



An Airborne Communications Roadmap for the U.S. Federal Air Marshal Service: Overview & Status

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Jim Griner
NASA Glenn Research Center



Introduction

- Federal Air Marshal Service (FAMS) Mission:
“To promote confidence in our Nation’s civil aviation system through effective deployment of Federal Air Marshals (FAMs), to detect, deter, and defeat hostile acts targeting U.S. carriers, airports, passengers, and crews.”
- After 9/11, the need for improved air to ground communications capabilities for the FAMs and other law enforcement officers was identified.

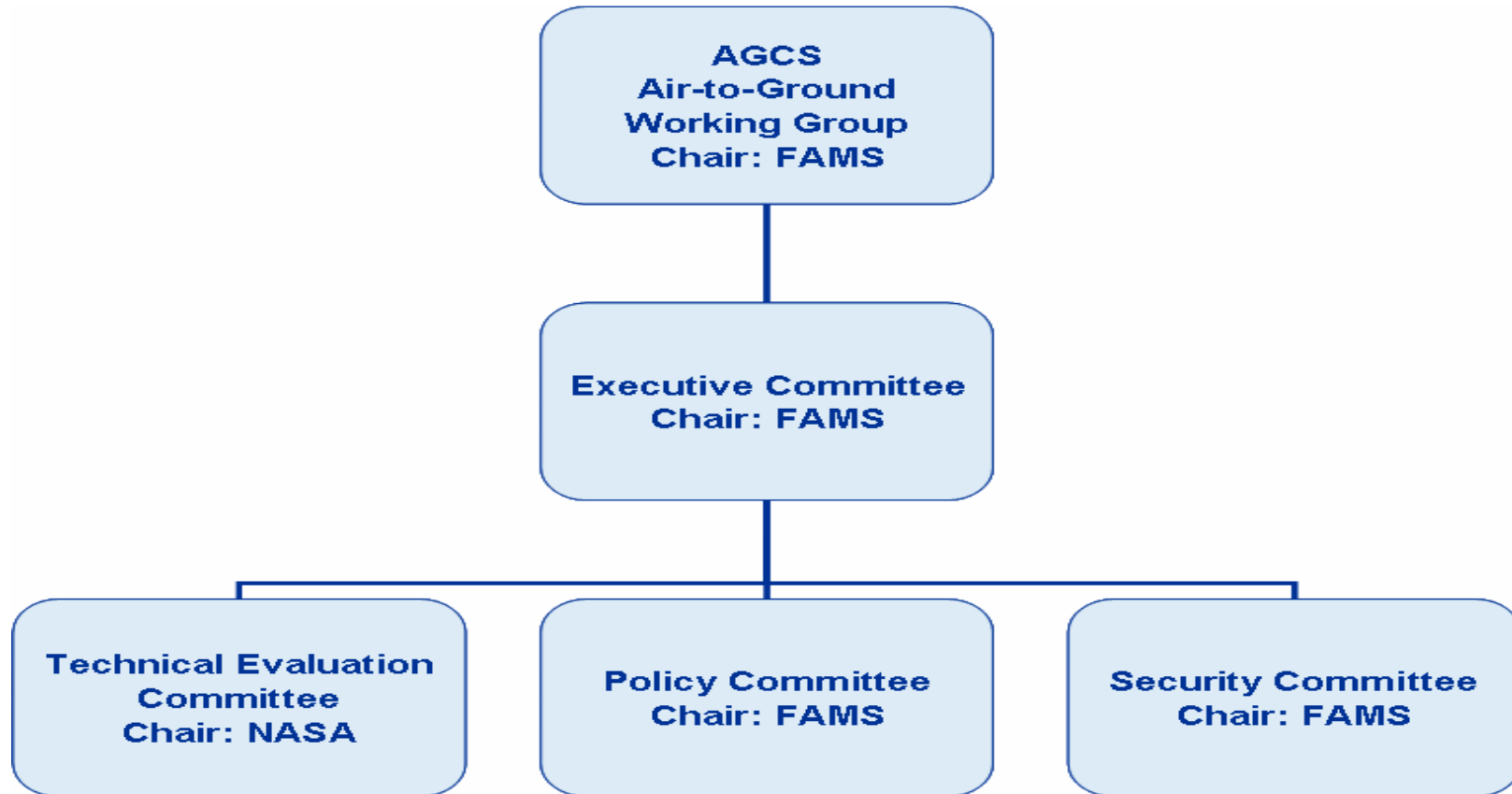


Communications Goal

A communications *capability* satisfying the operational needs of the Federal Air Marshal Service involving *aircraft platforms*.



