Australian Government
Australian Transport Safety Bureau

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VFR into dark night: Challenges in-flight and on-site

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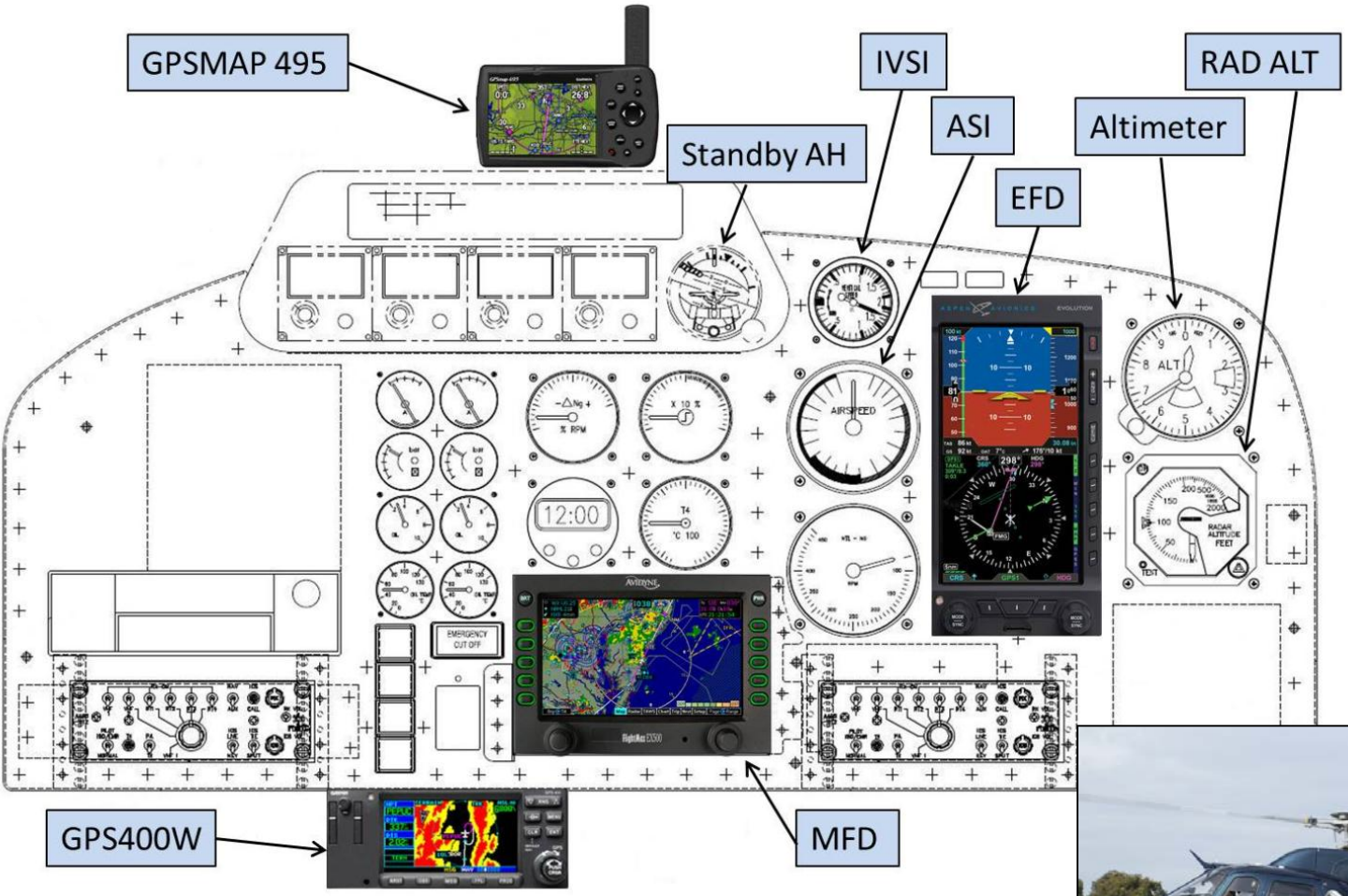
Australian Transport Safety Bureau

Topics

- Overview of the helicopter accident
- Key questions / scenarios
- Process
  - simulations
  - review of related accidents
  - spatial orientation modelling
  - human factors research

