AVISURE

MITIGATING BIRD STRIKE RISK

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Significant Strike Investigations

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Significant Strike Investigations

In Australia, wildlife strike (mainly birds and bats)

Why bother?

- Occurs at a rate 1200 strikes /year and increasing
- Rarely causes death, serious injury or hull loss
- Rates 7th on the list of a/c accident causes
- Rates 1st on the list of causes of aerodrome related incidents and accidents
- Costs the industry about $4000/RPT strike (~$5million a year to RPT)

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"……the operational and environmental costs associated with wildlife strike in Australia could be reduced to insignificant levels.

…..all it requires is the considered application of operational procedures and environmental management techniques which are already in widespread use……."

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Airspace Reality

"……in an airport handling 30 movements per hour (mostly RPT) we scored an average of 81 bird movements per hour inside the airport boundary. 10/hour were in inside the flight strip ……and this was at an airport with an active wildlife management program!

Faced with this separation standard most pilots and controllers would freak ….. and yet its relatively easy to manage this situation by applying existing technology and protocols……."

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“…..Embedded in every bird strike event lies the information to prevent it’s recurrence…..”

Determining the exact sequence of events can

1. Reduce the chances of recurrence
2. Offset aerodrome liability
3. Reduce aircraft operator costs
4. Contribute to environmental issues relevant to the wider community

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What is a Significant Strike Investigation?

Detailed analysis of bird or animal strikes to aircraft.

- Pull together ecological, biological and aviation data surrounding a strike
- Provide advice to aerodrome operators, aircraft operators aircrew and regulators

The objectives of an SSI:
- to determine the how, what, when, where and why of a strike

The overarching aim:
- to reduce strike rate

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When do you do is a Significant Strike Investigation?

1. Strikes causing serious incidents or accidents, delay or damage to an aircraft
2. Strikes involving unusual species for the region in question, an unusual series of strikes or strikes where the species ID is uncertain
3. Any unusual animal, wildlife or ecological phenomenon
4. Accidents or incidents where it is suspected that strike may have been a contributing factor or where strike is unlikely but needs to be ruled out as a contributing factor
5. Strikes or near misses or other occurrence involving apparently bizarre or unusual animal behaviour.

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Who Commissions a Significant Strike Investigation?

Aerodrome operators

Aircraft operators

Coroners/police

Aviation Investigation Authorities

Aviation Insurance Companies

Other involved or concerned persons

B747F hull loss after aborted TOFF (post V1) and overrun Brussels 25-05-08

DNA analysis confirmed bird strike to No.3 by a Kestrel

European Kestrel
Wing Span 0.8m
MTOW 320gms

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Significant Strike Investigation - what does it consist of?

"……..bird strike investigation doesn't really rate as a real air safety investigation because it's more to do with birds than aircraft……."

I wonder if these guys would agree?

Significant Strike Investigation - what does it consist of?

Common procedures include:

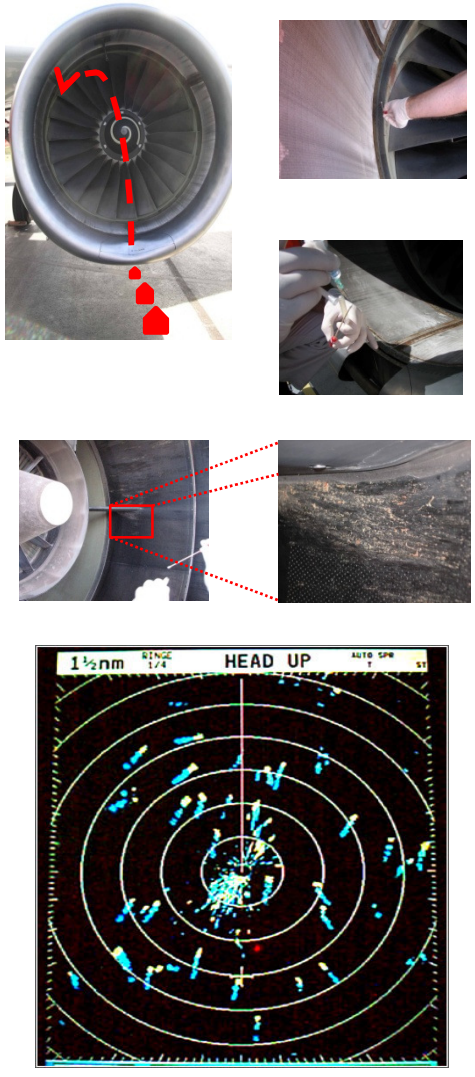
- Post-mortem examination of animals or animal remains
- Hair, feather or Molecular (DNA) analysis identification of remains

What species?
What sex?
What age?
What did it eat?
Where did it come from?
Why was it there?
Why did it die?
Did it really get hit by an aircraft?

