Twenty Third Meeting of the
Informal South Pacific ATS Co-ordinating Group (ISPACG/23)

FANS Interoperability Team Meeting (FIT/16)
Santiago, Chile, 24-25 March 2008

Agenda Item 5: Update on Aircraft Operational Issues

ADS-B IN TRAIL PROCEDURES

(Presented by Airbus)

SUMMARY

In Trail Climb/Descent Procedures (ITP) based on ADS-B data should soon be used in the North Atlantic. This paper presents the tests that have already been carried out and the way forward to proceed further.

1. INTRODUCTION

1.1 The use of ADS-B applications is steadily increasing in various parts of the world. ADS-B out and in data allow for new way of more efficient operations. One of these is called ITP Climb/Descend.

2. DISCUSSION

2.1 The objective of the In-Trail Procedure (ATSA-ITP) is to enable aircraft that desire flight level changes in oceanic airspace to achieve these changes on a more frequent basis, thus improving flight efficiency and safety.

2.2 Flight level changes can significantly improve flight efficiency by reducing fuel use. Optimum flight level usually increases throughout the flight (as fuel is burned and aircraft weight is reduced), but higher or lower flight levels may be more efficient because of more favourable winds. In addition to efficiency improvements, flight level changes can increase safety when turbulent conditions exist at the current flight level.

2.3 ATSA-ITP achieves this objective by permitting a climb-through or descend-through manoeuvre past a blocking aircraft, using a distance-based longitudinal separation minimum.

2.4 The ATSA-ITP does not change the responsibilities of either pilots or controllers; the flight crew continues to be responsible for the operation of the aircraft and conformance to its clearance; the controller continues to be responsible for separation and the issuance of clearances. ATSA-ITP does include new tasks for the flight crew in determining that the ATSA-ITP criteria are met (supported by automation). ATSA-ITP does not require the crew to monitor or maintain spacing to any aircraft during the manoeuvre. In the current definition, the ATSA-ITP also requires some limited checks from the controller.

2.5 The CRISTAL consortium is composed of Airbus, ISAVIA, NATS and Alticode

2.6 CRISTAL (Co-opeRative ValidatIon of Surveillance Techniques and AppLications of Package I) is a collection of Ground and Airborne Surveillance Application validation projects, executed in cooperation between Eurocontrol CASCADE and stakeholders at their local sites.

2.7 The objectives of the trials were:

- To refine and validate ATSA-ITP procedure
- To assess the operational acceptability for both aircrews and ground controllers
- To define the voice phraseology and optional CPDLC messages
- To take North Atlantic specific constraints into account and demonstrate the technical feasibility of the ITP procedure
- To develop a benefit model of ATSA-ITP in the North Atlantic
- To prepare a revenue flight trials phase

<u>Trials description (See fig 1 & 2 below)</u>

2.8 The trials consisted in an Airbus test aircraft (A340-600 AIB123) performing ITP climb / descent ahead / behind a Reference Aircraft (A330 SAS903 from Stockholm Arlanda). The tests were carried out in the Reykjavik area from a starting point (63N/10W) and along the 63N on the SAS903 track. The Icelandic radar controller instructed radar vectoring as well as Flight Level change instructions so as to position the AIB123 Aircraft according to initial conditions relative to the SAS903 i.e. 30 nm ahead, 1000 ft below, and ready to commence the first of the ATSA-ITP manoeuvres. Four steps were then conducted, both a/c were at M0.8 and the climb and descent were done by the AIB123 at V/S +/- 1000ft/min:

- An ITP Climb from FL300 to FL320, based on CPDLC negotiation, executed with the AIB123 around 32Nm ahead of SAS903

- An ITP Descent from FL320 to FL290, based on CPDLC negotiation, executed with the AIB123 around 32Nm ahead of SAS903

- An ITP Climb from FL290 to FL330 based on VHF voice negotiation, executed with the AIB123 around 30Nm behind SAS903

- An ITP Descent from FL330 to FL290 based on VHF voice negotiation, executed with the AIB123 around 30Nm behind SAS903.