Air-to-Ground Working Group Structure



AGWG Membership: US Government Agencies, Commercial Air Carriers, Pilots and Flight Attendant Unions, and Aviation Industry Trade Organizations



Working Group Tasks

1. Develop a *Technical Implementation Plan*, or **Roadmap**, for time-phased options for implementation of the Air-Ground Comm System (delegated to the Technical Evaluation Committee)
2. Develop a *Business/Government Partnership* to implement the Roadmap

Key Note:

FAMS intent is to ultimately procure standard communications services and end-user equipment from commercial providers to meet its requirements.

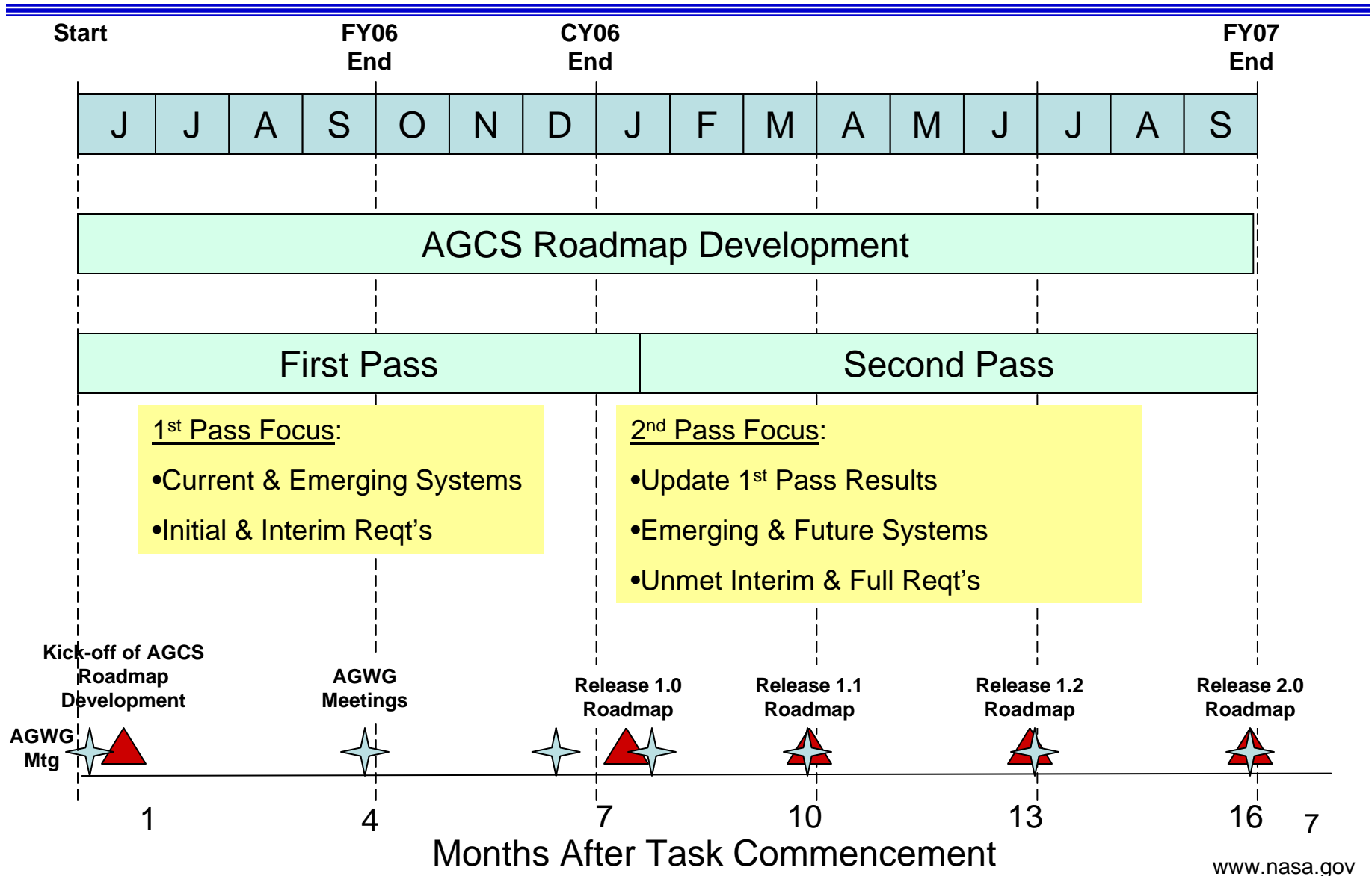
Technical Evaluation Committee Objective



Provide communications technology roadmap identifying *services*, *technology maturity*, and *gaps* for the Federal Air Marshal Service.

