Australian Government
Australian Transport Safety Bureau

Common Human Factors issues in recent incidents

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HF issues

Recent investigations have highlighted various HF areas

- Data entry error
- Monitoring
- Fatigue
- Expectancy
- Situation awareness
- Decision making
- Communication

B777 Melbourne, VIC

AO-2013-130: VH-VPF 15 August 2013

- Crew conducting an LIZZI 7V STAR with visual final segment to runway 34
- Descent below the approach path after waypoint SHEED to a height of about 500 ft AGL
- The descent was due to a data entry error:
  - had entered the threshold crossing altitude of 380 ft
  - instead of the required value of 1,270 ft.

What happened

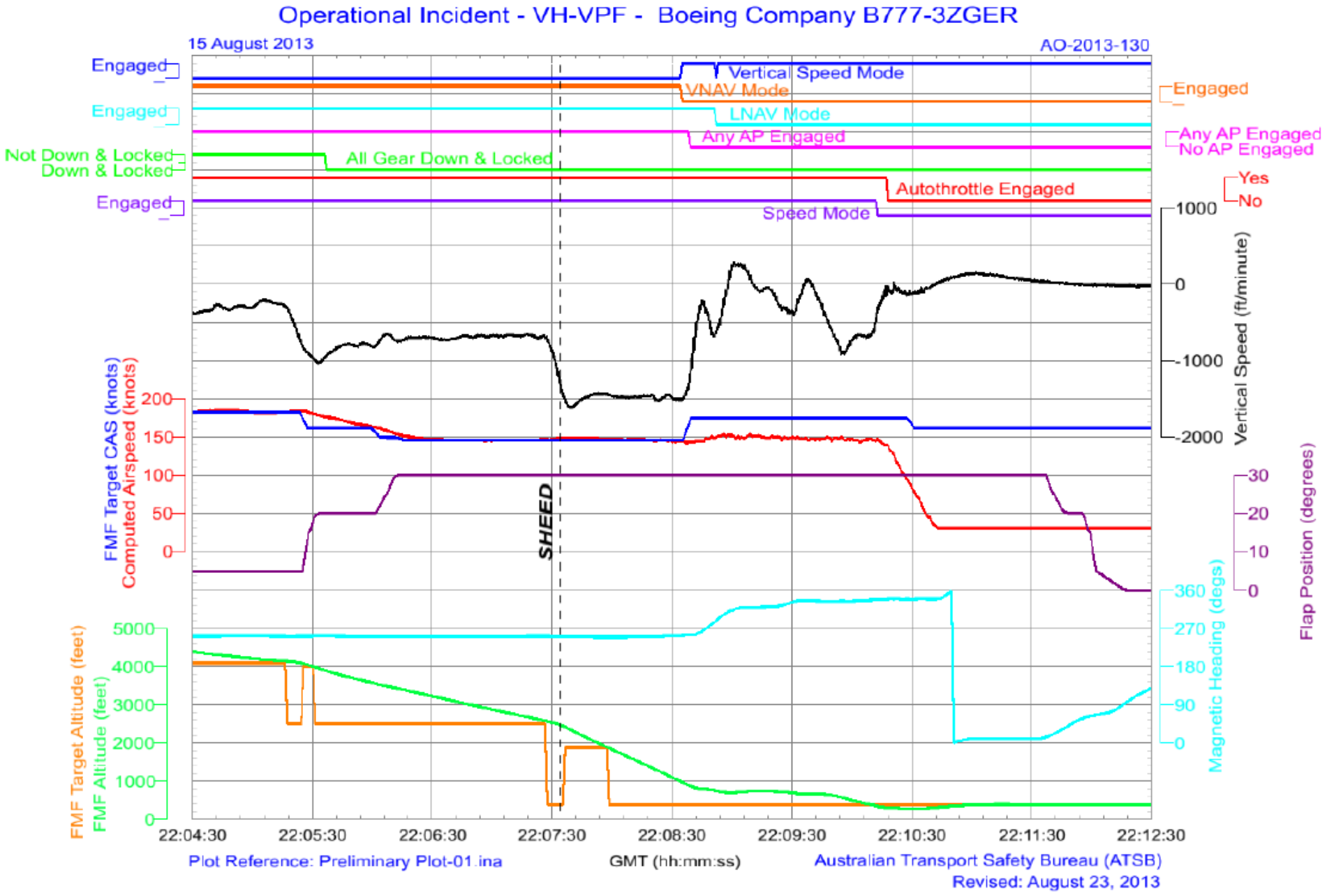
- Prior to commencing descent, while still in the cruise, the captain elected to conduct the STAR visual approach onto runway 34 and loaded the FMS accordingly
- FO was in the rest bunk
- Cruise relief FO reviewed but did not ‘verify’ the FMS figures
- On return to the flight deck, the FO reviewed the FMS and verified the approach, however the error remained undetected.

