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Agenda Item 6: **Assessment of operational requirements in order to determine the implementation of communications and surveillance (CNS) capabilities improvement for en-route and terminal area operations**

OPTIMI (Oceanic Position Tracking Improvement and Monitoring)

(Presented by Brazil)

SUMMARY

This information paper presents Brazil's and the SESAR Joint Undertaking interest to expand the Oceanic Position Tracking Improvement and Monitoring functionalities currently defined for the Atlantic airspace in the NAT, EUR and AFI regions, to the CAR and SAM Atlantic airspace.

The cooperation will consist of sharing technical and operational information on OPTIMI, promoting jointly global interoperability to enable a wide deployment of this functionality and eventually to perform flight trials to validate solutions for the downloading of safety critical data from the FDRs.

This information paper also provides some background information on the OPTIMI initiative and identifies some potential improvement areas connected to it.

1. INTRODUCTION

1.1. The SESAR Joint Undertaking (Single European Sky ATM Research Joint Undertaking) is a European Community body in charge of all the development activities in Europe to deliver the new generation of Air Traffic Management systems and procedures under the Single European Sky framework.

1.2. In June 2009, as a consequence of the tragic loss in the Atlantic Ocean of Air France Flight 447, the European Commission requested the SESAR Joint Undertaking to take an action on the improvement of monitoring of air traffic in oceanic and remote low density airspace. Consequently, the SESAR Joint Undertaking launched OPTIMI (Oceanic Position Tracking Improvement and Monitoring Initiative) as a collaborative project with air navigation service providers, airlines, manufacturers, SATCOM providers and other entities involved in the aviation sector at the European Atlantic airspace.

1.3. In May 2010, initial conversations took place between the EC and Brazil to improve the mutual technical and operational cooperation on ATM matters. In August 2010, a Letter of Understanding was signed by DECEA and the SESAR Joint Undertaking, agreeing in particular on possible joint activities in those topics connected to OPTIMI.

1.4. An OPTIMI-like experience focusing on main traffic flows between the Europe - South America (EUR/SAM) oceanic routing areas would increase the current efforts to integrate new technologies and procedures for the improvement of safety across the Atlantic.

2. THE CURRENT SITUATION

2.1. Although ACARS (Aircraft Communications Addressing and Reporting System) equipage and use is widely extended, only around 40 to 50% of the fleet used for oceanic flights in the Atlantic is equipped with FANS 1/A (Future Air Navigation System), allowing ADS-C (Automatic Dependent Surveillance - Contracts) and CPDLC (Controller Pilot Data Link Communications). These equipage figures are likely to improve in the future (over 60% in 2015). It is also noted that a rather low percentage of flight crews (around 10%) performs actually ATC FANS 1/A log-on. This could be caused by the cost of the use of this functionality, and the perception of low reliability of the communications.

2.2. Aircraft will be increasingly equipped either with ATN (Aeronautical Telecommunication Network) architecture (in particular for European airlines, subject to Commission Regulation (EC) No 29/2009) or with FANS 1/A architecture. In the future (although not before 2014) both architectures will be compatible with the FANS A/B architecture.

2.3. Deviations from ICAO SARPs have also been detected on coordination procedures between adjacent OACCs (Oceanic Area Control Centers), and between OACCs and SAR facilities. Flight plans are occasionally not received by ATS facilities causing difficulties in tracking aircraft.

2.4. Apart from flight tracking, the other main topic addressed by OPTIMI is the possibility of downloading FDR (Flight Data Recorder) data to ground when certain events on board trigger the transmission. Satellite communications are key to make possible this functionality. Today the Iridium constellation would allow this transmission with no latitude constraint; but on the other hand, most aircraft equipped for SATCOM functionalities in the Atlantic are using Inmarsat constellation.

3. OPTIMI DEMONSTRATIONS

3.1. Following an analysis of the current situation and a feasibility analysis, a flight demonstration campaign took place in oceanic zones of three selected ICAO Regions: the North Atlantic Region (NAT), the European Region (EUR) and the African Region (AFI). The campaign consisted of the following:

a) In the NAT region, Santa María FIR, 2 flights Paris-Martinique and 2 flights Paris-Guadeloupe, in October 2010;
b) In the EUR region, Lisbon FIR, 2 flights doing the Madrid-Caracas-Madrid route, and 1 flight from Lima-Madrid, in October 2010;
c) In the AFI region, Canarias FIR, 2 flight Buenos Aires-Madrid, and 1 flight Madrid-Tenerife in June and July 2010.

