Australian Government
Australian Transport Safety Bureau

Birdstrike involving a SAAB 340B, VH-OLM

Moruya Airport, New South Wales | 9 January 2015

Investigation

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Addendum

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Safety summary

What happened

On the morning of 9 January 2015, a Regional Express operated SAAB 340B aircraft, registered VH-OLM struck a flock of birds during its landing roll at Moruya, New South Wales. Inspection of the aircraft by the flight crew found bird impact marks but no visually identifiable damage. The crew continued their schedule to Merimbula, New South Wales. At Merimbula, the first officer noticed the tip of one propeller blade was missing, and the aircraft was subsequently grounded.

SAAB 340B, VH-OLM

Source: Victor Pody

What the ATSB found

The blade tip failure was almost certainly a result of the birdstrike during the landing roll of the previous flight, weakening the internal structure of the blade.

The flight crew conducted a visual inspection in accordance with the operator's procedures, and this inspection did not find any damage. However, the propeller manufacturer's birdstrike inspection procedure was deemed a maintenance task. As such, it was not suitable for flight crew.

What's been done as a result

The operator changed its birdstrike procedures to ensure aircraft remained on the ground until a maintenance inspection was carried out in accordance with appropriate documented inspection procedures. In addition, pilot and engineering notices were issued clarifying these requirements.

Safety message

Adherence to regulations and company procedures is essential for the ongoing airworthiness of aircraft. Therefore, it is vital that procedures are clear and do not lead to ambiguity or misinterpretation. Where uncertainty exists, seeking clarification from the relevant authority can reduce the risk of an unserviceability affecting flight safety.

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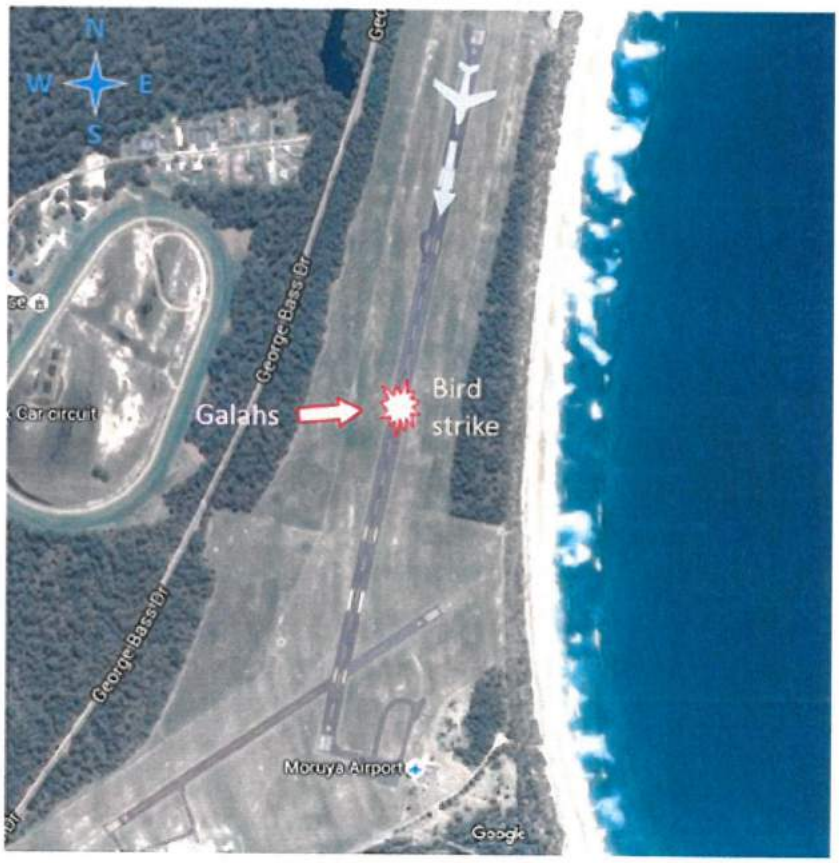
The occurrence

On the morning of 9 January 2015, the crew of a Regional Express operated SAAB 340B aircraft, registered VH-OLM, and were conducting a series of scheduled passenger flights between Sydney, Moruya and Merimbula, New South Wales. The first officer was the pilot flying on the Sydney to Moruya sector.

At about 0955 Eastern Daylight-saving Time, a visual, straight-in approach was conducted to land on runway 18[1] at Moruya. The aerodrome forecast for arrival at Moruya showed a 7 kt wind from the north-east, good visibility and cloud from 2,000 ft above the aerodrome.

After touchdown, as the aircraft slowed through 80 kt, the captain took control of the aircraft for the taxi to the terminal in accordance with normal company operating procedures. The crew reported that, shortly after the captain took control, a large flock of galahs[2] took off from the grass to the west (right) of the runway and flew at a low height over the runway eastbound (Figure 1). In anticipation of a birdstrike, the captain increased wheel braking and applied reverse thrust on both engines. Prior to reaching the galahs forward thrust was selected. Despite that action, about halfway down the runway the first officer observed birds had impacted the aircraft.

Figure 1: Moruya Airport showing aircraft and galah flock direction of travel and approximate impact point



Source: Google maps (Modified by the ATSB)

1 Runways are named by a number representing the magnetic heading of the runway.

2 A medium sized bird, 34 to 38 cm in length, weighing about 330 g. The galah is a member of the cockatoo family. It is distinct for its rose pink and grey colouring.

On reaching their designated parking area, and in accordance with the operator's birdstrike procedures, the flight crew carried out testing of the ice protection system before the engines were shut down, with no issues identified. Once the passengers who were disembarking at Moruya had left the aircraft, the first officer commenced an external inspection of the aircraft. The captain notified the airport reporting officer of the birdstrike. The airport safety officer subsequently found around 10 bird carcases on the runway.

The first officer found clear evidence of multiple birdstrikes on the right side of the fuselage, and the right engine and propeller, in the form of blood staining and bird carcass debris. One of the left engine propeller blades also displayed blood staining and white powder marks, consistent with a birdstrike. Despite the bird impacts, no evidence of ingestion into the engines or physical damage to the aircraft or propeller blades was observed.

The captain and the first officer reported that they subsequently carried out a detailed visual examination of the birdstrike-affected blades. The examination included rotating the propellers so that the forward and aft blade surfaces could be inspected for cracking, buckling, chips, dents or deformation along each affected blade's leading edge. When no damage was identified, the captain contacted the operator for further technical advice and the crew were subsequently cleared to continue with the flight schedule.