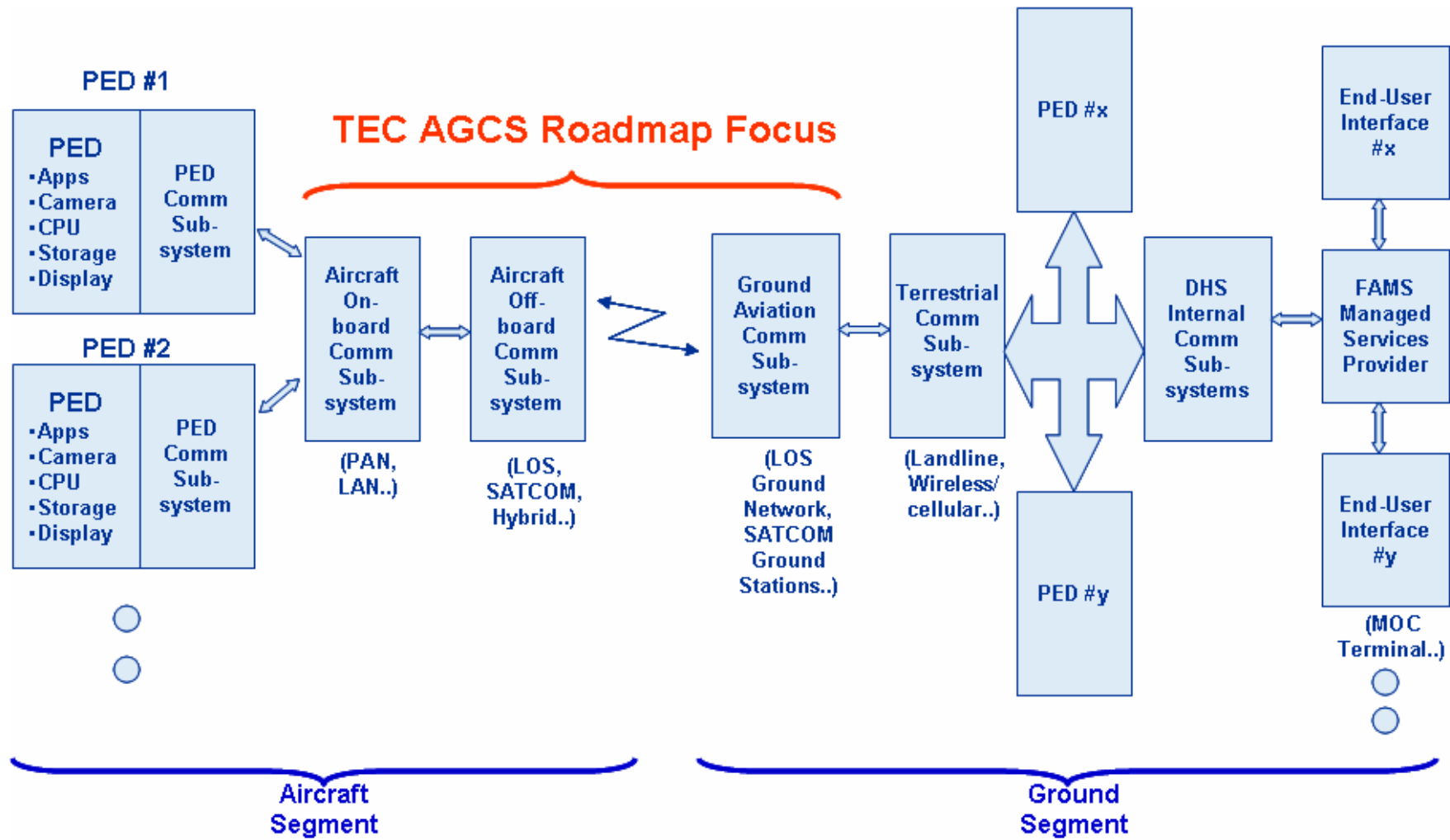


Overall Schedule





Roadmap Scope/Focus



Air Ground Communications System (End-End)



