



Australian Government
Australian Transport Safety Bureau

In-flight breakup involving PZL Mielec M18A Dromader VH-TZJ

37 km west of Ulladulla, NSW | 24 October 2013



Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation
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Addendum

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10	Added information about the 15 November CASA directions	29-11-2013

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The occurrence

The information contained in this preliminary report is derived from the initial investigation of the occurrence. Readers are cautioned that there is the possibility that new evidence may become available that alters the circumstances as depicted in the report.

On 24 October 2013, at about 0940 Eastern Daylight-saving Time,¹ the pilot of a PZL Mielec M18A Dromader, registered VH-TZJ (TZJ) (Figure 1) took off from Nowra Airport, New South Wales to conduct a firebombing mission in the Budawang National Park about 37 km west of Ulladulla, New South Wales. Another firebombing aircraft with one pilot and a support helicopter with two crew and one observer were also involved in the mission. The other firebombing pilot described the weather at the time as 'okay' with moderate wind and little turbulence.

Figure 1: VH-TZJ on 22 October 2013



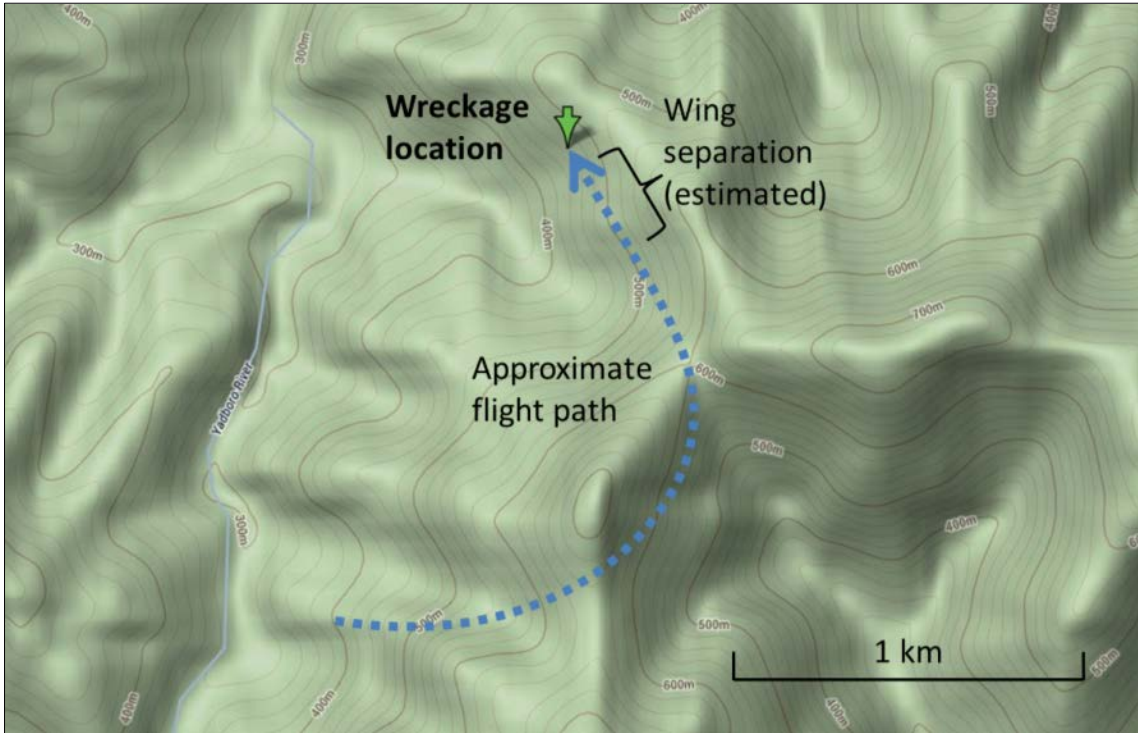
Source: Witness. Used with permission

At about 1000 the crew of the support helicopter identified a firebombing target near the north end of a ridgeline, and marked its location to the pilots of the firebombing aircraft by hovering over the target. The pilot of TZJ acknowledged the target location and advised the intended flight path. The crew of the helicopter then stationed nearby to observe the drop while staying away from the other aircraft's anticipated flight path.

