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Human Error Management

Plan Design Enable

1

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Learning Objectives

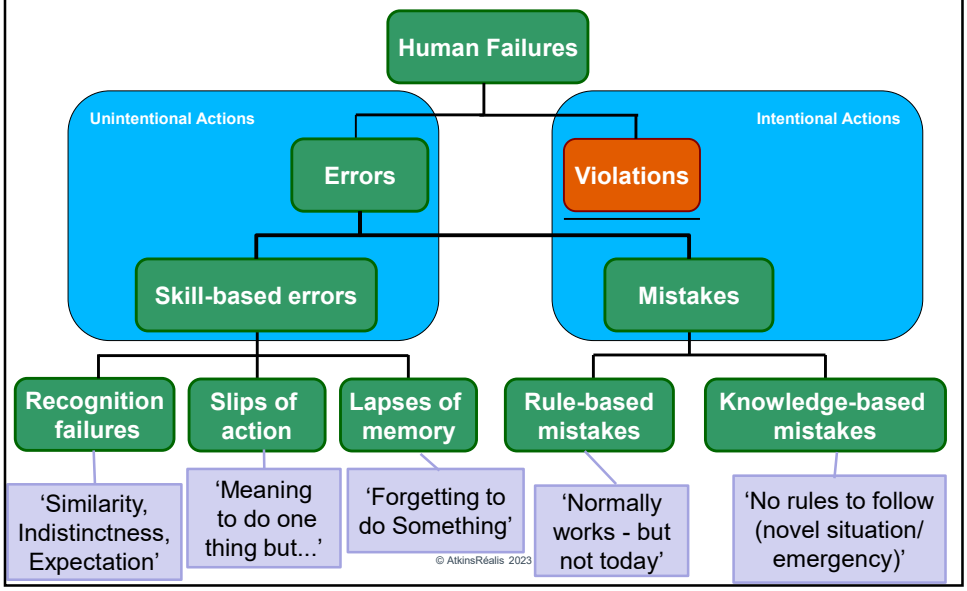
- To get an oversight into Human Error and how it affects safety management
- To introduce available systems and processes for Human Error Management

3

Structure

- Human Error
- Human Error Management
- Defence Aviation Error Management System (DAEMS)

Science Behind Human Failures/Errors



What Leads to Human Errors?

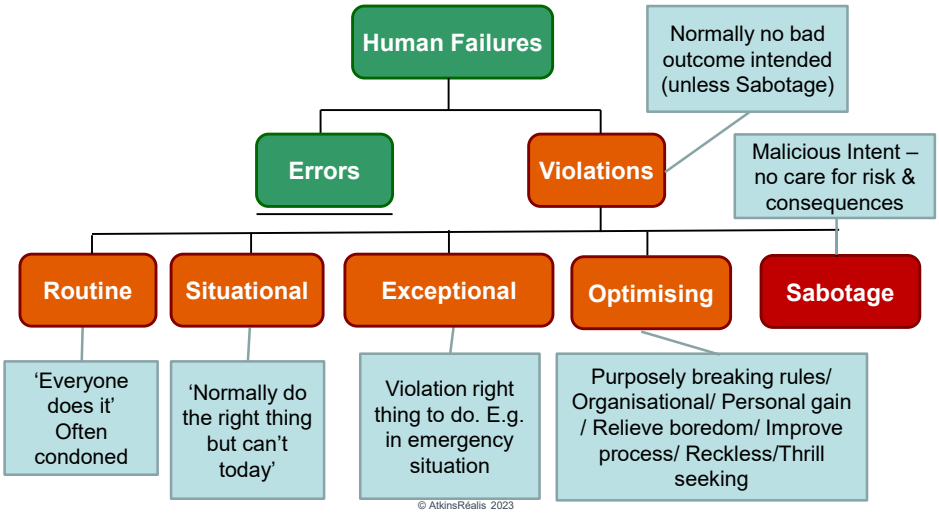
- Inappropriate Design
- Inappropriate Procedures
- Inappropriate Resourcing
- Bad Environment (wet, dark, hot, cold, vibration, NBC, etc...)
- Personal Factors (stress, distraction, tiredness)
- Factors effecting situational awareness
- Poor Communication.