Key Constraints

- Regulatory
 - RF interference to on-board and ground systems; certification
 - Compliance to Comm Assistance for Law Enforcement Act (CALEA)
- Operational
 - FAMS operational mission sensitivity
 - Aircraft operator constraints
 - RF interference, PIC approval (e.g. sterile cockpit), business case
- Programmatic
 - Unique Business/Govn't Partnership & shared funding strategy
 - FAMS as primary users, others secondary
 - Information protection in the context of building Partnership
- Other:
 - Nuisance to other passengers (for voice comm)



Users

- FAMS (Primary)
 - FAMS in the field
 - TSA FAMS Mission Operations Center (MOC) and Transportation Security Operations Center (TSOC), as chief coordination mechanisms
- TSA Explosive Division
- Force Multiplier Program (far term use)
 - Potential users at federal, state & local levels
- On-board flight crew
 - Pilots
 - Flight Attendants

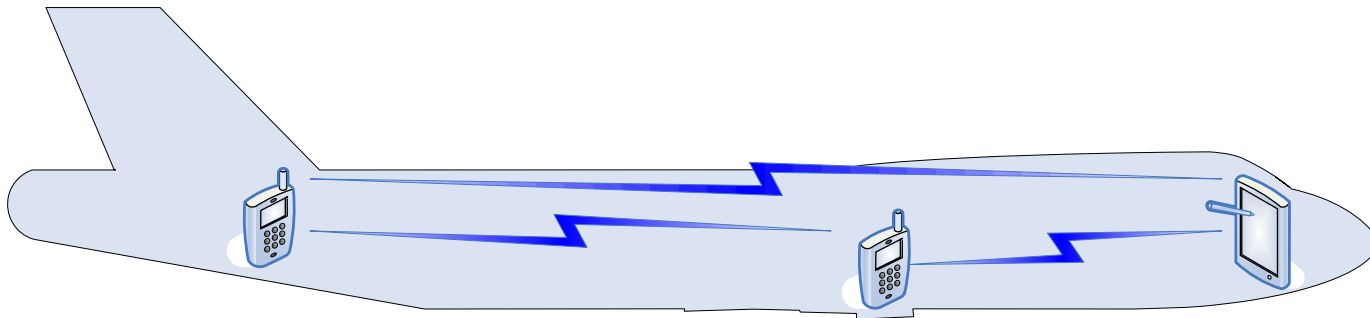


Operational Service Needs

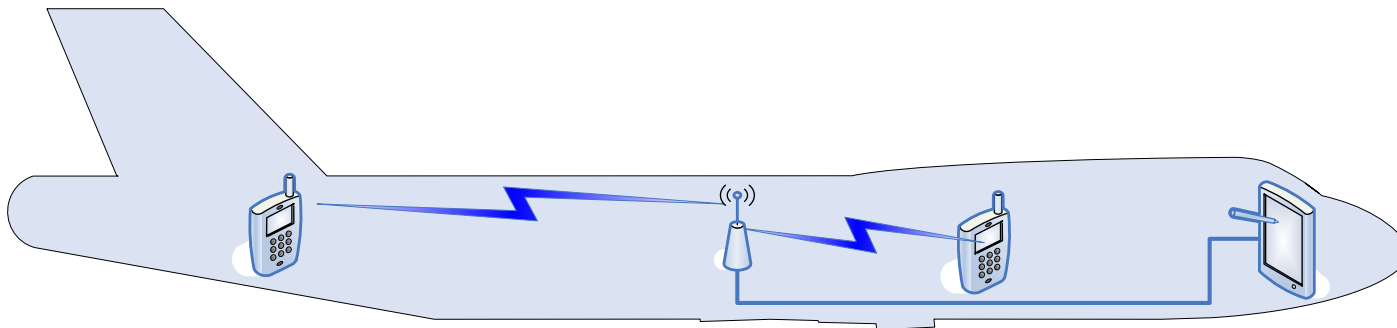
- Categorized as
 - Initial (within 2 yrs), Interim (within 5 yrs), Full (within 10 yrs)
- On-board:
 - Cabin and Cockpit
 - Voice, text paging, instant messaging, imagery, etc.
 - One-way and two-way
 - Connectivity (FAM-FAM, FAM-Pilot, etc.)
- Off-board:
 - Similar to on-board, but includes e-mail and Internet services
- Above mapped to phase of flight
 - Departure gate, departure taxi, departure, en-route, arrival, arrival taxi, arrival gate