  Nota: an orbit at FL290 was done by the AIB123 in between steps 2 and 3 to position the a/c from ahead to behind the SAS903.

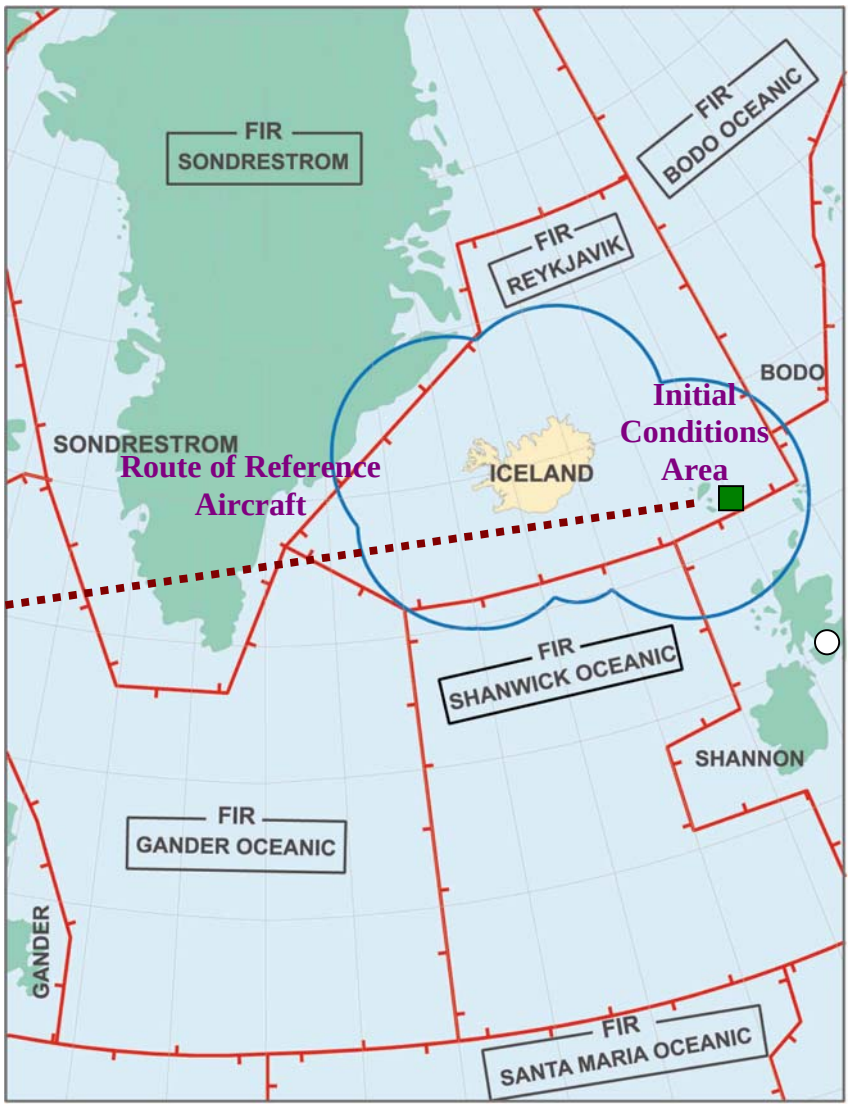

Fig 1

2.9 Details of the 4 steps:

Step 1: Ahead of Climb
AIB123 was 1000 ft below SAS903. The crew requested an ITP ahead of Climb to 1000 ft above SAS903 using the following ITP CPDLC phraseology :
REQUEST CLIMB TO [F320] Free text [ITP 32/AHD/SAS903].