Significant Strike Investigation - what does it consist of?

Common procedures include:

- Examination and sampling
  - aircraft
  - accident/incident sites
- Analysis of
  - FDR, ATC tapes and radar
  - ambient conditions
- Interviews and discussions
  - aircrew,
  - maintenance staff
  - aerodrome operations staff.

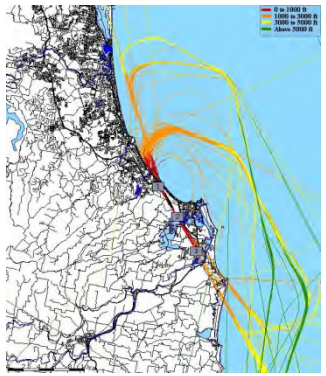


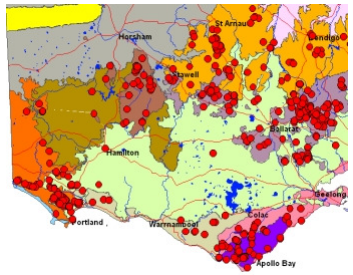
When & where did the strike occur?
What was the bird doing?
What attracted it there?
What was the a/c doing?
What was the crew doing?
Was there any damage?
Was there an incident/accident?
Was the strike related to the incident
What was the airside bird activity and dispersal levels?
Could the strike have occurred elsewhere?

Significant Strike Investigation - what does it consist of?

Common procedures include:

- Review, audit and analysis
  - local, regional and national wildlife survey trends
  - aerodrome bird strike trends and strike management programs
  - airside habitat and habitat management plans
  - off-airport habitats
  - consultation with external animal, ecological and aviation specialists





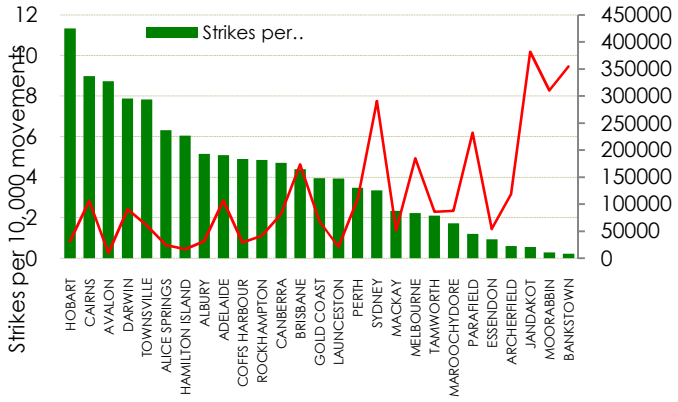
What birds are likely to be at that time. place and altitude?

Are bird movement patterns changing?

What is the strike risk by species and area?

Are current management practices effective?

Do we need to consider rerouting a STAR or SID or rescheduling?



Significant Strike Investigation Outcomes

Common outcomes include:

- Ruling in or ruling out whether a bird or animal strike contributed to an accident or incident
- Establishing the identity and number of species involved in a strike.
- Strategic modifications in airside wildlife management protocols and/or aircraft operations.
- Real time strike consequence estimate to aircrew in flight
- Early detection of changes in risk species distribution or movement patterns
- Early Identification of habitat and factors that may indirectly alter strike risk
- Early Identification of aerodrome, aircraft, flight path or operational factors that may affect strike risk or consequence.

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Significant Strike Investigation Benefits

- In some cases - resolution for bereaved
- Dynamic risk management process leading to decreased strike rate and improved safety
- Conservation of wildlife
- Detailed understanding of aerodrome and aircraft operations in the context of the local environment
- Decreased industry cost and delay
- Correct assignment of liability

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Significant Strike Investigations
Example 1

A suspect departure strike – but did a strike actually occur and did it cause any damage?

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Significant Strike Investigations
Example 1

RESULTS:

Analysis of the circumstances and PM established:

1. That location, size, colour, temperature and degree of rigour of the carcass were consistent with the aircrafts departure time and the pilot's recollection of events.
2. The bird was identified as a Fairy Martin, a small (~15gm) bird with a very low consequence rating.
3. The pattern of injury seen at PM was more consistent with vortex/pressure damage rather than direct impact with the airframe or engine.
4. These results were relayed to the pilot within 30 minutes of departure.