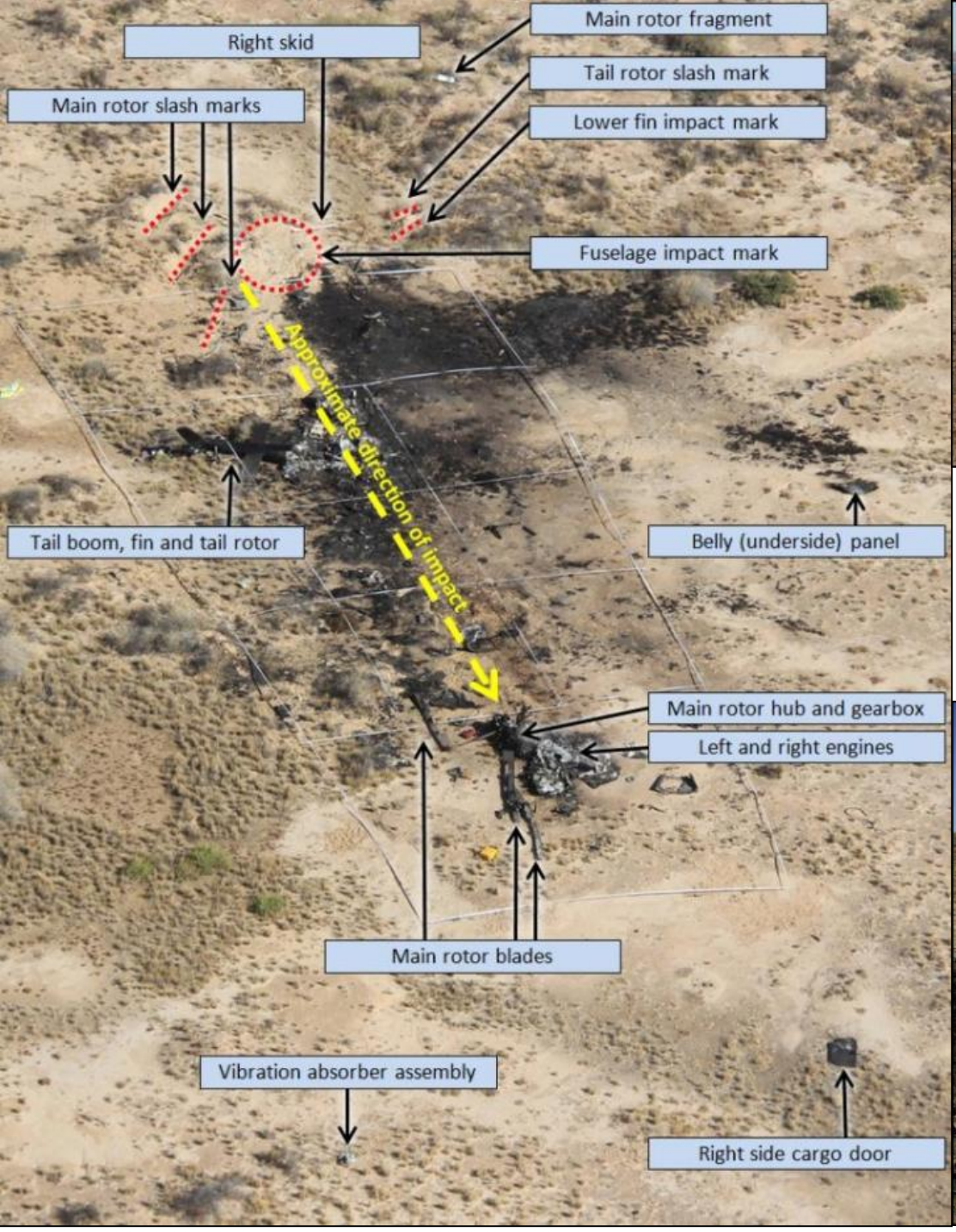
Occurrence details

- AO-2011-102
- Near Lake Eyre, SA
- 18 August 2011
- VH-NTV
- Aerospatiale AS355F2
- 3 POB (media crew)
- VFR at night