The helicopter crew later reported that TZJ made a broad, descending left turn onto an approximate north-north-westerly heading, flying along the ridgeline at about 100 ft above the trees and directly towards the target (Figure 2). At about the same time as or immediately after the aircraft's wings were rolled level, the left wing separated. The aircraft immediately rolled left and descended, impacting terrain. The accident occurred at about 1004. The aircraft was destroyed by impact forces and some parts of the wreckage were additionally damaged by small post-impact fires (Figure 3). The pilot was fatally injured.

¹ Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

Figure 2: Approximate aircraft flight path



Source: Google Maps. Image modified by ATSB

Figure 3: Main wreckage



Source: ATSB

Context

Pilot information

The pilot held an Air Transport Pilot (Aeroplane) Licence, issued in 2003. The pilot's logbook recorded a total of 9,501.6 hours, including 228.0 hours firebombing and 8,223.8 hours agricultural flying.

Records showed that the pilot was appropriately endorsed to fly the Honeywell TPE331 turbine-engined M18, with relevant experience including 169.3 hours on that version and 65.4 hours on the piston version. The pilot held a valid Class 1 Medical Certificate and was the aircraft operator's chief pilot.

The pilot flew TZJ from Trangie, New South Wales, to Nowra on 21 October 2013, before flying nine firebombing missions in the aircraft from Nowra over 21–22 October. Because of poor weather on 23 October, the pilot conducted only one operational flight that day.

On the morning of 24 October, the pilot took off in TZJ on a short flight to dump water that had been stored in the aircraft's hopper overnight, before returning to Nowra to take on a load of fire retardant. The accident flight was the aircraft's and pilot's first operational flight that day.

Aircraft information

General information

The aircraft, serial number IZ013-32, was a single-engine agricultural and firebombing aircraft manufactured in Poland in 1984. Following operation in the United States (US) it was first registered in Australia in 2004. Maintenance records showed that the aircraft had accumulated 8,815.4 adjusted² airframe hours prior to the accident flight. It was originally fitted with a radial engine and in 2004 it was fitted with a Honeywell TPE331-11U-612G turbine engine and Hartzell HC-B5MP-5BL five-bladed constant-speed propeller.

Under an Australian supplemental type certificate, the aircraft was permitted to operate at take-off weights up to 6,600 kg. Flight logs indicated that it was loaded to 6,100 kg take-off weight for each of the firebombing missions in the days preceding the accident. Fuel records showed that the aircraft was fully fuelled at the end of the previous day.

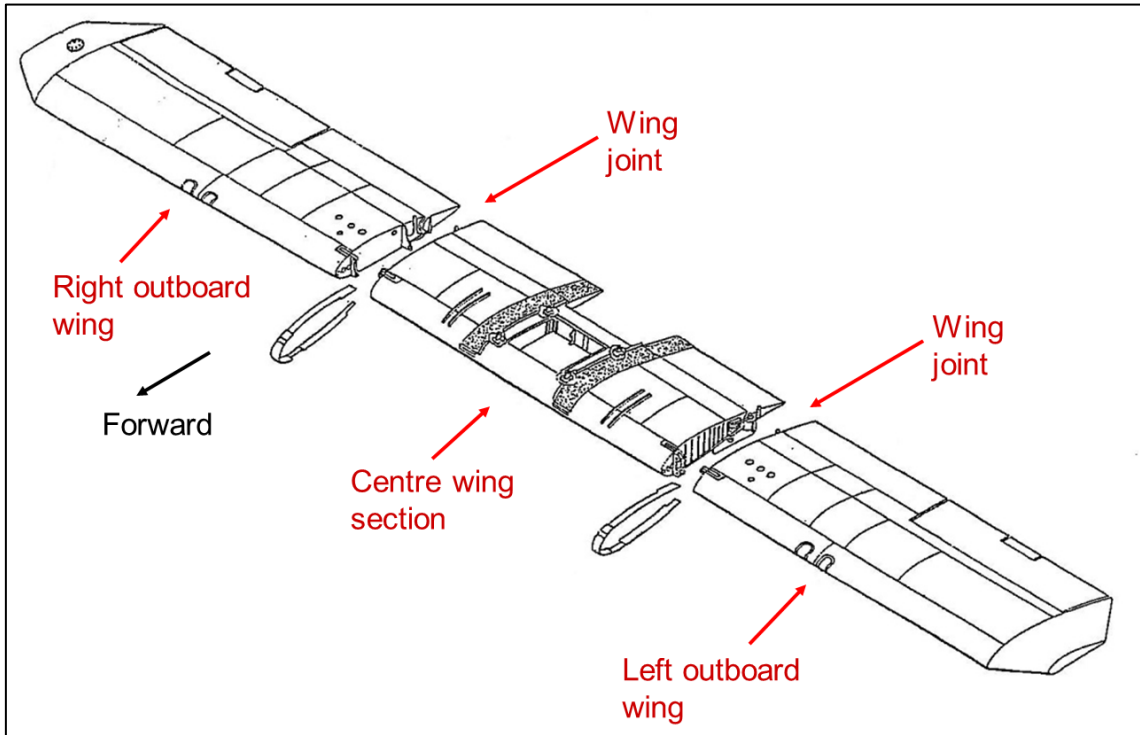
At the time of the accident, the aircraft was one of 30 M18 aircraft on the Australian register.

