Near-miss involving an Air France Boeing 747-400 and an Airtours A330 in Shanwick Oceanic Airspace, North Atlantic Track Echo, November 10, 2001

Micro-summary: **Numerous events lead to a near-miss between this Boeing 747 and Airbus A330.**

Event Date: **2001-11-10 at 1059 UTC**

Investigative Body: **Air Accident Investigation Unit (AAIU), Ireland**

Investigative Body's Web Site: **http://www.aaiu.ie/**

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FINAL REPORT

AAIU Report No.: 2002/009
AAIU File No.: 2001/0071
Published: 11 September 2002

Operator:	Air France / Airtours International
Manufacturer:	Boeing / Airbus
Model:	B747-400 / A330-200
Nationality	French / British
Registration	F-GISB / G-MDBD
Location	Shanwick Oceanic Airspace, North Atlantic Track ECHO
Date/Time (UTC)	10 November 2001, 1059 hrs

NOTIFICATION

The Irish Air Accident Investigation Unit (AAIU) was notified verbally of this serious incident on Saturday 10 November 2001, by the duty Station Manager, Air Traffic Services (ATS), Shannon Airport. Thereafter, a written Irish Aviation Authority (IAA) Incident Report Form, No. 274/01, was transmitted to the AAIU.

The Chief Inspector of Accidents, Mr. Kevin Humphreys, with Mr. Frank Russell, Inspector of Accidents (Operations), initiated a formal investigation into this serious incident, under the Air Navigation (Notification of Accidents and Incidents) Regulations, 1997.

Formal Notification of the serious incident and the investigation was sent to the UK Air Accidents Investigation Branch (AAIB), Bureau Enquêtes Accidents (BEA), France, ICAO and the IAA.

Under the provisions of Annex 13 to the Convention on International Civil Aviation (Chicago 1944), the Chief Inspector of the UK AAIB appointed Mr. J. J. Barnett, Principal Inspector of Accidents, as the United Kingdom Accredited Representative to this investigation.

The AAIU will publish a Report in compliance with the requirements of ICAO Annex 13 and Council Directive 94/56/EC of 21 November 1994.

SYNOPSIS

The circumstances leading to this serious incident were numerous. The first link in the chain of events was initiated by the Commander of AIH 065 (A330) requesting a westbound clearance for the oceanic entry point SOMAX for a time which was one hour later than actuality, his 1145 hrs request should have been 1045 hrs. This one hour error was not picked up by the Scottish Oceanic Control Area (OCA) based at Prestwick, whose callsign is Shanwick. OCA processed and approved the pilot's requested clearance for 1145 hrs at Flight Level (FL) 370 at SOMAX, on North Atlantic Track (NAT) ECHO. AFR 3671 (B747), which was on an eastbound track at FL 370 also, estimated SOMAX at 1109 hrs. Thus, there were two aircraft on reciprocal tracks approaching the same Reporting Point, SOMAX, and at the same Flight Level, 370. AIH 065 entered Shannon Oceanic Transition Area (SOTA) and came under Shannon Radar control on handover from UK ATC (Appendix A). The Sector Controllers in Shannon, in turn, did not pick up on the one hour error and gave Shanwick a revised estimate of 1148 hrs, which was plus three minutes on the original estimate for AIH 065 at SOMAX. Shanwick queried this new estimate and it was only then that the one hour error in the AIH 065 estimate and its significance was fully realised by both the Shannon and Shanwick Controllers respectively. Flight level separation instructions were then initiated by Shanwick.

Contemporaneous to these unfolding events the pilots of AFR 3671 and AIH 065 later reported observing, on their onboard anti-collision device, the Traffic Alert and Collision Avoidance System (TCAS), Traffic Advisories (TA's), as AIH 065 was descended by Shanwick to FL 350. The general area of the incident is West of 15º West, at approximately 50°N 1630° W, and is therefore outside the area of responsibility of Shannon ATC. It is also outside the area of coverage of Shannon Radar. In this non-radar environment over the North Atlantic the surveillance element of ATC relies on pilot's "position reporting".