On-board Notional Architectures



Personal Area Network

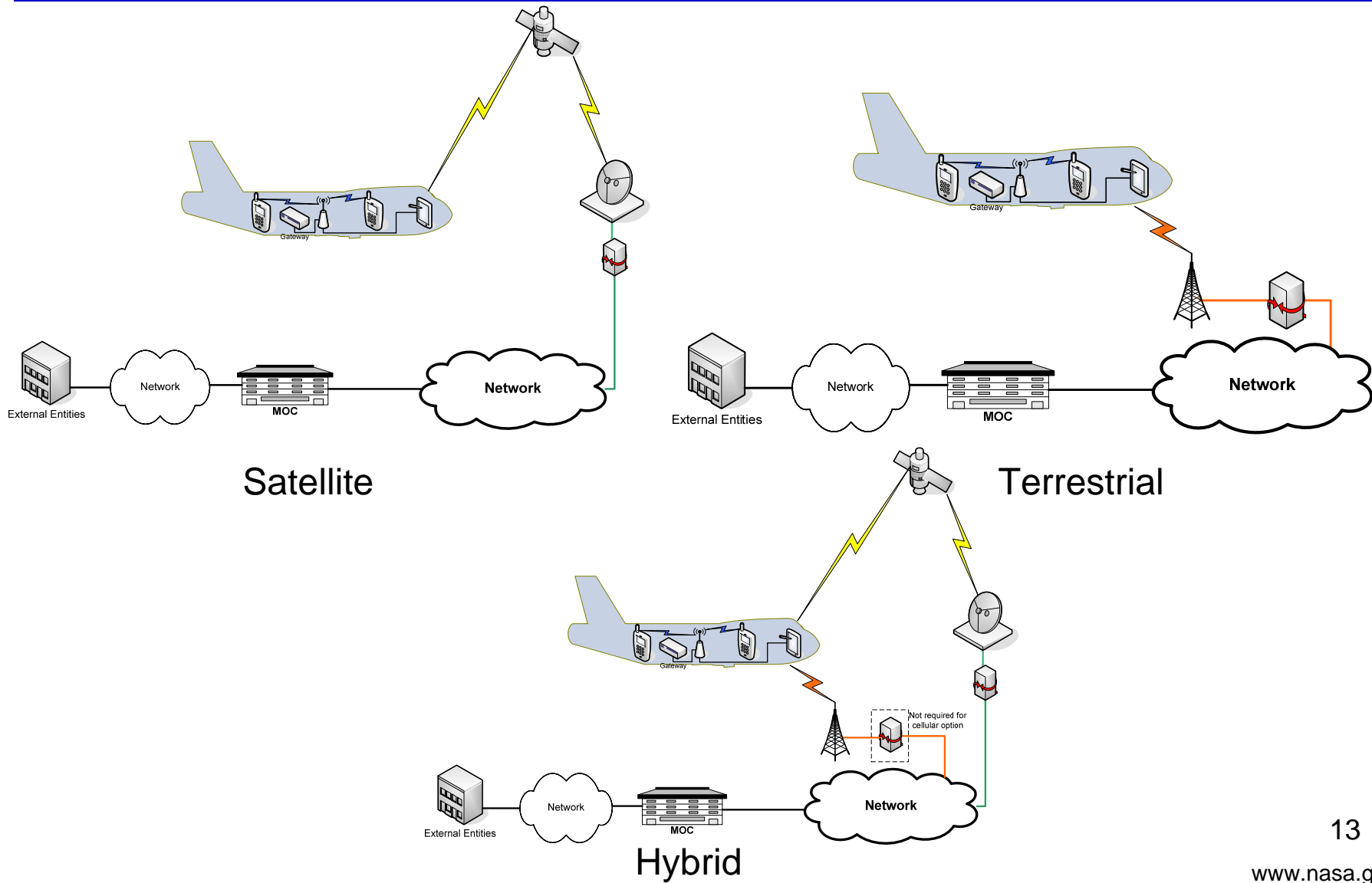


Note: Cockpit device may be wired or wireless depending on a number of factors (e.g., airline equipage, certification, etc.)