Wing structure

M18 aircraft have a cantilever wing; that is, it is anchored at one end with no mid-span supports. The wing consists of three sections: the central wing section, and the left and right outboard wing sections (Figure 4). Between each outboard wing section and the centre section there are three attachment points (Figure 5). At each of the main spar attachment points, a single lug on the outboard wing is secured between two lugs on the centre wing by a through bolt, expansion mandrel and bush (Figure 5).

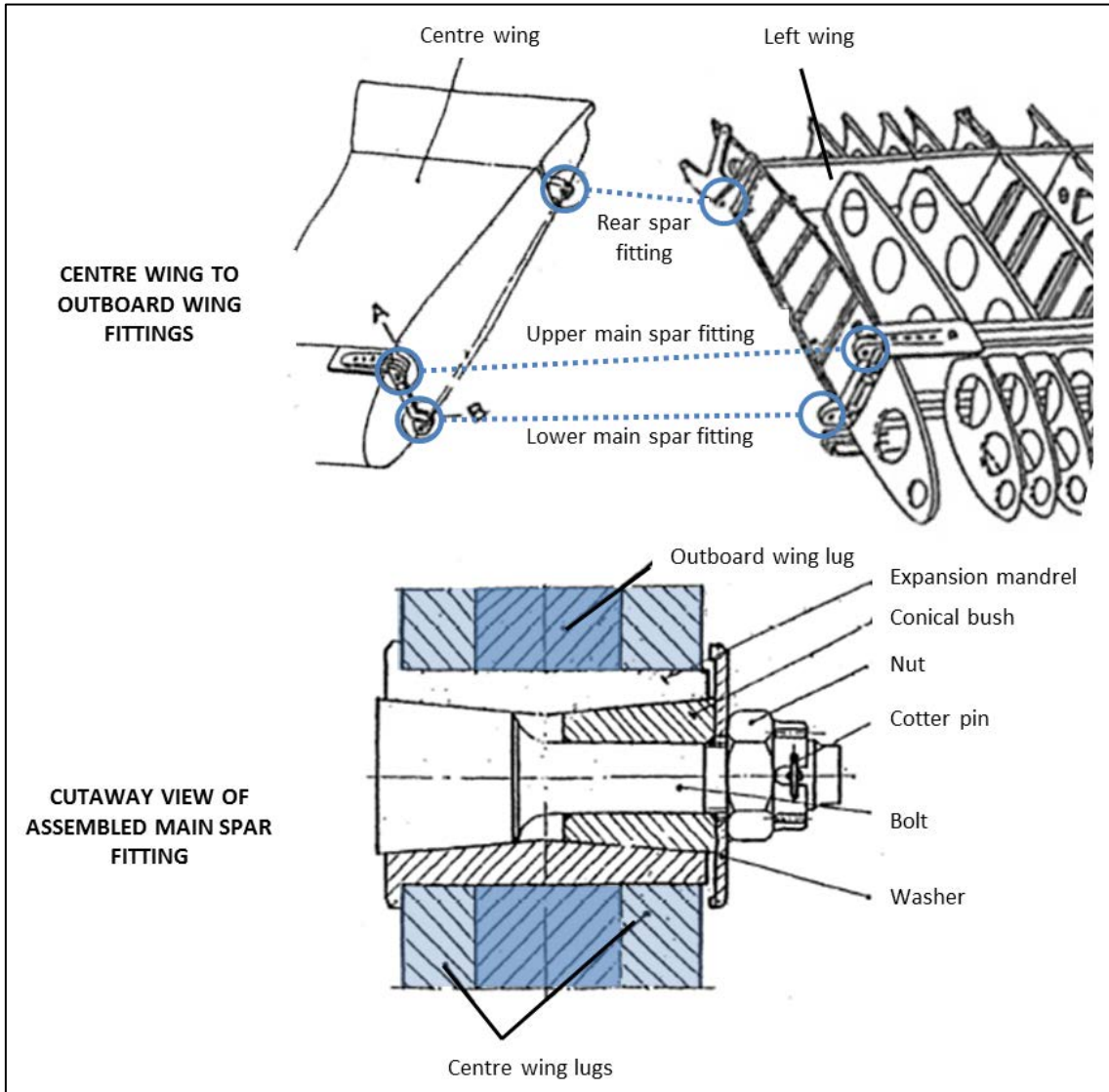
² The aircraft's service life was adjusted by a factor dependent on the take-off weight, up to a factor of 2.5 at 6,600 kg.