1. FACTUAL INFORMATION

1.1 History of the Flight.

AFR 3671, a B747-400 aircraft, was on a routine scheduled passenger flight from Havana, Cuba, to Paris, France. It passed 50°N 020°W eastbound at 1046 hrs routeing to SOMAX (50°N 015°W) at FL 370 under the control of Shanwick Oceanic. It estimated SOMAX at 1109 hrs. Visual meteorological conditions (VMC) prevailed.

AIH 065, an A330-200 aircraft, was on a routine passenger charter flight from London Gatwick Airport to Cancun, Mexico. The aircraft commander was operating as the Pilot Not Flying (PNF) for this sector. Shortly after take-off, at 0946 hrs the PNF called Shanwick on 127.650 MHz to request clearance into Oceanic airspace at reporting point SOMAX. He incorrectly stated his estimate for SOMAX as being 1145 hrs, instead of an actual estimate of 1045 hrs. After probing the flight in the Flight Data Processing System (FDPS) and finding no conflicting traffic, Shanwick issued a clearance to AIH 065 on Track "E", at FL 370, Mach 0.81 based on the PNF's estimate.

There was no reference to the ETA at SOMAX by Shanwick or by the pilot in his clearance readback to Shanwick. The flight proceeded and made initial contact with Shannon Radar at 1005 hrs. At 1009 hrs AIH 065 entered the Shannon Oceanic Transition Area (SOTA) at FL 330 at reporting point GAPLI. The Radar Controller then gave a further climb clearance to FL 370 and at 1045.45 hrs AIH 065 was transferred by the Planning Controller to the HF Radio Station at Ballygirreen, callsign Shanwick Radio for onward Oceanic communications. This call was made as AIH 065 had two minutes to run to the 15°W reporting point, SOMAX.

Simultaneous to this radio transmission a telephone call was made on a dedicated line to Shanwick from the Shannon Planning Controller with a revised time for AIH 065 for SOMAX at 1148 hrs (three minutes later than the PNF's original estimate). At 1048 hrs AIH 065 reported on HF by SOMAX to Shanwick Radio. At 1049 hrs the OCA Planner accepted this time (1048 hrs) into the FDPS and an immediate conflict was indicated with the AFR 3671 in the opposite direction at FL 370 and estimating SOMAX at 1109 hrs. The Planner transferred the flight (in FDPS) to the Enroute Controller for FL 370, warning him verbally of the situation. This Controller then began to probe an alternate level for AIH 065 and, at 1054.40 hrs entered into the FDPS a re-clearance at FL 350. The clearance, "*due traffic, descent now to level 350*" was passed as a priority message to Shanwick radio at Ballygirreen, the HF communication centre for OCA, which covers the Oceanic airspace from the domestic boundaries to 30°W. These instructions were transmitted by Shanwick Radio at 1057.29 hrs. Ten seconds later, AIH 065 acknowledged and reported leaving FL370, reaching FL350 at 1058.50 hrs. A priority instruction for AFR 3671 to climb to FL 380 was sent to Shanwick Radio at 1056 hrs. This was not transmitted to the flight until 1101.51 hrs, by which time the flights had passed.

Based on the pilot's Reports and the AFR 3671 TCAS TA commencing at 20 NM, it is calculated, in the absence of radar coverage, that the horizontal distance between the flights when AIH 065 began descent was less than 20 NM. As the flights were closing at a speed of about 16 miles per minute the minimum distance between the flights until 1000 feet vertical separation was established, is estimated at 10 NM. This is less than one minutes flying time. Oceanic separation requires that, in the circumstances of this incident, vertical separation will be achieved at least fifteen minutes before the aircraft are due to cross.

This occurred between 1058 and 1059 hrs, in daylight.

1.2 Air Traffic Control (ATC)

In accordance with the Oceanic procedures stated in the UK AIP (ENR 2-2-4), westbound aircraft departing from UK airports should request Oceanic clearance from "Shanwick" on VHF RT "as soon as possible after departure". Accordingly, AIH 065 contacted Shanwick at 0946 hrs, requesting a clearance at FL370 via Track "E" at Mach 0.81 and passed a SOMAX estimate of 1145 hrs. This SOMAX estimate should have been 1045 hrs. The UK AIP warns pilots that, as clearances issued by Shanwick are based on the aircraft's estimate for the Oceanic Boundary, it is essential that this estimate is correct.

