



**Australian Government**

**Australian Transport Safety Bureau**

**ATSB TRANSPORT SAFETY INVESTIGATION REPORT**

Aviation Safety Occurrence Report – 200503971

Final

**Flight control system event  
Sydney Airport, NSW  
Boeing Company 737-700, VH-VBD  
09 August 2005**





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### Abstract

At 2108 Eastern Standard Time on 09 August 2005, a Boeing Company 737-700 aircraft, registered VH-VBD, completed a scheduled flight from Melbourne, Victoria to Sydney, NSW. The pilot then reported that the aircraft had 'heavy' flight controls. An inspection by maintenance engineers revealed that the left lower rear elevator cable was incorrectly routed around a stiffener and that the stiffener and cable section had been damaged as a result of contact between them. The aircraft was withdrawn from service for repairs.

In the last week of July 2005, a contract maintenance organisation had replaced eight elevator control cable sections during a scheduled heavy aircraft maintenance check. The cables were replaced to comply with Boeing Company service bulletin 737-27-1254 revision 1.

While preparing the rear elevator control cables for removal, a cable end was not secured at the lower left rear elevator input quadrant, before removing the cable keeper. When the cable keeper was removed, the unsecured cable section slipped from sight. While recovering the cable, it was inadvertently misrouted around a fuselage stiffener. When the new cable was pulled into place it followed the same incorrect route around the stiffener. This resulted in contact between the cable and the stiffener.

As a result of the occurrence, the contract maintenance organisation implemented a number of changes to improve maintenance planning and documentation.

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# THE AUSTRALIAN TRANSPORT SAFETY BUREAU

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The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. 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. Accordingly, the ATSB also conducts investigations and studies of the transport system to identify underlying factors and trends that have the potential to adversely affect safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and, where applicable, relevant international agreements. The object of a safety investigation is to determine the circumstances in order to prevent other similar events. The results of these determinations form the basis for safety action, including recommendations where necessary. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations.

It is not the object of an investigation to determine blame or liability. However, it should be recognised that an investigation report must include factual material of sufficient weight to support the analysis and findings. That material will at times contain information reflecting on the performance of individuals and organisations, and how their actions may have contributed to the outcomes of the matter under investigation. 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.

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. While the Bureau issues recommendations to regulatory authorities, industry, or other agencies in order to address safety issues, its preference is for organisations to make safety enhancements during the course of an investigation. The Bureau prefers to report positive safety action in its final reports rather than making formal recommendations. Recommendations may be issued in conjunction with ATSB reports or independently. A safety issue may lead to a number of similar recommendations, each issued to a different agency.

The ATSB does not have the resources to carry out a full cost-benefit analysis of each safety recommendation. The cost of a recommendation must be balanced against its benefits to safety, and transport safety involves the whole community. Such analysis is a matter for the body to which the recommendation is addressed (for example, the relevant regulatory authority in aviation, marine or rail in consultation with the industry).

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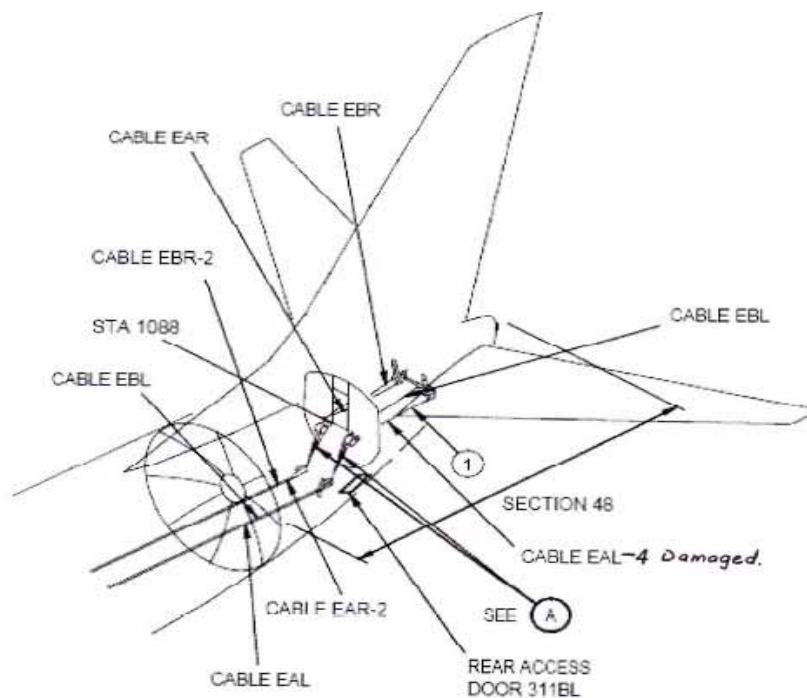
## FACTUAL INFORMATION

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### Sequence of events

At 2108 Eastern Standard Time<sup>1</sup> on 09 August 2005, a Boeing Company 737-700 aircraft, registered VH-VBD, completed a scheduled flight from Melbourne, Vic, to Sydney, NSW. The pilot subsequently reported that the aircraft had 'heavy' flight controls. An inspection by maintenance engineers revealed that the left lower rear elevator cable, EAL-4, was incorrectly routed around a stiffener and that the stiffener and cable section had been damaged as a result of contact between them (figure 1). The aircraft was withdrawn from service for repairs.