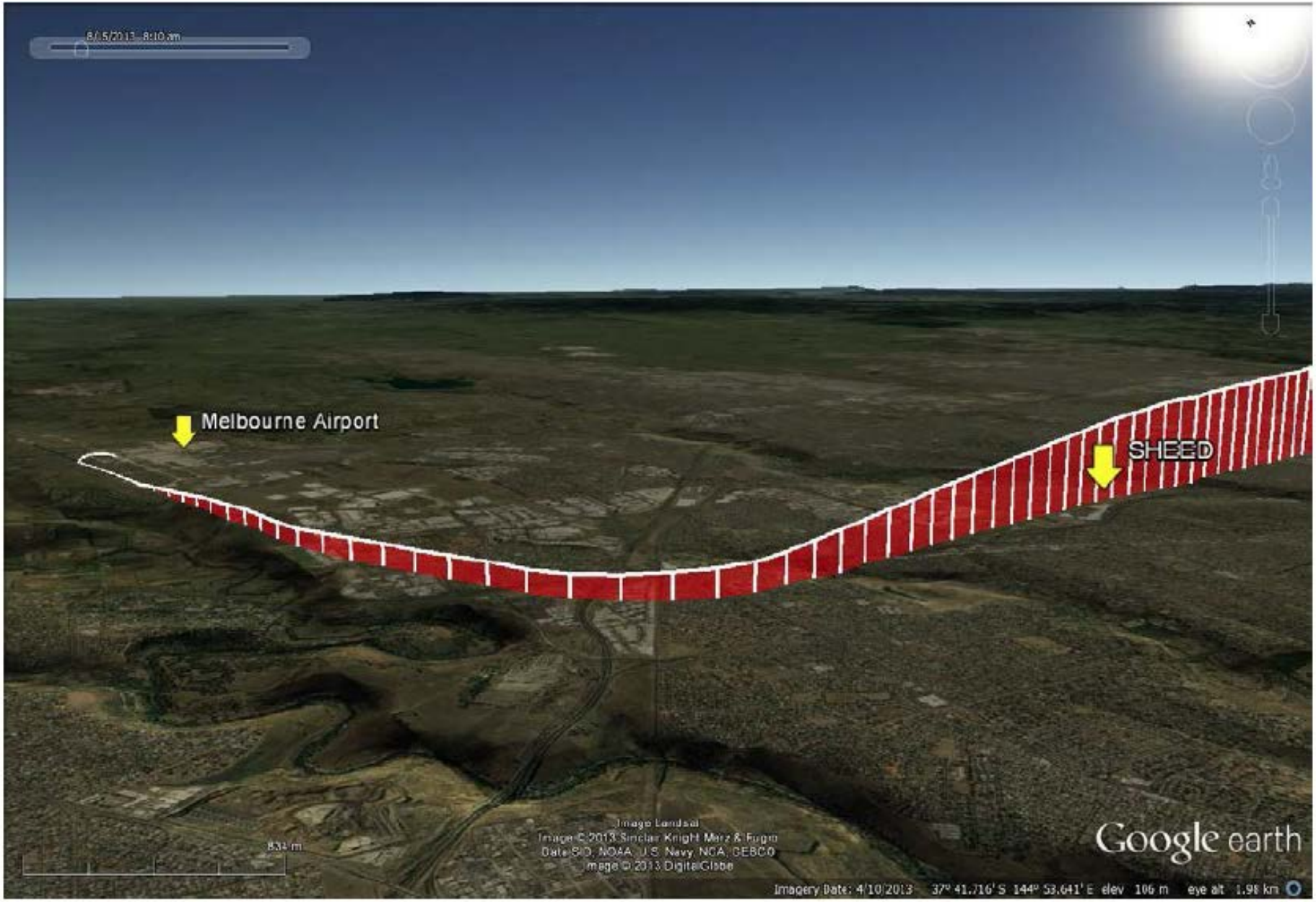
What happened

- During the approach onto runway 34, as they passed overhead the SHEED waypoint, the aircraft commenced a descent to reach the height for the extended runway waypoint
- FO immediately identified the descent rate as higher than normal. Captain was expecting an initial high descent rate so they continued
- Noting the captain was ‘eyes in’ the FO turned their attention outside and noted the aircraft was too low against approach path indicator (PAPI)

What happened

- The captain then engaged vertical speed mode to reduce the descent rate before disconnecting the autopilot and levelling at about 500 ft AGL
- The aircraft was flown level to re-intercept the approach path and landed normally.


Operational Incident - VH-VPF - Boeing Company B777-3ZGER
15 August 2013
AO-2013-130
Engaged
Vertical Speed Mode
VNAV Mode
Engaged
LNAV Mode
Any AP Engaged
Not Down & Locked
Down & Locked
All Gear Down & Locked
Autothrottle Engaged
Engaged
Speed Mode
Engaged
Any AP Engaged
No AP Engaged
Yes
No
1000
0
-1000
-2000
Vertical Speed (ft/minute)
FMF Target CAS (knots)
Computed Airspeed (knots)
200
150
100
50
0
SHEED
30
20
10
0
Flap Position (degrees)
FMF Target Altitude (feet)
FMF Altitude (feet)
5000
4000
3000
2000
1000
0
360
270
180
90
0
Magnetic Heading (degs)
22:04:30
22:05:30
22:06:30
22:07:30
22:08:30
22:09:30
22:10:30
22:11:30
22:12:30
Plot Reference: Preliminary Plot-01.ina
GMT (hh:mm:ss)
Australian Transport Safety Bureau (ATSB)
Revised: August 23, 2013


Melbourne Airport
SHEED
Image Landsat
Image © 2013 Sinclair Knight Merz & Fugro
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2013 DigitalGlobe
Google earth
Imagery Date: 4/10/2013 37° 41.716' S 144° 53.641' E elev 106 m eye alt 1.98 km

Why?

- The captain made an error (slip) when setting up the approach and assigned the threshold crossing height as the runway extension altitude.
- In addition, the relief cruise FO had cross-checked the data but not validated it
- This may have influenced the operational crew's check in that they were aware it has been 'checked' once.

Why?

- The FO had just returned from a rest break and was not expecting to conduct a visual approach
- The similarity of waypoints RW34 and RX34 increased the likelihood that crew could misinterpret one waypoint for the other.
- The ATSB found the flight crew were probably experiencing a level of fatigue known to affect performance

Other factors

- The operator's Route and Airport Information Manual contained guidance on performing a visual approach via SHEED.
- Presentation of relevant information: broken over a number of lines - it could be misread
- This possible association of '380' ft and RX34 was not the intention of the guidance or crew
- However, in contrast to a briefing paper which tabulated the information, it did increase the risk of an error.