GPSMAP 495
IVSI
RAD ALT
ASI
Altimeter
Standby AH
EFD
GPS400W
MFD

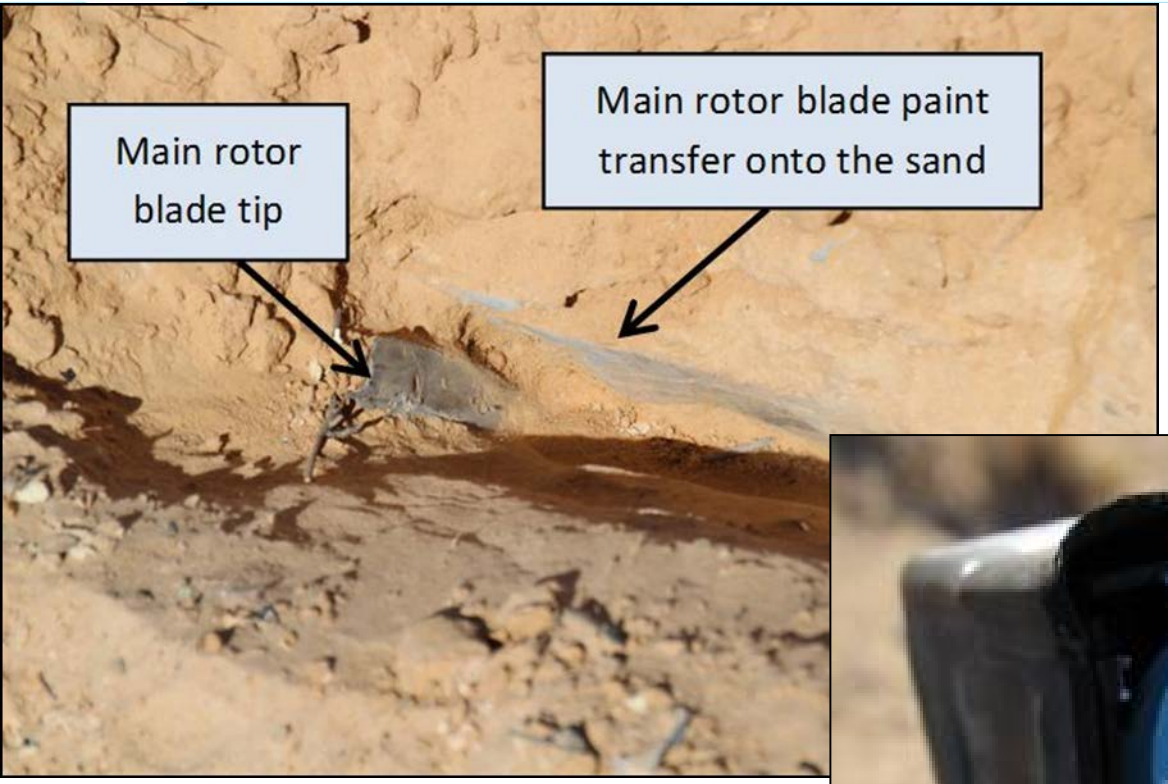
Basic facts

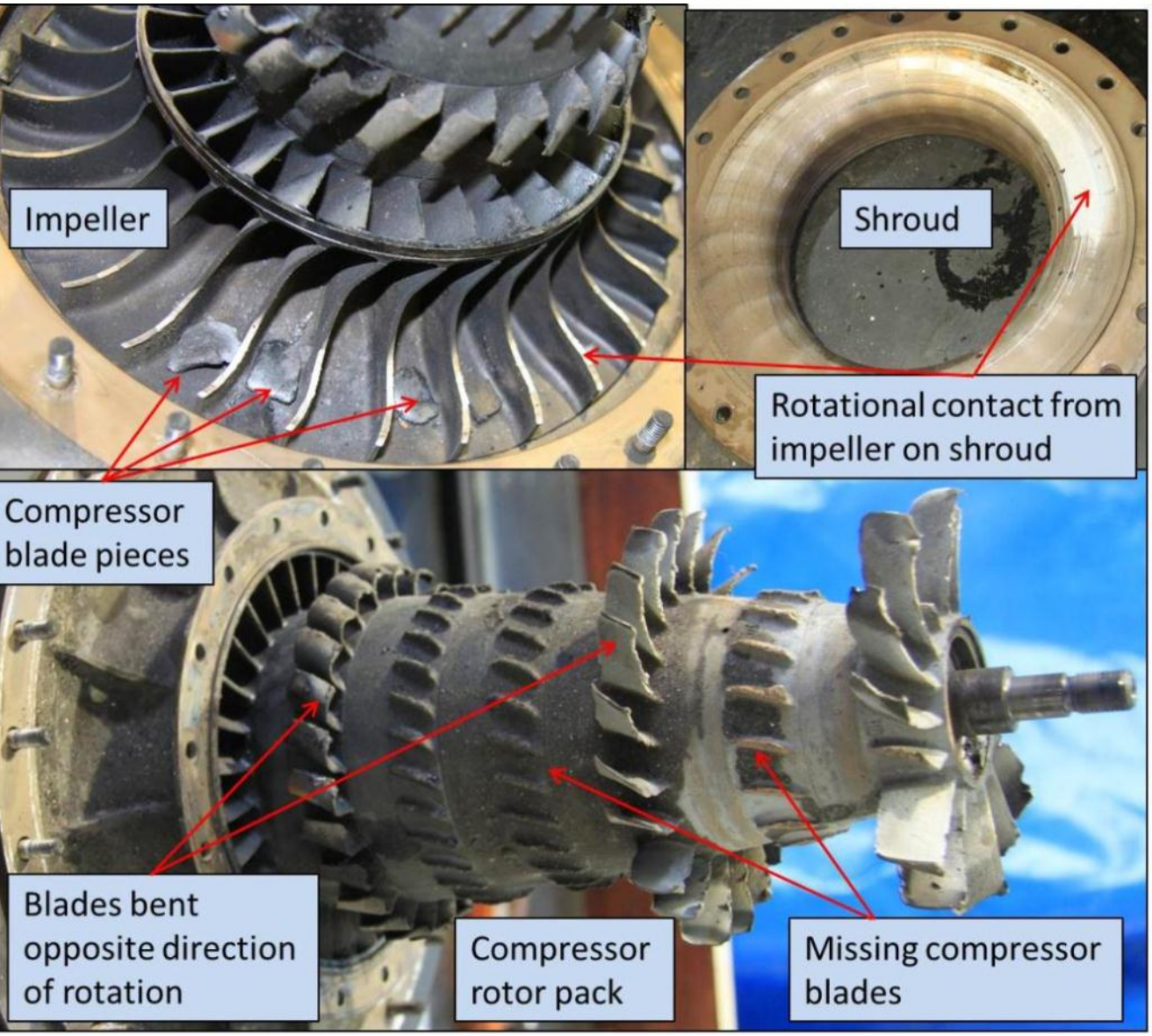
- Experienced media pilot
- Conducting a film documentary in the Lake Eyre area
- Had spent the late afternoon and early evening with a tour group at the entrance to Cooper Creek
- Departed after *“Nautical Twilight”*
- No cloud, no moon, no terrestrial light sources
- Helicopter seen departing to north-east; meant to depart to south


Main rotor fragment
Right skid
Tail rotor slash mark
Main rotor slash marks
Lower fin impact mark
Fuselage impact mark
Approximate direction of impact
Tail boom, fin and tail rotor
Belly (underside) panel
Main rotor hub and gearbox
Left and right engines
Main rotor blades
Vibration absorber assembly
Right side cargo door

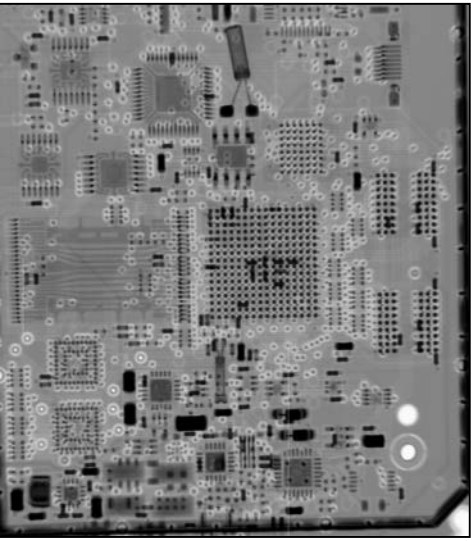
Site examination

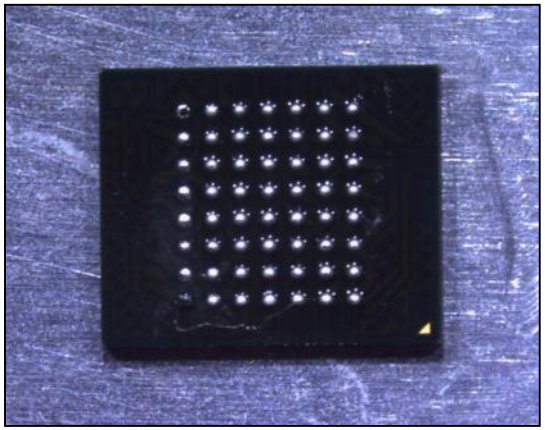
- Impact 3 km ENE of departure point
- All major components at site
- No indications of fire prior to impact
- Impacted terrain at high speed, 90 degrees right-side low attitude

