Some observations from recent ATSB investigations

PACDEFF 2023

Mike Walker

Overview

- Some air transport accident statistics
- ATSB SafetyWatch
- Risk management associated with change
- Use of available technology
  - Lockhart River controlled flight into terrain (CFIT) accident (March 2020)

Fatal air transport accidents 2001–2023

	Part 121 (large aeroplanes)	Part 135 (small aeroplanes)	Part 133 (helicopters)	Total	Total fatalities
Passenger	1	18 (4)	9 (1)	28 (5)	94
Medical		2 (2)	1 (0)	3 (2)	6
Freight	1	5 (1)		6 (1)	7
Total	2	25 (7)	10 (1)	37 (8)	107

VH- registered aeroplanes and helicopters. (Positioning flights in brackets.)
Reclassified based on CASRs that commenced Dec 2021 – most not operated under those rules.
Excludes marine pilot transfer, winching, aircraft with limited CoA, training, positioning flights not done as normal operation.

Fatal air transport accidents 2001–2023

Fatal air transport accidents 2001–2023

- 8 engine power loss (7 at low level)
- 7 IFR CFIT (4 on instrument approach)
- 4 VFR into IMC
- 2 VFR into adverse weather
- 2 VFR into dark night
- 3 helicopter loss of control at low level
- 2 flight instrument failure (both at night)
- 5 miscellaneous
- 4 unknown

Why SafetyWatch?

Highlights safety issues more broadly

Prompts heightened awareness from industry and public

Helps guide ATSB decision making on investigations

Some equivalents:

- TAIC *Watchlist*
- NTSB *Most Wanted List*
- TSB of Canada *Watchlist*

SafetyWatch

ATSB SAFETY CONCERNS

Our six current SafetyWatch concerns comprise

- Improving the management of fatigue
- Reducing the collision risk around non-towered airports
- Reducing passenger injuries in commercial ballooning operations
- Improving risk management associated with change
- Encouraging the use of available technology to enhance safety
- Reducing the severity of injuries in accidents involving small aircraft

Risk management associated with change

- Lot of change needs to be managed by transport operators
- Some guidance is available for each mode of transport
- Problems feature in several high-profile investigations across all transport modes
- ATSB plans to do a safety study to consolidate learnings about common types of change management problems and good practice used by industry

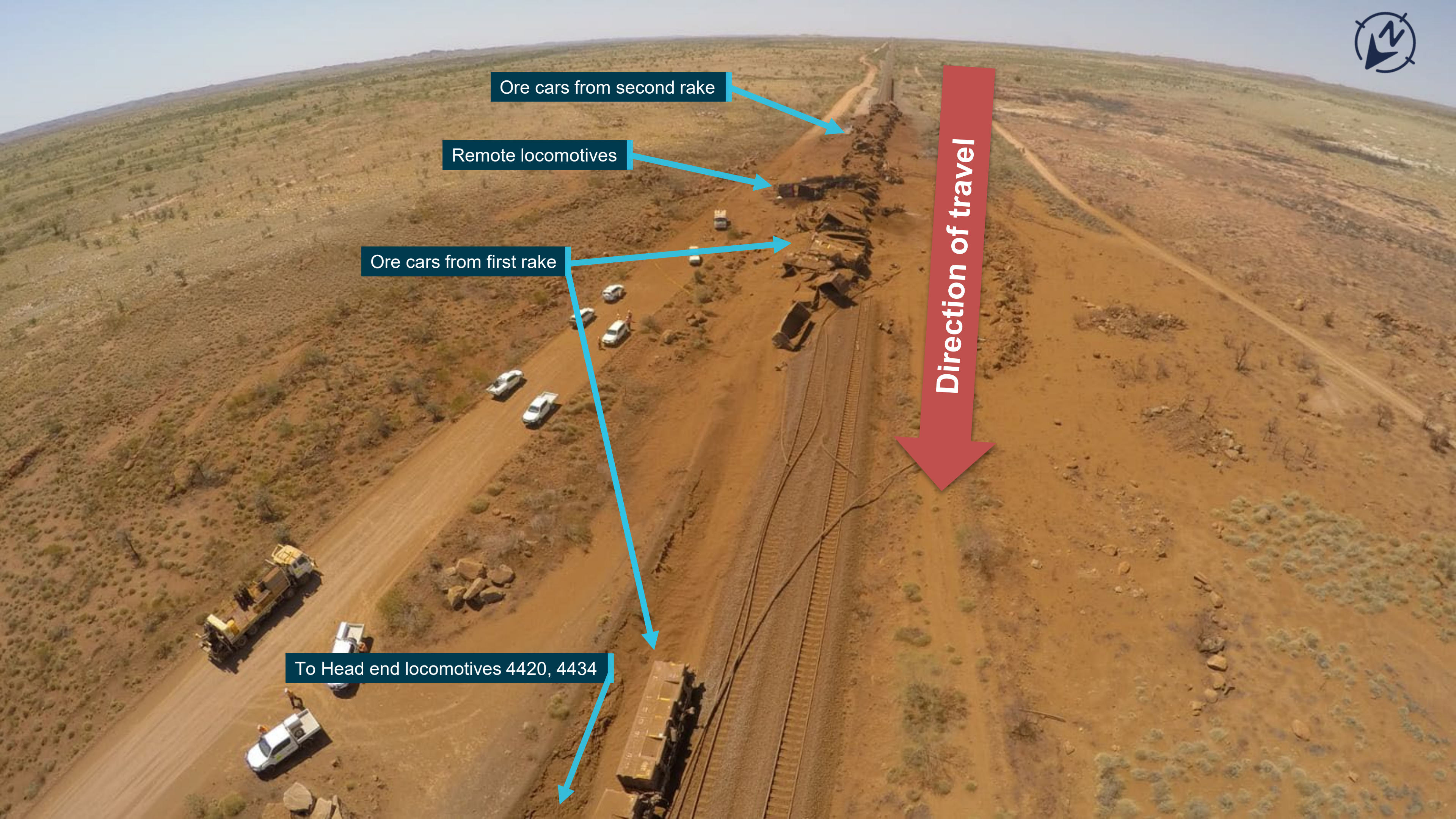
Australian Government
Australian Transport Safety Bureau