Error - Example

- Typhoon Turnaround:
  - LH gearbox oil replenish
  - Oil OX27
  - AMM went to OX27 Locker
  - Confirmed OX27 by tag
  - Replenished oil
  - Did not check actual can
  - OX38 used to replenish.

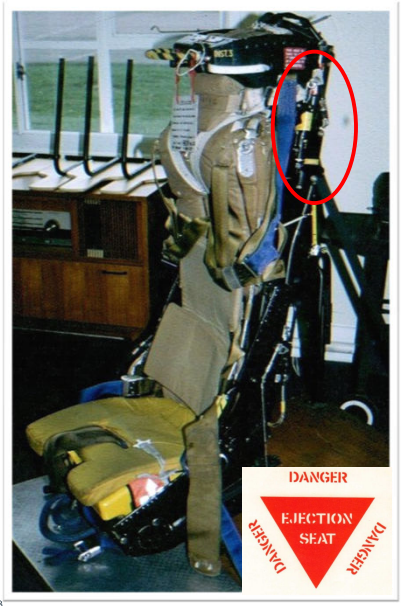
[RAF Air Clues Magazine Jul 2011]

Human Failure Classification (cont.)



Violation - Example

- Removing Ejection Seat from Jet Provost Mk5:
  - Task 100% supervision
  - Save time both do task
  - Supervisor inexperienced
  - Survival Equip removed
  - All connections to ac removed
  - (Except one)
  - Start raising seat
  - Noticed drogue gun still armed and connected
  - Stopped task
  - Near miss/hit.



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Drogue Gun Detail

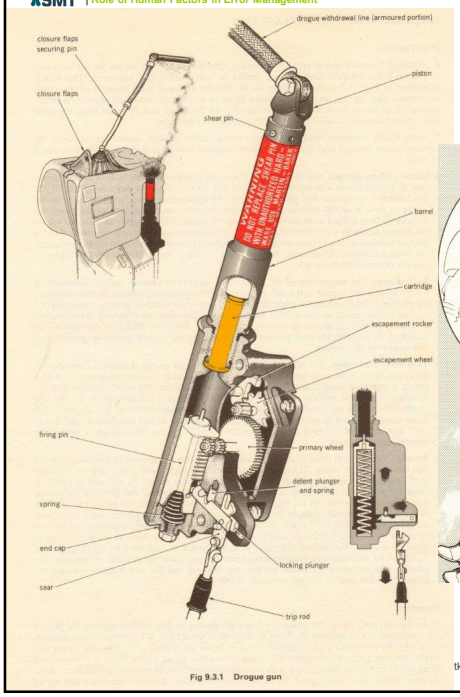
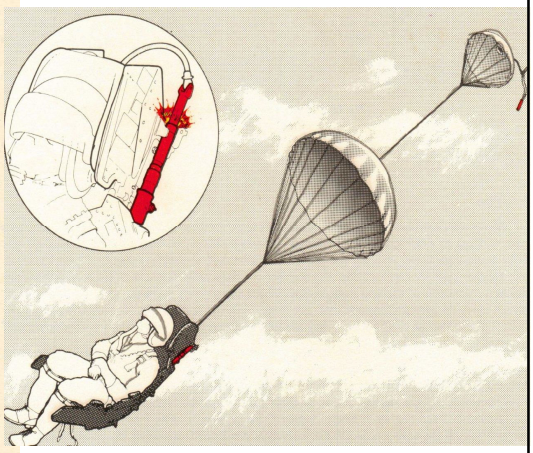


Fig 9.3.1 Drogue gun



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Error Outcomes

Causes and consequences of errors are not linear in their magnitude

[Source: ICAO SMM]

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Remember:
The best people...
Can make the worst mistakes!

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A Review of AAIB Reports Revealed These Frequently Found Issues:

- Night Shift:
  - Circadian Lows - Fatigue
  - Most Maintenance at Night
- Supervision:
  - Tackling Long, Hands-on Tasks
- Interruptions
- Failure to Follow Manuals
- Confusing/Misleading Manuals
- Shift Handovers
- Time Pressures
  - Real and Perceived
- Shortage of Equipment, Spares
- Shortage of Staff.

