L-Band Digital Aeronautical Communications System (LDACS) Future Communications in Aviation

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Motivation - Aeronautical Communications

Aeronautical communications for controlling and managing air-traffic in all phases of flight
Digital Datalinks in Air Traffic Management (ATM)

- Worldwide civil air traffic estimated to grow by 84% until 2040 compared to 2017
- Legacy systems in ATM will reach capacity limit
- VHF band is becoming saturated in high density areas of Europe, US and Asia
LDACS – Entities, Capabilities

- **LDACS**: L-band Digital Aeronautical Communications Systems

- **Terrestrial digital wireless communication system for civil operational aeronautical safety-of-life communication**

- Based on 3G and 4G technology

- **Enabler for digital data (ATN/IPS) and voice communication in civil aviation**
  - ATM communication (ATS, AOC, APC, AAC, ...)
  - Enables **broadband applications**: 4D Trajectories, Weather maps, SWIM integration, Digital Voice, Video capabilities
  - LDACS as broadband extension of VDL mode 2
LDACS - Main Characteristics

- **LDACS**: L-band Digital Aeronautical Communications Systems
- Controller/Pilot communications
- Centralized communication via ground station
- Cellular deployment concept
- Duplex scheme is FDD
- Multiple-access schemes
  - Forward link (FL): pure OFDM
  - Reverse link (RL): OFDMA/TDMA
- LDACS supports data and voice communication

**Standardization**
- System design finalized
- Performance evaluations by theory and simulations finalized
- ICAO Standardization initiated and draft SARPs ready
LDACS - Key Characteristics

- **LDACS** data rates & adaptive coding and modulation (ACM)
  - Bandwidth (overall / occupied): 625 / 488.28 kHz
  - Modulation rate (overall FL + RL): 833.33 ksym/s
  - Min. net data rate (overall): 291+270 kbit/s
  - Max. net data rate (overall): 1318+1267 kbit/s

Assignment for AM(R)S at WRC 2007

- JTIDS
- JTIDS
- JTIDS (MIDS)

GSM

- Power
- Frequency
- LDACS
- DME
- DME
- DME
- Galileo/GPS
- DME (1157-1213)

Preferred Deployment: Inlay Scenario

Main Issue: L-band Compatibility

Approach for LDACS Inlay Scenario:
- Out-of-band radiation reduction
- Interference mitigation at receiver
LDACS in Reality – Current Flight Trials

MICONAV Project
- Integration of LDACS hard- and software at DLR labs
- Preparation of flight trials including equipment certification
- Demonstration

Spectrum AS, GS1, GS3
LDACS Summary

- Intended for communication related to the “safety and regularity of flight”
  - Wireless data link between aircraft and ground network
  - Mostly infrequent and small messages (<200B) that must be delivered with very high reliability
- Must be deployed in aeronautical spectrum for regulatory reasons
  - Available spectrum restricts the data rate to several hundred kilobits/second
  - One-way latency is in the order of hundred milliseconds
  - High number of users (~250) per cell expected due to limited possibilities to deploy base-stations
  - For the same regulatory reasons standardization of LDACS layer 2 is performed under the umbrella of ICAO
- Shall be deployed in the aeronautical telecommunications network “ATN-B3”
  - Private IPv6 based global network for air traffic control and related services
  - Aircraft are multi-homed mobile IPv6 networks
  - LDACS is one of several down-links to the ground network
  - Network architecture is currently under development by industry (LISP-based multi-homing of provider independent mobile network prefixes)
LDACS Bibliography