Runaway and derailment of loaded ore train M02712

Near the 211 km mark south of Port Hedland, Western Australia, on 5 November 2018

ATSB Transport Safety Report
Rail Occurrence Investigation (Systemic)
RO-2018-018
Final – 17 March 2022

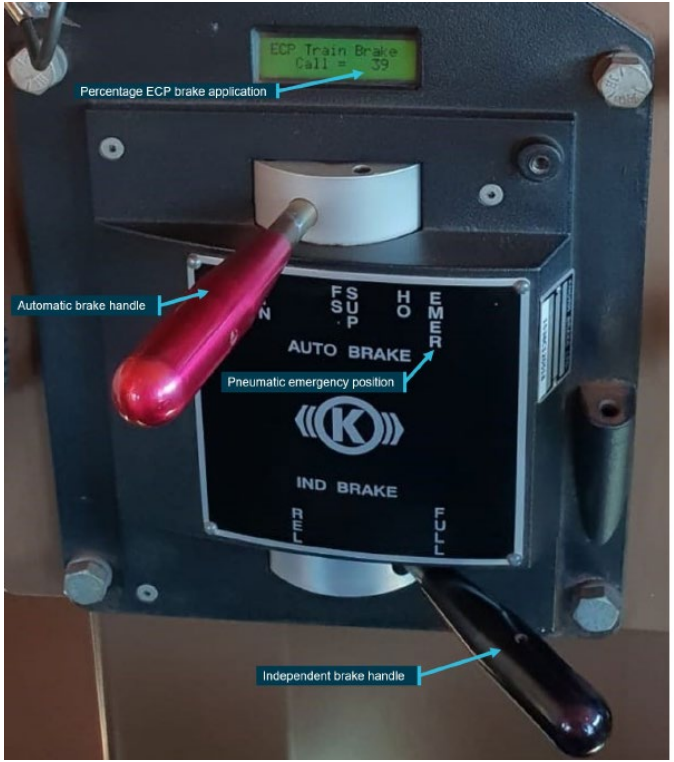
- Loaded ore train en route to Port Hedland
- Electronically controlled pneumatic braking (ECPB) overlay system
- Trainline communication lost, triggered automated ECPB emergency brake command, stopped train on a down grade
- Driver commenced applying handbrakes
- ECP brake application released after 60 minutes (as designed)
- Train rolled away with no driver, travelled 91 km at speeds up to 162 km/h
- Intentionally derailed (speed 144 km/h)
- 2 locos, 245 wagons destroyed



Ore cars from second rake
Remote locomotives
Ore cars from first rake
To Head end locomotives 4420, 4434
Direction of travel

Implementation aspects

- 2011–2015: BHP implemented ECPB and modification of ATP system
- Following a loss of trainline communication event in March 2017, identified need for additional driver action (move automatic brake handle to emergency position)
- 14 subsequent events between June 2017 and November 2018 where recovery was over 60 minutes: new safety-critical action not done on 9 occasions



Change management findings

- Implementation of ECPB overlay managed at an individual system level rather than through the application of a structured systems engineering approach.
- Risk assessment did not include the procedure for responding to brake pipe emergencies as a critical control, and risk control assessments did not test the effectiveness of this procedural control for preventing an uncommanded movement of a train.
- Although operating instructions contained the safety-critical action (apply automatic brake handle to the emergency position), the importance and reasons for the safety-critical action were not clearly communicated to drivers.

Findings abbreviated

Australian Government
Australian Transport Safety Bureau

Signal DP29 passed at danger involving suburban passenger train DW17 and near collision with another suburban passenger train

Park Road Station, Queensland, on 25 March 2019

ATSB Transport Safety Report
Rail Occurrence Investigation (Systemic)
RO-2019-009
Final – 29 March 2022

- Suburban passenger train, new generation rollingstock (NGR)
- Signal passed at danger (SPAD) at Park Road Station
- Departure signal at stop (red)
- Station staff provided ‘allright’ signal to guard
- Guard provided ‘rightaway’ signal (2 bells) to driver
- Driver departed without effectively checking departure signal indication
- Network controller made emergency call to driver, train stopped (305 m passed signal)

Implementation aspects

- At CBD stations, station staff provided guards with allright signal for all trains (informal practice to check departure signal)
- Dec 2017: NGR commenced operations (other train types still used)
  - NGR operating model placed guard at rear of train
  - guards could no longer see departure signals at some stations, new signal aspect indicators (SAIs) required
  - passengers needing assistance still in middle of train, required more involvement from station staff
- Jan 2019: station staff at suburban stations required to provide allright signal for all NGR services (but not check departure signal)
- 5 SPADs involving NGR trains at suburban platforms from March 2019 to March 2020 (and 6th in April 2021)


2
SAI illuminated
(departure signal at proceed)


2
25
50
SAI not illuminated
(departure signal at stop)

Figure 8: Location of the SAI relative to the location of the guard at Park Road platform 2

Change management findings

- Multiple processes did not effectively consider the risk of station staff at suburban platforms providing the allright signal for all NGR trains when the platform departure signal displayed a stop indication.
- Process for the installation of SAIs did not provide sufficient detail to ensure consistent and conspicuous placement of SAIs at station platforms.

