CDTI−ADS−B operational experience

Scandinavian Airlines System

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The total yearly cost of ATC induced delays for the European airlines is between one and two billion ECU, according to ECAC/McKinsey. At the same time the fees airlines pay for using the ATC service have increased on average 7,2 % annually over the last ten years.

Even with a modest annual growth of 5 % the total European air traffic volume will have doubled by 2011. It is obvious that the ATC system which is struggling to handle today's traffic in a satisfactory way will be incapable of handling tomorrows. "Tweaking" to tile current system will increase capacity, but not even Reduced Vertical Separation (RVSM), Basic RNAV, Precision RNAV etc. will solve the problem. The base for the current system was developed over 50 years ago in the infancy of radar and with far lower traffic densities. This carries over to the present system imposing artificial limitations − **there is no shortage of navigable airspace in Europe today or in the foreseeable future.**

The transition into the new system, the CNS/ATM environment, will be made in steps varying in size and time by the regional requirement. It is, however, our belief that any successful development and implementation has to be made in a cooperative approach where all affected parties are involved. A good example of this is the Continental Express/FAA/Honeywell GPS approach solution to Aspen and Steam Boat Springs, Colorado. SAS was approached by the Swedish CAA in mid− 1994 for possible involvement in the CNS Applications Research and Development program, (CARD), an already ongoing project for several years. The technology that CARD is based on is a Self−organizing Time Division Multiple Access (STDMA) data link which in this application uses the VHF band. The CARD project originated with the idea of developing a say that could prevent inadvertent runway intrusions. This was done by transmitting GPS derived positions over an STDMA VHF. Today that system is know as Automatic Dependent Surveillance − Broadcast (ADS−B).

ADS−B has the potential to be the cornerstone in "free Flight" as well as provide the position information needed for safety enhancing systems on the flight deck as Cockpit Display for Traffic Information (CDTI), runway intrusion system etc. In December 1995 SAS joined our partner Lufthansa and the aviation authorities of Sweden, Denmark Germany and the UK in the formation of the North European ADS−B Network, (NEAN) a three−year ADS−B evaluation program sponsored by the European Union. On January 28, 1996 I took off with SAS Fokker F28 SE−DGL as the first airliner in the world equipped with ADS−B VHF STDMA. Since then SAS' two equipped F28−4000 aircraft have made more than 6.500 flights.

The first phase of NEAN has focused on establishing the ground network and starting the verification process of the STDMA data link functionality integrity and range in an operational airline environment The ground network was established by the CAA's of the participating countries, Germany Denmark and Sweden in 1996. In February of 1997 these national network were connected together and the actual North European ADS−B

Network was established. During 1997 at least ten more commercial aircraft will be equipped with different levels of tile STDMA based ADS−B system, of which four will be Lufthansa longhaul aircraft A340 or B747−200 and two SAS DC−9. In addition more than 25 ground vehicles will be equipped.

In the first phase of tile NEAN project, January to December of 1996, a rather simple Man Machine Interface, MMI was used on flight deck. The functions made available to the flight crews were: DGNSS derived position including altitude, radial, distance and ETA to one of 30 defined airports/nay aids. On December 14, 1996. The MMI was replaced with a more advanced version based on a 586−processor and good memory capacity. The new MMI, MMI 5000, has stored the standard KSSU database, SAS flight plans, SAS timetable accurate airport maps in WGS 84, as well as the coordinates in WGS 84 for specific routes and approaches. The physical size of the MMI is limited to the space available in the aircraft initially intended for it's use, namely the F−28 and SAAB 340, but even so it is able to generate basic RNAV functionality, advanced map display and support data link communication.

The new MMI is thoroughly a CNS interface. As of June'97 SAS will have operated over 100 revenue flights on four DGNSS dedicated routes from Stockholm Arlanda: Arlanda−Gothenburg Landvetter−Arlanda, Arlanda−Ängelholm−Arlanda, Arlanda− Ronneby −Arlanda and Arlanda−Kritianstad−Arlanda. The first DGNSS approach, replacing NDB approach, is planned for mid September 1997 into Ängleholm RWY 32.

With MMI 5000, a full CDTI display, based on RTCA SC 186 WG 3 draft requirements was available directly from the start. The CDTI display includes the aircraft call sign or in the case of general aviation the registration member. Once on ground or approaching ground, airport ground maps are displayed with taxiway designators, gate members, etc. With the differential update, also linked via the STDMA data link to the GPS receiver, the **actual** navigation accuracy is one meter or less within 20 NM from the LAAS station. The communication applications will come onboard with the PETAL II software in the third quarter of 1997. But even before then basic communication applications such as PDC, ATIS and limited AOC will be available.

After more than a year of operation with STDMA based ADS−B, we at SAS have concluded that the system performs as we had originally hoped it would. The stability and range of the data link is very good. We have experienced some problems with the flight deck early MMI, but otherwise the functionality has been flawless. Our participation in the NEAN project has also had some positive side effects, for example raising the level of knowledge in the administration and pilot corps about satellite navigation in general as well as about the possibilities with ADS−B in particular. We are also very happy about the close and fruitful cooperation with the participating authorities In the coming 20 months of the NEAN project we expect an efficient use of the excellent platform we have in the F−28s for evaluation and validation of Communication Navigation and Surveillance applications. We also expect that future experience on the navigation side, for SAS and the Scandinavian authorities, will pave the way for utilization of the GPS capability in our Boeing 737−600 to be introduced in late 1998.

I started my presentation by describing the impact, which the current ATC system has on punctuality and on operational economy both directly and indirectly. To offer a safe, punctual service at a competitive price is the operational goal for most airlines. Therefore, the airlines' requirements for a future CNS/ATM system will not only be that it increase safety and capacity but also that it allow full use of the actual performance of our aircraft, that is 'Free Flight", ref. IATA DOC.GEN/3140. ADS−B has the potential to be the corner stone of a CNS/ATM system which fully uses the aircraft's performance and navigation potential. However, the data link carrying the ADS−B message has to have sufficient range and capacity not only to carry today's ADS−B message, but also the aircraft's trajectory. As an IATA representative in the −EUROCAE WG 51, which has the task of producing European MASPS and MOPS for ADS−B, I am well aware of the "political" impact of an STDMA based ADS−B system. As an airline representative, I find it totally unacceptable to dismiss a system which could fulfill our requirements based on anything else than pure facts.

SAS supports ADS−B and the technology that "best" will do the job. At the present time, and for the foreseeable future, we regard the STDMA data link to be that technology.