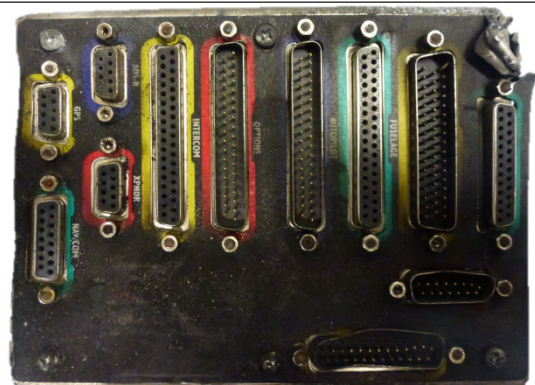
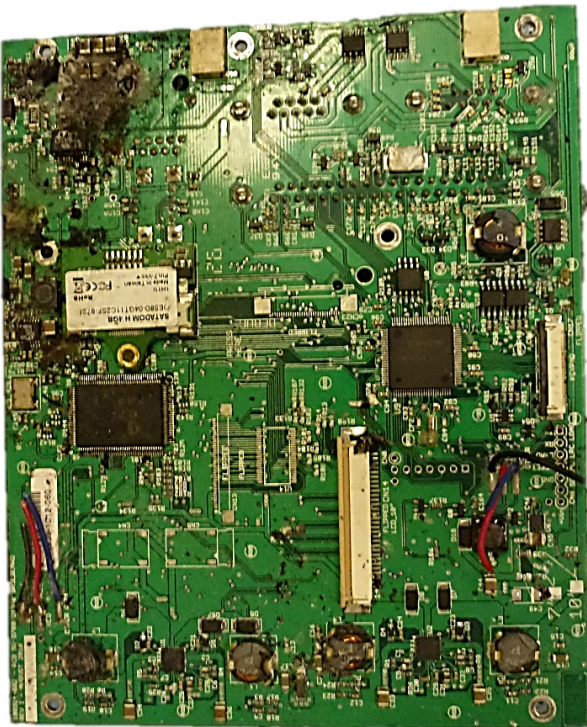




Technical assistance to the NSW Police – Recovery of data from an avionics system VANS RV-12

Lismore Airport, NSW | 24 March 2013



Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

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Addendum

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Introduction

On 24 March 2013, a Vans RV-12 amateur-built aircraft collided with terrain shortly after take-off from Lismore Airport, New South Wales. The pilot was fatally injured.

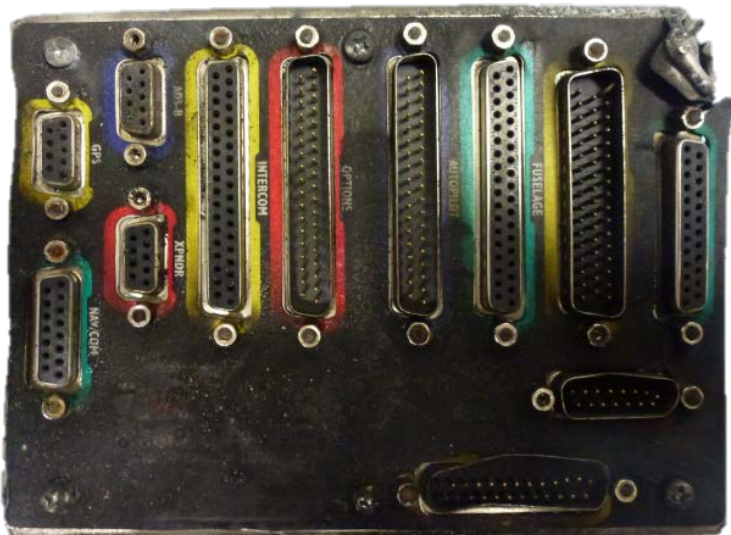
The NSW police service was responsible for investigating the accident on behalf of the state Coroner. On 10 April 2013, investigating officers contacted the ATSB and requested assistance with the recovery of data from the aircraft's *Dynon Avionics Skyview* system. The display unit (Figure 1) and control module (Figure 2) were subsequently sent to the ATSB for examination.