Findings abbreviated

SafetyWatch
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Use of available technology

- Functionality and availability of useful technology continues to improve
- Many cases where useful available technology not used or not used effectively
- Can be due to difficulties with awareness, cost, implementation, maintenance

Some technology examples

- Aviation:
  - ADS-B transmitting, receiving and display devices
  - Carbon monoxide detectors (with active warnings)
  - Recorders for small aircraft
  - TAWS and terrain awareness systems
- Rail:
  - Automatic train protection / positive train control
  - Applicable technologies for improving track worker safety
  - Remote weather stations

Australian Government
Australian Transport Safety Bureau

Controlled flight into terrain involving Cessna 404, VH-OZO

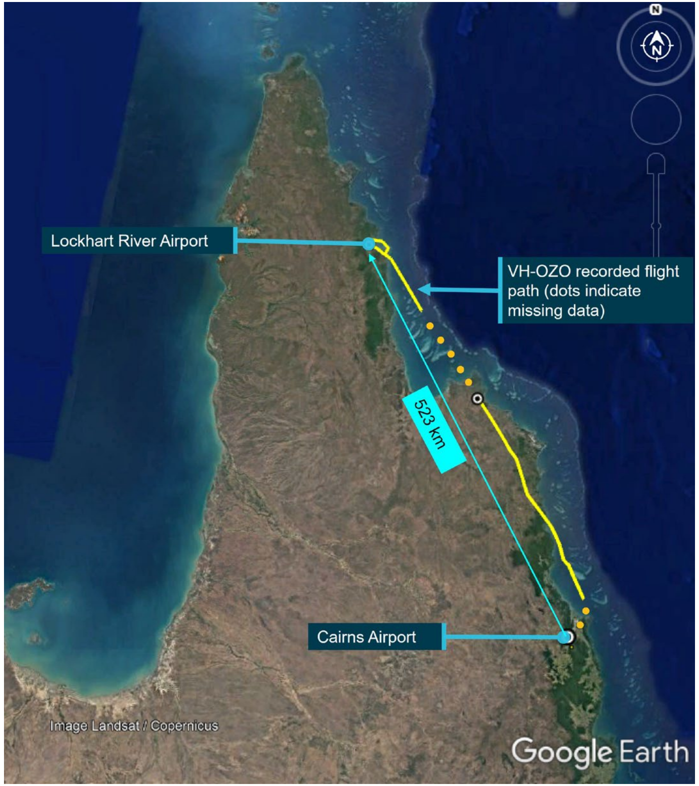
6 km south-east of Lockhart River Airport, Queensland, on 11 March 2020

ATSB Transport Safety Report
Aviation Occurrence Investigation (Systemic)
AO-2020-017
Final – 15 December 2022

- Controlled flight into terrain during RNAV GNSS instrument approach
- ATSB final report 15 Dec 2022
- Coroner findings 20 August 2023
  - accepted ATSB findings and endorsed safety messages

Background

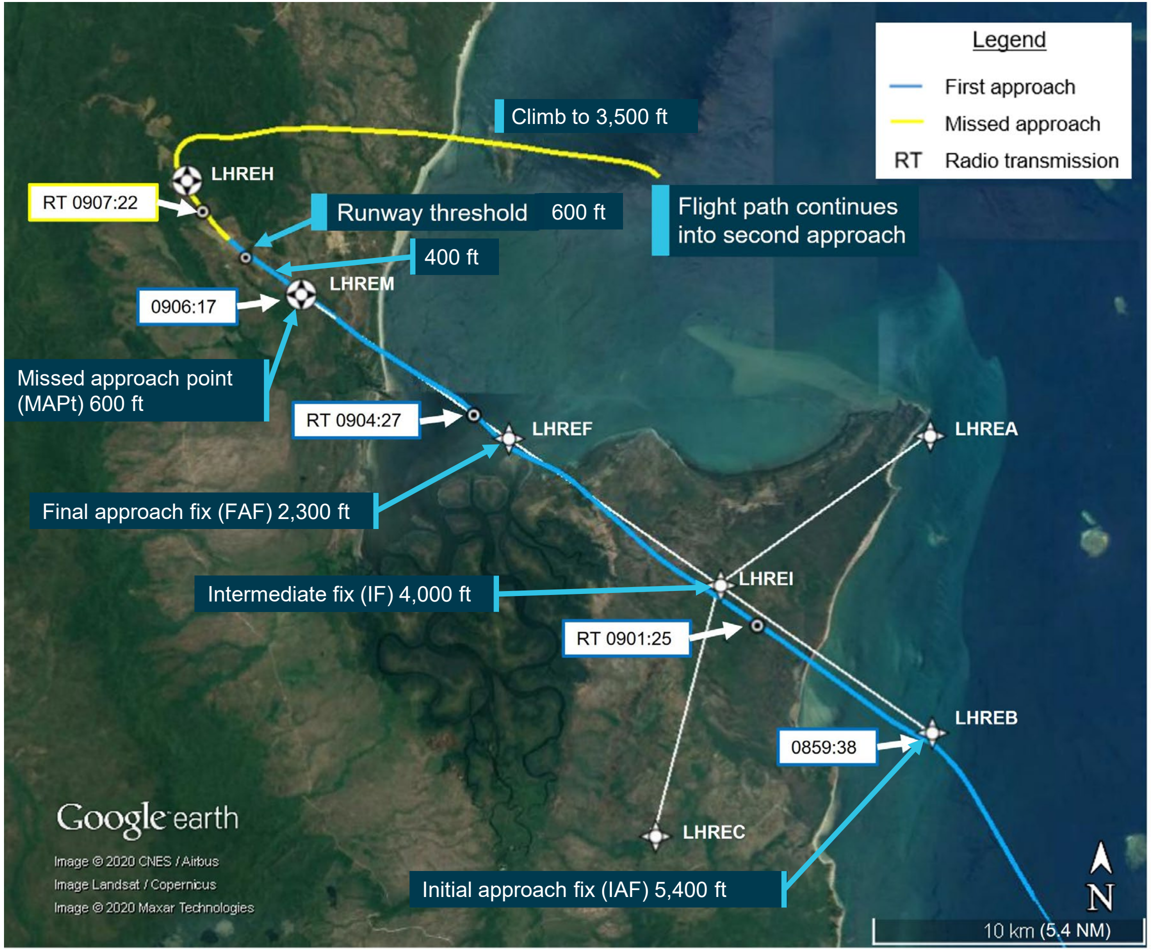
- Passenger charter flight, 11 March 2020
- Cairns to Lockhart River
- Cessna 404 Titan, VH-OZO
- Operated by Air Connect Australia
- Pilot and 4 passengers (to conduct work at local school)
- Instrument flight rules (IFR)
- Forecast indicated cloud/reduced visibility
- Fuel sufficient for holding/diversion