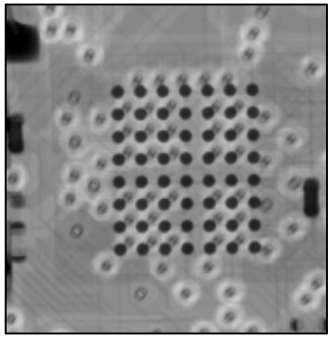

Main rotor blade tip
Main rotor blade paint transfer onto the sand

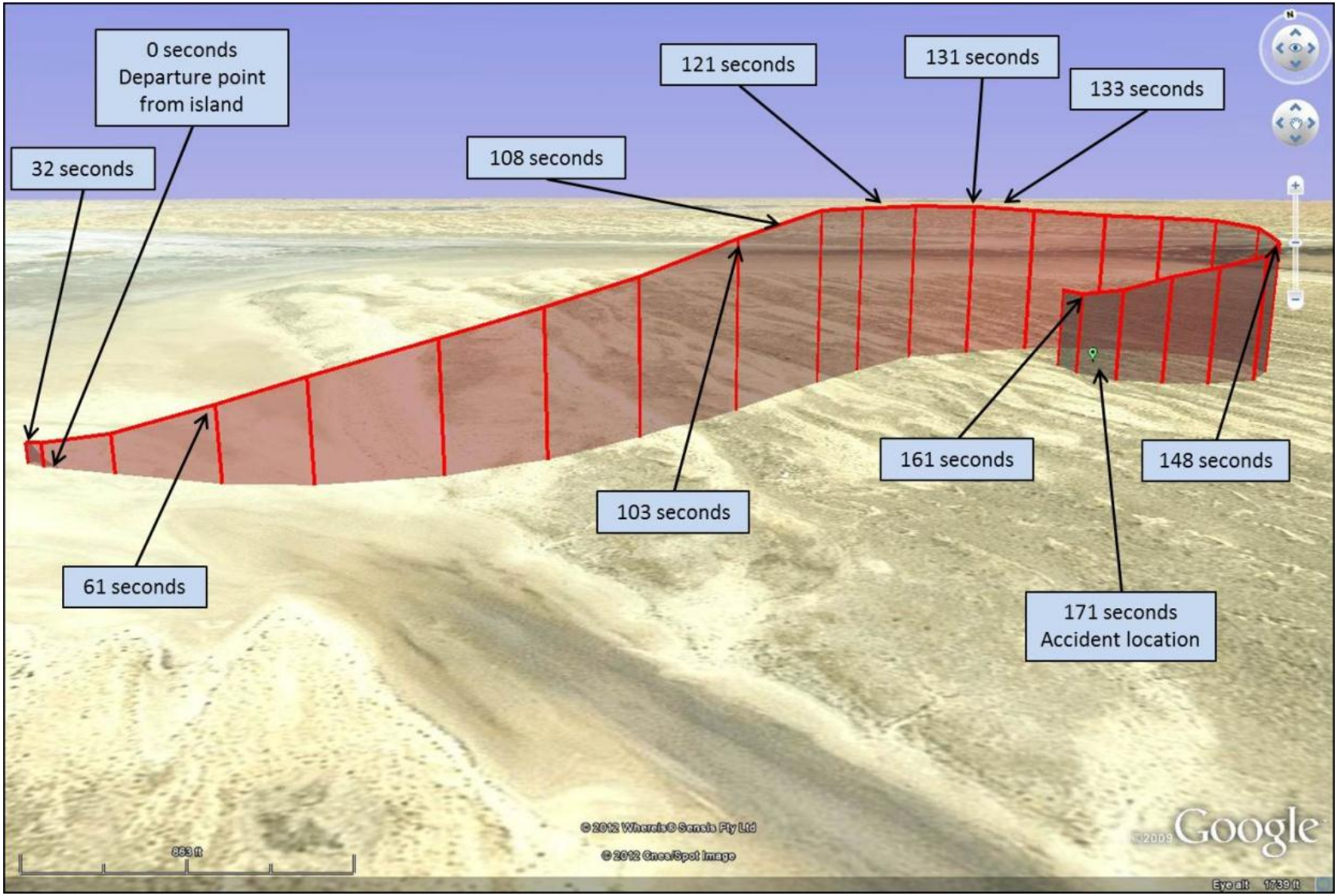

Impeller
Shroud
Rotational contact from impeller on shroud
Compressor blade pieces
Blades bent opposite direction of rotation
Compressor rotor pack
Missing compressor blades


NANDCS0
SAMSUNG 031
K9K8G08U0B
SDIN
REV
V19








0 seconds
Departure point
from island
32 seconds
61 seconds
108 seconds
121 seconds
131 seconds
133 seconds
103 seconds
161 seconds
148 seconds
171 seconds
Accident location
© 2012 Whereis® Sensis Pty Ltd
© 2012 Cnes/Spot Image
Google

Key questions / scenarios

Why heading to the north-east?