Figure 1: Dynon Avionics display unit – as received



Source: ATSB

Figure 2: Control module – as received



Source: ATSB

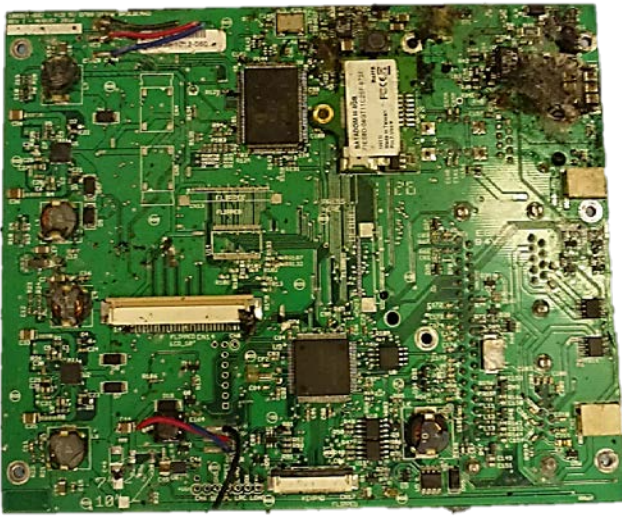
Examination

Physical Examination

The display unit (Figure 1) had been substantially damaged by fire and exhibited mechanical damage to the exterior case and screen. In preparation for subsequent handling, the device was decontaminated with a methylated spirits solution applied to the exterior of the device, and left to dry.

Due to the extent of mechanical damage to the device, it was disassembled and the internal components were inspected. The device contained a circuit board (Figure 3) which had minimal fire damage; however, some mechanical damage to components was evident.

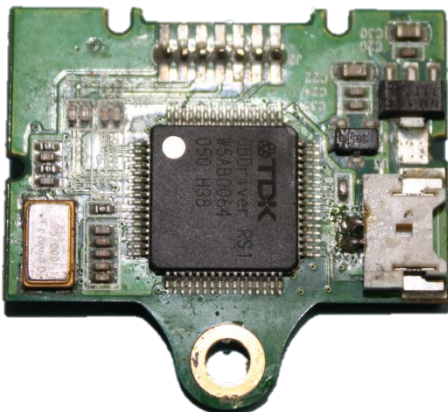
Figure 3: Recovered circuit board



Source: ATSB

The ATSB contacted the manufacturer of the display unit, Dynon Avionics for information on recovering stored data. The manufacturer advised that flight data was recorded on a 4GB *InnoDisk* Serial ATA Disk on module (SATADOM) which was soldered onto the circuit board (Figure 4). The SATADOM was subsequently de-soldered and removed from the circuit board in preparation for download.

Figure 4: Recovered *InnoDisk* SATADOM



Source: ATSB

Download

Download of the SATADOM was conducted via a conventional SATA computer interface, utilising a Tableau forensic download device to inhibit any writing to the non-volatile memory. Power requirements for the module were provided per the device manufacturer's datasheet.

Four logical disk partitions were identified and downloaded, totalling approximately 700 MB of data.

Discussion with the device manufacturer indicated that the data was recorded in a proprietary format and would require a custom utility to decode the recorded flight information. That utility and instructions for its use was subsequently provided – allowing the recovery of around 690 discrete data files, totalling about 1.6 GB.

A copy of the recovered data files relevant to the accident flight was compressed into an archive file 'AE-2013-069 Appendix A.zip' and is released as Appendix A to this report. The archive file is downloadable from the ATSB's website.

Recovered Data

Due to the recording logic of the device, the accident flight was separated between two sets of logging files. The first file set contained recorded data from the hangar area at Lismore Airport, to the point where the aircraft lined up on the runway. The second file set (containing the accident event) began at 0950:21UTC¹ on 23 March 2013 and commenced with the aircraft lined up on the runway and continued until the end of recorded data at 0950:46 UTC.

A ground track was produced in *Google Earth* which combined the positional information of the two data sets (Figures 5 and 6). To provide an indication of the aircraft dynamics during the accident flight, plots of pitch, roll, heading, indicated airspeed and altitude were generated from the accident data set (Figures 7 – 11). Stall sensor and elevator trim position data were also plotted for reference (Figures 12 and 13).