(ATSB AO-2020-017)

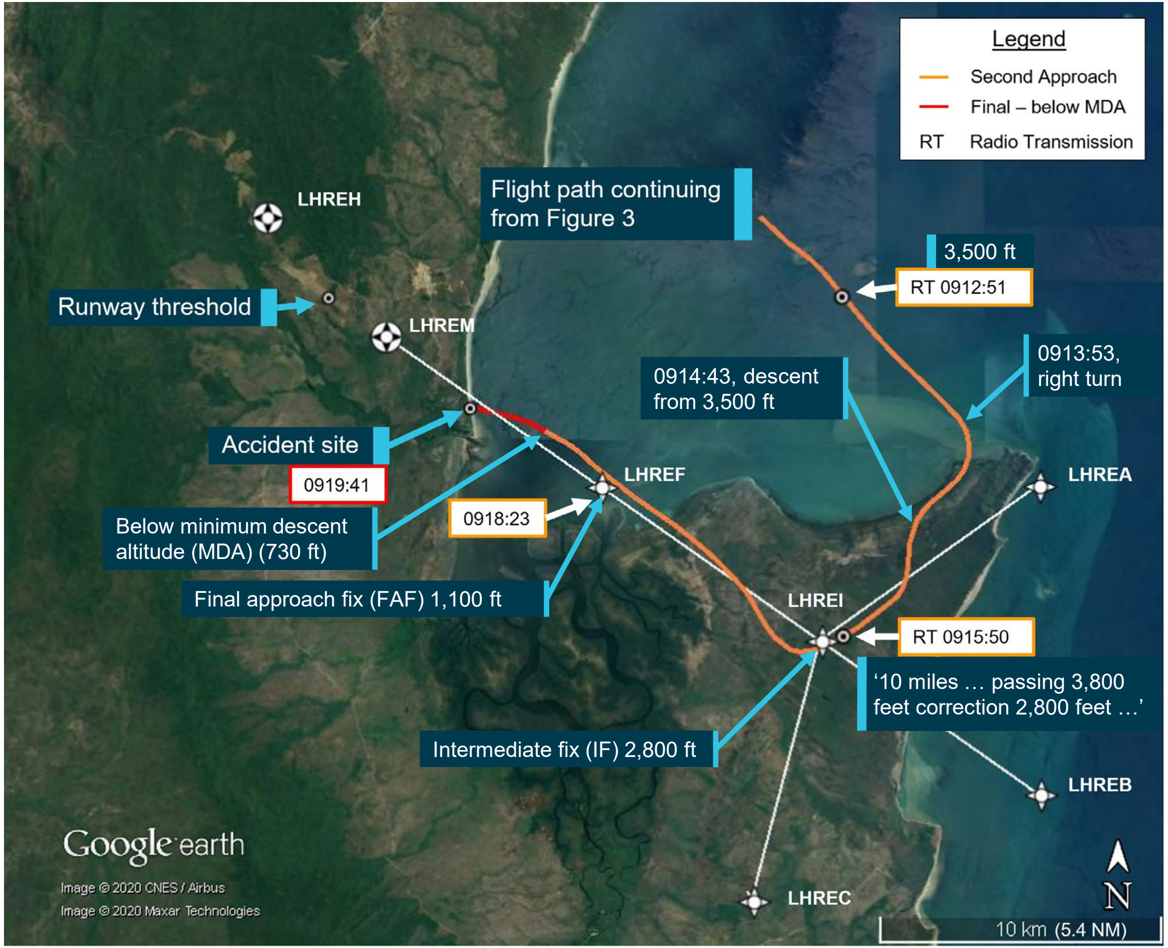
Approach 1

- First approach (RNAV GNSS to runway 30) and missed approach

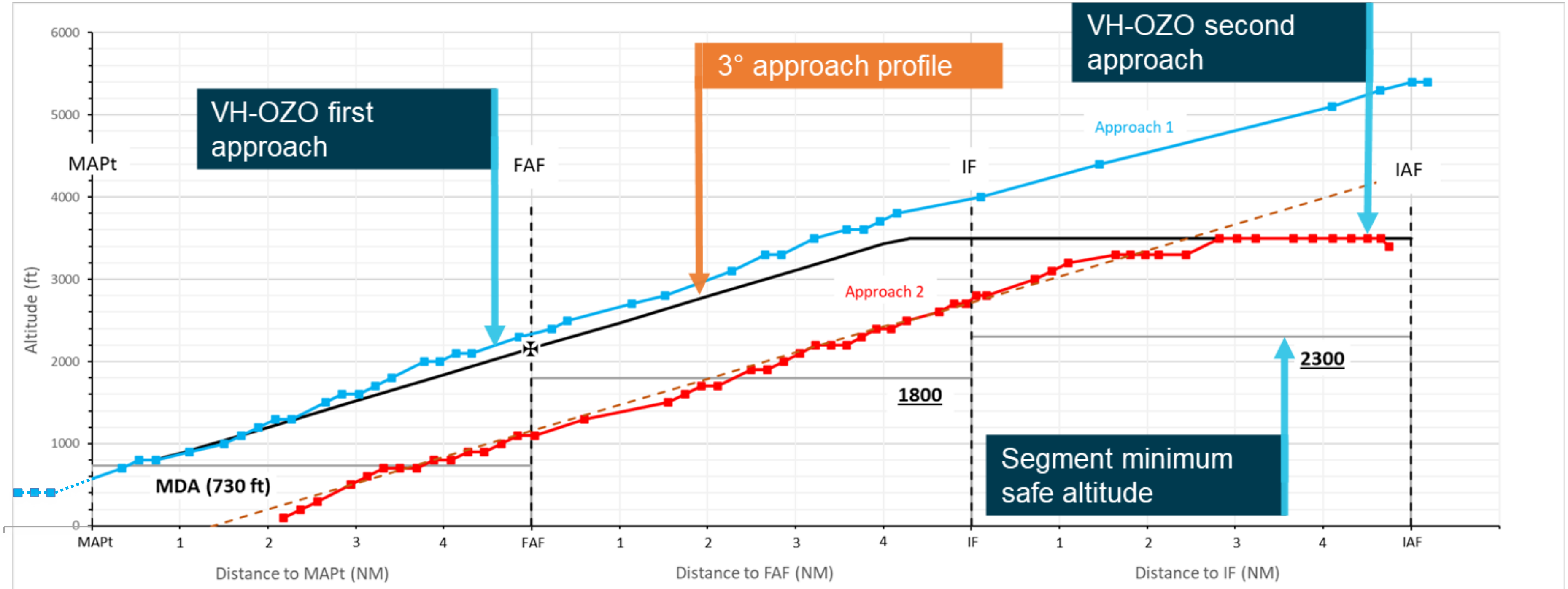


Approach 2

- Second approach and collision



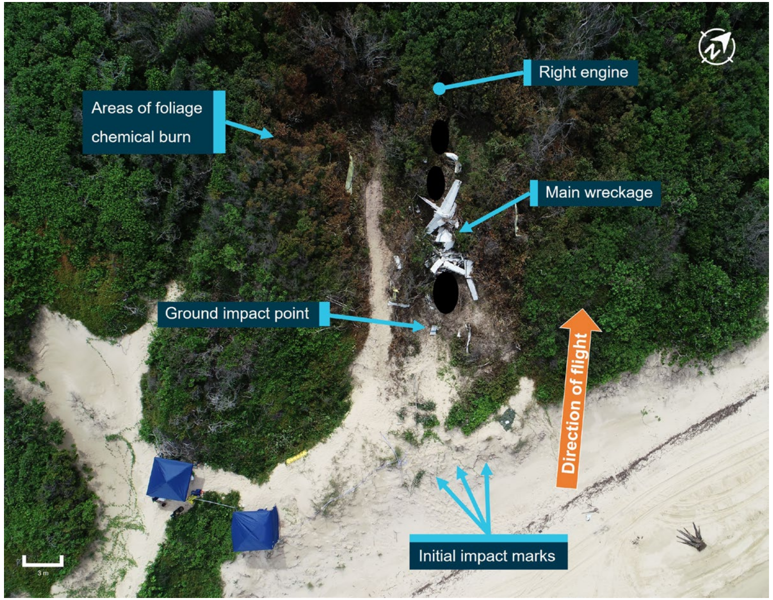
Recorded altitude



(ATSB AO-2020-017)

Accident site

- Impacted sand dune
  - 3.5 NM (6.4 km) short of runway
  - 2.1 NM (3.9 km) before MAPt
- Key points:
  - upright and wings-level
  - 5 degrees nose down
  - high speed (not survivable)
  - significant amount of fuel on board
  - engines – substantial power
  - landing gear extended