The procedural controller received the request and checked that ITP initiation conditions were met. Before issuing the ITP ahead of Climb Clearance the procedural controller checked with the radar controller whether radar separation existed between the AIB123 and other traffic.
The Airbus Flight Crew re-assessed ITP initiation conditions after the CPDLC clearance was received,
before starting the climb .
CLEARED ITP REFERENCE SAS903
CLIMB TO AND MAINTAIN [F320]
REPORT LEVEL [F320]

Step 2: Ahead of Descent
After Step 1, the distance between the aircraft was re-assessed. The flight crew requested an ITP ahead of Descent to 2000 feet below SAS903 using the following ITP CPDLC phraseology :
REQUEST DES TO [F290] Free text [ITP 32/AHD/SAS903].
The procedural controller received the request and checked that ITP initiation conditions were met. Before issuing the ITP ahead of Descent Clearance the procedural controller checked with the radar controller whether radar separation existed between the AIB123 and other traffic.
The Flight Crew will re-assessed ITP initiation conditions after the clearance was received, before starting the descent.
CLEARED ITP REFERENCE SAS903
DESCEND TO AND MAINTAIN [F290]
REPORT LEVEL [F290]

Orbit
The Radar controller cleared AIB123 for a right-hand orbit so that the aircraft ended up 30 NM behind SAS903, 2000 ft below.

Step 3: Behind Climb
The flight crew then requested an ITP behind Climb to 2000 ft above SAS903 using the ITP voice phraseology:
REYKJAVIK, AIB123, REQUEST ITP CLIMB TO FL330, 30 MILES BEHIND SAS945
The radar controller received the request and advised the Procedural controller, who then checked that ITP initiation conditions were met. The radar controller issued the ITP behind Climb Clearance with the approval of the Procedural controller.
The Airbus Flight Crew re-assessed ITP initiation conditions after the clearance was received,
before starting the climb.

Step 4: Behind Descent
The flight crew then requested an ITP behind Descent to 2000 ft below SAS903 using the ITP voice phraseology:
REYKJAVIK, AIB123, REQUEST ITP DESCENT TO FL290, 30 MILES BEHIND SAS945.

The radar controller received the request and advised the Procedural controller, who then checked that ITP initiation conditions were met. The radar controller then issued the ITP Behind
Descent Clearance with the approval of the Procedural controller.
The Flight Crew re-assessed ITP initiation conditions after the clearance was received, before starting the descent.