Local Area Network



Off-board Notional Architectures



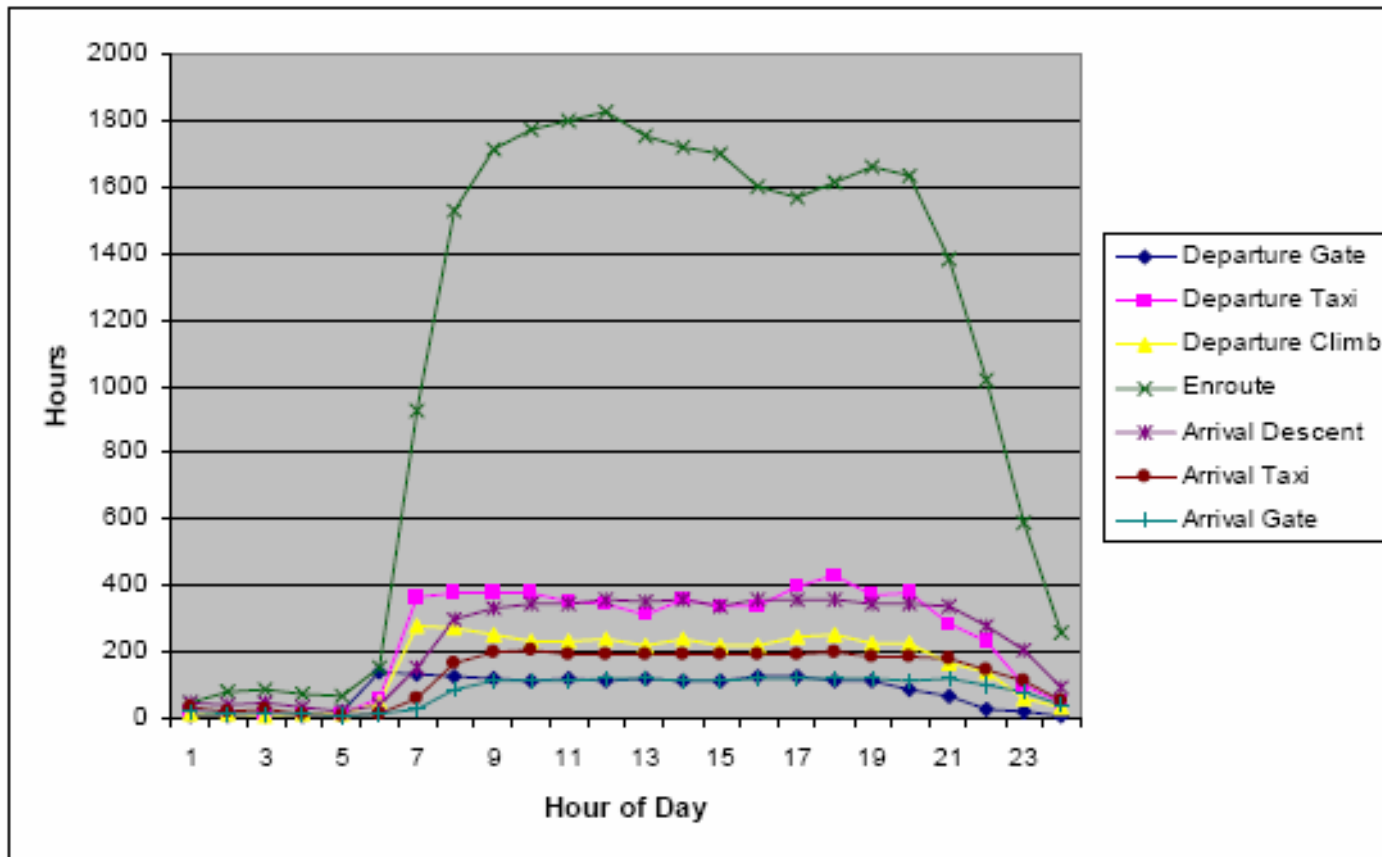


Comm System Performance Requirements

- System availability/reliability
- Propagation/coverage
- Spectrum
- Performance:
 - Capacity
 - Latency
 - Link quality (e.g. Bit Error Rate)
 - Accessibility
 - Integrity
 - Security



Total Communication Capacity (Flight Data Input)