Research – error detection

- Research during line operations by Thomas, Petrilli and Dawson (2004) found that ‘less than half the errors committed by crew were actually detected’
- We know that if something (whether it is an error or not) is detected by a crewmember as unusual, it becomes harder for them to spot any other issues and often crew will find one error but not another.

Research - fatigue

- Fatigue can adversely influence reaction time, efficiency, motivation and increase variability in performance, lapses or errors of omission (Battelle Memorial Institute, 1998)
- Research indicates that less than 6 hours sleep in the previous 24 hours can increase fatigue risk (Thomas and Ferguson, 2010; Williamson et al 2011)

A330 Melbourne, VIC

AO-2013-047: A330 VH-EBV, 8 March 2013

- Crew conducting a LIZZI 6A STAR for runway 16
- Captain entered a low target altitude into FCU while the auto-flight system was in open descent
- Resulted in a deviation below the normal approach profile and descent below the control step
- During the late stage of this descent, a ground proximity warning occurred

What happened

- Crew planned and commenced the approach in managed mode
- During the descent, switched to open descent mode to facilitate an increased descent rate in response to track shortening and high speed descent clearance
- Despite being offered further track shortening, the crew declined.
- ATC then asked for the crew to hold a higher speed during approach
- Crew responded that they would attempt to meet this.

What happened

- During the descent, the captain set 1,000 ft in the FCU
- At that stage, the aircraft was about 1,800 ft below the nominal 3° descent profile
- About 1 minute later, the FO told the captain they were ‘too low’
- Captain then selected vertical speed mode and reduced the descent rate. Eight seconds later the first EGPWS ‘terrain’ alert activated.