The crew then operated the aircraft from Moruya to Merimbula. After engine shutdown at Merimbula, the first officer opened the forward left door and observed that the tip of one of the left propeller blades had detached (Figure 2). The aircraft was declared unserviceable and grounded.

There were no reported injuries to the crew or passengers. No damage to the aircraft structure was identified as a result of the loss of the blade tip.

Figure 2: Left engine propeller showing damaged blade tip on arrival at Merimbula

Source: Regional Express

Context

Personnel information

Both the captain and first officer held valid Class 1 medical certificates, and were appropriately qualified to conduct the flight. The captain had a total aeronautical experience of approximately 7,000 hours with 4,300 hours flying SAAB 340 aircraft. The first officer had a total aeronautical experience of around 5,400 hours with 4,200 hours flying SAAB 340 aircraft.

A review of the crew's recent history indicated that fatigue was not a factor, with both crew reporting they had an average to good sleep during the previous 72 hours.

Aircraft information

The aircraft, a SAAB Aircraft CO 340B-2, was manufactured in 1990 and entered the Australian aviation register in October of that year. The aircraft is a twin engine turbo-prop and configured to carry 36 passengers and three crew. The aircraft was maintained under Civil Aviation Safety Regulation Part 42, which detailed the continued airworthiness requirements for regular public transport aircraft.

Aircraft damage information

The majority of the bird remains were found on the right side of the fuselage behind the forward right door, which was consistent with birds contacting the lower half of the right propeller disc. Small items of debris were also observed on both engine nacelles. There was no evidence of debris entering either engine. All of the blades on the right propeller showed evidence of impact with birds. Only one blade on the left propeller displayed evidence of bird contact.

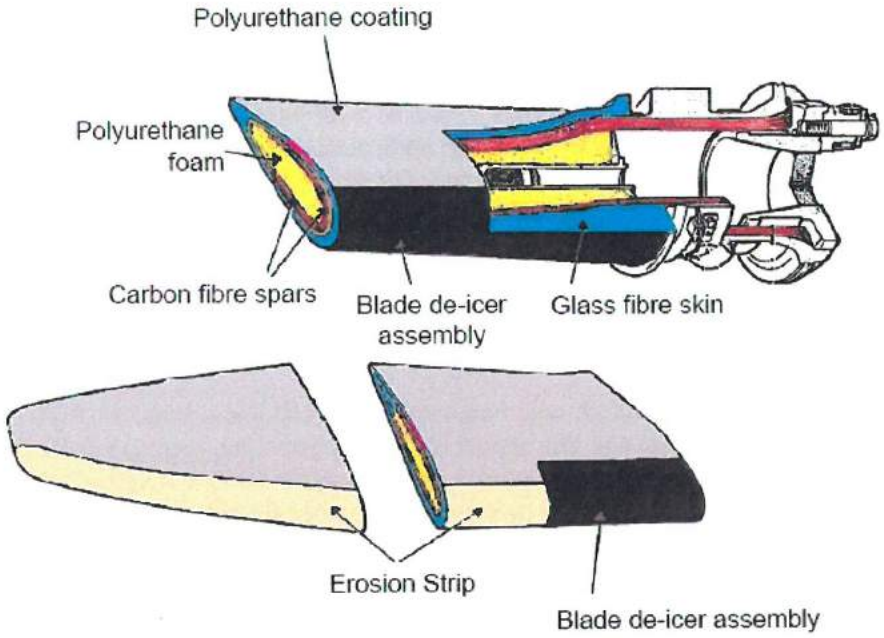
Data from the aircraft's flight data recorder for the flight from Moruya to Merimbula was examined. That data did not show any anomalies that would have identified the point when the propeller blade tip separated.

Propeller blade

Propeller blade construction

The propeller blades were manufactured by Dowty Propellers. They were made of composite construction with a polyurethane foam core, carbon fibre spars, glass fibre skin, and a polyurethane coating. A braided metal strip between the glass fibre and polyurethane coating ran from the tip of the blade to its root, providing lightning protection (Figure 3).

Figure 3: Propeller blade construction

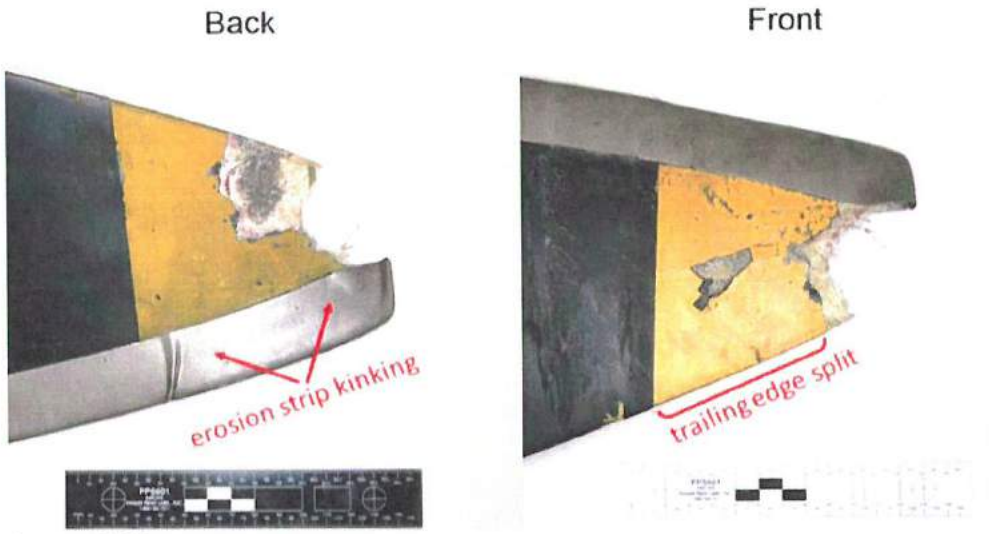


Source: Dowty Propellers modified by ATSB

Left propeller blade damage

The left propeller blade presented with white powder impact marks toward the trailing edge, about 300–400 mm from the blade tip; about one third up the blade's length. A section of blade was missing from the tip. Within the tip damage region, splitting at the trailing edge was identified (Figure 4). Damage to the leading edge erosion strip near the tip was also identified, with kinking on the back, and a corresponding crack on the front of the blade.

