Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Aviation Occurrence Investigation – 200700065
Final

Navigation event
28 km north-west of Sydney Airport, NSW
11 January 2007
ZK-OJB
Airbus A320

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Abstract

On 11 January 2007, at about 0718 Eastern Daylight-saving Time, an Airbus A320 aircraft, registered ZK-OJB, departed runway 34L at Sydney Airport, NSW for Auckland, New Zealand and was assigned a radar heading by Air Traffic Control (ATC). The controller noticed that the aircraft turned onto an incorrect heading and informed the flight crew. The crew checked the aircraft's compasses and found that they were reading approximately 40 degrees incorrectly and that a GPS PRIMARY LOST message had appeared on the aircraft's multi-purpose control and display unit and navigational display. The crew advised ATC that they had navigational difficulties and elected to return to Sydney for landing.

When the aircraft returned to the departure gate, the flight crew noticed that the inertial reference system (IRS) had been aligned to the incorrect longitude. The operator's investigation into the incident found that the IRS had been aligned by maintenance staff prior to the crew boarding the aircraft. The incorrect alignment of the IRS was not noticed during a number of subsequent checks prior to departure.

As a result of this incident, the operator has proposed to develop a training program for all company pilots designed to improve discussion and guidance in relation to threat and error management issues.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the Transport Safety Investigation Act 2003 and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

Reported information

The information presented below, including any analysis of that information, was prepared principally from information supplied to the Bureau.

History of the flight

On 11 January 2007, after an overnight layover in Sydney, NSW an Airbus A320 (A320) aircraft, registered ZK-OJB, was being operated on a scheduled flight from Sydney Airport to Auckland, New Zealand. The flight crew taxied for a planned takeoff from runway 25, but that was subsequently changed by Air Traffic Control (ATC) to runway 34L. In addition, the flight crew was requested by ATC to expedite their taxi for departure. However, the flight crew indicated later that those requirements had not been significant in the development of the occurrence.

At about 0718 Eastern Daylight-saving Time[1], the aircraft departed runway 34L and was given radar vectoring by ATC. Shortly after, the controller noticed that the aircraft had turned onto an incorrect heading and informed the flight crew.

A check of the aircraft's compasses by the flight crew found that they were reading approximately 40 degrees incorrectly, and that a GPS PRIMARY LOST message had appeared on the aircraft's multi-purpose control and display unit and navigational display. The flight crew advised ATC that the compass was unserviceable and that they were experiencing navigational difficulties. In addition, they believed that the aircraft's Instrument Landing System was affected.

The flight crew elected to return to Sydney and ATC provided radar vectoring in order to allow for a reduction in the aircraft's fuel load and, as a result, for a landing below the aircraft's maximum landing weight. The aircraft remained in visual meteorological conditions and was radar vectored for a visual approach and landing.

When the aircraft returned to the departure gate, the flight crew noticed that the aircraft's Inertial Reference System (IRS) had been aligned to 01520.3 E[2] instead of the correct 'SYD reference' longitude of 151.10.6 E.

Operator's investigation

The operator's investigation found that maintenance staff had aligned the IRS to an incorrect longitude prior to the crew boarding the aircraft for the first flight by the

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time, as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

2 The operator confirmed that the longitude had been incorrectly set to 01520.3 E. The operator commented on the similarity with the expected data, but indicated that the leading '0' resulted in 'a considerable shift in the entered location.'

aircraft that day. The flight crew did not notice that data input error during their subsequent checks prior to the departure.

The operator found no aircraft systems anomaly that might have contributed to the development of the occurrence.

Maintenance action to align the aircraft's IRS

The duty engineer understood that, in order to avoid fuel discrepancies on Airbus aircraft, an aircraft's IRS was to be aligned prior to refuelling. That was reported to be a normal practice on Airbus A330[3] and A340 aircraft[4] but was not required in the A320.

The operator had previously issued a Departure Preparation Maintenance Aid which, although not intended to replace approved A320 procedures, was developed to assist maintenance staff 'with "on-time performance" and cockpit and cabin preparation tasks.' Its use included when there had been a layover of in excess of 4 hours, and required the application of electrical power to the aircraft. As such, the action by the Sydney maintenance staff to align the aircraft's IRS was, although not mandated in the operator's documentation, routine procedure in the A320 in order to assist flight crews in their preparation for flight.

During the operator's investigation, the engineer that aligned the aircraft's IRS acknowledged 'that he may have incorrectly entered the position data.'