Data Limitations

The RV-12 was a two-seat kit-built aircraft. Avionics and aircraft wiring were not required to be installed or checked by an appropriately licensed aircraft maintenance engineer. The calibration and installation of avionics and the associated sensors should be considered when analysing the recovered data. In that context, the following observations are made:

- The pitch attitude appeared to be offset by around 12 degrees.
- The roll appeared to have had a small contribution from changes in the aircraft heading.
- The elevator trim position appeared to have been mapped from -1 to 1; this range represents the travel of the motor arm attached to the pitch trim servo. Further information is required to convert this value into elevator trim position

Further information

The NSW Police Service was responsible for investigating the circumstances of this accident. This report and the associated data were prepared by the ATSB to assist with that investigation. This report, including the referenced data files, has been released under section 25 of the *Transport Safety Investigation Act 2003* (the Act). Per section 27(1) of the Act, this report and the appended data files are not admissible in evidence in any civil or criminal proceedings. The recovered InnoDisk SATADOM containing the original data was returned to the NSW Police Service on 13 November 2013.

¹ Coordinated Universal Time (abbreviated UTC) is the time zone used for civil aviation. Local time zones around the world can be expressed as positive or negative offsets from UTC.

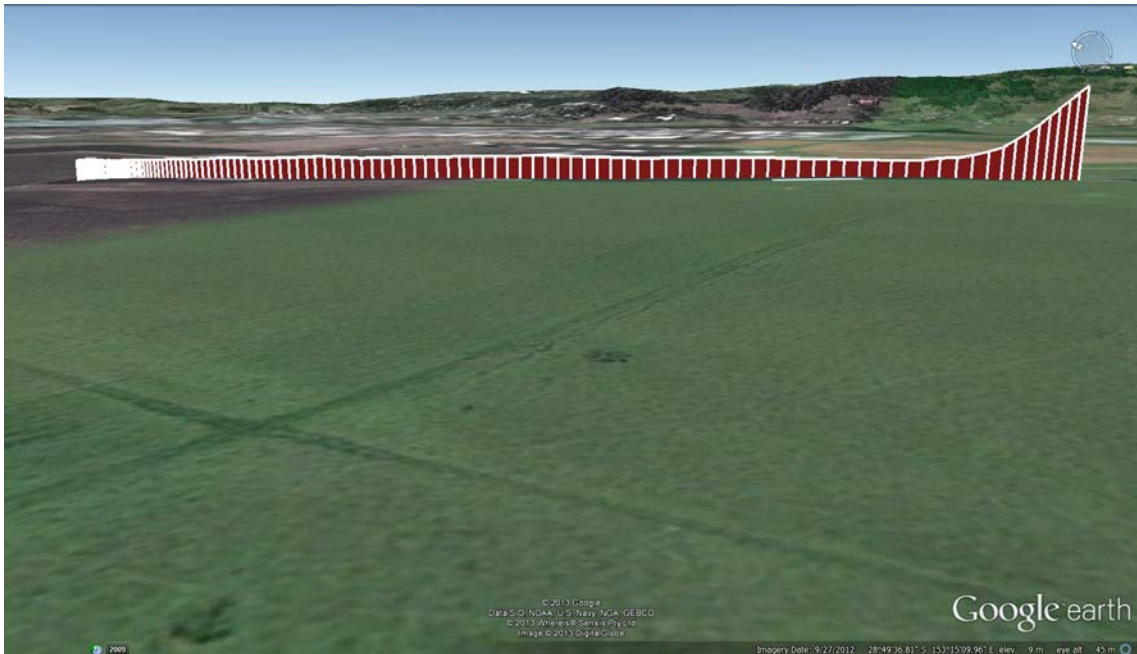
All inquiries regarding the investigation or the occurrence event should be referred to the NSW Police Service.