The clearance requested was received by the Clearance Delivery Officer (CDO), whose duties are listed in the Prestwick Oceanic ACC MATS Part 2, Page DUT 10-1, one of which includes "confirm any estimate which is more than one hour from the time of request". The CDO did not notice the pilot's error on this occasion. The CDO, in accordance with local procedures, then inputted a Request Clearance Message (RCL) into the FDPS and AIH 065's details, as passed by the pilot, were input and sent to the Oceanic Planning Controller (No. 1). Planner No. 1 then called up this information in his queuing system. He noted that, although the MATS Part 2 does not state that the Planner will check an aircraft's boundary estimate for accuracy, it is his practice to make a credibility check. The Planner did not notice the error on this occasion. He cleared the aircraft on its requested routeing. The CDO passed this clearance to AIH 065 at 0950 hrs. It is not a requirement for the CDO to mention an aircraft's estimate for the OCA boundary in an Oceanic Clearance message, therefore it was not done on this occasion.

At 1005 hrs AIH 065 made initial contact with Shannon Radar and was identified by the Radar Controller. At 1009 hrs it entered the SOTA at reporting point GAPLI at FL 330. At 1022 hrs Radar advised AIH 065 to climb to FL 370. At 1035 hrs there was a changeover of the two Radar and Planning Controllers at ACC 8 – the sector controlling AIH 065. The outgoing Controllers did not advise the two incoming Controllers at Sector 8, during the handover of responsibility, of anything unusual. At 1045.45 hrs the new Planning Controller advised AIH 065 that he was 2 minutes to 15W position and to report to Shanwick Radio on 127.9. Thus, the two new Controllers, in turn, did not notice any significant estimate discrepancy other than a slightly later estimate for SOMAX from 1145 hrs to 1148 hrs, which was passed by telephone to Shanwick by the Planning Controller at 1046.50 (any time revision of three minutes or more has to be notified to Shanwick). The Planning Controller has as his primary source of flight information an Electronic Data Display (EDD) which warns Controllers by a flashing field on the EDD Rest Page if there is a difference in time between the oceanic clearance time and the system time (i.e. real time). The boundary time for a flight is first computed from the flight plan as received on the teleprinter circuit (AFTN) and the details are displayed at the appropriate time on the Controllers EDD. Prior to entry into Shannon airspace, boundary estimate details are relayed automatically by London Air Traffic Control Centre (LATCC) to Shannon. This activates the FPL within Shannon computer system (CAIRDE) and, also, calculates forward exit boundary estimates within the system. Twelve minutes before the aircraft enters Shannon airspace the FPL becomes active within the ATC Sector, is accepted by the Sector Controllers and the flight progress strip is printed. Subsequently, the flight progress monitoring function in the CAIRDE computer system upgrades the system flight plan from Radar derived data every three minutes. Thus, the Controller was able to advise Prestwick of the later three minute update for the AIH 065 at the boundary but, in so doing, he failed to notice the whole hour difference on the EDD, he only read the minutes. While the Radar Controller and the Planning Controller act as a team, neither acted on the flashing on the EDD which only related to AIH 065 at this time. The flashing commences when the system detects a five or more minute discrepancy in boundary times – the flashing would have been in progress for at least forty minutes (the EDD has no data recording facility) – a period of time that included two separate teams of Controllers on Sector 8. The time discrepancy was also clearly displayed on the Flight Progress Strip.