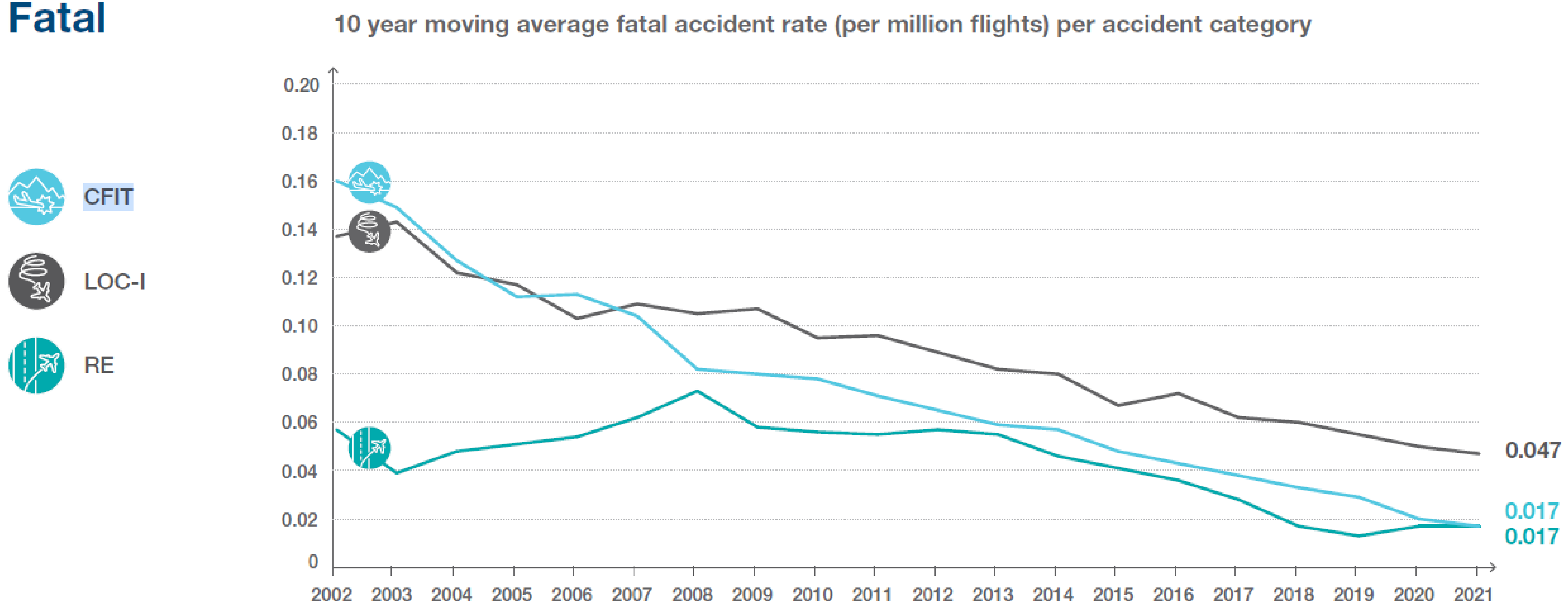
(ATSB AO-2020-017)

Controlled flight into terrain (CFIT)

- Definition: airworthy aircraft under control of pilot(s) flown unintentionally into terrain, with no or very limited prior awareness of proximity to terrain
- VH-OZO accident very likely a CFIT:
  - aircraft appeared to be in controlled flight until impact with terrain
  - no indication of medical problem or incapacitation
  - no indication of aircraft system or mechanical problem

CFIT statistics – worldwide

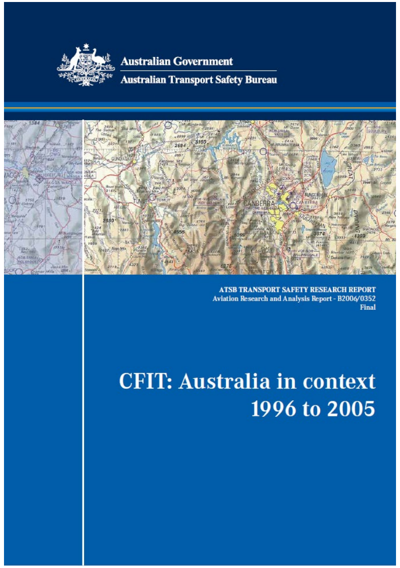
Fatal



Airbus, A Statistical Analysis of Commercial Aviation Accidents, 1958–2021 (for Western-built, commercial transport jets)

CFIT statistics - Australia

- 1996–2005:
  - 25 accidents (15 fatal accidents, 47 fatalities)
  - 9 accidents IFR during instrument approach (7 fatal accidents, 31 fatalities)
    - 6 air transport operations (5 fatal accidents), including 1 at Lockhart River (May 2005, Metro 23, conducting RNAV GNSS approach to runway 12, 15 fatalities)
- 2006–2022:
  - 1 accident IFR during instrument approach (VH-OZO in 2020, air transport, 5 fatalities)