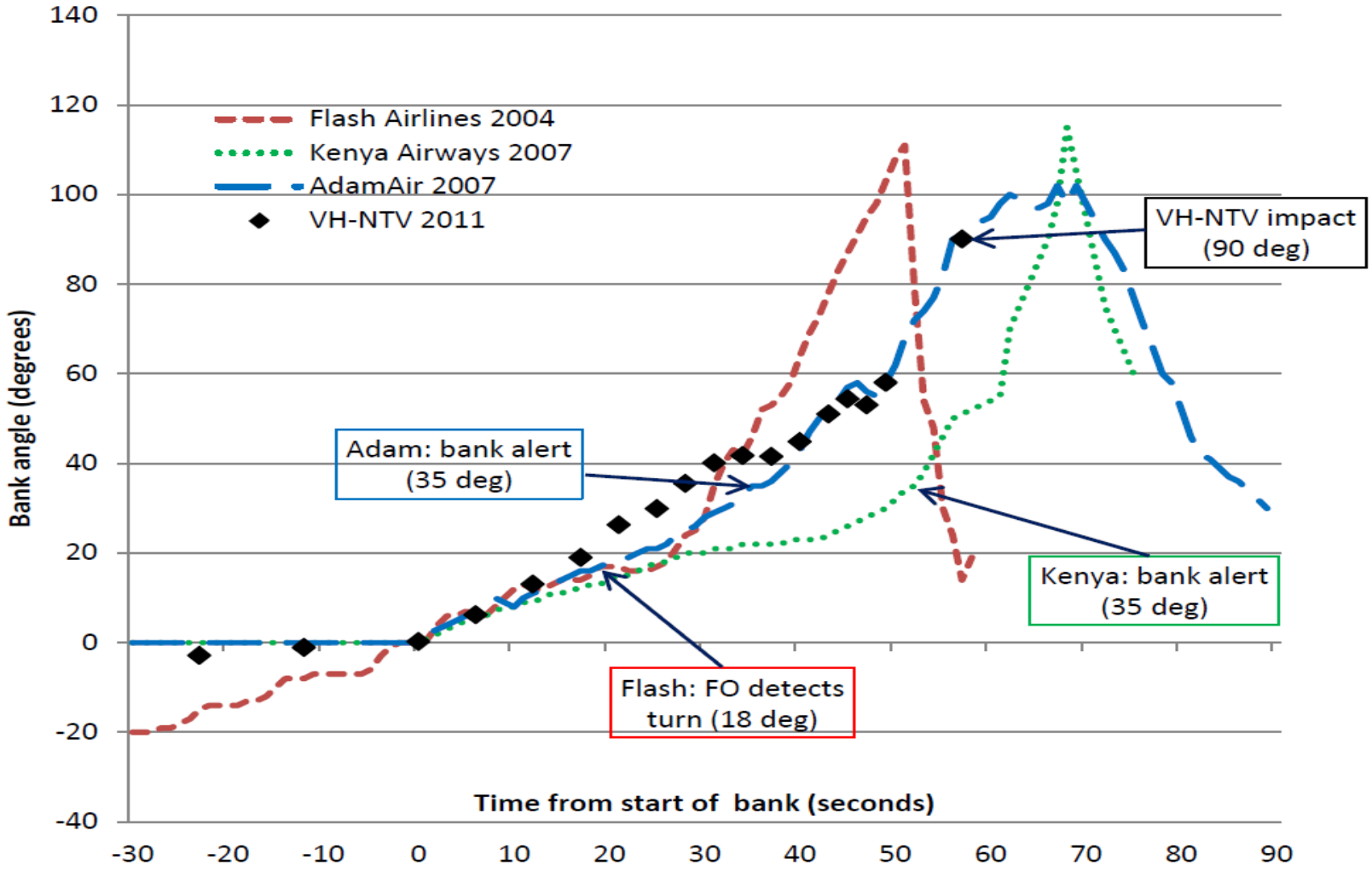
Key questions / scenarios

- Why descent and increasing bank for 38 seconds?
  - pilot incapacitation?
  - spatial disorientation?

Simulator trials

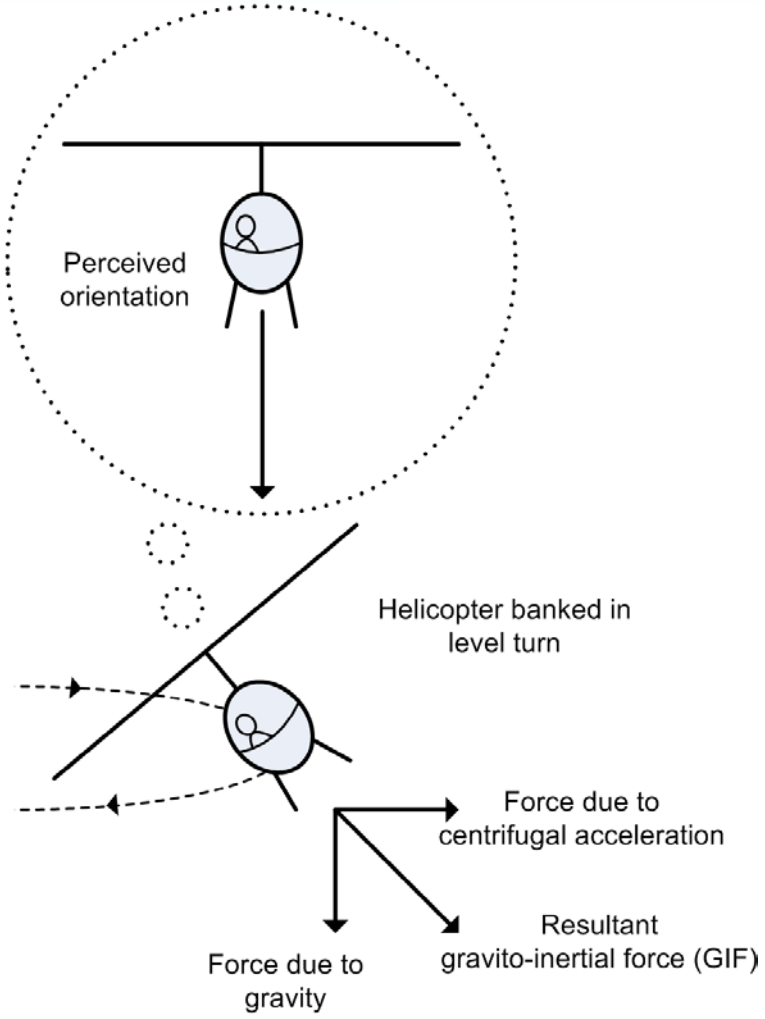
- ATSB trials in fixed base simulator
  - matched flight path if made continual adjustments
  - controls in fixed position produced different flight paths
- American Eurocopter trials found similar results
- Sudden and significant incapacitation unlikely

