DVB-S2/RCS Suitability for the Provision of Air Traffic Management Services

Cristina Párraga, Núria Riera, Sandro Scalise, Christian Kissling

Institute of Communications and Navigation, DLR

IWSSC 2006, 14 - 15 September 2006, Leganés, Madrid
Outline

- Motivation
- The ANASTASIA Project
- Technologies Competitive Analysis
- ATM Services: a case for DVB-S2/RCS
- Required enhancements
- Conclusion
The Motivation: Air Traffic Growth

- Air traffic is growing, especially in Europe and USA
- Current Air Traffic Communications means are expected to reach their capacity limit by 2020
- Safe flying in a future (busy) airspace will require:
  - significantly increased volumes of information exchanges
  - reliable and adequate communications mechanisms
- Current Air Traffic Management Communications means will not be able to support the capacity demand growth
- Satellite systems are considered an integral part of future global ATM communications concepts
- The ANASTASIA Project is one of the European initiatives investigating the satellite component of future solutions
ANASTASIA Overall Concept

ANASTASIA stands for Airbone New and Advanced Satellite techniques and Technologies in A System Integrated Approach

- Integrated Project 6th Framework Programme (EC) led by Thales Avionics
- New needs: improve operational capacity and safety of the air transport system
- Define the new Communication & Navigation techniques and technologies beyond 2010
- Based on new space based technology: Satellite Communications and Satellite Navigation
The ANASTASIA Objectives

ANASTASIA aims to carry out research, evaluation and cost benefit analysis to define future CNS avionics beyond 2010.

- Consolidate Nav, Com & Surveillance Requirements
- Identify Technologies and Architectures
- Select Most Promising Architecture
- Develop Prototype Systems
- Flight Trials
- Report and Disseminate
- Improve
- Prototype
- Demonstrate
- Identify

ANASTASIA aims to carry out research, evaluation and cost benefit analysis to define future CNS avionics beyond 2010.
The ANASTASIA Competitive Analysis

- Competitive analysis according to scoring system and several criteria
- INMARSAT BGAN scored the best candidate system
- A future DVB-RCS standard supporting mobility:
  - One of the best opportunities
  - Penalized due to technology readiness and spectrum allocation criteria
Air Traffic Management: a Case for DVB-RCS

- Satellite communications are well located physically to support aviation requirements, including ATM

- SatCom has achieved small penetration into ATM due to (mainly) financial considerations

- The introduction of DVB-S2 allows for much more efficient and cost-effective system design
  - Adaptive Coding and Modulation
  - Generic Streams, more suited for multimedia traffic than MPEG-TS

- Passenger Communications can mitigate costs
  - DVB-S2/RCS provides broadband capacity
  - CBB is not the end of the story
Air Traffic Management: a Case for DVB-RCS (II)

DVB-S2/RCS has a number of significant advantages

- Support of QoS is a matter of implementation (flexible)

- It can accommodate a variety of applications with different requirements
  - Important requirement for aeronautical applications (ATC, AOC, APC)

- It is an open standard
  - No dependency on proprietary solutions
  - Assuring interoperability (important feature for the achievement of a global solution)

- Currently, it is under discussion to re-open the standard for the support of mobility
  - Even more suited for aeronautical communications
DVB-S2/RCS for Safety Critical Services

There are open points to be solved for the provision of safety critical services (ATC)

- Directive antennas are required to achieve sufficient link margin
  - Mechanically steered antennas suffer from vibrations in fuselage, reducing antenna lifetime
  - Electronically steered antennas are preferred
    - Further research for Ku-band in ANASTASIA

- QoS architecture must be defined on top of the DVB MAC
  - Variety of applications and requirements
  - Traffic differentiation required
  - Important features: multicast, party line

- Security concepts must convince aeronautical conservative counterparts
  - Required for integral solution for cabin and cockpit
DVB-S2/RCS for Safety Critical Services (II)

- Rain fades vs. availability
  - Not relevant when flying over the clouds
  - ATC requires very high availability in all flight phases
  - Fade mitigation through Adaptive Coding and Modulation
  - Integration with terrestrial solutions for APT service volumes
- Integration with standardized Aeronautical Telecommunications Network (ATN) protocol
- DVB must go for International Civil Aviation Organization (ICAO) certification

DVB must go for certification because

- The International Civil Aviation Organization (ICAO) standards are crucial for aviation safety.
- Aeronautical Telecommunications Network (ATN) protocol is the backbone of air traffic management.

The diagram illustrates the integration of DVB-S2/RCS with the ATN protocol, showing how data flows from the airborne to the ground network, ensuring reliable communication during all flight phases.
Conclusion

- Air traffic is growing and current Air Traffic Management Communications means will not be able to cope with it
- Satellite Communications are integral part of the vision for a future global solution
- The satellite component is being investigated in the ANASTASIA project
  - DVB-S2/RCS is very well positioned as potential solution
  - Further work is required to guarantee required features
  - This is the baseline for the end-to-end system design based on DVB-S2/RCS that will be proposed by ANASTASIA