Figure 4: Overview of wing structure



Source: PZL. Image modified by ATSB.

Figure 5: Centre wing to left wing attach fittings



Source: PZL. Images modified by ATSB.

Wing attach fitting maintenance requirements

In 2000, investigations by the US National Transportation Safety Board into a number of US M18 accidents in which the wings separated in-flight discovered severe corrosion and cracking in the wing lower attach fittings, which led to fatigue cracking and failure of the fitting.³

On 3 August 2000, the aircraft manufacturer issued service bulletin (SB) E/02.170/2000, which provided procedures for dealing with corrosion of the centre wing-to-outboard wing attach fittings. The SB included a procedure for inspection of fittings found to be affected by corrosion and stated that:

- ‘the only acceptable inspection method is magnetic cracks detection’⁴ (original emphasis)
- ‘the critical area of the joints include the lower surfaces of the [main holes] in the wing lower attach joints’

³ National Transportation Safety Board investigations FTW00LA149, FTW99LA170, and FTW00LA267.

⁴ ‘Magnetic cracks detection’ probably refers to magnetic particle inspection, a form of non-destructive test (NDT). Using this method, the application of a magnetic field to the area of inspection draws a ferromagnetic liquid into any cracks, making them more visible.

- the inspections did not require outboard wing removal
- any cracked fittings and worn-out expansion mandrels were subject to mandatory replacement.

On 11 September 2000, CASA approved a procedure for inspection of the fittings using eddy-current testing as an alternative to the magnetic particle inspection required by the SB. This procedure provided information on preparing the area for inspection, instrument calibration, and other matters specific to the eddy-current testing method. It did not require wing removal and did not specify any particular critical area for inspection. Being a replacement for the inspection part of the SB, it did not provide repair instructions.

On 19 October 2000, the Civil Aviation Safety Authority (CASA) issued airworthiness directive (AD) AD/PZL/5. It specified that the centre wing-to-outboard wing attach joints were to be inspected, using magnetic particle methods, for cracks in the lugs, corrosion in the main holes, and ovalisation of the main holes. The inspection was to be carried out in accordance with the manufacturer's SB and was mandatory for all M18s⁵ after the fittings accumulated 2,500 hours service. Further inspections were required every 500 airframe hours or every 12 months, whichever came first.⁶

Aircraft maintenance information

Maintenance records indicated that the main spar attach point fittings on TZJ were installed new in 2004. The aircraft records indicated that since then it had accrued 3,980 flight hours, and 5,784 adjusted hours. A valid maintenance release was found in the wreckage.

The main spar attach fittings were last inspected on 8 August 2013, using the CASA-approved eddy-current procedure. Records indicated that since then, the aircraft had accumulated 120.1 flight hours and 154.7 adjusted hours, not including the accident flight.