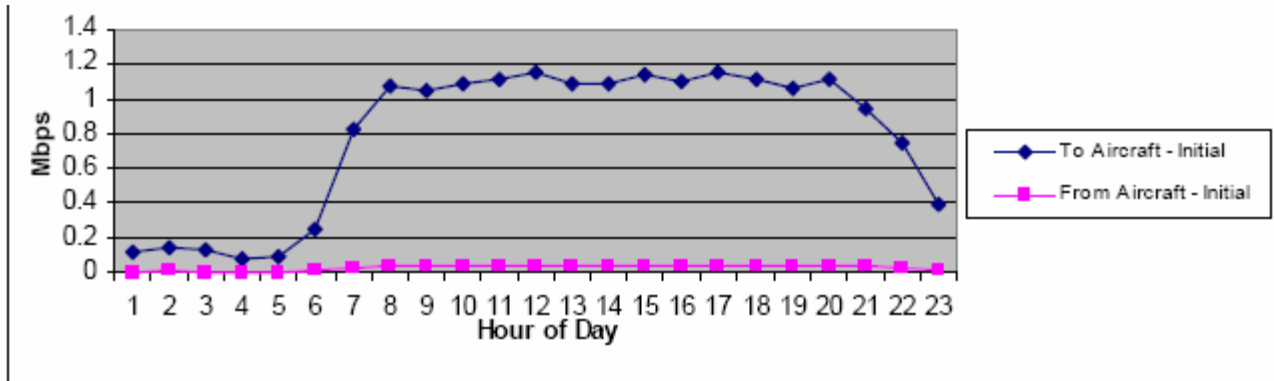


24 hour time block from midnight until 11:59:59 p.m. on Wednesday, August 15th, 2007.

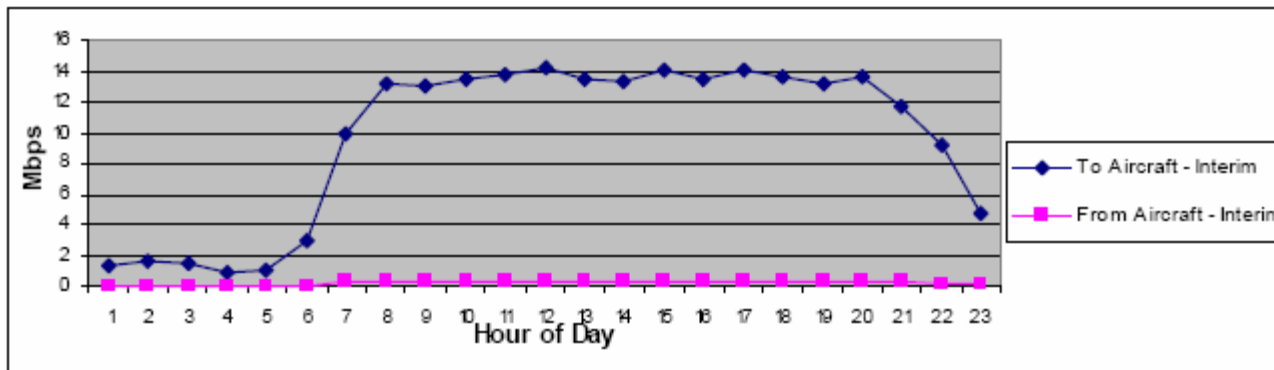
This figure represents cumulative hours of domestic flight time in each of the 24-hour time blocks, for that day's 23,247 commercial flights.



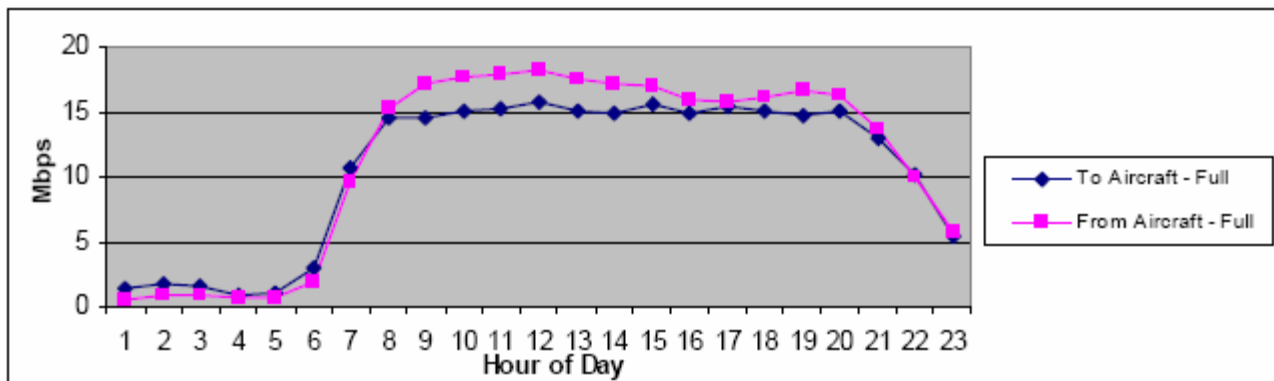
Total Communication Capacity



The flight data was processed using, FAMS data requirements, and data message rates.



The total communication system capacity requirements averaged over each hour time slice of a 24 hour period are shown, assuming 100% domestic FAMS coverage.





Next Steps

- Development of FAMS AGCS Reference Architecture Document (FARAD)

... leading to

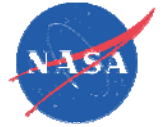
- Development of FAMS AGCS Business/Government Partnership plan.