Previous accidents



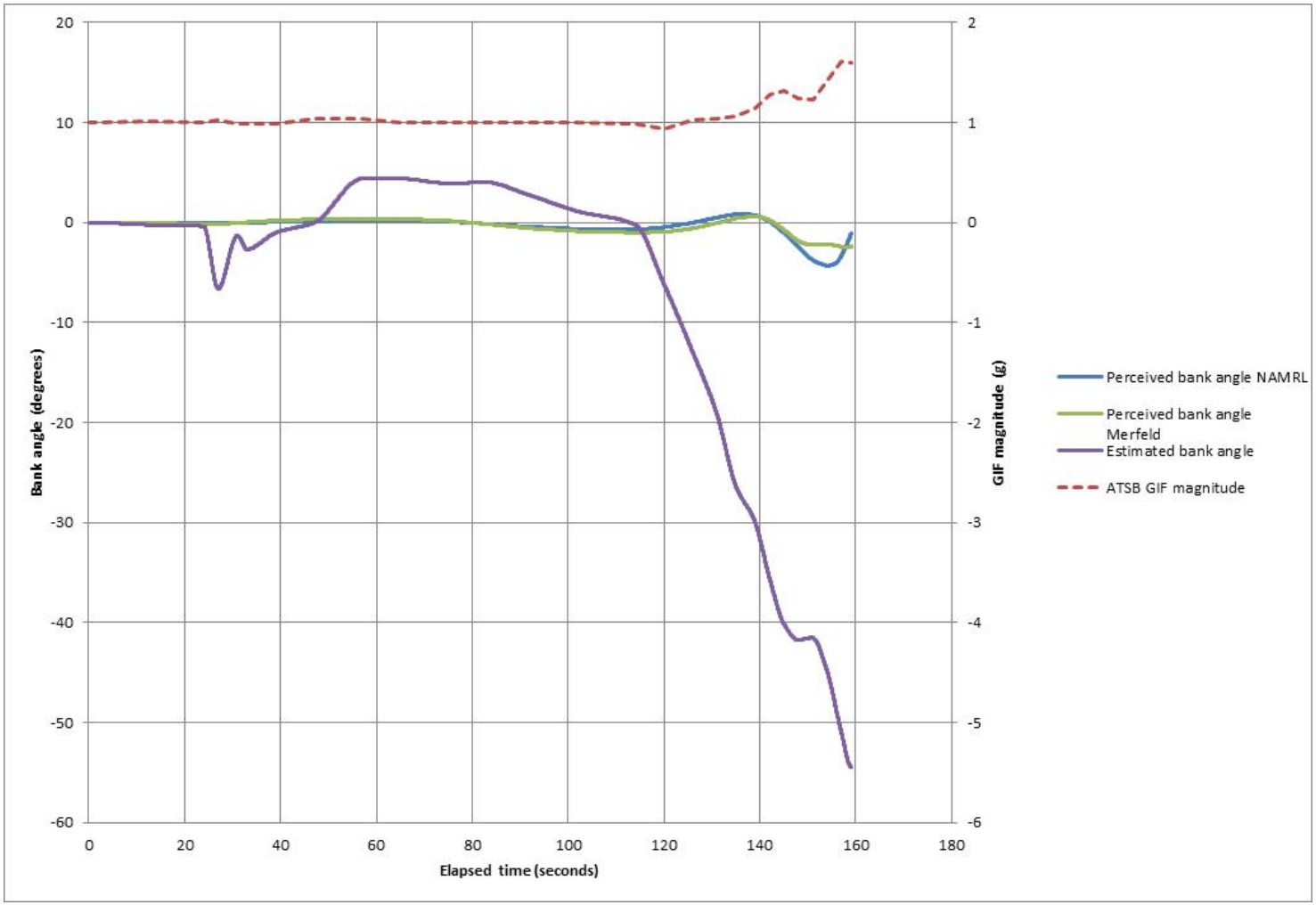
Spatial disorientation

- Many misperceptions
  - movement below threshold
  - the leans
  - somatogyral illusion
  - somatogravic illusion