Figure 4: Left propeller blade damage showing tip separation, kinking, crack, and splitting of trailing edge



Source: ATSB

Blade history

A review of the damaged blade's service history showed it was installed on the propeller as a new item in 2000. The propeller had also undergone a number of inspections since that time, including

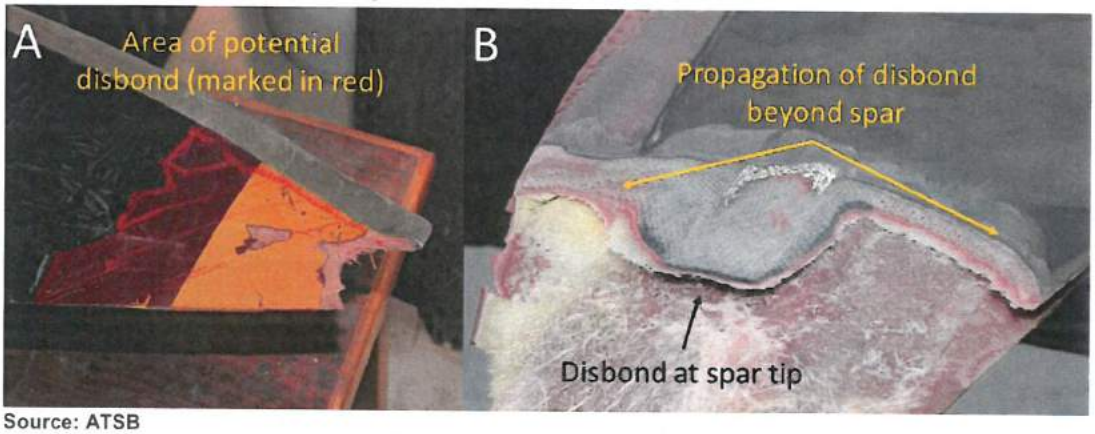
overhaul in 2011. The overhaul facility advised that during the 2011 propeller overhaul, ultrasonic NDT was carried out on the propeller's blades. All of the blades were found to be serviceable. There were no reported incidents of impact to the blade prior to this occurrence.

Blade examination

The damaged blade was sent to the ATSB for in initial assessment. A visual inspection, and a 'tap test' using a metallic object were conducted on the blade. That test revealed a potential area of delamination or disbond under the surface extending from the tip separation point.

The blade was subsequently sent to a third party laboratory for NDT and destructive testing under the supervision of the ATSB. A dual probe ultrasonic tester was used over the entire surface of the blade. Disbond was detected in a region extending from the spar through to the tip of the blade (Figure 5A). Further destructive testing in the form of surface grinding was carried out to determine at which layers the disbond had occurred. That action showed disbonding at the carbon fibre spar tips. The disbond had also propagated along the glass fibre layer of the blade beyond the spars (Figure 5B).

Figure 5: Region of disbonding shown



Source: ATSB

The propeller manufacturer determined the damage was consistent with the effects of impact on the blade from the birdstrike. The most likely failure mechanism was considered to be delamination between the blade's foam core and spar barrier membrane. The delamination then progressed outboard into the fibreglass layer beyond the spar resulting in the subsequent tip failure.

The propeller manufacturer concluded that the kink in the erosion strip on the back of the blade (Figure 4) was consistent with an impact on the front of the blade near the tip, bending the blade tip rearwards rather than forwards. The manufacturer considered this damage was consistent with a bird or other hard object impact. It also stated that it considered that the buckling of the guard would probably have occurred as a result of the impact rather than due to subsequent aerodynamic loading. Therefore, it believed the kink would most likely have been present at the time the blade was inspected at Moruya.

Propeller and blade maintenance requirements

Birdstrike procedure

The operator's policy and procedures manual included a section on birdstrikes, which stated:

> Following a known or suspected Bird Strike the Flight Crew must complete the External Inspection (Crew Change) in its entirety in accordance with the SAAB 340 Flight Crew Operating Manual [FCOM].
>
> Generally, blood and/or feathers are noticeable in the impact area of a bird strike. In low light conditions a torch must be used.

> Any defect, major damage or evidence of ingestion into an engine or airframe intake (include AC & DC Generator intakes) must be entered in an AML [aircraft maintenance log] and an engineering inspection must be performed prior to any subsequent flight.
>
> If the inspection does not reveal the existence of a defect or damage, and there was no effect on the aircraft's performance following the event, the aircraft may continue to operate.
>
> Prior to the next flight, the Ice Protection must be checked in accordance with the SAAB 340 Flight Crew Operating Manual.

Flight crew inspections

The operator's SAAB 340 flight crew operating manual (FCOM) included procedures for three types of external aircraft inspections by flight crew:

- daily inspection, conducted prior to the first flight of the day
- crew change inspection, conducted prior to the next flight when a flight crew accept an aircraft previously flown by another crew that day, if the aircraft has been taken off-line for maintenance during the day, or the aircraft is left unattended and not under continuous surveillance of the flight crew
- post flight inspection, conducted at the conclusion of each flight.

The FCOM procedures for a daily inspection and a crew change inspection both included a detailed list of items required to be checked by a flight crew. The only propeller specific items were:

> Inspect propeller assembly for oil or grease leakage from hub assembly
>
> Inspect propeller de-icer boots...

The FCOM procedures for a post-flight inspection included a smaller list of items. In terms of propellers, the items included:

> Propellers – including freedom of rotation and each blade front and back for obvious damage.

Maintenance procedures

The operator's system of maintenance was conditional on the inclusion of the relevant manufacturer's maintenance manuals. Consequently, birdstrike inspection procedures were derived from the aircraft manufacturer's aircraft maintenance manual (AMM) for airframe inspections, and the propeller manufacturer's component maintenance manual (CMM) and an aircraft specific propeller maintenance manual (PMM) for propeller inspections.

The CMM and PMM provided the primary source of information on maintenance requirements and serviceability limitations of the propeller and its blades. Contained within the introduction chapter of the CMM was the statement:

> Use qualified personnel and good engineering practice for all procedures and standard practices used in this manual.

