NEWSKY Project

Mobile aeronautical communication network
Based on Internet technologies
For cockpit and cabin services
Integrating satellite and terrestrial data links
NEWSKY Project Facts

- European Commission Project (FP6)
- Time frame: February 2007 - October 2009
- Man-power effort: 250 PM
- Total financial volume: 3.6 M€

- Project partners:
  - German Aerospace Center (DLR, prime)
  - Thales Alenia Space
  - QinetiQ
  - Deutsche Flugsicherung (DFS)
  - TriaGnoSys
  - University of Salzburg
  - Frequentis
Future Trends for Aeronautical Communications

- **Less voice, more data** communications for new applications and services.

- **Network-Centric Operations**: increased information exchange among the various parties in the aviation community, Collaborative Decision Making (CDM) and System Wide Information Management (SWIM).

- Less route based airspace design, more **negotiated 4D trajectories** for optimised flight trajectories resulting in lower fuel consumption and reduced environmental impact.

- More information available in the cockpit, more autonomous operations.

- More **passenger and crew communications**.

  → **New communication systems as key enabler**
Challenges Addressed (1):
Coexistence of Different Airborne Services

- Several airborne services with highly diverse requirements shall coexist:
  - ATS (Air Traffic Services) data traffic required to implement the SESAR concepts of operation (trajectory based ATM, CDM, SWIM)
  - AOC (Airline Operational Communications) data traffic will strongly increase for efficient airline operations
  - APC (Air Passenger Communications) is foreseen to be further developed to meet passengers’ expectations of on-board communication services
Challenges Addressed (2): Heterogeneous Deployment of Data Link Technologies

- **Several current and future data links** are foreseen to fulfil the communication requirements of global information availability and sharing.
- **Disparate communication systems** result in low cost efficiency and low system efficiency.

![Diagram of communication systems including satellite links, air-air links, ground network, and airport links.](Image)
Challenges Addressed (3): Heterogeneous Deployment of Networking Technologies

- **ATN/OSI** is being deployed in combination with VDL2
- However, commercial networking solutions based on the widely deployed IETF Internet Protocol Suite (IPS) have diverged significantly from the aeronautical networking solutions based on OSI protocols
- **IPv4/IPv6** protocols are deployed in aeronautical communications in ground networks, IPv4 is used for airline and passenger air-ground communications, IPv6 protocols have been proposed by ICAO WG-I (ATN/IPS) for air-ground
Vision of “Networking the Sky”

- **Problem Statement**: Disparate communication systems are available or in development, resulting in low cost efficiency and low system efficiency.
- Development of solutions for an *aeronautical communication network based on IPv6* for the integration and interoperability of *different services* and *different data links* (terrestrial and satellite).
NEWSKY Integrated Networking Approach

- NEWSKY focus on transport and network layer and on interface to data links
- IPv6 based networking solutions for air-ground communication for cost savings, high reliability and an optimal alignment with the evolution of communication and security technologies
- NEWSKY is an enabler and provides transport mechanisms for SWIM services
NEWSKY Architecture at a Glance (1/2)

➤ Segregation of data traffic
  ➤ Physical segregation of operational and non-operational data traffic in the short term
  ➤ Segregation using security tunnels as long-term option

➤ Security
  ➤ Security tunnels used for integrity, authentication, encryption
  ➤ Security Access Gateways form the cryptological endpoint

➤ Data link selection and handover framework
  ➤ Simple or dynamic link selection methods using available link information and user preferences
  ➤ IEEE 802.21 Media Independent Hand-Over framework provides abstracted link layer intelligence and network information to upper layers for optimal link selection and optimization of handovers
NEWSKY Architecture at a Glance (2/2)

- **Mobility**
  - Solution based on Mobile IPv6 (MIPv6) and extensions for network mobility (NEMO), local mobility and multihoming
  - Home Agent as anchor point on the ground for the mobile node. Home Agent is located in a global ACSP
  - NEMO Route Optimization solution: Global Home Agent to Home Agent (Global HAHA) as baseline protocol

- **Quality of Service (QoS)**
  - DiffServ architecture with well dimensioned capacity
  - DSCP tagging to ensure QoS across different networks

- **Reliable Transport Layer**
  - TCP for short-term deployment
  - TCP with parameter adaptation, Reliable UDP for ATS/AOC, Performance Enhancing Proxies for AAC/APC
Key NEWSKY Benefits

- **Cost savings**, high reliability and an optimal alignment with the evolution of communication and security technologies by tailoring commercial of-the-shelf components wherever possible.

- **Interoperability** between different communication systems

- **Modular system concept** which enables simple introduction of new data link technologies

- **Optimised communications performance** for each type of application by using the right communication link technology at the right place and time

- **Efficient and flexible** utilization of the overall aeronautical frequency spectrum

- Increased availability and reliability through efficient use of different communication links
NEWSKY Inputs to Standardisation

- **ICAO** ACP WG-I (Internet Protocol Suite)

- **IETF** MEXT (Mobility EXTensions for IPv6)
  - Shape IETF standards to be applicable for aviation

- **AEEC**: NIS (Network Infrastructure and Security), MAGIC (Manager of Air-Ground Interface Communications)
Demonstration at ATC Global, March 2009, Amsterdam
NEWSKY Integrated Satellite and Air-Ground Communications Test-Bed
Testbed Components and Features

- Implementation of selected NEWSKY functionalities in a laboratory environment
- Completely IPv6 based (except satellite portion)
- **Support of all kind of applications** running over IPv6, shown:
  - VoIP (UDP traffic)
  - Weather map download (TCP traffic)
  - CPDLC messages (TCP traffic)
- **Support of all kind of links**, shown:
  - BGAN Inmarsat link
  - Emulated L-DACS link
- Demonstration of inter-technology handover and network mobility
- Logical segregation of ATC/AOC and AAC/APC traffic
NEWSKY Network Simulation

- Global assessment of NEWSKY protocols and algorithms
Summary

- NEWSKY provides a concept and preliminary design of an integrated mobile aeronautical communication network with focus on air-ground communications and IPv6 technologies.
- Provide strong inputs to SESAR JU and to follow-up activities in the EC project SANDRA.

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