Flight crew checks of the alignment of the aircraft's IRS

The operator's procedures required the flight crew to align the IRS before the aircraft's first flight each day. If using latitude/longitude coordinates, that meant that the departure gate data was entered as the aircraft's present position. There were four subsequent checks prior to departure where the flight crew might have been expected to have normally identified the data entry error, including the:

- Cockpit preparation Flight Management Guidance and envelope System (FMGS) data confirmation check (IRS alignment). That check required the flight crew to confirm that the distance between the IRS and flight management system (FMS) positions was less than 5 NM. If that was not the case, a fast alignment of the IRS was recommended in order to ensure that 'the aircraft position is consistent with the position of the airport, the SID and surrounding NAVAIDs.'
- Ramp position check, which required a check of the flight management computer (FMC) position with an independent data source, and that that position was 'within reasonable limits' with the position on the appropriate position reference (POSREF) page.
- Cell phone interference IRS reasonableness check, which necessitated a 'check for reasonableness' of the IRS position[5].

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3 The maintenance provider routinely maintained Airbus A330 aircraft in its own fleet.

4 Neither the Airbus A330 nor A340 were operated by the operator.

5 The terms 'consistent' and 'reasonable/reasonableness' were not defined.

- Runway entry procedure. The runway entry procedure included a check that 'the relationship between the FMGS position and the runway position is reasonable.'

The operator's investigation also found that there was a previous occasion where incorrect coordinates had been entered during the IRS alignment at Sydney Airport. On that occasion the crew noticed the problem during the pre-flight check.

Operator consultation with the aircraft manufacturer

During its investigation into the occurrence, the operator consulted with the aircraft manufacturer in regard to the adequacy of its existing operational and maintenance procedures and documentation. That consultation included with safety, human factors, operational and engineering representatives.

The operator reported that advice was received from the aircraft manufacturer indicating that:

- the operator's existing procedures were adequate
- there was no requirement for additional preventative procedures or documentation
- existing maintenance procedures were valid and appropriate.
- the aircraft manufacturer felt that the occurrence was primarily human factors-related.

ANALYSIS

The maintenance action to align the aircraft's inertial reference system (IRS), although not mandated, was in accordance with the operator's documented procedures. The reason for the inadvertent input of incorrect position data in the IRS could not be determined.

The reported insignificance of the external influences during the taxi, and the lack of evidence of any other potentially adverse influences on the preparation for, and conduct of the flight ought to have allowed the detection by the flight crew of the incorrect alignment of the IRS. The investigation was unable to determine why the incorrect positional data remained undetected by the flight crew, despite the four separate pre-take-off procedural defences.

FINDINGS

Context

From the evidence available, the following findings are made with respect to the navigation event involving Airbus A320 aircraft, registration ZK-OJB that occurred approximately 28 km north-west of Sydney, NSW on 11 January 2007. They should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- Maintenance personnel inadvertently entered incorrect position information in the aircraft's inertial reference system (IRS).
- The input of incorrect positional data in the IRS remained undetected by the flight crew, despite four separate pre-take-off procedural defences.

Other key finding

- There was no aircraft systems anomaly that might have contributed to the development of the occurrence.

SAFETY ACTIONS

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Aircraft operator

Incorrect position information entered in the inertial reference system

The initial advice from the aircraft operator included that a review was carried out of their procedures and that, as a result of that review, no changes were required to the operator's standard operating procedures.

ATSB comment

As part of its directly involved party process, the ATSB sought an understanding of the operator's approach to the continuing alignment of the inertial reference system (IRS) in the A320 by its maintenance staff, and of any action being considered in order to minimise the possibility for similar future occurrences.

Aircraft operator comment

In response, the aircraft operator advised that the intent was for engineers to carry out the task during maintenance preparation in order to identify any maintenance/technical discrepancies well before departure and to not interfere with any checks carried out by flight crews.

The operator indicated that its operations and maintenance managers saw no need to discontinue that procedure.

Undetected IRS positional data

The initial advice from the aircraft operator included that a review was carried out of their procedures and that, as a result of that review, no changes were required to the operator's standard operating procedures.

In addition, the operator proposed to develop a training program covering approximately 10 occurrences where crew procedural error was identified as a factor. The training would include all pilots and was designed to improve discussion and guidance in relation to threat and error management issues.

ATSB comment

As part of its directly involved party process, the ATSB sought an understanding of any consideration by the operator of, or in response to, the data input inaccuracy having remained undetected during the mandated four checks of the IRS during the preparation for, and conduct of the flight.

Aircraft operator comment

The aircraft operator provided additional advice that a human factors-based de-brief was undertaken with the flight crew regarding the omissions of standard operating procedure. This and a number of other basic checklist-related incidents were used by the operator for inclusion in refresher courses that were attended by all of the operator's pilots. The aim of that training was twofold: to heighten pilots' awareness of the importance placed by the operator on checklist discipline, and on the avoidance of complacency.

The operator completed those actions on 12 October 2007.