Figure 5: Recovered GPS track



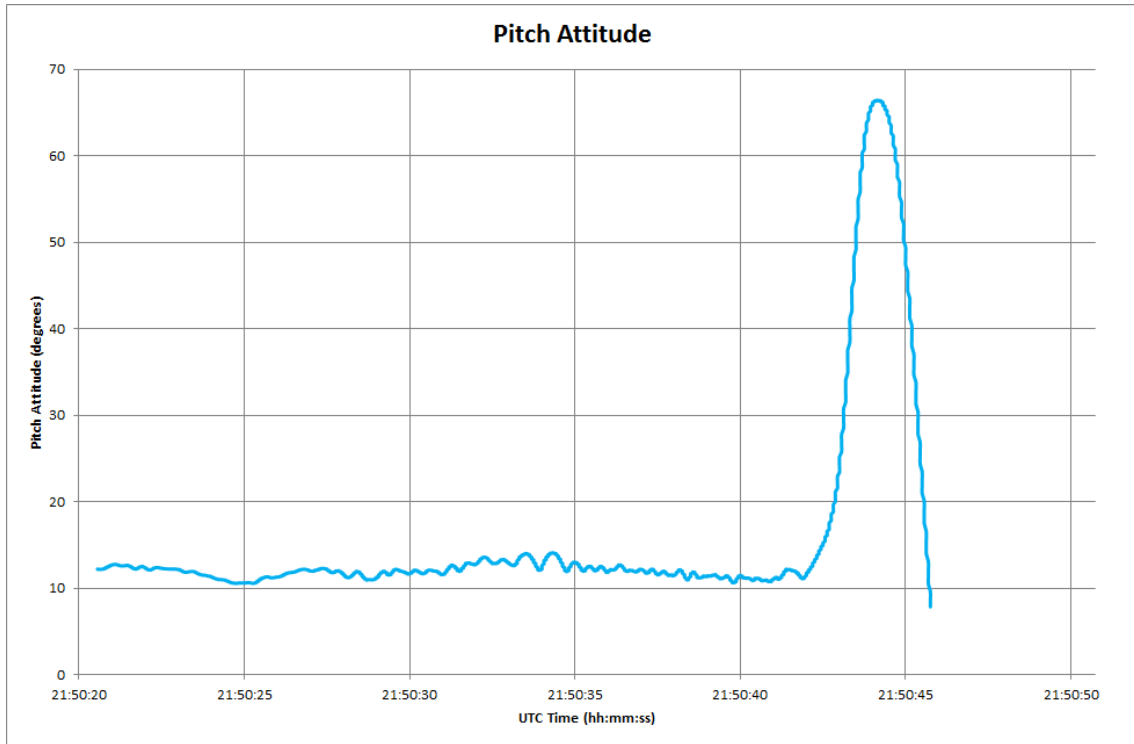
Source: ATSB

Figure 6: Accident flight GPS path



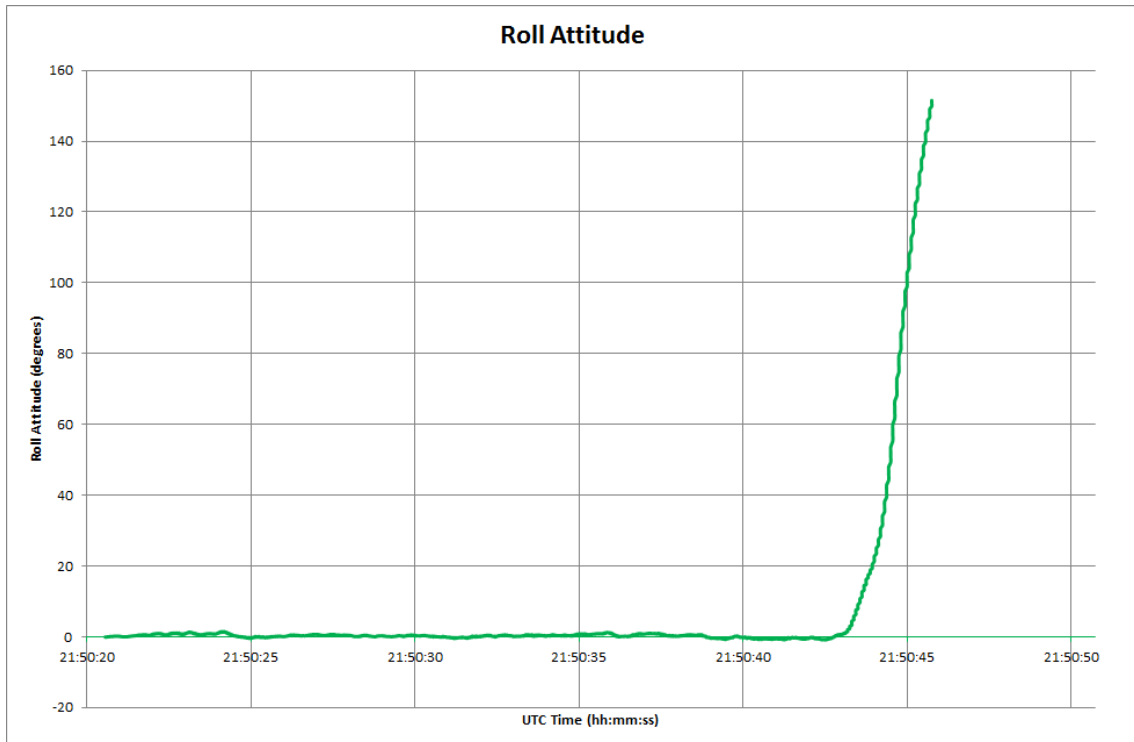
Source: ATSB

Figure 7: Recorded pitch attitude



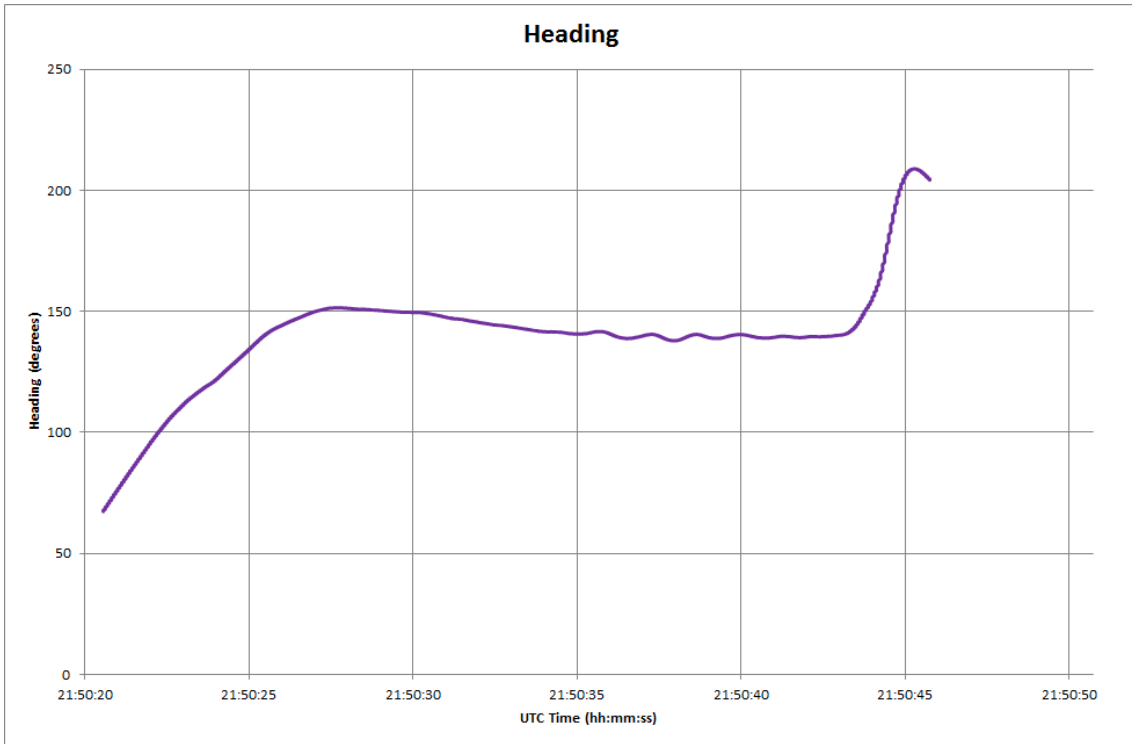
Source: ATSB

Figure 8: Recorded roll attitude



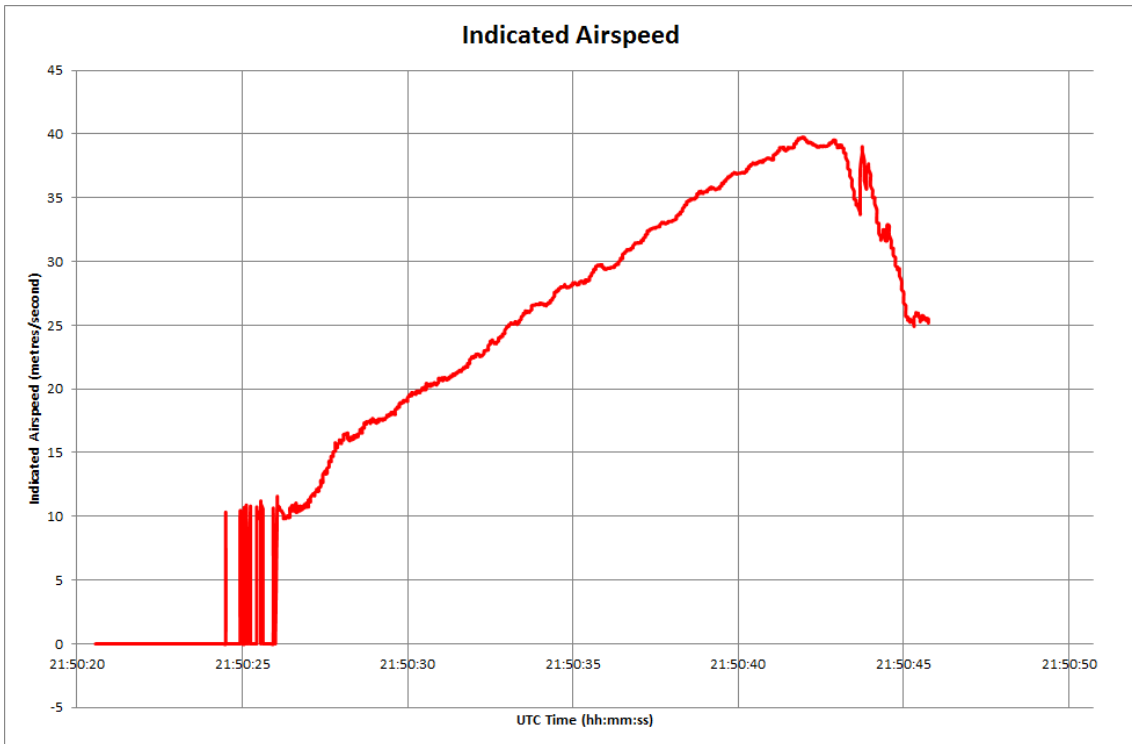