At Shanwick, this revision was input into the FDPS system. By this time, Planner 1 was on a break so Planner 2 called down the information onto his display at 1048.29. No conflictions were predicted. At 1049.17 a position report message was received from Ballygireen stating that A1H 065 was at SOMAX at 1047. As the aircraft was now technically in the OCA, Planner No. 2, at 1050.44, passed control to the Enroute Controller. However, a message was received immediately afterwards indicating a conflict with AFR 3671 at 1059. The Enroute Controller realising that he had about 8 minutes until the aircraft crossed, immediately probed his computer for a safe level to which he could descend AIH 065. Meanwhile other members of the ATC team telephoned Shannon to check the credibility of the aircraft's position report and Ballygireen to warn of a possible priority descent message. It was this call to Shannon that alerted the two Controllers at Sector 8 of the one hour estimate error for the first time. At 1054 hrs a message was transmitted to Ballygireen for AIH 065 *"priority due traffic descend now flight level three five zero report leaving report reaching"*. This message was sent on the direct teleprinter circuit (AFTN). It was issued to AIH 065 at 1057.29. The pilot reported leaving FL 370 at 1057.39 and, at 1057.52, sighting AFR 3671. AIH 065 reported reaching FL 350 at 1058.50. Meanwhile, at 1056 hrs, a priority message was passed to Ballygireen for AFR 3671 to climb to FL 380. However, this was only transmitted to AFR 3671 at 1101.50, after both aircraft had passed. Each aircraft commander reported receiving TCAS Traffic Advisory (TA) warnings. Both flights continued on to their respective destinations.

Hundreds of westbound flights are normally processed and cleared by OCA on a daily basis, three hundred and sixty five days a year. The Controllers at Prestwick and Shannon involved with the progress of AIH 065 recalled that their respective control sectors were not very busy on the morning of the incident, in fact operations were relatively quiet.

1.3 AIH 065

AIH 065 was operated by Airtours International, now renamed My Travel Airways since May 2002. The commander of the aircraft, who was also the PNF, obtained Oceanic clearance from Shanwick in compliance with his company's Flight Crew Operations Manual (FCOM) 2. The clearance received was *"okay clear to Cancun via track Echo from SOMAX er to maintain Flight Level three seven zero at MACH decimal eight one"*. There was no mention of the pilot's estimate for SOMAX by Shanwick, it is not a requirement to mention the aircraft's estimate for the OCA boundary in an Oceanic clearance message.

The PNF in turn, did not mention his ETA for SOMAX in his readback of the Shanwick clearance. In addition, the PNF did not record the ETA at SOMAX on the Oceanic chart and entered the time for SOMAX as 48 on the flight plan, omitting the whole hour.

A procedure was introduced some years ago by the UK NATS whereby the time estimate was included in the clearance transmission. Although it was promulgated appropriately, it was found that this led to some confusion with aircrew who asked if the time was a "restriction"; this had increased the RT workload. Consequently, the procedure was rescinded.

1.4 AFR 3671

AFR 3671 was operated by Air France from Havana, Cuba, to Paris, France. It was flight planned eastbound by Gander Oceanic on Track E at FL370, Mach.85. The commander of AFR 3671 reported that he was cruising at FL370 eastbound on Track E, in receipt of an ATC service from Shanwick Oceanic, when he got a TCAS TA with a westbound traffic at the same level. At a range of 20 NM the other traffic descended to FL 350. At the closest point, the other traffic passed about 1200 ft directly below his aircraft at about 016°30'W. Later on, he was informed by Shanwick that the other traffic was one hour earlier than its estimate for the OCA entry point.

1.5 PHRASEOLOGY

A Memorandum of Understanding between the IAA (Shanwick Aeradio) and the UK National Air Traffic Services Scottish and Oceanic Air Traffic Control Centre (Prestwick OACC) for Aeronautical Communications Services in the Shanwick Oceanic Control area of the ICAO North Atlantic Region, which has been regularly reviewed and updated, has been in place since 1966.

Section 4.2 "Messages Originated by Prestwick OACC", inter alia, reads as follows:

4.2.1 "Messages originated by Prestwick OACC for delivery to aircraft shall be transmitted to Shanwick Aeradio via the discrete datalink circuit, which connects Prestwick and Ballygirreen. Acknowledgements by aircraft of such messages shall be forwarded by Shanwick Aeradio to Prestwick, also via datalink. Should it be necessary to relay a message by telephone, in either direction, confirmation *should where* necessary be sent via datalink as soon as practicable.

4.2.2 Prestwick OACC shall be advised after a lapse of not more than *fifteen minutes* from the time of receipt, should the message not be delivered to the addressee aircraft.

