



## FUTURE GENERATION AERONAUTICAL SATELLITE COMMUNICATIONS FOR AIR TRAFFIC MANAGEMENT MISSIONS



**“The development of a communications system using satellite technology is a very attractive proposition since it also provides a service in areas where terrestrial systems cannot be deployed. Alongside emerging satellite navigation systems, SDLS will contribute to much better accuracy in aircraft position monitoring, allowing greater numbers of aircraft to safely occupy a given segment of airspace at any one time. With this new system we want to prove that a “second generation” satellite system can meet the stringent requirements of the ATM's “safety of life critical functions”.”**

Claude Loisy, SDLS Project Manager, European Space Agency.

Nowadays civil aviation is essentially using a dedicated aeronautical sub-band of the VHF frequency band for supporting their safety communications. In airspace not covered by the VHF system, HF communication band is used with a poor audio quality. With the continuous increase of air-traffic world-wide, shortage of the capacity required for supporting safety communications will be an issue in the order of 6 to 10 years.



#### BUSINESS CHALLENGES

In this context, a dedicated satellite-based system, as SDLS, is a suitable candidate to provide required capacity for Air Traffic Management in high traffic density airspace maintaining the safety of aeronautical operations, and also offering global coverage in oceanic and desert regions.

In 1995, some preliminary studies about a satellite system for civil aviation were done conducted from the European Space Agency (ESA). Other 1998 report about SDLS provided the initial reasoning and the detailed justifications to start this R&D activity and foresaw the interest of deploying a new generation of aeronautical satcom system in order to complement aviation's existing Air/Ground communication means. Other important fact was the demise of LEO based Iridium system, which had been candidate to provide the service.

The situation significantly evolved since May 2000, after Eurocontrol (entity in charge of air traffic management in Europe) recognized the potential interest

of the concept underlying "the current ESA project known as SDLS in order to solve the shortage of the current communication infrastructure".

Thus, in 2000 ESA started ASTE activity NM 9.11 "Satellite Data Link System for Air traffic Management" in the ARTES program framework and in the area of performance demonstration of SDLS in order to take full advantage of the place left vacant by Iridium.

The whole SDLS program is constructed in consecutive phases consistent with current International Civil Aviation Organization (ICAO) standardization steps in order to allow reviewing the evolution. During 2003, a study work that involved a key technical analysis and SDLS System definition was carried out. It was a mandatory bridging step towards the final operational system. In addition, the feasibility of in-flight tests using Eurocontrol provided opportunities is also being studied.

This market, Avionics, Earth-Stations and Space segment, has its peculiarities, which are mostly dictated by the Aviation context:

- > The ICAO standard will be an open standard to be elaborated by consensus among the active parties within the ICAO machinery, to be finally formally approved by the ICAO Member States
- > It is likely that there is room for only one system, compliant with a still to be defined worldwide-recognised ICAO standard
- > As a consequence, if there were competing initiatives in the ICAO standardisation process, the end result (after a few years) would be one winner and possibly some losers
- > There is therefore a decisive bonus for early starters in the race, provided they also have a good system.

## SOLUTIONS

Atos Origin was in charge of designing and implementing Satellite Access Control protocols. This real-time software solution controls the use and assignment of satellite channels, offers basic transport services for data communications, simple datagrams (short messages) and voice communications. It also addresses in real-time the pilot and controller voice streams switching satellite channels so as to provide "Party Line" service emulating VHF radiotelephony operation. Atos Origin software was developed in C language for high-performance real-time Vx-Works, Operative System.

The baseline centralized "polling" technique for controlling satellite access to shared medium was modified to a more general, flexible CDMA-ALOHA approach after evaluating several alternatives. This fact had an important impact in designing and implementing Atos Origin communication protocols but the decision received explicit congratulations from Erling Kristiansen-ESA technical assistant for SDLS project. The hybrid CDMA-ALOHA technique appeared suitable for meeting SDLS project needs offering better performance and higher capacity than polling solution.

In the next phase of the project, Atos Origin was in charge of the access and protocol analysis. Logical channels distribution and corresponding physical carriers definition were carried out, based on a reference traffic matrix, defined bearer services and simulations results. A raw CDMA framing model was retained for the feeder link while two models are proposed for the return link, the basic model that Alcatel initially proposed, and the independent mini slot model that was proposed by Atos Origin and that has been proven to be the most efficient solution.

## BENEFITS

The currently used aeronautical satellite communication systems, known in aviation as AMSS (Aeronautical Mobile Satellite System) and installed on some aircraft, are mainly targeted at passenger communications. The main drawback of these systems is that they do not match with the strict requirements of safety communications; that's the reason why they have very limited usage in this framework. Furthermore, their operational price is at present prohibitive. Last statements point out that does not exist any satellite system similar to SDLS in the market.

The purposes of SDLS project are to prove the benefits of this new concept and help in the definition of a new open standard in the framework of ICAO efforts to define the Next Generation Satellite System (NGSS). SDLS offers several technical and service innovations, for example:

- > Point-to-multipoint voice service: Additionally to classic point-to-point conversation, SDLS demonstrator implements what was called as Party-Line. It allows several pilots to listen to conversation between aircraft pilot and ground controller. This service emulates the existing one in VHF band and SDLS is the first satellite system that can offer it.
- > SDLS APR service: Consisting in an alternative positioning service based on datagrams that emulates a radar system and can be used as a back-up system.

SDLS is designed so as to demonstrate technical performances for a new necessary standard to meet communication requirements of future ATM systems as currently specified by the International Civil Aviation Organization (ICAO).

## About Atos Origin

Atos Origin is an international information technology (IT) services company. Its business is turning client vision into results through the application of consulting, systems integration and managed operations. The company's annual revenues are more than EUR 5 billion and it employs 47,000 people in 50 countries. Atos Origin is the Worldwide Information Technology Partner for the Olympic Games and its clients include ABN AMRO, Akzo Nobel, Alstom, BNP Paribas, BP, Ericsson, EDF, Euronext, Fiat, France Telecom, ICI, ING, KPN, Lucent, Philips, Renault, Royal Bank of Scotland, Saudi Aramco, Schlumberger, Shell, Telecom Italia, UBS, UK Department for Work and Pensions, Unilever, Vivendi Universal and Vodafone. For more information, please visit the company's web site at [www.atosorigin.com](http://www.atosorigin.com) Atos Origin is quoted on the Paris Euronext Premier Marché and trades as Atos Origin, AtosEuronext, Atos Worldline, Atos KPMG Consulting and Atos Odyssee.