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With that list in mind – HF Case Study

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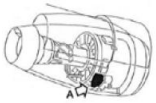
Airbus A319-131, G-EUOE, Heathrow Airport, 24 May 2013

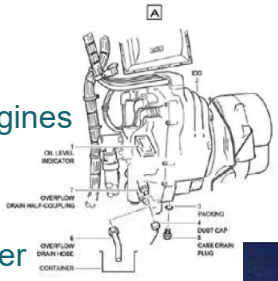
[Informed by AAIB Aircraft Accident Report 1/2015 dated 14 July 2015]

G-EUOE Incident Detail

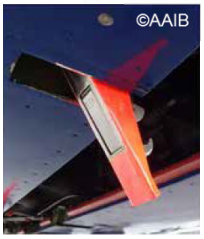
- During takeoff from Runway 27L at London Heathrow Airport, the fan cowl doors from both engines detached from the aircraft, damaging the airframe and a number of aircraft systems
- Ac returned to 27R leaking fuel from damaged fuel pipes on stbd engine which ignited and external fire developed
- Ac landed safely. It was brought to a stop on the runway attended by emergency services
- Fire extinguished. All passengers evacuated via port side of ac.

Why the Doors were Unlocked - IDG Oil Check





©AAIB



- Daily/weekly check
- IDG oil checked – both engines
- Both below ‘Add Oil’
- No oil or IDG gun
- Techs elected to return later
- Left cowl doors on hold open device
- No warning in cockpit
- No open job entry.

Fan cowl doors on the hold-open device; latch handle hook engaged. Cowling not locked!

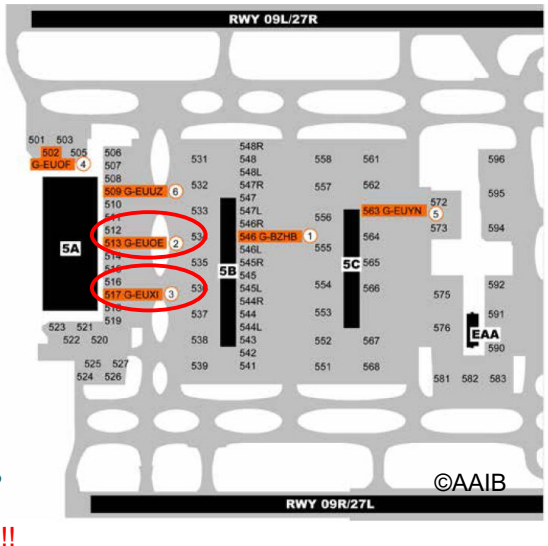
Location of Aircraft G-EUXI & G-EUOE

- 1 to 6, order of ac visited
- Returned to wrong ac

  G-EUXI – A321 (Longer ac)
- Doors locked?
- Oil levels ok?
- Agreed someone

  locked doors– Fatigue?
- Agreed oil cooled

  & settled to green – Fatigue?
- G-EUOE doors still unlocked!!



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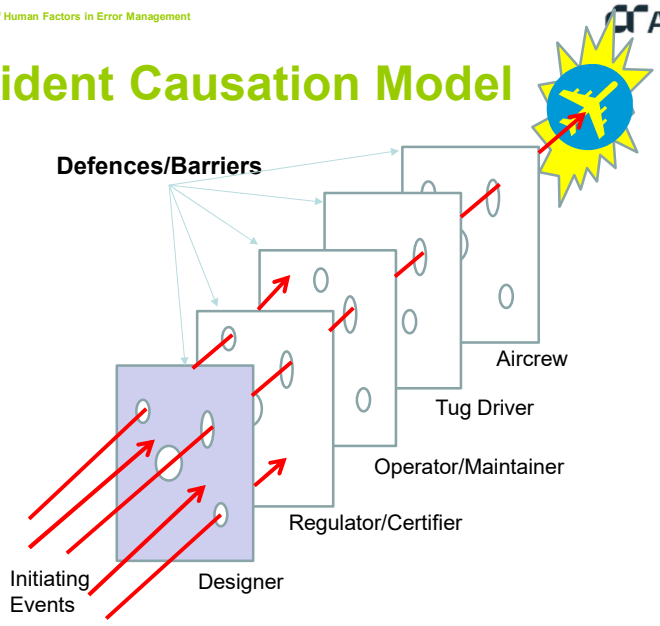
Accident Causation Model



[Adapted from Accident Causation Model – Prof James Reason]