4.2.3 If a message is of such urgency that information on its delivery status is required within a lesser period of time than normal Prestwick OACC shall insert the word "PRIORITY" at the beginning of the text of the message. In this case, Shanwick Aeradio shall advise OACC after a lapse of not more than *eight minutes* if delivery has not been effected".

The requirement in Section 4.2.3 above has been incorporated in OACC MATS Part 2 and is considered appropriate to MATS Part 2 procedures.

In addition MATS Part 2, Page COM 2-1, goes on to comment "It is much more expeditious to relay messages via traffic dispatch when communicating instructions/messages for aircraft in emergency as a direct telephone call has to be re-directed to the appropriate operator".

In the subject event the appropriate priority messages were passed within the stated deadline time of eight minutes. However, sending messages, by whatever means, takes time. It took about 2 minutes 15 seconds for the instruction for AIH 065 to descend to be sent by Shanwick to Ballygirreen, it took just under a further 3 minutes for this instruction to reach the crew of AIH 065. They then commenced descent. The instruction to climb for AFR 3671 was received by the crew after the flights had passed.

1.6 Other Information

1.6.1 Oceanic Separation requires that vertical separation will be achieved *fifteen* minutes before aircraft are due to cross.

1.6.2 After the event, the Controllers at Shanwick and Shannon were relieved of their duties by management, in compliance with local procedures, for de-briefing, counselling and re-training, where necessary. Also, the Operator of AIH 065, issued a Flight Safety Incident Report to their aircrew where it stated, inter alia, "*the method adopted for completing the ETAs at waypoints in this case, reveals that it is very likely that a "Human Factors" error was made".*

2. ANALYSIS

General

Fundamental to ATC operations are three interlinked elements of aircraft separation, namely, *Flight Level, Time, and Airspeed*. If any one of these elements is missing then the operation's safety is compromised until corrective action is taken by the system, i.e. by Air Traffic Controllers or by electronic means or both.

The Incident

In the subject investigation two of the above elements were missing at a crucial stage in the flights of AFR 3671 and AIH 065, namely Flight Level and Time. The origin of the extra one hour incorrect estimate for SOMAX lay with the PNF of AIH 065, but this error was not picked up by the Shanwick Controller, who confirmed the requested clearance, nor by the Shannon Radar Controllers who monitored AIH 065's progress through the SOTA.

It is normal practice for pilots to request clearances to ATC, including giving correct estimates for reporting points. It is also normal practice for ATC to check and confirm such requests and to advise any corrections if necessary. This is part of the normal daily routine interchange between pilots and ATC.

On this occasion, however, the human factor failure of the cockpit crew of AIH 065, the three Controllers at Shanwick and the four Controllers at Shannon combined to produce an unthinkable situation whereby two passenger aircraft were allowed come within minutes of a possible head on collision.

While the human factors and systemic failures in this instance are clear and cumulative at all levels, including:

- the wrong estimate
- the non-adherence by Controllers to published procedures
- the inability of the FDPS to carry out a credibility check of estimates
- the failure of Controllers to act on a flashing sign on the EDD Rest Page

the investigation is very struck by the readback of the initial clearance to SOMAX and the omission of the time estimate by both ATC and the PNF.

In the procedural non-radar environment of the OCA, timing is critical. It is quite clear that a readback of the clearance time would have at least provided an opportunity to detect the error by either of the cockpit crew. Unfortunately, this did not happen and the stated reasons for ATC not giving estimate readbacks are difficult to comprehend, e.g. including time in clearances increases the CDO workload as it increases the numbers of questions from pilots querying is this time a restriction etc.? As a result, further clarification had to be given by CDO's.

In the unique circumstances of this incident the use of the word "Priority" in the message to Ballygirreen is seen to be wholly inadequate. This word is used quite frequently in normal traffic messages to Ballygirreen and the protocol for its use is long established and understood by Controllers. However, with the belated realisation of the developing situation by Shanwick, the urgency of the situation should have been addressed by a more compelling word or words on the telephone and teleprinter messages such as *avoiding action* or *immediately* or *immediate avoiding action.*

It is clear that the connecting links in the chain of events leading to a potentially catastrophic accident were only broken when AIH 065 reported his position on HF and this information was relayed to Shanwick, which, in turn, triggered off the recovery action by them. In the final analysis it was fortuitous that this timely position report was made, as the two ATC systems failed to detect any anomaly in the AIH 065 flight plan up to that point in time.