The PMM inspection and check section included the following requirements in a section titled 'Bird Strike or other Impact Damage':

1. Propellers which have had, or are thought to of had a bird strike or other impact must be examined immediately.
2. Refer to propeller blade damage limits for allowable damage limits and repairs. Refer to CMM 61-10-39 Check. If the damage is within the allowable limits the propeller can stay in service.
3. If the damage is more than the allowable limits, but within the repair limits, a ferry flight may be allowed. The operator should write a ferry flight request on a concession form and send it to Dowty Propellers. Refer to Service Letter E340.
4. Equipment sent for repair must be clearly identified with the reason why.

The CMM 61-10-39 check section described the procedure of examination as a two-level process, consisting of a general check of all parts and a special check of specific parts. The section also contained non-destructive testing (NDT) techniques to be used on the blade assemblies and it provided blade damage limits relevant to blade location.

The CMM general check procedure included a section titled 'Impact Damage', which applied to birdstrikes. This section stated:

1. If the propeller has had impact damage, do the applicable visual and NDT inspection procedures given for the area of impact.
2. If the position of the impact will cause impact damage to other propeller components, do the applicable visual and NDT inspection procedures given for 'secondary' area of impact...
3. If it is not clear where the damage is, or if there is doubt concerning secondary impact damage contact Dowty Propellers.

The ATSB found ambiguity in the CMM procedures for assessing blades following a birdstrike impact. It was not readily apparent from the procedures whether the bird contact alone would constitute damage or whether subsequent blade NDT was required. As a result, the ATSB sought clarification from the manufacturer. The manufacturer advised:

> Generally, the intent is that there must be signs of damage before NDT is required.... Not many impacts leave no trace at all and generally, anything that is going to cause structural damage will have an associated visual indicator...
>
> Dowty would not consider evidence of animal matter as damage however it would be an indication that there had been an impact and that further investigation may be needed, again we would always recommend caution if there was any doubt.

Therefore, according to the manufacturer, the presence of feathers and dust marks (a visual indicator), while not displaying visible damage, may require further investigation.

Additional information

In 2011, the operator applied to the Civil Aviation Safety Authority (CASA) for approval to allow flight crew to undertake birdstrike inspections of aircraft. The CASA response (9 February 2012) highlighted the requirements of the Civil Aviation Safety Regulation Part 42 and the associated Part 42 Manual of Standards. Guidance on the continuous airworthiness requirements was provided,[3] including examples of situations that would exclude flight crews' ability to undertake inspections, as well as situations where flight crew inspections would be allowed.

CASA determined that where a specific birdstrike inspection was required by a manufacturer, that inspection would be deemed an engineering maintenance task and outside the scope of flight crew approved maintenance. Where specific inspection requirements did not exist and where there had been no effect on the aircraft's performance, external inspection by flight crews to determine if damage had been sustained was acceptable. CASA stated that the operator needed to submit its proposed procedures to CASA's oversighting office for the operator.

Based on the CASA advice, and believing there was no manufacturer specific inspection, the operator developed a draft birdstrike inspection procedure for flight crew. The draft procedure (and associated external inspections) was submitted to CASA's oversighting office for the operator and, following minor amendments, was issued to flight crew in an operations notice on 24 February 2012, and incorporated into the operator's policy and procedures manual in April 2012.

Following the 9 January 2015 occurrence, the operator advised the ATSB that it had misinterpreted the requirements in the CASA letter. The operator also advised that when it developed its birdstrike procedure, it relied on the aircraft manufacturer's AMM and information

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[3] The CASA letter discussed instructions for continuing airworthiness (ICA) issued by various aircraft type certificate holders. It did not specifically refer to ICA issued by propeller or other manufacturers.

from the aircraft manufacturer. It inadvertently did not consider the propeller manufacturer's PMM. As noted in in the previous section, the PMM documented a birdstrike inspection.

The operator advised the ATSB that it had approached the propeller manufacturer to include tap testing of the blade surface as part of the engineering birdstrike inspection procedure. The manufacturer indicated that a tap test of the blade is of very limited value because it did not give a sufficiently definitive result and risked not detecting blade delamination, except for the blade erosion strip.

Wildlife hazard management requirements and guidance

General requirements and guidance

A number of regulations, standards, and guidelines apply to wildlife hazard management at airports. The International Civil Aviation Organization established the standards for the management of collisions between wildlife and aircraft. It also provides guidance on effective wildlife management programs.

Within Australia, CASR 139 required a certified aerodrome to have an aerodrome manual, which must include details regarding bird and animal hazard management. The Manual of Standards (MOS) for Part 139 provides more detailed requirements. These included a requirement that, where regular monitoring confirmed the existence of a bird or animal hazard, or at the direction of CASA, the aerodrome operator must develop a bird or animal hazard management plan. The plan had to be developed by a suitably qualified person such as an ornithologist or biologist, and had to address the following factors:

- hazard assessment, including monitoring action and analysis;
- pilot notification [reporting];
- liaison and working relationships with land use planning authorities;
- on-airport bird and animal attractors which provide food, water or shelter
- suitable harassment methods; and
- an ongoing strategy for bird and animal hazard reduction, including provision of appropriate fencing.

Advisory Circular (AC) 139-26(0) *Wildlife hazard management at aerodromes* provides further guidance information about managing wildlife hazards at aerodromes. It states that that once a wildlife hazard is identified, appropriate and effective treatment should be employed. Treatment methods fall into two categories:

- pre-emptive (such as removal of food sources, maintenance of grass, etc.) and where necessary
- active (such as scare tactics using horns, siren, or dogs).

Further guidance on wildlife hazard management is available from the Australian Aviation Wildlife Hazard Group document *Wildlife Risk Assessment and Analysis*, and the Australian Airport Association's publication *Wildlife Hazard Management at Airport - Airport Practice Note 9.*

Galahs

The ATSB's bird information data sheets for the management of birdstrike risks at airports, *ATSB bird information sheet number 6*, refers to the galah (reproduced in the Appendix). The information sheet advises that all bird management strategies should seek to make an airport as undesirable as possible to birds through habitat modification. With regard to galahs, amongst various suggestions, it recommends that:

- a tall grass policy (30 cm) be maintained as galahs find it difficult to see approaching predators
- manage grasslands to limit production of seeds.

Additional active management strategies that can be used to disperse and control the birds include:

- use of pyrotechnics (cracker shells), portable distress callers, sirens, lights and vehicles
- use of trained animals (birds of prey, dogs, etc.), and where necessary, and permitted, culling may be required.