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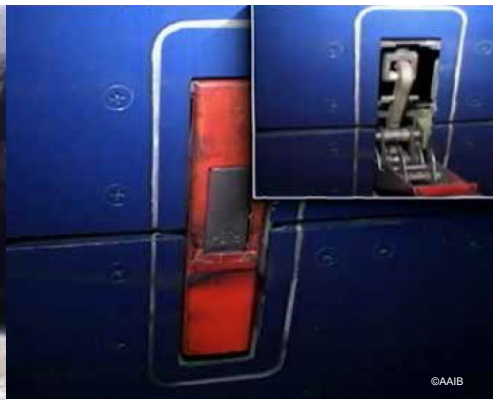
Last Defence - Cowl Door Latch Check – Aircrew & Tug Driver



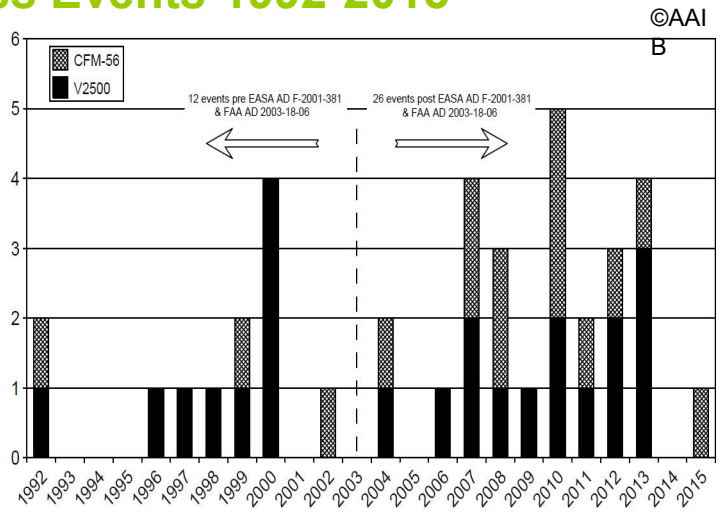
Organisational & Contributing Factors

- Failure to follow a procedure (routine)
- Tools not readily available (IDG pump & oil)
- Paperwork removed from AC (standard practice)
- AC misidentification error (not unique but never reported)
- Fatigue (overtime)
- Under reporting –eBasis (opportunity capture/use safety data)
- Task allocation
- Inadequate training = inefficient pre-flight checks
  - Tug driver
  - Flight crew

[Source: AAIB]

WAS THIS A UNIQUE ACCIDENT?

Airbus 320 Family Fan Cowl Door Loss Events 1992-2015



[Source: AAIB]

Type Design Issues

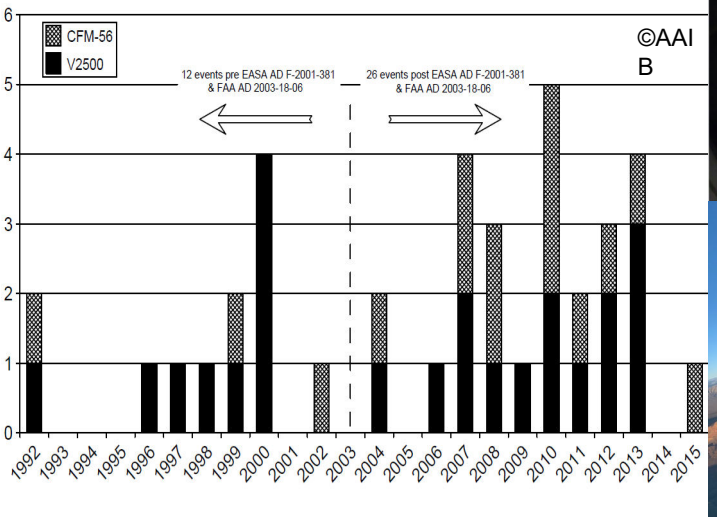
- No cockpit indication cowls locked
- Difficult to see if latches unlocked on hold open device
- Latches originally not painted or painted same colour as cowl
- 2000 AAIB recommended a cockpit indication of unlocked cowl doors
  - Airbus responded with a SB to paint latches **day glow** and a warning on cowl doors - "Make Sure the Fan Cowl Doors are Fully Latched When Closed"

[Source: AAIB]

Day Glow Not Always the Best Colour!