3. CONCLUSIONS

3.1 Findings

3.1.1 The serious incident occurred in Shanwick Oceanic airspace, west of reporting point SOMAX on North Atlantic Track Echo, at 1059 hrs in daylight, on 10 November 2001.

3.1.2 This area**,** west of 15° West, is a non-radar coverage area, beyond the range of Shannon Radar Control.

3.1.3 AFR 3671 was correctly cleared by Gander Oceanic at FL 370 via SOMAX eastbound to Paris. The Commander of AFR 3671 reported observing TCAS TA on AIH 065 at 20 NM.

3.1.4 AIH 065 was incorrectly cleared by OCA at FL 370 westbound via SOMAX to Cancun on the basis of the incorrect estimate for SOMAX.

3.1.5 The PNF of AIH 065 gave an incorrect estimate for SOMAX to Shanwick, this estimate was one hour later than actuality. Neither he or his First Officer were aware of this error throughout the remainder of the flight. The PNF of AIH 065 reported observing TCAS TA on AFR 3671 as he descended to FL 360.

3.1.6 Shanwick acknowledged and processed the AIH 065 clearance request in the FDPS and, finding no conflictions, confirmed it. In the message readback there was no mention of the estimate time by either the PNF or Shanwick.

3.1.7 Three Controllers at Shanwick failed to notice the one hour error, no estimate credibility check was carried out, contrary to ATS procedures.

3.1.8 Four Controllers at Shannon, while AIH 065 was traversing SOTA, failed to notice the flashing signal on the EDD Rest Page, which should have alerted any one of them to the estimate error at SOMAX, contrary to ATS procedures.

3.1.9 The Planning Controller stated the wrong hour, 1148 instead of 1048, when he passed the required three minute time revision to Shanwick.

3.1.10 Once the error was recognised, the subsequent sending of messages via telephone and teleprinter to Ballygirreen was in compliance with laid down procedures and within the time limits set for PRIORITY messages. However, the use of the word PRIORTY in this instance is considered unsuitable to convey the urgency of the then developing *abnormal* situation.

3.1.11 The flights were closing at a speed of about 16 miles per minute, thus the minimum distance between AFR 3671 and AIH 065 until a safe vertical separation was achieved is estimated at less than 10 NM. This is less than *one* minutes flying time.

3.2 Causal Factors

3.2.1 The incident was caused by the Commander (PNF) of AIH 065 requesting a westbound clearance at SOMAX which was incorrect by one hour.

3.2.2 This initial error was compounded by Shanwick Controllers confirming the requested clearance, through human factors and systemic failures to carry out an estimate credibility check. This error was further compounded by a human factors failure by the Controllers at Shannon to act on this incorrect estimate, which was being clearly indicated on their EDD. The final error was the passing of a revised estimate for SOMAX by the Planning Controller which continued with the original one hour incorrect clearance.

4. SAFETY RECOMMENDATIONS

It is recommended that:

4.1 The UK NATS review its avoiding action guidance to the ATC service, with specific reference to the phraseology used by civil Controllers. ***(SR 19 of 2002)***

4.2 The IAA/UK NATS should amend current wording in their 1966 Memorandum of Understanding as a priority, to include mutually agreed phraseology and delivery times for messages in non-normal ATC situations. ***(SR 20 of 2002)***