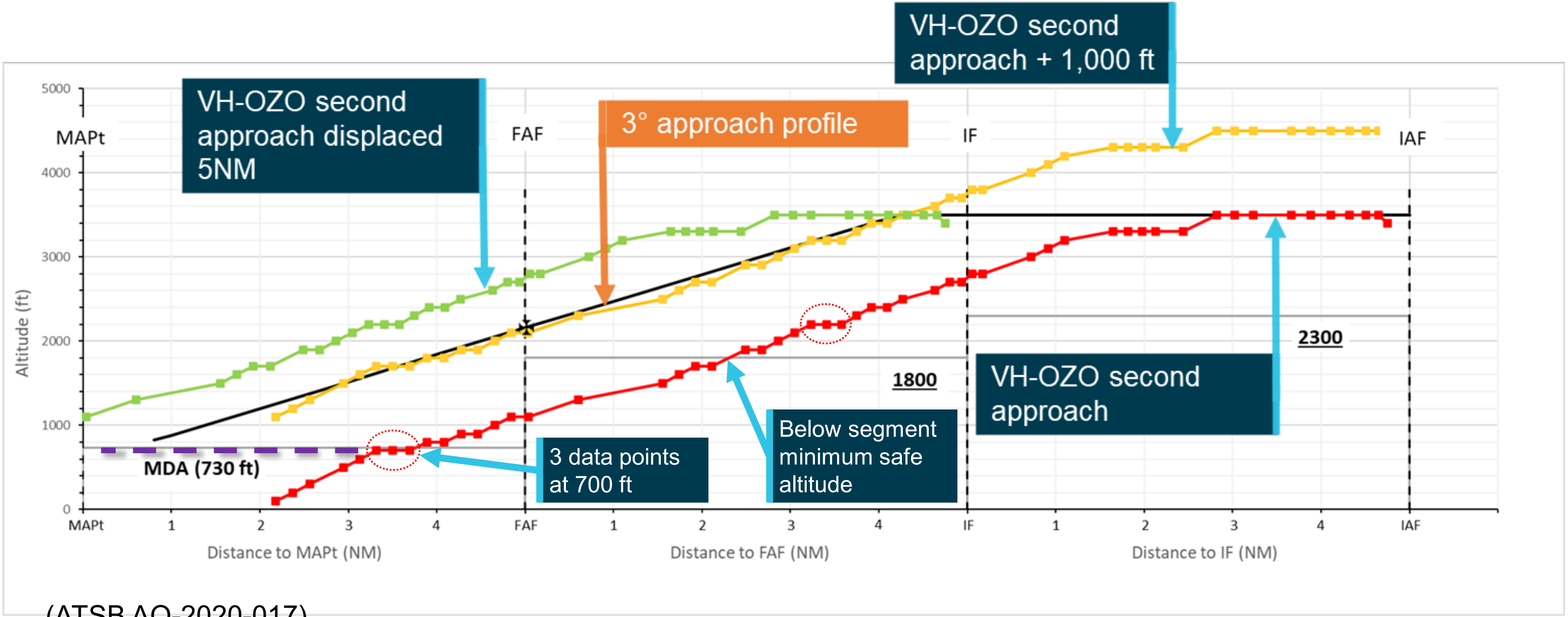


Reasons for vertical profile

- 3 main scenarios:
  - 1 – misunderstood position along the approach
  - 2 – believed aircraft was 1,000 ft higher
  - 3 – intentionally descended early to try to gain visual reference
- Most likely scenario was believing 1,000 ft higher (altimeter misreading) but insufficient evidence for a definitive conclusion
- Regardless of scenario, altitude was not being effectively monitored for extended period

(ATSB AO-2020-017)

Recorded data for second approach
Scenario 1 – misunderstood position along approach
Scenario 2 – believed 1,000 ft higher
Scenario 3 – intentionally descended early to try to gain visual reference



(ATSB AO-2020-017)

Additional information

- Pilot met qualification, recency, medical requirements:
  - 3,220 total hours, 1,177 hours multi-engine aeroplanes
  - 21 RNAV GNSS approaches in last 6 months (12 in last 90 days)
- Small operator:
  - chief pilot and the pilot of accident flight (who did almost all the flying)
  - 1 aircraft (VH-OZO, leased)
  - no evidence of any organisational or commercial pressures
- Lockhart River:
  - RNAV GNSS approaches to runway 30 and 12, NDB approach to 30
  - known to experience low cloud and reduced visibility

(For ATSB AO-2020-017)

Aircraft information

- Cessna 404 Titan
- Piston engine, certified with 9 passenger seats
- Manufactured in 1980
- Fitted with instrumentation required for IFR operations
  - conventional analogue indicators
  - 2 Garmin GNS 430W GPS/Nav/Com units
- Not fitted with a terrain awareness and warning system (TAWS)
  - not required by regulation for this type of aircraft

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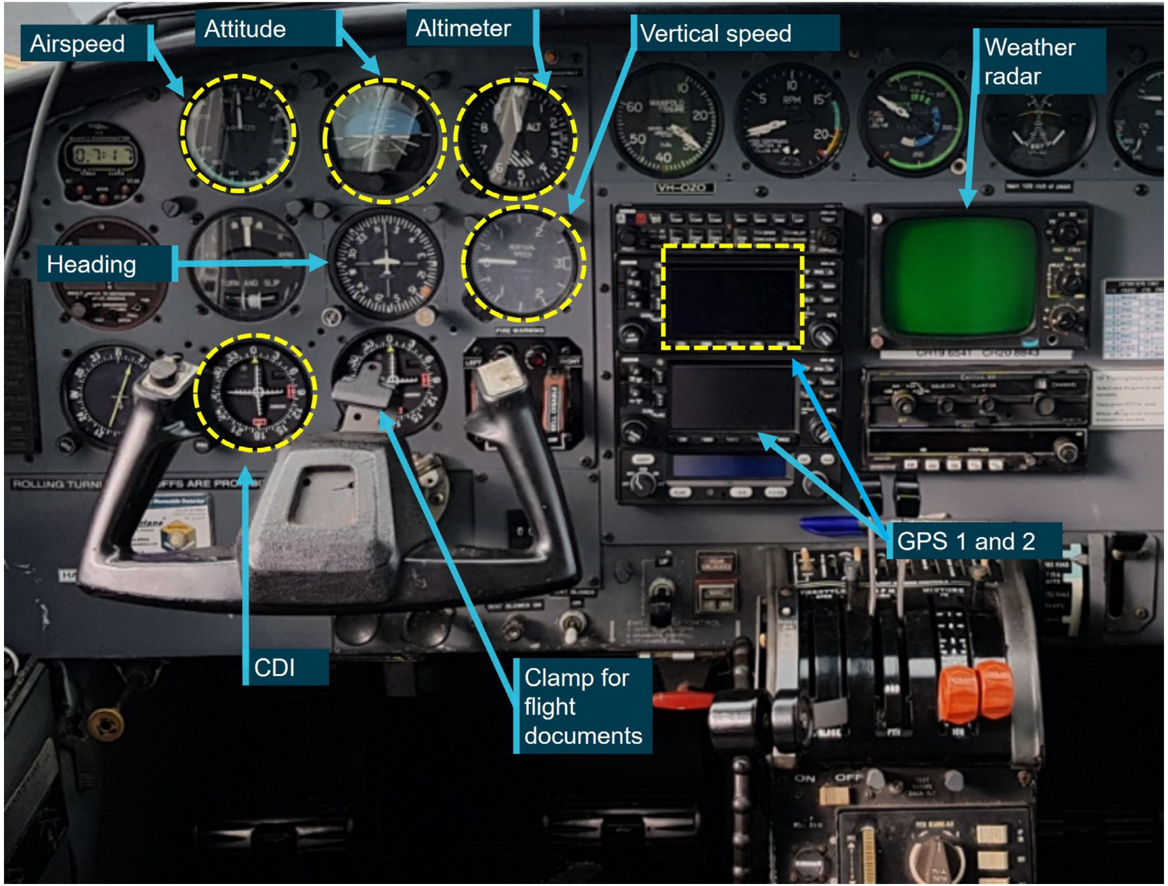
Airspeed
Attitude
Altimeter
Vertical speed
Weather radar
Heading
CDI
Clamp for flight documents
GPS 1 and 2
VH-OZO