Wreckage and site information

The on-site examination found that the left wing had separated at the attachment joint between the outboard wing and centre wing sections, about 6 m from the wingtip (Figure 6). Preliminary examination of the attach fittings indicated that the left outboard wing lower attachment lug had fractured through an area of pre-existing fatigue cracking in the lug lower ligament (Figure 7 and Figure 8). The fatigue cracking reduced the structural integrity of the fitting to the point where operational loads produced an overstress fracture of the remaining lug material. The detached section of lug was retained by the centre wing lugs and showed a matching fracture surface (Figure 8).

A number of aircraft components were removed from the accident site for further examination at the ATSB's Canberra facilities, including:

- both sections of the separated lower main spar lug and the remainder of the lower main spar attach fitting (left wing)
- the entire upper main spar attach fitting (left wing)
- part of the rear spar attach fitting (left wing)
- the entire lower main spar attach fitting (right wing).

⁵ Including models M18, M18A, M18AS, M18B, and M18BS.

⁶ Some aircraft were permitted to have the upper main spar fittings inspected every 800 hours or 12 months.

Figure 6: Outboard left wing (underside of wing visible, lower attach fitting arrowed)



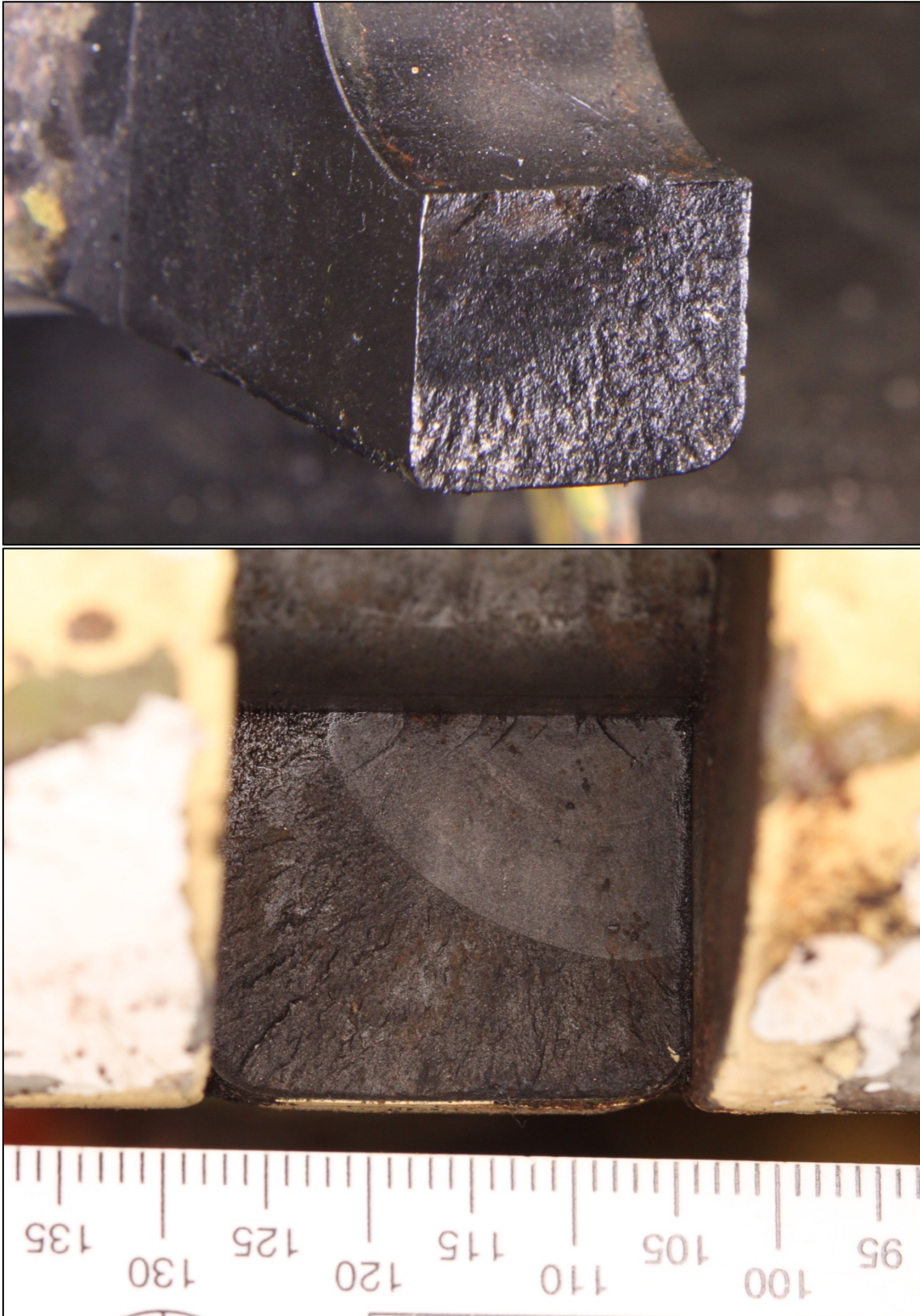
Source: ATSB

Figure 7: Lower main spar attach fitting



Source: ATSB

Figure 8: Mating fracture surfaces of left lower main spar attachment lug. Main (outboard) part above, detached (inboard) part below.



Source: ATSB

Previous ATSB investigations

Since 2006, the ATSB has investigated three other fatal accidents involving M18s, including one in-flight breakup.⁷ That in-flight breakup involved a separation of the outboard 1.8 m of the right wing, and the failure mechanism did not involve fatigue cracking. The other two accidents involved an in-flight loss of control.⁸

In April 2013, the ATSB published a safety issues investigation report into operations of the M18 Dromader at take-off weights above 4,200 kg.⁹

All of these investigation reports are available on the ATSB website at www.atsb.gov.au.

⁷ ATSB investigation AO-2008-084: *In-flight breakup - 58 km south-west of Nyngan, New South Wales, 29 December 2008, VH-IGT, PZL M18A Dromader*

⁸ ATSB investigations 200600851: *Aircraft loss of control -20 km SSW of Cootamundra, NSW - 16 February 2006 VH-FVF, PZL M-18A Dromader* and AO-2011-082: *Collision with terrain - PZL-Mielec M18A Turbine Dromader, VH-FOZ, 23 km WSW of Dirranbandi, Qld, 19 July 2011*

⁹ ATSB investigation AI-2011-150: *Operation of the PZL-Mielec M18 Turbine Dromader at take-off weights above 4,200 kg*