3.2. During these flight demonstrations, the following elements were tested:

1. Use of demand contracts
2. Use of CPDLC for provision of position reports
3. Detection of inconsistencies between flight plan on ground and performed flight plan
4. Detection of vertical deviations with Vertical Deviation event contract
5. Detection of lateral deviation with Lateral Deviation event contract
6. Detection of lateral deviation without Lateral Deviation event contract
7. Detection of Offset
8. Emergency mode establishment with ADS-C periodic contract established
9. Emergency mode establishment without ADS-C periodic contract established (event contract established)
10. Emergency mode establishment without ADS-C contract established
11. Use of SATCOM voice
12. Review of procedures and information gathering for SAR
13. AOC emergency message forward to ATC

3.3. Additionally, 2 trials in the Airbus simulation facilities took place in October 2010 to test Altitude Change event, which obviously could not be tested on a commercial flight. Finally, 2 demonstrations on the FDR downloading of data to ground were performed in December 2010..

3.4. Feedback to all these tests has been gathered from the different actors participating in them (ATCOs, pilots and SAR personnel). The results generated a set of recommendations for an enhanced flight tracking and monitoring functionality over oceanic and remote regions.

4. THE OPTIMI SOLUTION

4.1. In the event of a SAR operation, the search area increases proportionally to the square of the time between 2 position reports. Consequently, the costs of SAR operations decrease significantly by increasing reporting frequency. On the other hand, the operating cost of reporting increases with its frequency. The optimum frequency balancing both has found to be 1 positioning reporting each 15 min.

4.2. Although OPTIMI was not initially conceived for operational safety reasons, an analysis of safety data for Shanwick FIR has also shown that additional safety benefits are anticipated. More than 25% of Losses of Separation in oceanic areas might be avoided using the OPTIMI solution.

4.3. The recommended short term solution is the following:

1. Use of FANS 1/A based ADS-C periodic position reports with a 15 minutes period.

2. Use of FANS 1/A based ADS-C deviation alert on the following events:

    a. Lateral deviation of 5NM from the nominal route.
    b. Vertical deviation of 300ft above or below the nominal altitude.
    c. Altitude change descent rate of 5000ft/min.
    d. Deviation from nominal waypoint.

4.4. It can be noted that such solution would generate a set of tangible benefits in the FIRs concerned. The associated cost is the basic cost of implementation of FANS 1/A, which is already catered for in most of the cases. The expected extra cost related to the exchange of data between the aircraft and the ground is only about 10€ per flight.

5. POSSIBLE FUTURE IMPROVEMENTS

5.1. Besides the solution described above, the project has made the following recommendations which will be formally transmitted to ICAO at a later stage:

5.2. It is recommended that all OACCs and SAR facilities jointly review their protocols of notification and intervention in case of emergency to align them with the dispositions of ICAO Annex 12 Search and Rescue and ICAO Doc. 9731 International Aeronautical and Maritime Search and Rescue Manual.

5.3. It is recommended that the Contracting States make use of any suitable incentive mechanism to encourage the installation of FANS1/A equipment and the use of ADS-C and CPDLC by Airlines and ANSPs.

5.4. FDR safety critical data download triggered by events has demonstrated to be a powerful tool in this field. Nevertheless, the feasibility of real time FDR downloading is dependent on the volume of data downloaded. The determination of the triggering parameters of the downloading, and the most relevant parameters to be downloaded is an area for further study.

5.5. Also the speed of data transmission is key for the best use of FDR downloading capabilities. SAT OPTIMI, a parallel initiative launched by the SESAR Joint Undertaking at the end of 2010, is already working in this field. The conclusions and recommendations will be available early in April 2011.

5.6. A data repository is seen as a good option to answer the issues connected to downloaded data storage and management. This concept could be based on a central repository configuration or on a configuration of sequential repositories. The regulatory impact of these solutions should be studied.

5.7. Finally, other practical aspects of the operation could be refined, such as the activation of ADS-C emergency mode, or the further standardization of phraseology for CPDLC messages.

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