Airport information

Moruya was a certified, uncontrolled, two runway airport situated close to the coastline (Figure 1).

The airport had a bird and animal (wildlife)[4] management program. This includes daily inspection of the airport with reporting on wildlife activity, low level harassment with a vehicle to disperse wildlife, and maintenance of grass areas to minimise or deter habitation. The airport coordinator advised that the local galahs tended to stay close to the buildings and trees, but it was not usual for them to be in the runway area. The grass around the runway was long and had been scheduled for cutting that day. The airport coordinator considered the longer grass may have attracted the galahs to feed on the grass seeds.

The airport's records of wildlife strikes indicated they were not seasonal, with birdstrikes occurring throughout the year, over the previous five years. In 2014, however, the only three reported birdstrikes were confined to the first quarter of the year (January to March). None of these involved galahs.

A review of the 2014 annual report revealed a consistent number of galahs resided at the airport, with between two and 10 birds observed regularly. Their activity was predominantly around the terminal area in the early morning, usually departing before 0800. There was only one instance of flocking behaviour by galahs in the 2014 report. That occurrence was in February 2014 when large groups of about 32 galahs were observed coming in from a nearby camping area to graze near the terminal building, and departing by about 0800.

The presence of birds at Moruya Airport was frequent and significant enough for the aeronautical information package, *En Route Supplement Australia*, to include an additional information note that a bird hazard exists.

The ATSB compared birdstrike rates per 10 000 aerodrome movements for Moruya against other regional aerodromes, and the birdstrike rates for Moruya were considerably lower than most.

Other occurrences

A review of the ATSB occurrence database for the period 1977 to 2014 did not reveal any additional blade failures or in-flight blade tip failures for the propeller type due to a birdstrike.

[4] Wildlife includes all birds, bats and terrestrial animals as a practical definition.

Safety analysis

Introduction

During the landing roll at Moruya Airport, a number of birds were struck. On the following flight, the left propeller blade tip failed. This analysis examines the actions of the flight crew, the failure mechanism of the blade, inspection requirements following a birdstrike, and factors that may have identified the potential risk of blade failure.

Flight crew actions

The presence of galahs to the right of the runway during the landing roll presented a high risk of impact to approaching aircraft. The captain followed appropriate actions to maximise aircraft deceleration while minimising potential impact damage through effective use of reverse thrust and aircraft wheel braking. Despite the crew's best efforts, the subsequent impact with the birds was considered unavoidable.

The birdstrike inspection carried out by the flight crew was in accordance with the operator's procedures. The crew reported performing a thorough visual inspection of the individual blades on both propellers, including rotation of the propellers to sight along each blade surface for damage or deformation. Despite the lack of visible damage associated with the bird impacts, the captain sought further advice from the operator's engineering department before determining the aircraft was serviceable. The engineering department reportedly advised the captain to follow the flight crew's documented procedures, and if no damage was evident, continue with the flight schedule.

Blade failure mechanism

Review of the blade's service history showed it had undergone numerous non-destructive tests (NDT) and inspections, including an ultrasound inspection in 2011. None of those inspections revealed evidence of internal delamination. As there were no previously reported incidents of impact to the blade, it is unlikely that a pre-existing defect below the blade surface existed or influenced the blade's failure.

Examination of the blade found that the failure mode was consistent with a bird impact. Consequently, given the failure occurred on the flight following the birdstrike, it is almost certain that impact with one or more galahs initiated the internal delamination of the blade. This led to a rapid decay of its structural integrity and subsequent separation of the tip, as the blade was subjected to aerodynamic loads during the following flight.

The propeller manufacturer indicated that the buckling of the blade guard would probably have occurred as a result of the impact rather than due to subsequent aerodynamic loading, and the damage to the guard would have been evident when the blade was inspected by the flight crew at Moruya.

The ATSB agrees it is plausible that the birdstrike resulted in cracking of the leading edge of the guard. However, the extent to which the damage to the guard would have been readily detectable when the blade was inspected at Moruya is unclear. Once the leading edge guard lost structural integrity, together with internal delamination damage, it is difficult to determine the nature of the subsequent loading conditions during flight.

Inspection requirements

The flight crew were not familiar with the propeller manufacturer's inspection procedure, however, there were specific propeller inspection instructions in their normal procedures following a birdstrike, and the captain and first officer reported carrying out a thorough visual examination of the propeller blades in line with these procedures. Regardless of the nature of the flight crew's

inspection, both CASA and the propeller manufacturer considered the inspection to be a maintenance task, and required it to be carried out by qualified maintenance personnel.

The ATSB could not determine if an engineering inspection would have highlighted any possible damage. However, if an appropriately qualified person inspected the multiple bird impacts on the blades, they may have sought further advice from the propeller manufacturer in accordance with the documented propeller manufacturer's maintenance procedure 'if there is doubt concerning secondary impact damage…' As the flight crew did not have this document, they would not have been aware of this procedure. Despite this, the captain did seek further advice from the operator's engineering department. As an on-site engineering inspection was not carried out, the operator's engineering department may not have had a full appreciation regarding the multiple birdstrikes.

The discussion between engineering and the flight crew focused on the presence of visible damage to the blade, and the documented flight crew inspection procedures. Consequently, the reported blade condition did not raise concerns with the engineering department about potential secondary damage or reduced structural integrity. That determination presented a missed opportunity to undertake an engineering inspection of the aircraft prior to take off. Consequently, the potential to detect sub-surface damage was also missed.

The Civil Aviation Safety Authority (CASA) provided the operator with advice on interpreting regulations for situations where pilots may or may not undertake birdstrike inspections. That advice included that if specific birdstrike inspection procedures within instructions for continuing airworthiness (ICA) deemed the inspection task as being a maintenance requirement then they were not suitable for flight crew. It is apparent the operator misinterpreted the advice from CASA as only referring to the aircraft manufacturer's procedures and not also the propeller manufacturer's procedures. As a result, the operator's procedures allowed flight crew to undertake visual inspections after a birdstrike (beyond confirmation of whether there was a strike).

Moruya Airport bird and animal control

The frequency of bird and animal (wildlife) strike incidents over a 10 year period did not indicate that an increasing wildlife problem existed at Moruya Airport. The presence of galahs was common, however the galahs were typically in small numbers, and contained to around the buildings and treed areas.