Safety action

On 25 October 2013, the Civil Aviation Safety Authority (CASA) issued directions to the registered operators of eight M18 (Dromader) aircraft, stating that the aircraft must not be flown until further notice.

On 1 November 2013, CASA issued directions to all registered operators of the 29 M18 aircraft in Australia that the aircraft must not be flown until further notice. In addition, it directed that operators of M18 aircraft provide information relating to the fulfilment of airworthiness directive (AD) AD/PZL/5 (including maintenance certification and non-destructive test reports), as well as information about each aircraft's operating weights.

On 15 November 2013, CASA issued an amendment to AD/PZL/5, revoking the approval for the eddy-current procedure for conducting the wing joint inspections. It also added a 100-hourly visual inspection, and additional wing-off inspections every 2,500 hours. CASA also issued a direction to the registered operators of M18 aircraft in Australia that the aircraft could be flown once the amended AD was complied with.

On 22 November 2013, CASA issued AD/PZL/5 Amendment 2, to additionally require magnetic particle inspections to be conducted on aircraft with less than 2,500 hours time in service, allow the use of CASA-approved alternative magnetic particle inspection methods, reduce complexity of the AD, and make corrections to reference documents.

Continuing investigation

The investigation is continuing and will include examination of the:

- wing attachment point inspection procedures, and methods used in practice
- approval mechanisms for the alternate method of compliance
- history of the aircraft's operations and maintenance.

It is anticipated that the final investigation report will be released to the public no later than October 2014.

Should any significant safety issues emerge in the course of the investigation, the ATSB will immediately bring those issues to the relevant authorities or organisations and publish them as required.

General details

Occurrence details

Date and time:	24 October 2013 – 1000 EST	
Occurrence category:	Accident	
Primary occurrence type:	In-flight breakup	
Location:	37 km west of Ulladulla, New South Wales	
	Latitude: 35° 20.62' S	Longitude: 150° 04.78' E

Aircraft details

Manufacturer and model:	PZL Mielec	
Registration:	VH-TZJ	
Serial number:	IZ013-32	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 1 (fatal)	Passengers – 0
Damage:	Destroyed	

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.

Investigation

ATSB Transport Safety Report Aviation Occurrence Investigation

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Preliminary – 2 December 2013

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