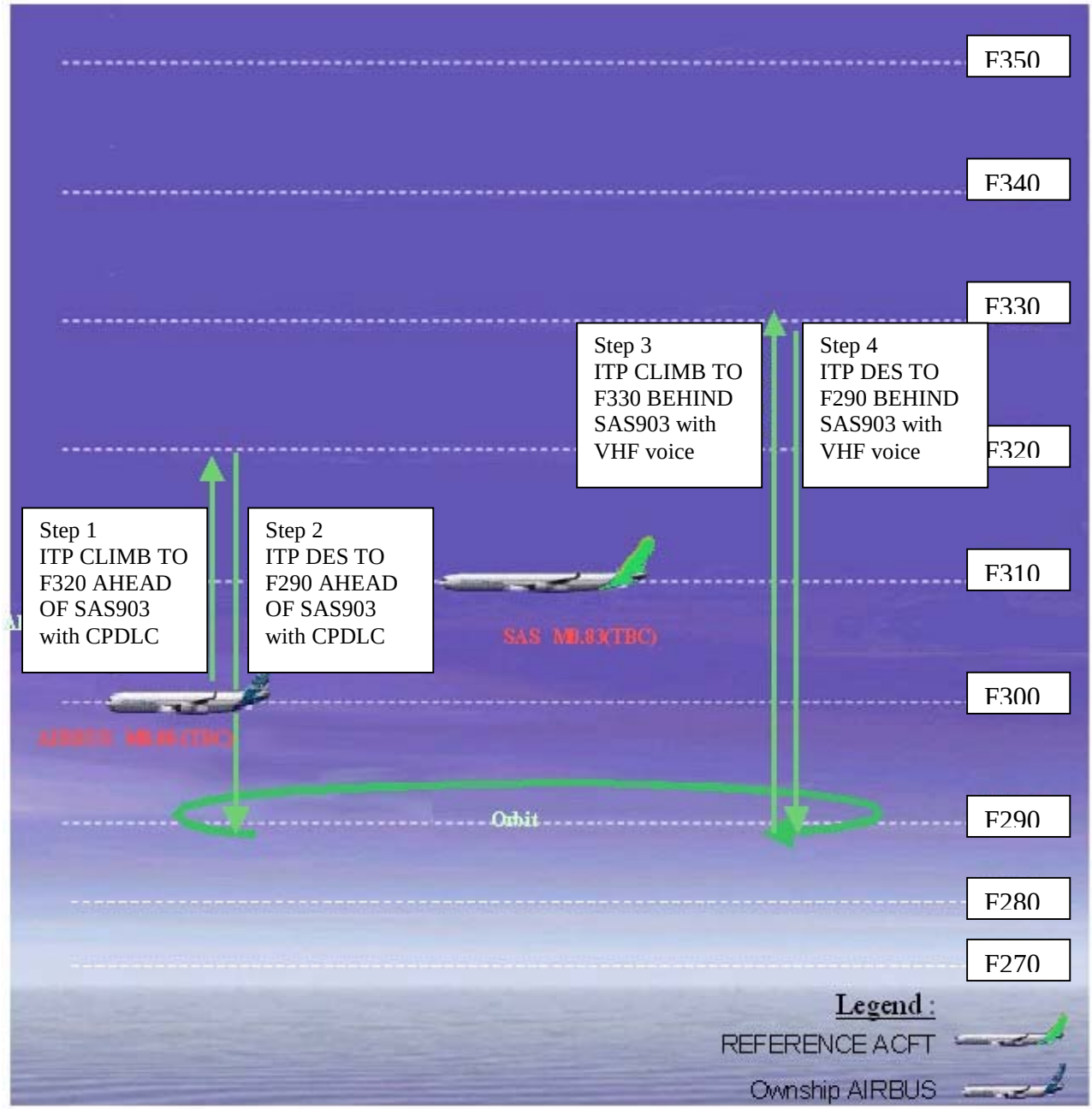

Fig 2.

2.10 Results of the Tests:

Waiting for the final report and from an operational and a/c point of view only, the following points are worth mentioning:

- ITP procedures were found appropriate and easy to follow. They did not raise any specific crew workload.

  - Understanding and completing the ITP procedure through either CPDLC or voice phraseologies did not raise any adverse comments from the crew. The considered onboard HMI was found appropriate to carry out ITP climb and Descent.

  - CPDLC was considered as efficient and without ambiguity to cope with ITP Climb/Descent. Standardised messages (at least "pre-canned free text" messages) have to be proposed and agreed upon to ease the use of CPDLC and avoid free text messages to be typed. The messages used during the trials were found appropriate.

  - Voice phraseology was assessed through VHF and as such should not prevail for HF operations. Crew considered that HF voice might impair the easiness of the ITP. They all agreed that CPDLC is to be favoured.

- The trials have been very positively rated by the crew. They are promising for the forthcoming certification of the ADS-B ATSAW systems and for further operational approval of the ITP application.

- The SAS crew did not report any wake vortex encounter in either climb or descent manoeuvres.

2.11 The Way Forward:

ATSA ITP will be certified by Airbus by the end of 2009, while in parallel pioneer airlines could be looked for to participate in operational trials in Europe and in North Atlantic by next year under the Eurocontrol Cristal program lead with the involvement of ISAVIA and UK NATS.

3. ACTION BY THE MEETING

The meeting is invited to take the above information into account and to consider the interest of ITP operations in the South Pacific