According to the *Moruya 2014 bird and animal report*, and along with the birdstrike statistics for Moruya, the airport's reliance on the maintenance of the grass adjacent to the runway as a pre-emptive means of bird management generally appeared to work for maintaining low wildlife strike incidents. On the day of the occurrence, the grass around the runway was long, and was scheduled for cutting later in the day. The *ATSB bird information sheet* indicates long grass can deter galahs. However, in this instance, the presence of grass seeds on the long grass may have contributed to their increased numbers and proximity to the runway. Consequently, when birds are located in the grass adjacent to the runway, an increased risk of aircraft strikes existed.

Findings

From the evidence available, the following findings are made with respect to the damage and subsequent propeller blade tip separation associated with the birdstrike occurrence involving a SAAB 340B, registered VH-OLM, at Moruya Airport, New South Wales on 9 January 2015. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- The impact from multiple galahs almost certainly reduced the structural integrity of a propeller blade, resulting in the separation of its tip during the subsequent flight.

Other factors that increased risk

- The permitting of flight crew to carry out post birdstrike inspections was outside the approval of the regulator and propeller manufacturer, and reduced the likelihood of identifying serviceability issues.

Safety issues and actions

Additional safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Regional Express

As a result of this occurrence, Regional Express advised the ATSB that it had undertaken pro-active safety action through issuing the following:

- Notice to aircrew NOTAC 091/15, REPORTING OF BIRD AND WILDLIFE STRIKES - REISSUED. Which stated:

  If there is any evidence of impact (blood/feathers/dust) on the propellers following wildlife strike the aircraft must not depart until an engineering inspection is complete. In addition to the requirements of PPM 13.1 1-Bird Strike, an AML [aircraft maintenance log] must be raised for wildlife impact with the propeller. All bird and wildlife strikes or suspected strikes encountered on approach/departure, take-off/landing should be reported to the Network Ops Centre (NOC) as soon as practicable following a strike. The NOC will then inform the aerodrome operator to enable immediate dispatch of the ARO [aerodrome reporting officer] to inspect the runway and vicinity of the airport in the effort to locate and remove any animal remains, as well as assisting in the identification of the species for wildlife management within the region. The SMS requirements remain unchanged.

- Notice to engineers NOTEM 83, Bird Strike Inspections. Which stated:

  Until further notice if a bird (wildlife) strike is reported and there is evidence of impact (blood/feathers/dust) on the propeller then the aircraft must not be released to service until both the CAM [continued airworthiness manager] and Chief Pilot have given approval. AML is required to be raised for any event where there is evidence of impact on the propeller.

- Engineering technical notice TN-SAAB-6100-008-15, Propeller Bird Strikes. Which stated:

  1. Introduction

     This Technical Notice is issued to provide information for engineers dealing with aircraft bird strikes involving contact with propeller or any other impact experienced by the propeller whilst installed.

  2. Content

     When an aircraft is reported to have experienced a bird strike and there is evidence of contact with the propeller an AML must be raised and an engineering inspection of the propeller must be conducted IAW the applicable maintenance manual.

     For Dowty propellers refer to the applicable Maintenance Manual and Component Maintenance Manual, a flow chart is provided on page 2 of this TN to help engineers perform the required inspection and make airworthiness assessment for Dowty propellers.

     For the Hamilton Sundstrand propeller refer to the Maintenance Manual P5199, CHECK, Inspection After Impact procedure. A copy of this procedure is included on page 3 of this TN. **Note:** It is a requirement to check the blade track as part of this procedure.

     The same procedures should be used for any report of impact experienced by the propeller while it is installed.

These notices were subsequently included in relevant manual updates.

General details

Occurrence details

Date and time:	9 January 2015 - 0956 EDT	
Occurrence category:	Serious incident	
Primary occurrence type:	Birdstrike	
Location:	Moruya Airport, New South Wales	
	Latitude: 35° 53.9' S	Longitude: 150° 08.7' E

Captain details

Licence details:	Air Transport Pilot Licence, (Aeroplane)			
Ratings:	Command – Multi-engine, Instructor Grade 3			
Medical certificate:	Class 1 Valid			
Aeronautical experience:	Total	6,999 hours	On-type	4,264 hours
Last flight review:	August 2014			

First Officer details

Licence details:	Commercial Pilot Licence, (Aeroplane)			
Ratings:	Command – multi-engine			
Medical certificate:	Class 1, valid			
Aeronautical experience:	Total	5,399 hours	On-type	4,235 hours
Last flight review:	December 2014			

Aircraft details

Manufacturer and model:	SAAB 340B	
Year of manufacture:	1990	
Registration:	VH-OLM	
Operator:	Regional Express	
Serial number:	340B-205	
Total Time In Service	47,891 hours	
Type of operation:	Low Capacity Regular Public Transport	
Persons on board:	Crew – 3	Passengers – 16
Injuries:	Crew – 0	Passengers – 0
Damage:	Minor	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- flight crew
- aircraft operator (Regional Express)
- propeller manufacturer
- propeller overhaul organisation
- Moruya airport operator
- United Kingdom Air Accidents Investigation Branch
- Swedish Accident Investigation Authority
- Australian Bureau of Meteorology.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the captain, first officer, Regional Express, Moruya airport operator, Civil Aviation Safety Authority (CASA), Dowty Propellers, and the United Kingdom Air Accidents Investigation Branch.

Submissions with comments were received from the operator, CASA and the propeller manufacturer. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