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Significant Strike Investigations
Example 1

CONCLUSION

It was highly unlikely that this event caused significant damage to the aircraft
(Later inspection at the arrival port found no evidence of strike or damage)

Main outcomes

Timely and specific information delivered to the pilot helped him to resolve any ambiguity about whether to continue or abort the flight

No specific outcome with respect to aerodrome bird management - at this airport this species is not considered a significant hazard and is not actively managed.

Cost of investigation: Costs absorbed by *AVISURE* as part of ongoing service to the operator

Cost benefit: The aircraft operator avoided a potentially costly abort, fuel dump and delay of service.

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Significant Strike Investigations
Example 2

WHAT BIRDS SHOULD WE MANAGE.....?

A possible strike – but species, strike location and management significance unknown

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Significant Strike Investigations
Example 2

Procedures used

Aircraft damage examination and sampling

Molecular DNA identification

Review and analysis of:

- species distribution and habits
- occurrence report,
- flight procedures
- ambient conditions
- ambient bird hazard status
- recent ornithological surveys
- existing strike records

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Significant Strike Investigations
Example 2

Results

1. DNA ID test identified organic remains on the affected area as coming from a White Tern - a pelagic bird species of the family Sternidae.
2. The identified species had never been detected or struck in the vicinity of the arrival port.
3. The identified species is more commonly reported over the ocean in the vicinity of the departure port.
4. Ambient weather at the arrival port (e.g. the likelihood of strong onshore winds driving a marine species landward) appeared not to be a factor in this occurrence.
5. The SID procedure used on departure took the aircraft a significant distance into the preferred marine habitat of the species.
6. In the early cruise the aircraft was offshore but well outside the known vertical profile of the species.
7. The STAR procedure used on arrival took the aircraft predominantly over land.

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Significant Strike Investigations
Example 2

Conclusions

1. It was likely the aircraft was struck in flight on the day in question but it was much more likely that the aircraft was struck on departure rather than on arrival.
2. The strike was most likely a one-off occurrence involving a species uncommonly found in the airport environs.
3. The species is so infrequently reported close to land that no specific aerodrome management for this species was warranted.
4. The possibility that the species was changing its habits and distribution was considered.

    Ongoing surveys should detect any significant landward change in species distribution and management plans would be reviewed on this basis.

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Significant Strike Investigations
Example 2

Main outcomes

1. The strike was most likely well outside the duty of care or reasonable management scope of either the arrival or departure aerodrome operators.
2. No audit or amendment to wildlife management plans was warranted or recommended
3. The aircraft operator and insurer were able to reasonably confirm the cause of significant damage to the aircraft.

Cost of investigation: ~ $2500 (2007)

Cost benefits: The arrival aerodrome operator confirmed the validity of his wildlife hazard management program and avoided litigation and potentially costly RMP reviews.

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Significant Strike Investigations
Example 3

IT'S ENOUGH TO DRIVE YOU BATTY.....

A confirmed strike at a known location but species and management significance unknown

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Significant Strike Investigations
Example 3

Procedures used

1. Aircraft damage examination and sampling
2. Forensic Hair Analysis and Molecular (DNA) Analysis
3. Review and analysis
   - Crew occurrence report
   - In Flight procedures
   - Approach procedures
   - ambient conditions
   - ambient bird hazard status
   - recent surveys
   - existing strike records
4. Review of emerging diseases and disease status in local wildlife
5. Survey and analysis of regional off-airport wildlife colonies, foraging sites and movement patterns.

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Significant Strike Investigations
Example 3

RESULTS:

1. No feathers were detected.
2. Small black hairs were observed fused into in dried blood and organic remains in the bypass inlet
3. Microscopy determined that the hairs came from a Pteropid (Flying Fox) species and DNA analysis confirmed the ID as Black Flying Fox *(Pteropus alecto)*

4. DNA Analysis confirmed that all samples taken came from the one individual.

5. The ;
   a) distance and bearing of the local Flying fox camps,
   b) local foraging sites
   c) time of strike relative to last light,
   d) wind and mean estimated groundspeed of a flying fox

   were all consistent with the strike

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Significant Strike Investigations
Example 3

CONCLUSIONS

1. The aircraft was struck by a Black flying Fox. The strike most probably occurred greater than 1nm offshore at an altitude greater than 1000'.