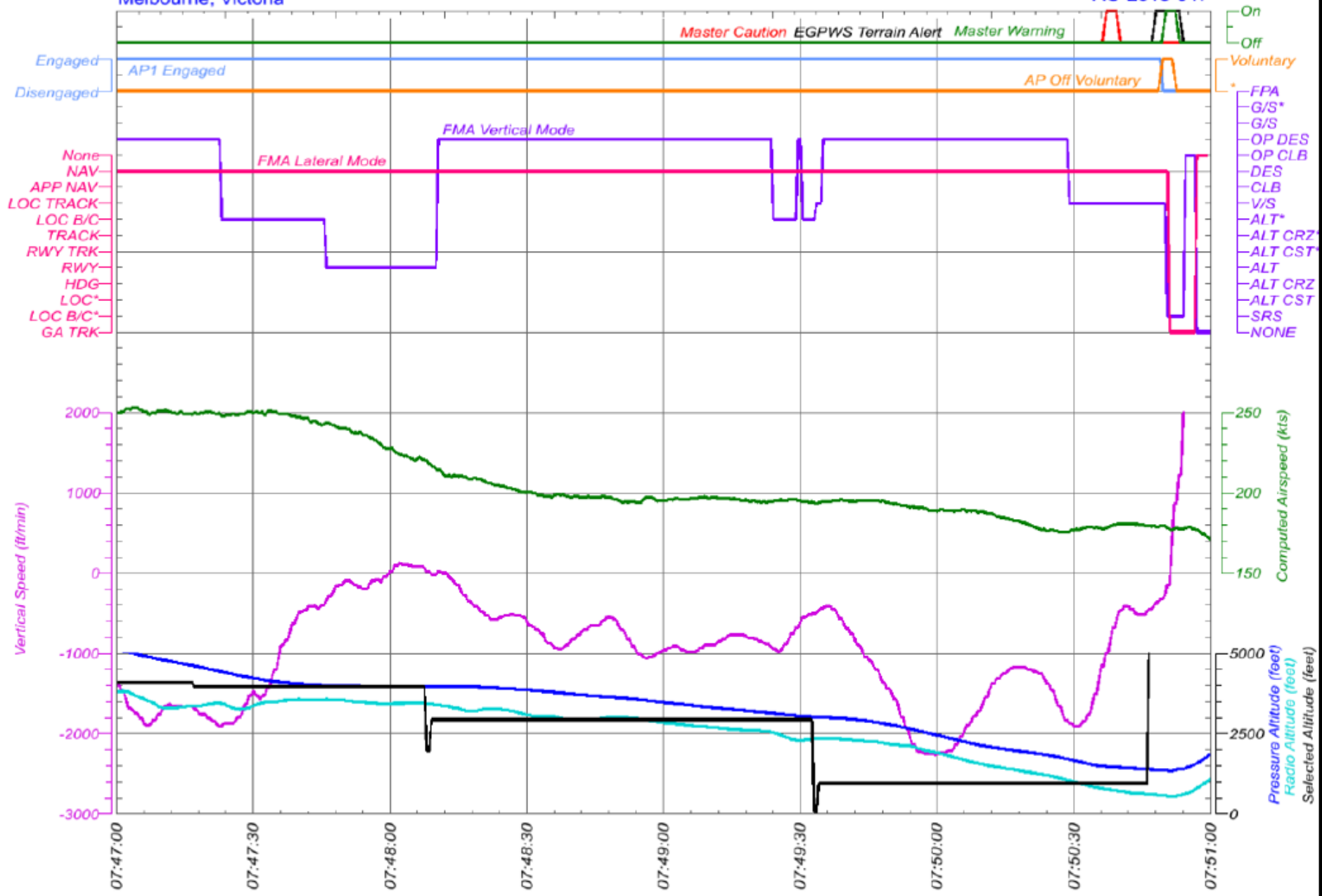
What happened

- The second ‘terrain’ warning, and a ‘PULL UP’ warning activated
- Despite the day visual conditions, the captain conducted the full EGPWS recovery manoeuvre and levelled off at 4,000 ft.
- ATC vectored the aircraft for a ILS and this approach and landing were normal.

VH-EBV Airbus A330 GPWS Warning

08 March 2013
Melbourne, Victoria

AO-2013-047



Plot 1_EGPWS Warning

UTC (hh:mm:ss)

Australian Transport Safety Bureau

Why?

- During the approach, the captain became focused upon the spurious ILS indications showing the aircraft was high, which matched their expectation
- FO communicated the position of the aircraft as ‘low’ just prior to the EGPWS ‘terrain’ alert – too late to prevent the subsequent warnings
- FO was not aware the captain had set ‘1,000’ in the FCU and the captain did not appear to call this selection.

Why?

- Captain had disrupted sleep the night before
- Captain had not eaten breakfast or lunch (but had snacked just prior to the arrival into Melbourne)
- Captain reported a developing sore throat throughout the flight and subsequent cold/illness
- While the duty pattern had required time zone changes, the FO was adequately rested and fit for duty.

Why?

- The flight crew's situation awareness was degraded during the approach, leading to an undetected flight path deviation for most of the descent.
- The operator provided limited guidance on conducting visual approaches, which was not conducive to the crew having a shared mental model

Research – nutrition

- Research has provided inconsistent results regarding the effects of missed meals on performance
- Barshi and Feldman (2012) have recently concluded that low blood sugar due to a lack of food has a range of effects on cognitive performance, and the effects are often significantly underestimated (see also Feldman and Barshi 2007)
- It is also widely accepted that regular nutrition is an important fatigue countermeasure.

Research - monitoring

- Research into flight path monitoring has shown that often crew do not detect that the aircraft has deviated from the desired flight path but deviations are rare and often have no consequence (Dismukes & Berman, 2010)
- The UK CAA (2013) provides guidance on development of pilot monitoring skills:
  - importance of ‘a structured and interactive briefing’
  - ‘brief the plan for energy management with altitudes and minimum approach gates’

ATR72 Moranbah, QLD

AO-2013-085: ATR72 VH-FVR, 15 May 2013

- Crew conducting a visual approach for runway 16
- Captain initiated a descent during the approach from circuit height of 1,500 ft AGL to avoid cloud, levelling off at about 440 ft AGL
- Toward the end of the descent, and during the subsequent climb and approach, a number of terrain awareness warning system alerts occurred.

