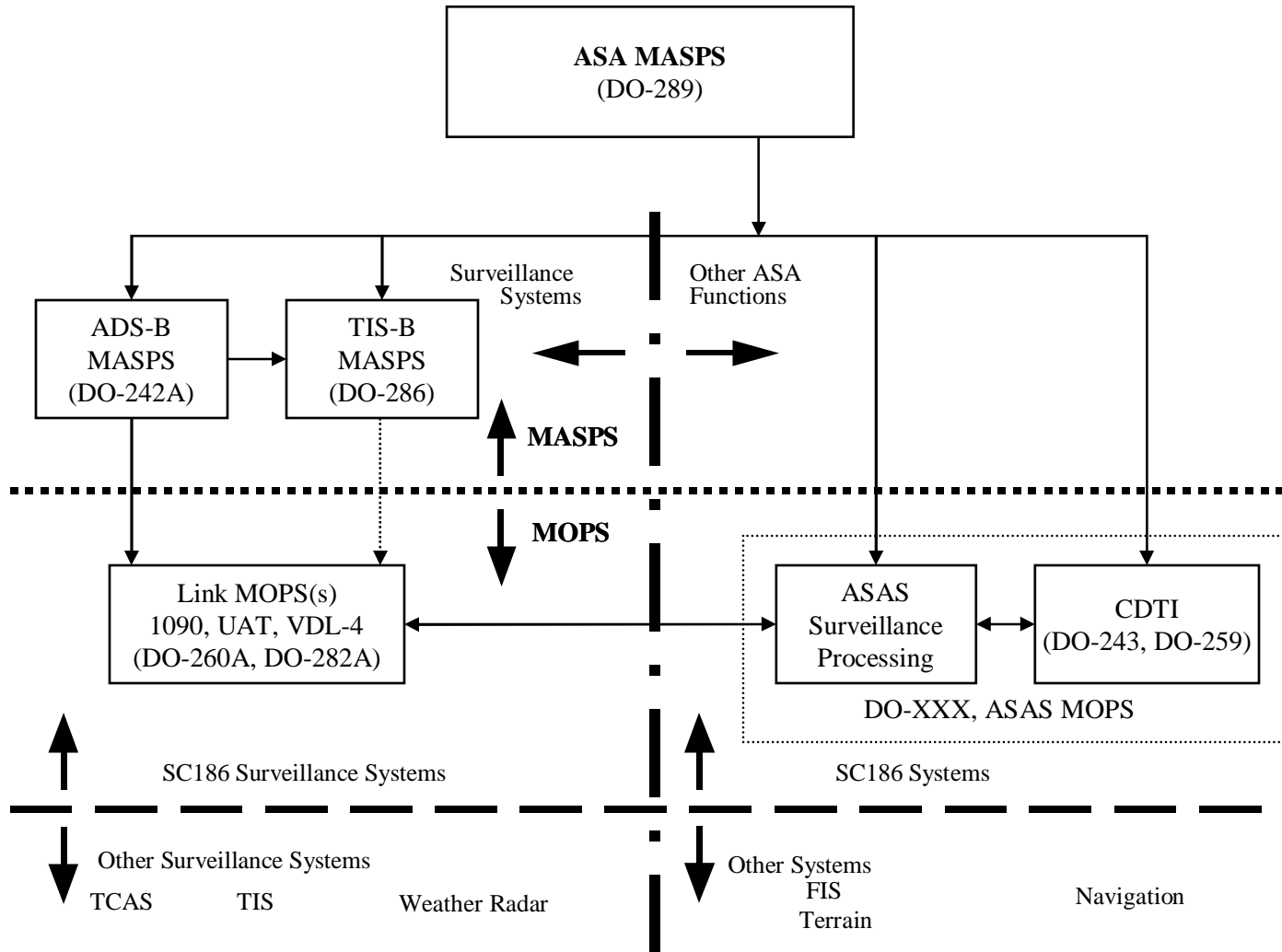
## ■ Standards

- All ARINC standards status are reviewed

## ■ Interest to NASA

- Forum for monitoring developments in industry
- Provides an insight into work activities of other industry groups not currently supported
- Bearing on future NASA architecture design and development studies

# SC-186 Document Hierarchy



ASA: Airborne Surveillance Applications  
 ASAS: Airborne Separation Assistance System



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## *SC-186 Involvement*



- **WG-2: Traffic Information Services - Broadcast (TIS-B)**
- **WG-4B/Surveillance Transmit Processing SubGroup**
  - Providing SubGroup Secretary
- **NASA's Interest**
  - Principle committee for the S component of CNS
  - Keep up on latest concepts for distributing surveillance data via multiple data links
  - JPDO considers ADS-B to be a critical component of NGATS
  - Standards apply to ACAST Sub Projects covering surface, terminal, en route and MMDA activities





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## *SC-186 WG-2, TIS-B*



- **Task: Develop revision A to the Traffic Information Services - Broadcast (TIS-B) MASPS (DO-286)**
- **Revision A adds functions to support the Airborne Surveillance Applications (ASA) MASPS plus adds a rebroadcast of ADS-B as TIS-B messages.**
  - **UAT ADS-B messages rebroadcast as 1090 ES TIS-B messages**
  - **1090 ES ADS-B messages rebroadcast as UAT TIS-B messages**
- **Status**
  - **DO-286A published on April 7, 2005**