2. There was no obvious reason why a Flying Fox would be tracking over the ocean at this position and altitude.

3. Either
    1. The reported strike position was incorrect
    2. The animal was tracking abnormally because it was sick or disorientated.
    3. Local flying foxes had established a unusual seaward foraging track to access a southern headland that supported a novel foraging resource

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Significant Strike Investigations
Example 3

FOLLOW UP:

1. Observations over subsequent weeks showed:
   a) no evidence of any flying foxes tracking seaward and likely to conflict with the established visual or instrument approaches to the runway in question.
   b) no evidence of any novel foraging resource that might attract flying foxes along a conflicting seaward track.

2. Flying foxes carry a variety of emerging diseases. Some of these can cause unusual behaviour and some are of public health significance.
   a) Survey and observations of local colonies showed no clinical evidence of epidemic.
   b) However local environmental and health authorities were notified of the possibility.
   c) Similarly the airline operator was notified of the possibility that its maintenance personnel were exposed to pathogens.

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Significant Strike Investigations
Example 3

Main outcomes

1. The strike was apparently an unlikely and one-off occurrence involving an animal displaying unusual tracking and altitude behaviour.
2. It was well outside the duty of care or reasonable management scope of the arrival aerodrome operator.
3. This observation triggered further surveys and investigations to determine:
    1. Whether there had been a change in animal movement patterns that could further compromise air safety.
    2. Whether there was a disease outbreak in regional bat colonies that may in turn compromise public health.
4. No amendment to existing aerodrome wildlife management plans was warranted or recommended

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Significant Strike Investigations
Example 3

Main outcomes (cont)

5. The aircraft operator was advised on biohazard protocols for maintenance personnel coming into contact with animal remains.
6. The aircraft operator and insurer were able to reasonably confirm the cause of significant damage/delay to the aircraft.
7. The frequency of flying fox strikes is increasing in the northern ports of Australia and new approaches are required to assess and offset the changing risk.

Cost: ~ $4500 (2007)

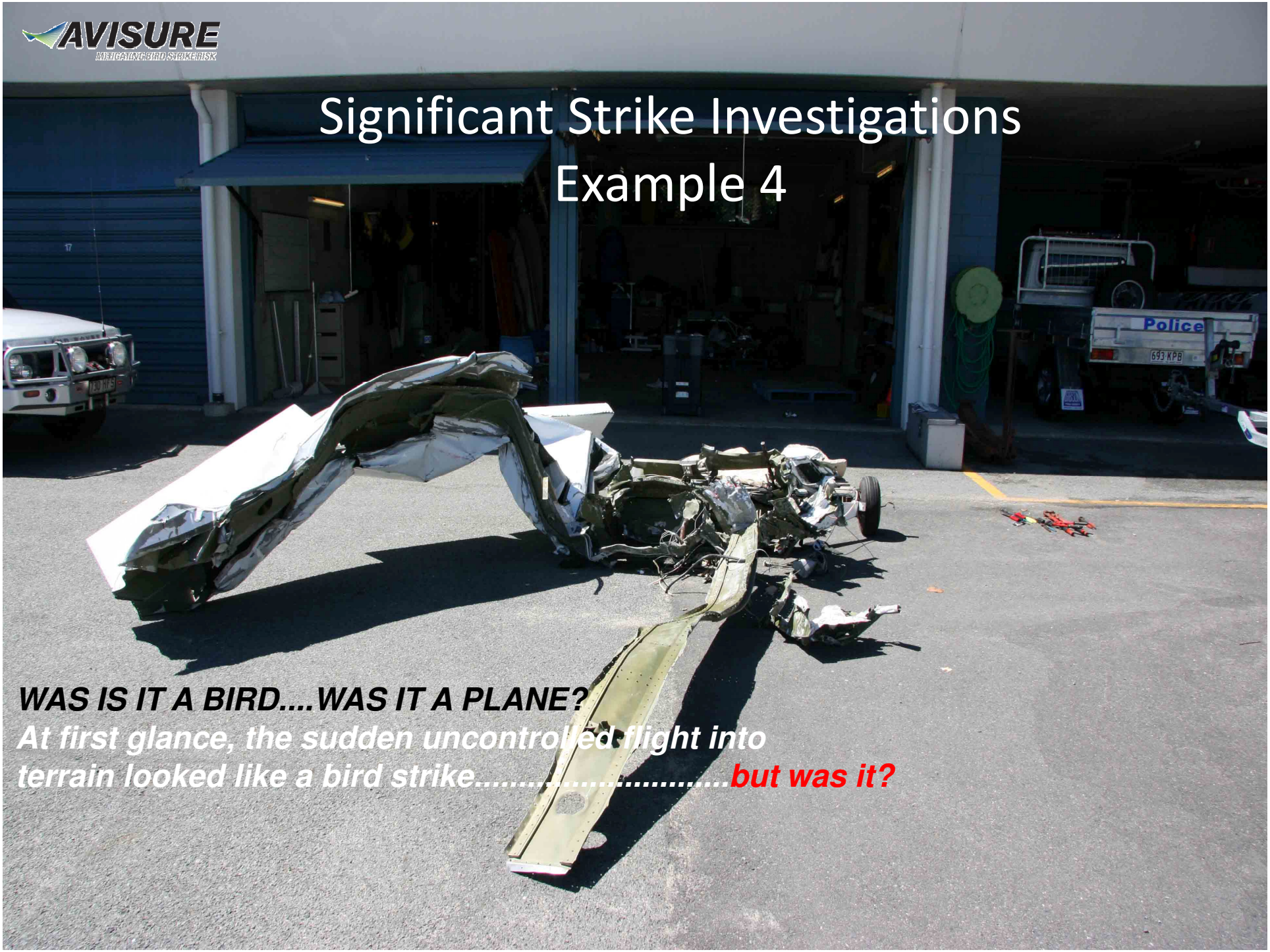
Cost benefits:

Surveys and observations failed to detect a novel seaward Flying fox foraging route. In turn this avoided any requirement to reassess established approach procedures.

The aerodrome operator confirmed the validity of his wildlife hazard management program and avoided potentially costly reviews to RMP.

Local wildlife authorities were given early warning of a possible public health risk.

Significant Strike Investigations
Example 4



WAS IS IT A BIRD....WAS IT A PLANE?

At first glance, the sudden uncontrolled flight into terrain looked like a bird strike.....but was it?

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Significant Strike Investigations
Example 4

PROCEDURES USED

Examination and sampling of:
- accident sites
- ambient conditions at the time of the occurrence.
- aircraft wreckage

Molecular DNA identification of
- organic remnants
- microscopic samples

Analysis of aircraft flight details, ATC tapes and radar records

Interviews and discussions with aircrew, maintenance staff and aircraft manufacturers.

Review of
witness statements
local, regional and national bird/animal census and movement trends

Examination and analysis of off-airport habitats, particularly local bird or animal congregations.

Extensive consultation with external bird, ecological and aviation specialists

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Significant Strike Investigations
Example 4

RESULTS

1. The aircraft crashed into the sea about 1nm offshore. Canopy fragments were found on land about 1.5nm downwind.

2. Some impact deformation on leading edges was consistent with the possibility of bird strike but could not be readily discriminated from primary collision or salvage impacts.

3. Initial canopy failure at altitude was highly likely and bird strike was initially high on the list of possibilities. *(commonest cause of in flight collision)*

4. However no animal residual organic material or microscopic DNA remnants were detected on the ejected canopy fragments

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Significant Strike Investigations
Example 4

RESULTS

5. the position and altitude of the aircraft as it entered UCFIT was inconsistent with the habitat preference of local bird species.

6. The position and altitude of the aircraft as it entered UCFIT was inconsistent with known migratory bird tracks and timings

7. No gross animal organic material or residual animal DNA was detected anywhere on the airframe.

8. There was no other evidence, witness statement, biological consideration or inference to support birds strike as a contributing factor

CONCLUSION

Although it could not be ruled out completely we concluded that bird strike was unlikely to have contributed to this accident.

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Significant Strike Investigations
Example 4

Main outcomes

The general circumstances in this case indicated that bird strike was high on the initial list of possible causes.

Partitioning the investigation to include an SSI by specialists freed the primary investigators to focus on all other aspects of the investigation and established that an obvious cause was, in this case, unlikely.

Cost: ~ $12,000 (2007- a long and complex procedure)
Cost absorbed by *AVISURE*

Cost benefits: No obvious short term cost benefits. T
The main benefit may be that the negative SSI helped clarify the accident sequence. This in turn may contribute to closure for the bereaved and to future prevention.


Offering dedicated risk management strategies and services that can be applied worldwide to mitigate and manage the incidence of bird strike, Avisure's team of experts work around the globe with airports, airlines and the military.
Risk Mitigation & Audits
Training & Education
Management Plans & Implementation
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Ornithologists
Habitat and vegetation specialists
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