FARAD - Overview

The FARAD describes top-level architectures to serve as a reference for implementation of the proposed AGCS and provision of desired services, in a “non-sensitive” document.

- Architectures are described from multiple “views.”
 - Telecommunications components
 - Phases of flight
 - Security
 - End-to-end operational
- Top-level interface descriptions are described between the onboard FAMS and the FAMS MOC/TSOC



FARAD - Scope

The FARAD is intended to address only the FAMS top-level telecommunications services requirements, and to provide a flexible architectural framework for an AGCS that meets those requirements.



FARAD - Services

Service Types

- The airborne FAMS must be able to communicate with one another, to non-FAM personnel on-board, as well as with aircraft systems, openly or discreetly.
 - Voice, text alerts, instant messaging, imagery exchange, Internet access, e-mail, aircraft parameter alerts, and surveillance video

Service Environment

- The airborne environment of a FAMS user introduces additional complexities in that they will be using a PED (Portable Electronic Device) with far less processing power and memory than a laptop or PC, which precludes the use of some application types.



FARAD – Reference Architectures

Identify individual components as they relate to logical areas of the overall architecture.

Components View

Analyzes the architecture by segmenting the communications network into logical sub-elements or segments.

- On-board Network
- Air to Ground Network
- Ground Network

Phases of Flight View

Analyzes the architecture by describing phases of flight and the utilization of the communications network across these phases.

Security View

Analyzes the architecture from the view of security services and capabilities

- Initial provision
- Interim provision
- Full provision

End-to-End View

Encompasses the complete system to illustrate architectural element effects that may not have appeared in the compartmented views.



FARAD – cont.

Interfaces

Specify the pertinent aspects of protocols, applications, or other technical mechanisms utilized for secure, reliable communications.

- On-board Network
- Air to Ground Network
- Ground Network

Solution Space

The solution space that bounds the commercial service offerings is described in three dimensions of required service provision: on-board and off-board the aircraft; individual phases of flight; and implementation priority

Onboard

| | Departure | | | Arrival | | | |
|---------------------------------|-----------|------|-------|---------|---------|------|------|
| | Gate | Taxi | Climb | Enroute | Descent | Taxi | Gate |
| Voice | | | | | | | |
| Cockpit (Pilots) | - | 2 | - | 2 | - | 2 | - |
| Cabin (FAMS) | 1 | 1 | 2 | 1 | 2 | 1 | 1 |
| Cabin (Crew) | - | 2 | 3 | 2 | 3 | 2 | 2 |
| Paging (Textual) | | | | | | | |
| Cabin (FAMS) | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| Cabin (Crew) | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Instant Messaging (Chat) | | | | | | | |
| Cabin (FAMS) | 1 | 2 | 3 | 2 | 3 | 2 | 2 |
| Imagery (Still) | | | | | | | |
| Cabin (FAMS) | 1 | 1 | 3 | 2 | 3 | 1 | 1 |
| Cabin (Crew) | 2 | 2 | 3 | 2 | 3 | 2 | 2 |
| Surveillance Video | | | | | | | |
| Cabin (FAMS) | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Aircraft Alerts | | | | | | | |
| Cabin (FAMS) | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Air to Ground

| | Departure | | | Enroute | Arrival | | |
|---------------------------------|-----------|------|-----------|---------|---------|------|------|
| | Gate | Taxi | Departure | | Arrival | Taxi | Gate |
| Voice | 1 | 1 | 3 | 2 | 3 | 1 | 1 |
| Paging (Text Messaging) | 1 | 1 | 2 | 1 | 2 | 1 | 1 |
| Instant Messaging (Chat) | 1 | 1 | 2 | 2 | 2 | 1 | 1 |
| Imagery (Still) | 1 | 1 | 3 | 2 | 3 | 1 | 1 |
| Internet Access + E-Mail | 2 | 2 | 3 | 2 | 3 | 2 | 2 |
| Surveillance Video | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Aircraft Alerts | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

FARAD – Company Specific Appendices



It is recognized that few, if any, commercial providers will offer solutions identical to one of the reference architectures, or meet all the requirements identified in all phases of flight.

- Description of a company’s unique communication system offerings as they depart from elements within the FAMS AGCS reference architectures, and identification of the communications capabilities that can be provided and in which phases of flight.
- Description of company’s specific elements outside the FARAD, including business aspects of providing services, any potential impacts on air carriers and airworthiness certification, and technical performance considerations.