What happened

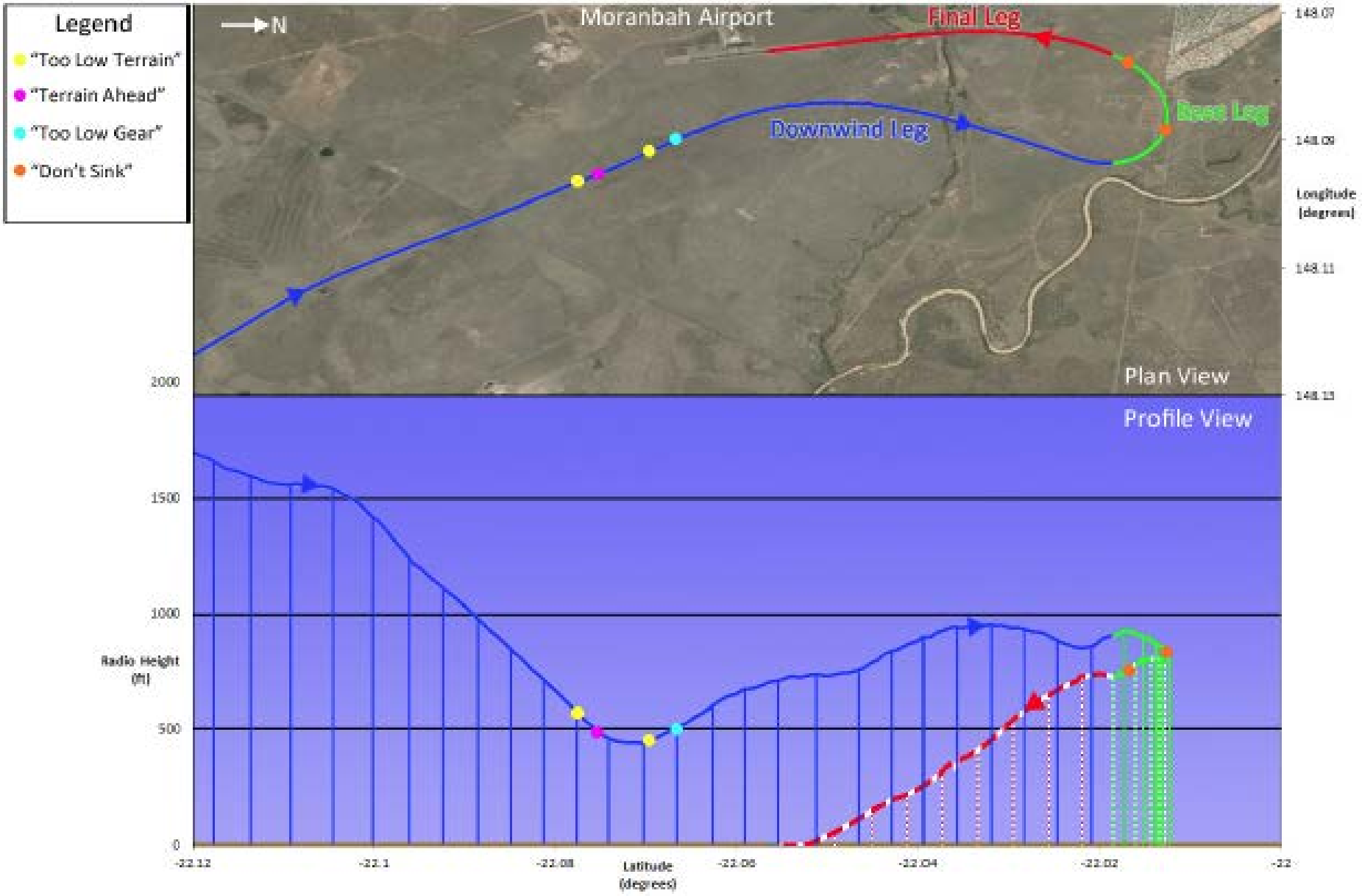
- The crew planned to conduct the NDB approach, they were not approved for RNAV GNSS
- The sequencing/arrival plan changed, and as a result, the crew switched to a visual approach
- During the approach, while entering the circuit area, the captain realised they would need to manoeuvre around cloud on downwind
- The captain initiated and called the descent without informing the FO of a limit or discussing the action.