Source: ATSB

Figure 9: Recorded heading



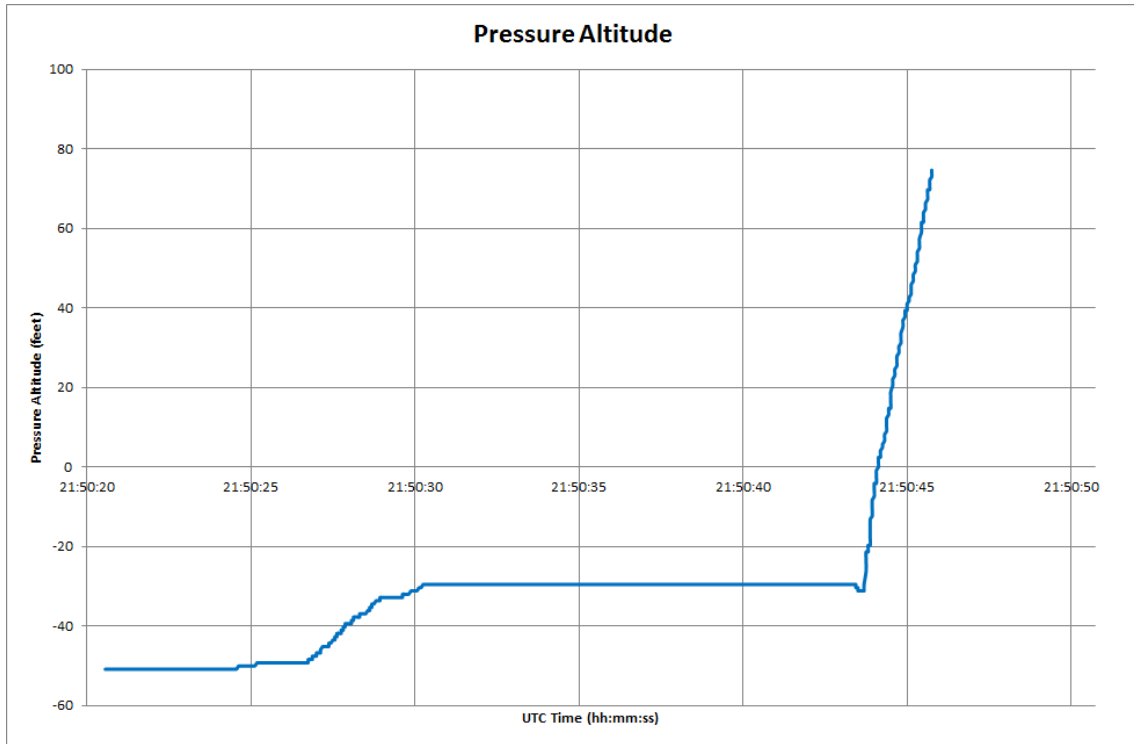
Source: ATSB

Figure 10: Recorded indicated airspeed



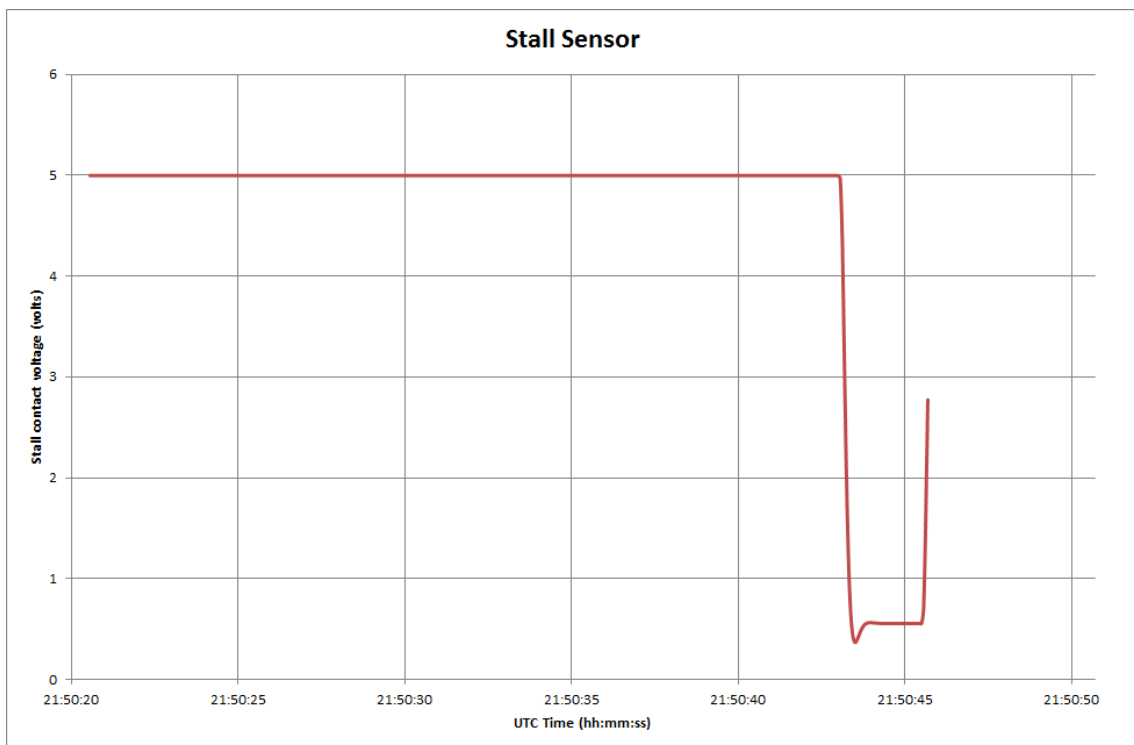
Source: ATSB

Figure 11: Recorded pressure altitude



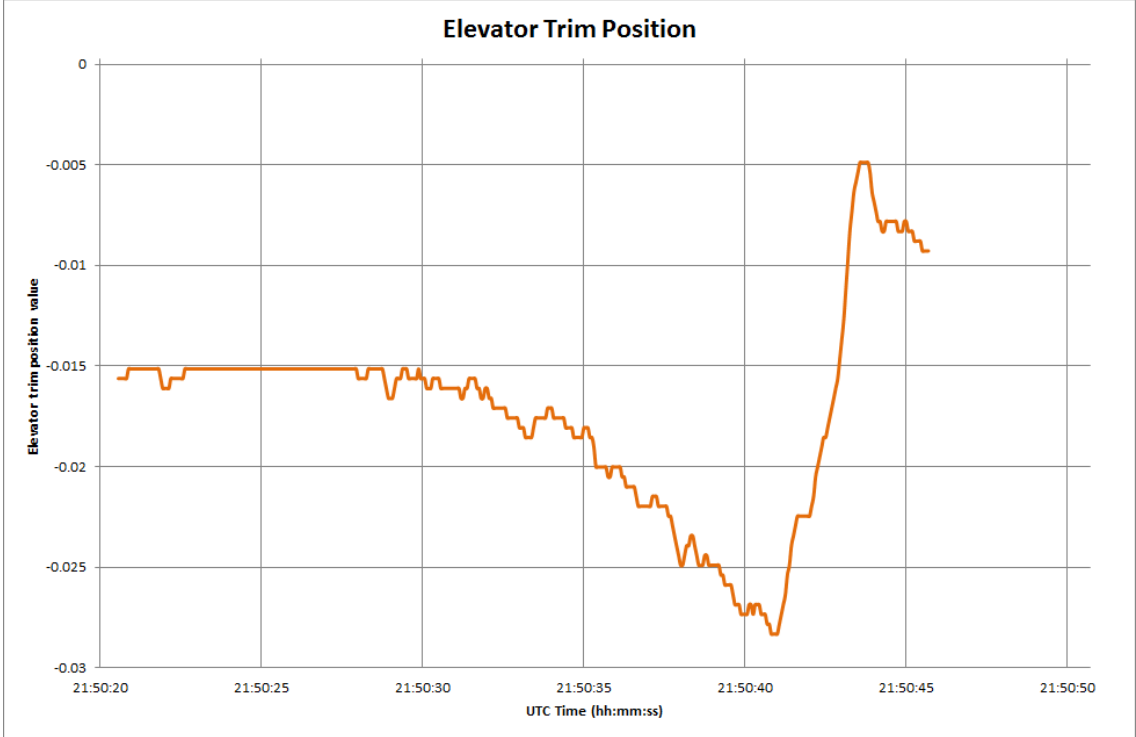
Source: ATSB

Figure 12: Recorded stall sensor



Source: ATSB

Figure 13: Recorded elevator trim position



Source: ATSB

Appendices

Appendix A – Raw Data Files

A compressed archive file (AE-2013-069 Appendix A.zip) is released as part of this report (available at www.atsb.gov.au) and contains four raw data files in comma-separated value (.csv) format, and a configuration file for the unit (.dfg):

- system.s1.2013-03-23_21-50-20.AHRS_4382.csv
- system.s1.2013-03-23_21-50-20.EMS_3564.csv
- system.s30.2013-03-23_21-32-26.AHRS_4382.csv
- system.s30.2013-03-23_21-32-26.EMS_3564.csv
- config0.dfg

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

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 identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, 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 initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation External Investigation

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from an avionics system VANS RV-12
Lismore Airport, NSW, 24 March 2013

AE-2013-069

Final – 4 December 2013