ALT
1015

TAWS

- Provides visual and aural alerts of approaching terrain
- Forward-looking
- Class A and Class B
- Very effective in reducing CFIT risk, involves cost to fit
- Required in Australia since 2005 for turbine-engine aeroplanes
  - MTOW 15,000 kg or carrying 10 or more passengers on a regular public transport or charter flight under the IFR
  - CASA evaluating changes since 2006
  - requirements in a number of countries applied to broader range of aircraft

TAWS requirements for air transport

	Turbine-engine aeroplanes		Piston-engine aeroplanes	
	10+ seats	6–9 seats	10+ seats	6–9 seats
ICAO	Standard	Recommended	Standard	No
United States	Yes	Yes	No	No
Canada	Yes	Yes	Yes	Yes
Europe	Yes	Yes (CoA 2019+)	Yes	No
New Zealand	Yes	Yes	Yes	No
Australia 2005	Yes (carrying 10+)	No	No	No
Australia 2021*	Yes	No	Yes	No

* New CASRs commenced December 2021, transition arrangements

GNS 430W unit

- Common unit in small aircraft
- Provides GPS navigation and other functions
- Various NAV pages

Simulations of NAV default page (top) and map page (bottom) prior to reaching LHREA

(Developed by ATSB using Garmin tool)

GNS 430W terrain awareness system

- Not equivalent to a TAWS
- Supplemental awareness only
- Advisory info on terrain page
- Visual 'pop-up' alerts
  - premature descent
  - forward-looking terrain avoidance
- No aural alerts or altitude callouts
- Alerting function can be inhibited
- Alerting function is often inhibited

Simulation of NAV terrain page

Premature descent alert

Some recent US CFIT accidents

- Several fatal CFITs with TAWS inhibited during normal operations (mainly VFR flights at low height, Alaska)
  - Class B TAWS terrain clearance 700 ft en route, 500 ft descent
  - see NTSB AAR-17/02, AAR-18/02
- NTSB issued recommendations to FAA to mitigate the risks of nuisance alerts on TAWS in such operations
- FAA issued information for operators (InFO 20023) in March 2023 to inform about the risks associated with distraction and complacency brought about by routine use of the TAWS terrain inhibit feature and importance of procedures for use

Contributing factors (abbreviated)

- Reduced visibility
- Aircraft kept descending below recommended profile
- Pilot did not effectively monitor altitude for extended period
- Aircraft exceeded lateral tracking tolerance, no missed approach
- Pilot experiencing very high workload
- Aircraft not fitted with a TAWS
- Aircraft not fitted with system that provided vertical guidance information
- Limitations in operator’s risk controls

(ATSB AO-2020-017)

Limitations in operator’s risk controls

- Although the operator had specified a flight profile for a straight-in approaches and stabilised approach criteria in its operations manual, and encouraged the use of stabilised approaches, there were limitations with the design of these procedures.
- In addition, there were limitations with other risk controls for minimising the risk of CFIT, including
  - no procedures or guidance for the use of the terrain awareness function on the aircraft’s GNS 430W GPS units
  - limited monitoring of the conduct of line operations.

(ATSB AO-2020-017)

Stabilised approach criteria

- Widespread recommendations for aircraft to be stable on approach
  - flight path, speed, configuration, checklists
  - 1,000 ft in instrument meteorological conditions (IMC)
  - 500 ft in visual meteorological conditions (VMC)
  - introduced for larger air transport aircraft but broadly applicable to all operations
- Operator had stabilised approach criteria in its operations manual, but applicable height was 300 ft (IMC and VMC)
  - some other operators had similar guidance

(ATSB AO-2020-017)

Safety issues

- Limitations in operator's risk controls
- TAWS requirements in Australia not consistent with ICAO standards and recommended practices and less than comparable countries
- CASA had not provided formal guidance regarding content of stabilised approach criteria

(ATSB AO-2020-017)

ATSB safety message

- Install a TAWS (even if not required)
- If TAWS not viable, develop procedures and guidance for terrain awareness functions on existing equipment
- Upgrade GPS/nav system to one that provides vertical guidance
- Develop / review flight profiles with clear guidance for configurations and speeds at key points on approach
- Develop / review stabilised approach criteria to ensure application heights are suitable
- Review frequency / content of flight crew proficiency checks (and consider options for obtaining and reviewing recorded flight data for normal operations)

(ATSB AO-2020-017)

Closing observations

- We need to help safety-critical personnel do their tasks
- Some ways of doing this:
  - maximise the use of useful available technology
  - understand the current risk controls and context before making changes
  - consider human factors aspects when making changes
  - ensure new or changed risk controls are working effectively

For question, email michael.walker@atsb.gov.au.