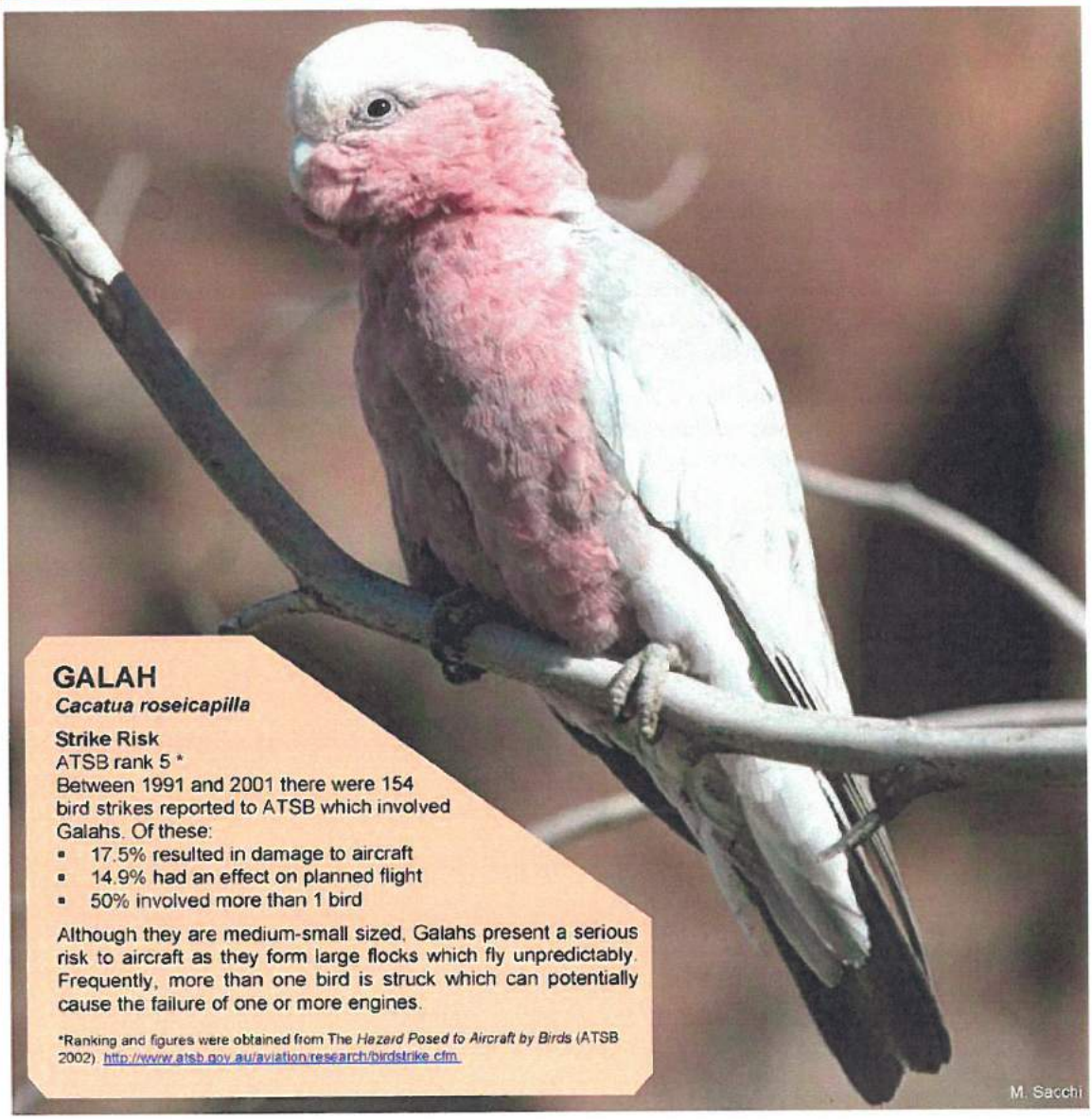
Appendix A: ATSB Bird Information Sheet No 6

Australian Government
Australian Transport Safety Bureau

ATSB Bird Information Sheet No.6

Galahs

Managing bird strike risk at Australian airports



GALAH

Cacatua roseicapilla

Strike Risk
ATSB rank 5 *
Between 1991 and 2001 there were 154 bird strikes reported to ATSB which involved Galahs. Of these:

- 17.5% resulted in damage to aircraft
- 14.9% had an effect on planned flight
- 50% involved more than 1 bird

Although they are medium-small sized, Galahs present a serious risk to aircraft as they form large flocks which fly unpredictably. Frequently, more than one bird is struck which can potentially cause the failure of one or more engines.

*Ranking and figures were obtained from The *Hazard Posed to Aircraft by Birds* (ATSB 2002) http://www.atsb.gov.au/aviation/research/birdstrike.cfm

M. Sacchi

About Galahs

Galah

Cacatua roseicapilla

Size
Length 34-38cm; wingspan 75cm; weight 330g.

Identification
Adult Galahs are a pink cockatoo with grey wings and tail; whitish crest. Males have a dark brown eye and females have a red eye.
Juveniles are similar to adults but have a grey eye-ring and a greyish colouration on the breast.

Distribution
Galahs are widespread throughout Australia excluding the most arid regions and dense forest environments.

Preferred Habitat
Galahs prefer open areas with suitable nesting trees, access to water and food. They are commonly observed along roadsides, rail yards, along watercourses, urban parks, and open grassed areas such as playing fields, golf courses and airports.

Food
They primarily forage on the ground for seeds, but will also eat a variety of organic matter. In many agricultural areas galahs have become a significant pest feeding on grain and other crops.

Behaviour
Adult Galahs will mostly remain within the same territory; however young individuals tend to roam.

Breeding
In southern Australia, breeding takes place from July to December, however, in northern Australia breeding occurs from February to June. The nest is comprised of a leaf-lined tree hollow, in either a dead or living tree. Up to 5 eggs are laid.

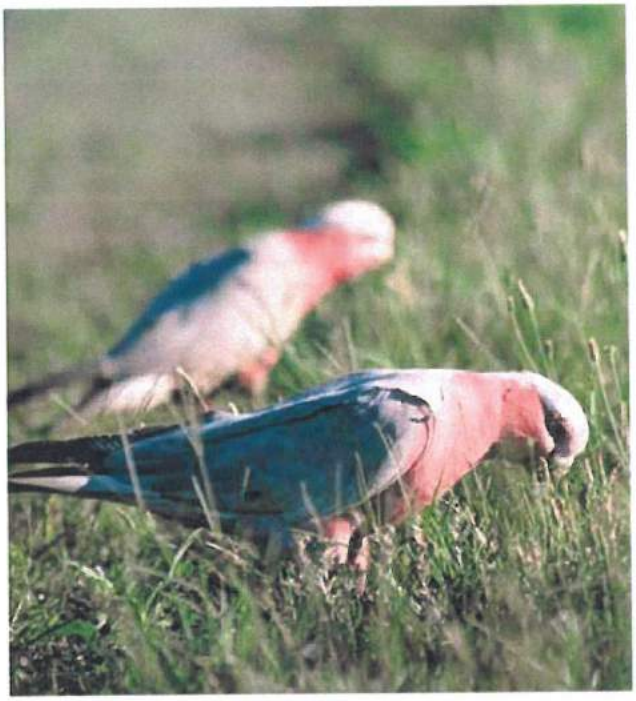
K. Murray

Galahs at Airports

The Galah is one of the most abundant and familiar cockatoos in Australia. Galahs are commonly observed foraging on the ground in short grasslands, or drinking from various water sources. The main attractions for Galahs at airports include:

- **Food**
  The airport environment provides Galahs with a consistent food source, mainly from an abundance of seeds released from poorly managed grasslands. Seeding weeds also provide Galahs with food.
- **Water**
  Permanent water bodies at airports provide Galahs with a reliable water source that may not be available in surrounding areas, attracting large numbers to airports to drink. Galahs may make visits to an airport part of their daily routine when they know that water is available.
- **Perching Sites**
  Perching sites such as fences, signs, trees and buildings are readily available at airports and adds to the appeal of the airport environment.
- **Transit Routes**
  Poorly managed areas immediately surrounding an airport can attract Galahs, increasing the number which transit over the runways between foraging sites. Such attractions could include weedy grasslands or grain silos. It is important that local grain authorities and adjacent landholders are encouraged to manage grasslands and grain storage areas to minimize the attraction of Galahs.

Managing the Galah Hazard at Airports



Habitat Modification

All bird management strategies should seek to initially make an airport as undesirable as possible to birds through habitat modification. An assessment of the airport should be completed by a person qualified and experienced in identifying bird attractions and recommending site-specific modifications.

Limiting Galah attraction at airports may require:

Limiting Food Supply

- ✓ Employ a tall grass policy in all non essential areas. Grass maintained at around 30cm makes it difficult for Galahs to see approaching predators.
- ✓ Manage grasslands to limit the production of seeds. This involves mowing at a height which only removes seed heads, whilst maintaining tall grass.
- ✓ Practice good weed management by removing weeds before they are able to seed.

Limiting Water Sources

- ✓ Water sources must be managed to ensure that no water is available to Galahs.

Perching Areas

- ✓ All non-essential signs and posts should be removed from airside areas.

Active Management

Active bird management involves scaring or removing birds from the airport. There are numerous options available for the task, some of which have limited effect in the long term as birds become used to them. Generally, a combination of techniques provides the best results. For Galahs, the following active management options can be considered:

- ✓ Disperse Galahs using pyrotechnics (such as cracker shells), portable distress callers, sirens, lights and/or vehicles.
- ✓ Occasional culling (shooting) may be required (under permit from the relevant state or territory authority) to reinforce the impact of equipment used for dispersal. It should not, however, be considered as the primary solution for airports.
- ✓ Using trained animals such as birds of prey and dogs to disperse birds from airports has been highly successful in North America and Europe. This can be a costly operation, requiring specially trained animals and experienced handlers. Permit requirements for such activities vary between states and territories in Australia.

Note: not all the suggested strategies have been trialed at Australian airports and it may be necessary for each airport to independently trial any particular method before incorporating it into their bird management plan.

Weed Management

The management of weeds at airports is vital for minimising the food source which attract seed-eating birds such as Galahs. An integrated weed management strategy which uses a wide range of control options should be adopted for greatest success. The four elements of an integrated strategy are:

1. Identification
   - Identify the weeds present on airport.
2. Plan
   - Develop a suitable plan which is aimed at managing weeds efficiently and effectively.
3. Control
   - Physical: mechanically removing weeds.
   - Biological: the use of biological organisms which forage on or inhibit growth of weeds.
   - Chemical: chemically killing weeds and preventing regrowth.
4. Follow up and monitoring
   - It is very important for all weed control work to be followed up with a monitoring program to ensure that no outbreaks occur.

Species and hazard rankings for the 20 most struck Australian birds (1991–2001).

Species	*Number of Strikes Recorded*	*% Resulting in Damage to Aircraft*	*% Having Effect on Planned Flight*	*Composite Hazard Ranking*
Eagle	38	55.3	13.2	1
Ibis	39	41.0	17.9	2
Duck	52	26.9	19.2	3
Bat	72	25.0	13.9	4
Galah	154	17.5	14.9	5
Gull	136	15.4	3.7	6
Kite	90	14.4	4.4	7
Hawk	156	12.8	5.1	8
Pigeon	53	16.9	0	9
Owl	19	5.3	10.5	10
Lark	16	12.5	0	11
Starling	17	11.8	0	12
Magpie	117	5.1	5.9	13
Plover	143	6.9	2.8	14
Curlew	31	9.7	0	15
Peewee	18	0	5.6	16
Falcon	18	0	5.6	17
Swallow	66	4.6	0	18
Kestrel	92	1.1	0	19
Sparrow	38	0	0	20

*Source: *The Hazard Posed to Aircraft by Birds* (ATSB 2002). http://www.atsb.gov.au/aviation/research/birdstrike.cfm

Did you know?

- The name 'Galah' was derived from the word some Aboriginal groups use to describe the bird.
- After initially leaving the nest at around two months of age, still dependent young are placed in crèches with young from other breeding pairs for a further two months.
- Galahs are monogamous, a breeding pair will remain together for life.
- Galahs are considered a pest in grain growing areas because of the damage they can cause to crops. They are often observed eating grain awaiting transport which is stored in sacks or open air storage areas.
- Galahs have benefited from large scale habitat modification. Land clearing for agriculture, cultivation of cereal crops and creation of new and permanent water sources has allowed galahs to expand into otherwise uninhabitable areas.
- Galahs are a popular cagebird worldwide, advertised as Rose-breasted or Roseate Cockatoos in some areas.

For further information:

ATSB (02) 6274 7452
www.atsb.gov.au

The ATSB investigates air safety occurrences for the sole purpose of enhancing safety. Consequently, ATSB material is confined to matters of safety significance and may be misinterpreted if used for any other purpose.

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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

Enquiries 1800 020 616
Notifications 1800 011 034
REPCON 1800 020 505
Web www.atsb.gov.au
Twitter @ATSBinfo
Email atsbinfo@atsb.gov.au
Facebook atsbgovau

Investigation

ATSB Transport Safety Report
Aviation Occurence Investigation

Birdstrike involving a SAAB 340B, VH-OLM, Moruya Airport, New South Wales, 9 January 2015

AO-2015-007
Final– 14 December 2017