What happened

- During the descent, the aircraft's vertical speed increased and the first TAWS alert 'Too low Terrain' activated passing 560 ft AGL
- Another 3 TAWS alerts activated within 12 seconds of the aircraft being levelled at 440 ft AGL
- The crew reported the base of the cloud was at about 500 ft AGL
- the captain had commenced levelling the aircraft just prior to the TAWS alerts.

What happened

- The crew elected to continue, and climbed the aircraft to 1,500 ft, which was about 870 ft AGL while configuring for landing
- Another TAWS alert activated ‘Don’t sink’ during the turn onto base. This was considered spurious as the aircraft was not descending at that time
- The crew reported being stabilised by 500 ft AGL and a normal landing was conducted


Legend
"Too Low Terrain"
"Terrain Ahead"
"Too Low Gear"
"Don't Sink"
N
Moranbah Airport
Final Leg
Base Leg
Downwind Leg
Plan View
Profile View
148.07
148.09
148.11
148.13
Longitude (degrees)
2000
1500
1000
500
0
Radio Height (ft)
-22.12
-22.1
-22.08
-22.06
-22.04
-22.02
-22
Latitude (degrees)

Why?

- During the start of the cloud avoidance descent, the FO was concentrating on completing necessary tasks and was not expecting a descent at that time
- The captain decided to descend and conducted this action while announcing it to the FO. This was without first discussing it or nominating any descent limits
- The FO later reported:
  - understood what the captain was doing
  - did not need to call the high descent rate once identified as this would exacerbate the captain's workload

Why?

- Both crew felt the cloud base would be able 300-400 ft below circuit height
- Lack of discussion about the descent (as opposed to tracking around the cloud or reverting to an NDB approach) negated any opportunity for the crew to recognise the descent rate was higher than anticipated
- During the descent, the captain was focused on avoiding the cloud, and FO was completing tasks
- Subsequently, the descent rate went unnoticed.

Why?

- While the operator had decision making and communication guidance in place, this was contingent upon there being enough time to implement it
- The operator also had guidance on dealing with deviations from the SOP
  - however in this case both crew felt they could descend below 1,500 ft as that SOP was not mandatory as AIP allowed descent due ‘stress of weather’
- This misunderstanding about the circuit height SOP removed a trigger for the crew to conduct a go-around instead of descending.

Conclusions

- Many of these issues are exacerbating factors for other errors and actions
- Fatigue in particular is often hard to prove as contributory as generally there are other human performance issues which can equally ‘explain’ the event
- However fatigue is often a ‘local condition’ and will influence crew performance without being contributory.

Conclusions

- The issue of nutrition and it's influence on performance needs further research but may be another influencing factor on performance
- Factors such as expectancy, situation awareness, mental models and workload continue to influence incidents and accidents
- Incidents involving data entry errors, monitoring, decision making and communication issues continue to occur.

Conclusions

- There has been much guidance published recently on enhancing monitoring skills
- Recognition of how performance can be affected by various human factors needs to be incorporated into any training or procedural ‘fix’
- Good communication is important for shared mental model and good situation awareness, as well as effective monitoring.

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Thank you

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