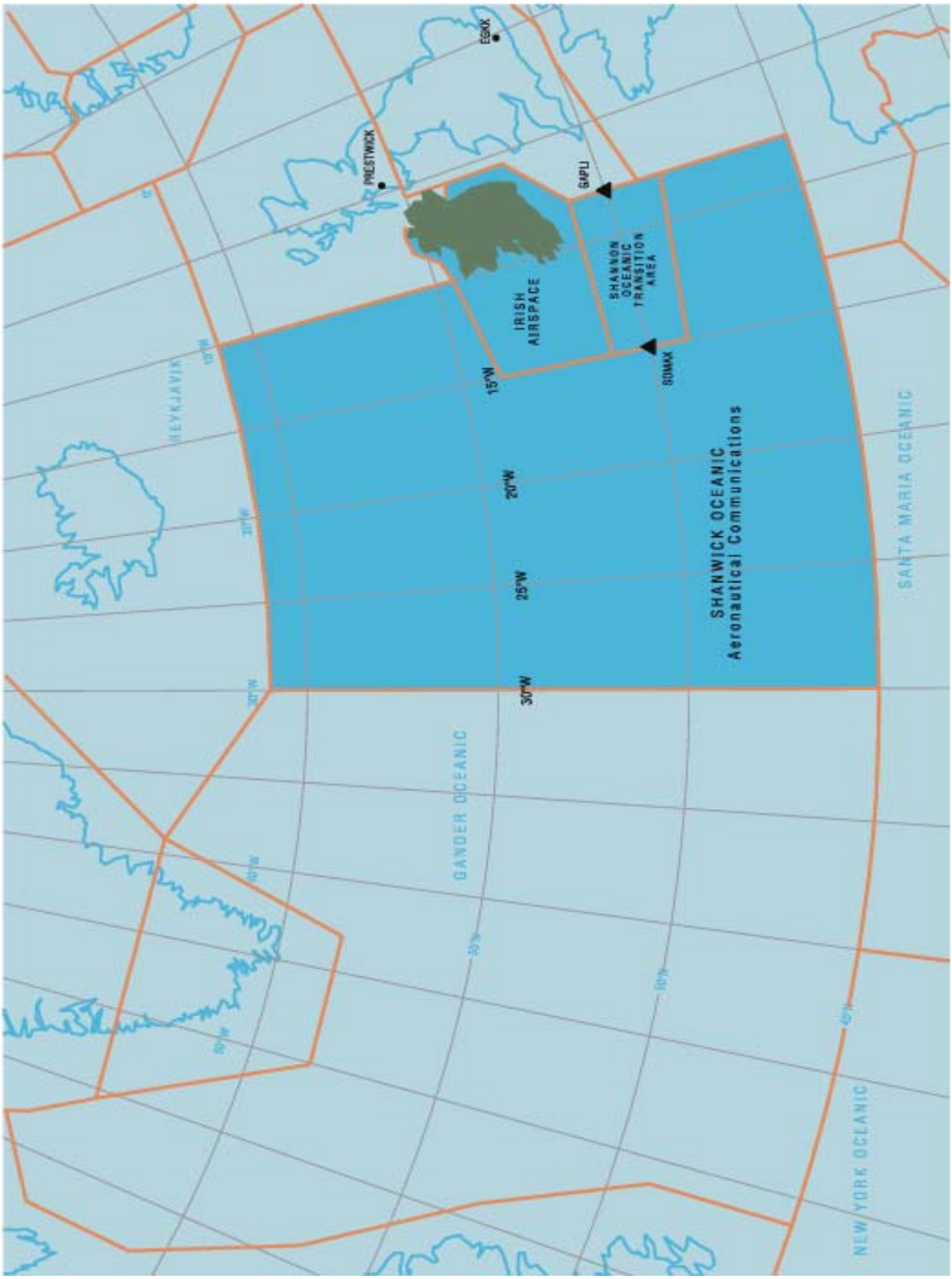
4.3 The IAA/UK NATS should consider the introduction of a software message exchange facility between Shanwick and Shannon to facilitate the automatic detection of flight profile errors. ***(SR 21 of 2002)***

4.4 The UK NATS should consider reintroducing estimate times for reporting points in Oceanic Airspace in their traffic clearance messages to aircrew. ***(SR 22 of 2002)***

4.5 The UK CAA should write to UK transatlantic operators to remind them of the correct procedures for cross-checking oceanic airspace clearances. ***(SR 23 of 2002)***

4.6 The IAA should examine the possibility of presenting alert discrepancies and estimates more overtly to the Controllers. This could possibly include a flashing alert on the radar screen. ***(SR 24 of 2002)***

APPENDIX A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