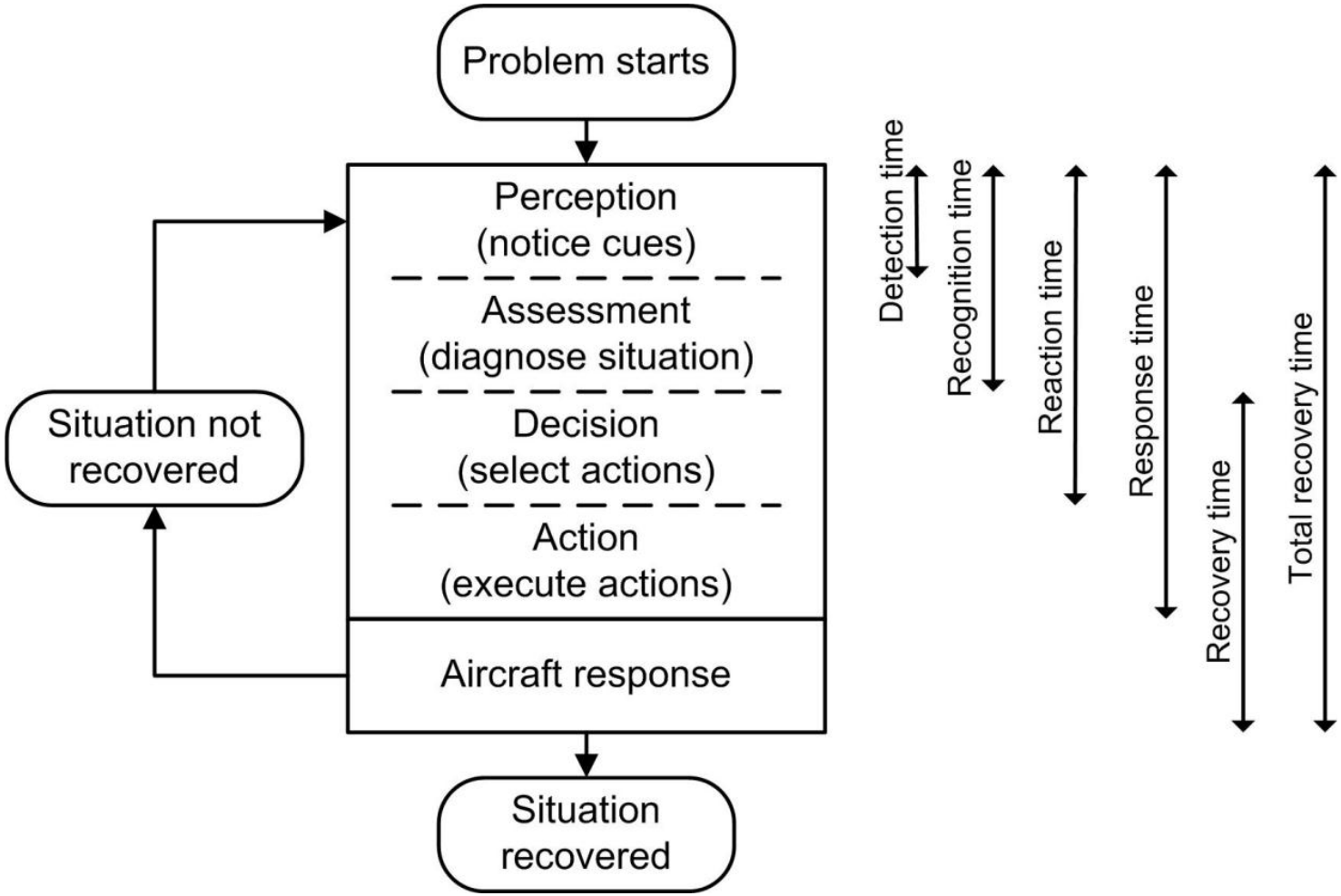



Perceived
Actual
Cockpit view
Not actual conditions
Day view intended to show aircraft relative position only
Actual Pitch, Perceived Pitch
Actual Roll, Perceived Roll
Actual
Perceived
Time to Impact
70.0
G Meter (NOT IN AIRCRAFT)
Start
Stop
1000
NAMRL 2005

Spatial orientation modelling



Why can it take so long?



Factors influencing SD

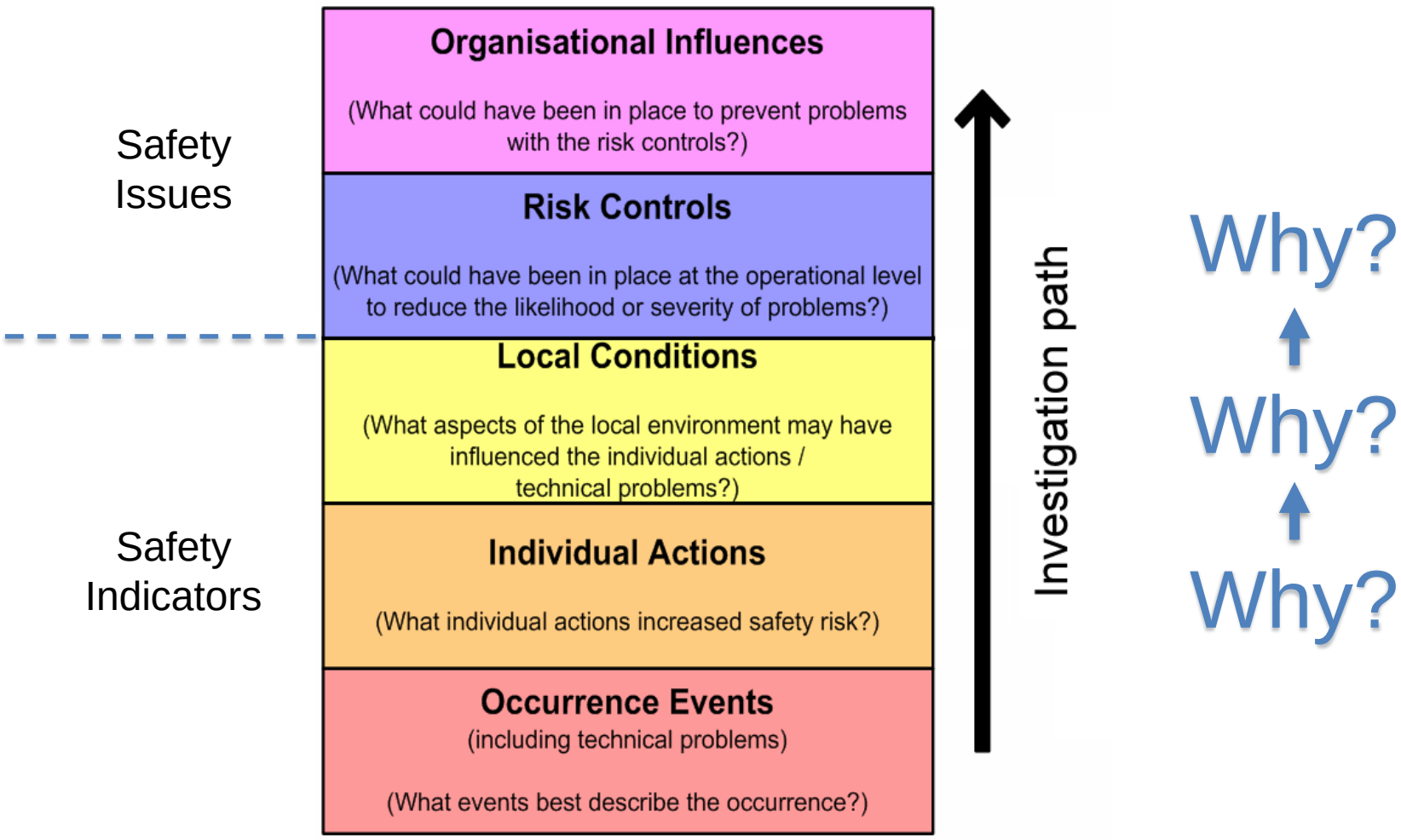
- Limited perceptual cues (external, non-visual)
- Attention diverted by problem with track
- Abnormal event not expected
- Limited recent instrument flying
- No autopilot or stabilisation system