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## **SC-186 WG-4B, ASAS MOPS**



- **Task: Develop an Airborne Separation Assurance System (ASAS) MOPS**
- **Surveillance Transmit Processing (STP) SubGroup**
  - Specify requirements for translating navigation system and other data into ADS-B required inputs First version of ASAS MOPS will describe STP subsystem requirements
- **Airborne Surveillance and Separation Assurance Processing (ASSAP) SubGroup**
  - Specify basic surveillance processing requirements (e.g., correlation of TCAS, TIS-B, and ADS-B data)
  - Specify application processing requirements
- **Status: Anticipate publishing ASAS MOPS containing:**
  - STP subsystem requirements – Mar 06
  - ASSAP subsystem requirements – Mar 07



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## *SC-206 AIS Data Link*



- **Tasks: Prepare 3 documents**
  - Revise DO-267A, MASPS FIS-B Data Link
  - Revise DO-252, MIS AUTOMET
  - Develop MASPS for FIS/AIS applications - “Tactical Use” (as opposed to “advisory, non-control use”)
- **Status: First meeting held July 18-20, 2005**
- **NASA’s Interest**
  - Committee dealing with the N component of CNS
  - Keep up on latest concepts for distributing navigation related data via multiple data links
  - SC-206 aligned with JPDO Weather IPT NGATS concepts
  - Standards apply to ACAST Sub Projects covering surface, terminal, en route, oceanic and MMDA activities



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# *RTCA 2005 Symposium & Forum*



## ■ Symposium

- Theme: Implementing the 21<sup>st</sup> Century Global ATM System
- March 15 - 16, 2005

## ■ Forum

- Theme: Safe Flight 21 - Operational Benefits Through Collaboration
- May 25, 2005

## ■ Interest to NASA

- Keep NASA informed of NAS modernization activities
- Activities apply to ACAST Sub Projects covering terminal, en route and oceanic activities



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## ICAO ACP WG “N”

### ICAO Aeronautical Communications Panel (ACP) Working Group “N”

#### ■ Objective

- » Develop ATN technical provisions
  - Further advancement is expected as operational requirements evolve and new requirements emerge
- » Monitor operational requirements and develops new standards and/or guidance material as required
- » Subgroups
  - N1 Internet Communication Services
  - N2 Air/Ground Applications
  - N3 Ground/Ground Applications
  - N4 Security Services

#### ■ Standards

- ICAO Manual 9705



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## ICAO ACP WG “N” (cont’d)

- **Interest to NASA**
  - Participate under FAA lead
  - NASA funded tasks supported FAA introduction of information paper “ATN over IP” (Basis was CNS/GRC studies/analysis 1999, 2000)
  - Setting IPv6 end-to-end standards (including A/G data link)
  - Transition to IP for flight critical data
  - Secure protocols and security techniques for flight essential data
  - Protected Mode CPDLC
  - Leverage NASA/EUROCONTROL IPv6 studies
  - FAA – Eurocontrol Future Communications Study
- **Current Work Plans**
  - N1 completed Recommendation Paper – presented June 2005
  - Change from ISO to IP network protocols
  - Ground-Ground changes proceeding
  - Air-Ground IP
    - » 12 month study to address IP mobility, security and other issues in order to conform to ATN requirements
    - » Decide on mobility in application or network layer
  - Other Applications



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## *Future Activity Summary*

- **Continued participation in Industry Standard Groups**
  - AEEC
  - RTCA
  - ICAO
- **Determine needs for JDPO/NGATS**
- **Foster the adaptation of IP in aviation segments**
  - **ADN 664, Part 8 has been adopted by AEEC as of 28 March 2005**
  - **ICAO ACP WGN now ready to address IP for air-ground data link (mobility issue)**
  - **ADN WG Part 5 Updates: Quality of Service, Security & Mobility**
  - **ADN WG Part 8**
    - » Industry chair on Part 8 of ARINC 664 – Update after ICAO study
    - » Accepted industry author for draft 1 supplement 1 for IP mobility for flight essential data link
    - » Accepted industry author for collaboration middle-ware for system wide information system (SWIM)



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## *Future Activity Summary*

- **SC-186 (ADS-B)**
  - **Surveillance Transmit Processing (STP)**
    - » Secretary for STP SubGroup
    - » Compiling and editing inputs plus preparing the STP subsystem section of the ASAS MOPS. Publication anticipated in Mar 06.
  - **ASSAP subsystem development effort underway**
  - **ADS-B Package 1 OSED, SPR and Interop specification development**
  - **CDTI subsystem development on-going**
- **SC-206/EUROCAE (Aeronautical Information Services)**
  - **Revise MASPS for FIS-B data link**
  - **Revise Minimum Interoperability Standard (MIS) for AUTOMET to include air-to-air data exchanges**
  - **Develop MASPS for using FIS and AIS applications tactically**





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