**Figure 1: Cable run of misrouted cable EAL-4**



In the last week of July 2005, a contract maintenance organisation had replaced eight elevator control cable sections during a scheduled aircraft maintenance check. The cables were replaced to comply with the requirements of Boeing Company service bulletin 737-27-1254 revision 1. The contract maintenance organisation's forward planning department<sup>2</sup> was not tasked to provide fully work-scoped documentation for the service bulletin requirements, and supplementary task cards from a previous job were copied and used instead. The task cards contained insufficient instructions for the required work to be satisfactorily completed.

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- <sup>1</sup> The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time, as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.
  - <sup>2</sup> The forward planning department were responsible for work-scoping the aircraft operators requirements and raising the required documentation for the maintenance department.

While preparing the rear elevator control cables for removal, a trainee engineer did not tie-off<sup>3</sup> the cable end at the lower left rear elevator input quadrant before removing the cable keeper<sup>4</sup>. When the cable keeper was removed, the unsecured cable section slipped from sight at fuselage station 1156.

While recovering the cable, the trainee and an aircraft maintenance engineer inadvertently misrouted the cable around the stiffener at fuselage station 1147. When the replacement cable was pulled into place, it followed the same incorrect route around the stiffener. The trainee and the engineer did not inform the team leader of the cable loss and made no record of the loss of cable run integrity. They also did not carry out an inspection to see if the recovered cable was routed correctly.

A duplicate inspection of the elevator control cable run was subsequently carried out by two licensed aircraft maintenance engineers (LAMEs). Both engineers had concerns about the 'heavy' feel of the elevators. A noise was heard near the vicinity of the incorrectly routed cable, however, the LAMEs believed the noise was the result of a cable seal rub. They did not initiate a thorough inspection to positively determine the source of this noise or why the elevators felt 'heavy'. They also were not made aware that they could move the horizontal stabiliser to the full nose-up position to facilitate better access to inspect the area.

The duplicate inspections were recorded and certified on the operator's duplicate inspection form. The form used to record the duplicate inspections had been superseded and withdrawn by the operator on 1 May 2003 and it did not reflect the correct scope of duplicate inspections required.

The elevator functional tests conducted after the cable replacements and the duplicate inspections were not completed to the scope required by the Boeing Company service bulletin. The engineers were following the supplementary task card instructions that did not list all the tests required by the service bulletin.

The aircraft was released to the aircraft operator on 1 August 2005 and remained in service until the pilot in command reported the 'heavy' flight controls on 9 August 2005. Following this occurrence, the aircraft operator repaired the stiffener, replaced the damaged cable section and completed the required inspections and tests. The aircraft returned to service on 12 August 2005.

### ***Maintenance organisation investigation***

Following this occurrence, the contract maintenance organisation conducted an internal investigation. The investigation report recorded that time pressures may have contributed to the lack of notification to the team leader of the cable loss, and the lack of an inspection when the original cable was recovered. The report also indicated that time pressures also contributed to a less stringent duplicate inspection after the new cables were fitted.

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3 The practice of tying string to the cable end and then securing the other end to the replacement cable or aircraft structure to retain the control cable run integrity.

4 A cable keeper is the mounting attachment used to retain a cable end in position.



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## ANALYSIS

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The mis-routing of the elevator control cable was the result of the original cable dropping from position following release of the cable keeper. The cable had not been tied off appropriately to retain the control run integrity. Subsequent control system inspections were not sufficient to ensure that the replacement cable had been routed correctly.

The investigation has highlighted the necessity of using forward planning processes<sup>5</sup> for critical work tasks, and the necessity to report and record all non-routine work events. Had the loss of control cable run integrity been recognised as a critical event and a record been made of the event, then more rigorous inspections may have detected the mis-routed cable.

Because the forward planning department had not been tasked with providing fully work-scoped documentation for the control cable replacement, inappropriate task cards from a previous task were copied and used. This, in conjunction with the use of a superseded duplicate inspection form, increased the risk of errors being made.

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<sup>5</sup> The forward planning process requires production planning staff to accept the workscope after review with forward planning and the maintenance team leader assigned to manage the work task through to completion.



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## SAFETY ACTION

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As a result of this occurrence, the contract maintenance organisation advised the Australian Transport Safety Bureau that it had taken the following safety actions:

- The planning department is now required to work-scope all service bulletin actions, and
- The maintenance organisation has completely reviewed its duplicate inspection process and its accompanying form has been replaced. The new process aligns with regulatory requirements.