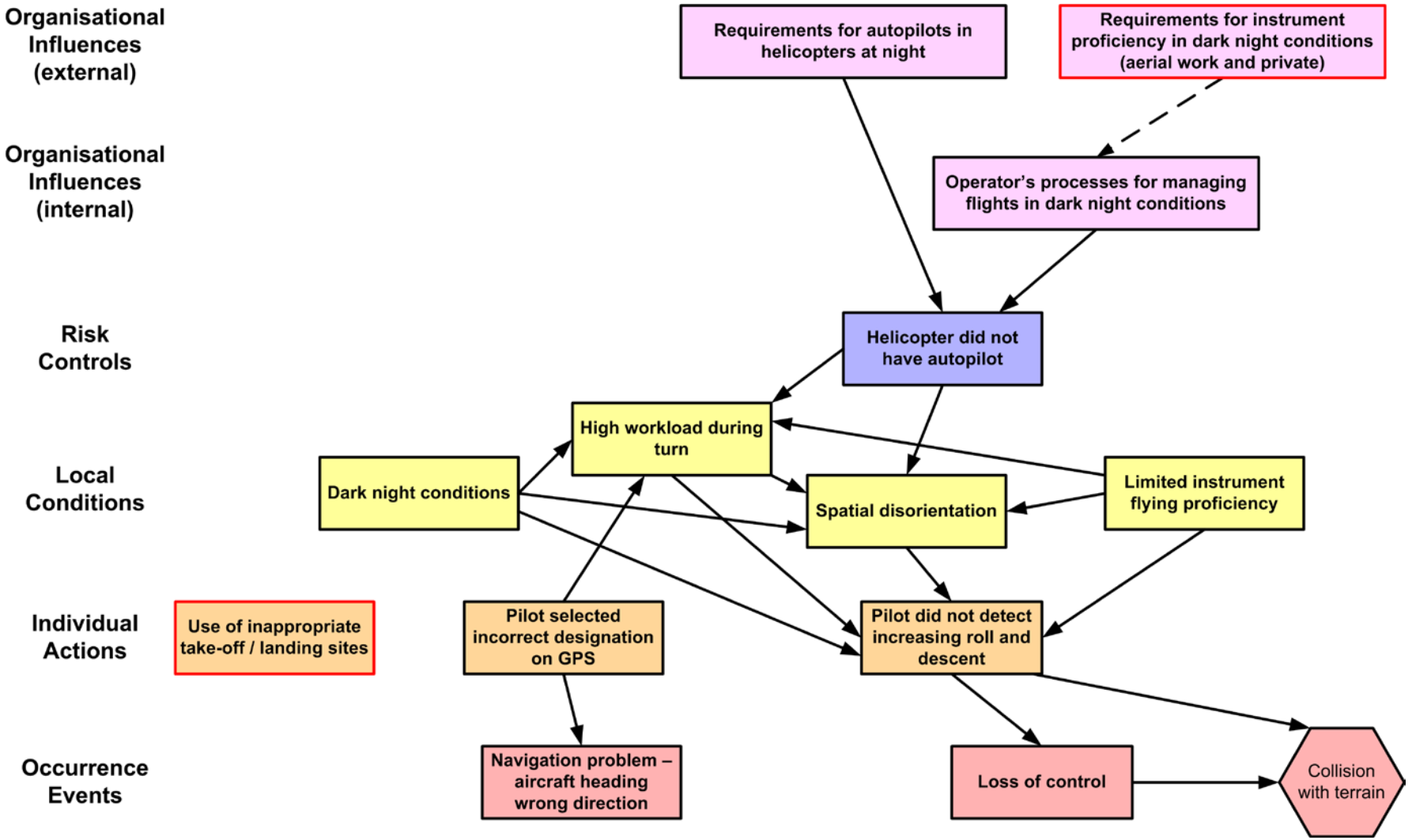
Safety management aspects

- Why conduct the dark night flight?
  - Operator did some but not much night flying
  - Some risk controls in place for night flights – no specific procedures for dark night operations
  - Some controls exceeded regulatory requirements (e.g recency, check & training), not always followed
  - Recent introduction of a formal risk management process – no hazards identified for night ops

Requirements for night ops

- Dark night VMC is effectively the same as IMC, but requirements are less onerous
- In Australia, good guidance material (CASA CAAP for night VFR) but limited on identifying potential for dark night conditions
- ATSB identified 2 safety issues
- CASA modifying autopilot requirements; reviewing definition of ‘visibility’ and CAAP guidance


Safety Issues
Safety Indicators
Organisational Influences
(What could have been in place to prevent problems with the risk controls?)
Risk Controls
(What could have been in place at the operational level to reduce the likelihood or severity of problems?)
Local Conditions
(What aspects of the local environment may have influenced the individual actions / technical problems?)
Individual Actions
(What individual actions increased safety risk?)
Occurrence Events
(including technical problems)
(What events best describe the occurrence?)
Investigation path
Why?
Why?
Why?


Organisational Influences (external)
Organisational Influences (internal)
Risk Controls
Local Conditions
Individual Actions
Occurrence Events
Requirements for autopilots in helicopters at night
Requirements for instrument proficiency in dark night conditions (aerial work and private)
Operator's processes for managing flights in dark night conditions
Helicopter did not have autopilot
High workload during turn
Dark night conditions
Spatial disorientation
Limited instrument flying proficiency
Use of inappropriate take-off / landing sites
Pilot selected incorrect designation on GPS
Pilot did not detect increasing roll and descent
Navigation problem – aircraft heading wrong direction
Loss of control
Collision with terrain

Conclusions

- ‘VFR into dark night conditions’ should have similar profile to ‘VFR into IMC’
- A significant time with no action can be explained
- Key lessons / reminders:
  - thorough sequence of events analysis
  - detailed review of related occurrences
  - teamwork to identify, define and test hypotheses