EZY2715 engine cowl loss – 12 Aug 2013

Airbus 320 Family Fan Cowl Door Loss Events 1992-2015



[Source: AAIB]

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  - Airbus responded with a SB to paint latches **day glow** and a warning on cowl doors - "Make Sure the Fan Cowl Doors are Fully Latched When Closed"
  - They also included warnings in FCOM and AMM

- AAIB 2015-002 rec EASA requires Airbus to modify A320-family aircraft to incorporate a reliable means of warning when the fan cowl doors are unlatched
- AAIB 2015-003 rec EASA CS-25 amended to include fan cowls in system safety assessment.

[Source: AAIB]

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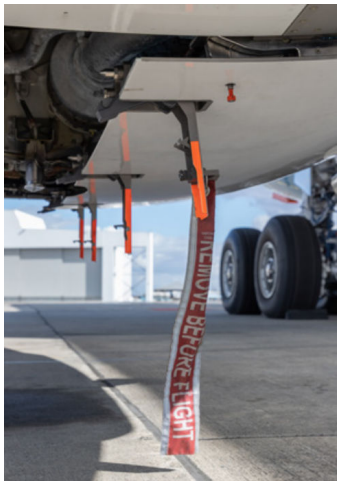
What's been done

- Cockpit indicator on 320neo

ENG1(2) FAN COWL NOT CLSD

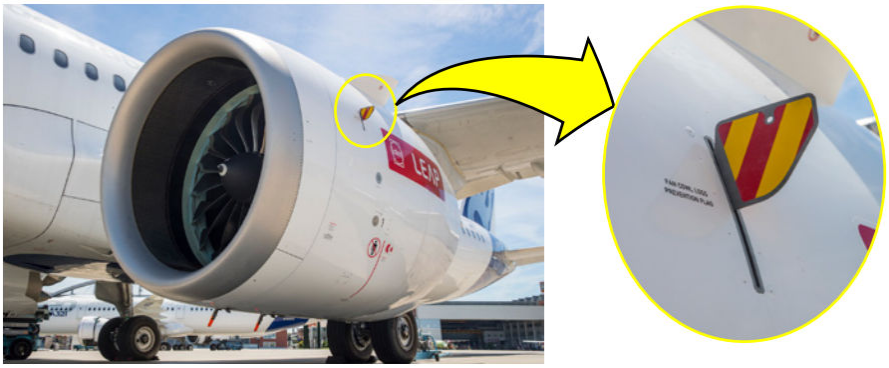
- Airbus has introduced a new forward latch that needs a key to open it and the key can't be removed with the cowls open
- Also introduced an optional IDG gauge viewing window on CFM56 engines
- Doubled oil check interval (to reduce mishap probability).



[Source: AAIB & Preventing Fan Cowl Loss – Airbus 28 Apr 2019]

What's been done (cont'd)

In addition to the cowl position monitoring, a prevention flag extends mechanically from the surface of the left-hand fan cowl when the forward latch is opened to warn the ground personnel and the flight crew that the latch is not closed on A320neo equipped with CFM LEAP-1A engines



What can be done?

Introduction to Error Management

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Maintenance Error (Good News)

- Maintenance Errors are NOT random:
  - They fall into systematic patterns
  - Not committed by a few careless or incompetent individuals

"*Different people in different kinds of maintenance organizations (often very good people in excellent organizations) keep on making the same blunders*".

[Source: J Reason and A Hobbs, Managing Maintenance Error A Practical Guide (Aldershot: Ashgate, 2003)]

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MOD Air Maintenance Errors

- Failure to follow process:
  - TRDS, Swash plate, removal of incorrect boroscope panel, wrong lifting shackle
- Independent Inspections
- Fuel/Hyd leaks – from a variety of systems:
  - Failure to Torque correctly
  - Overfilled systems
- Failure to secure panels / filler caps / sound proofing
- Ground handling incidents:
  - Aircraft / GSE / Servicing platforms / blades
- Failure to identify issues on AF/BF (panels, switch positions),
- FOD in aircraft:
  - AGS, kim wipes, personal effects, tools
- Falls from aircraft
- Common issues:
  - Process clarity – who is responsible
  - Perceived pressure
  - Accepted norms.

[Source: JHC 2012]

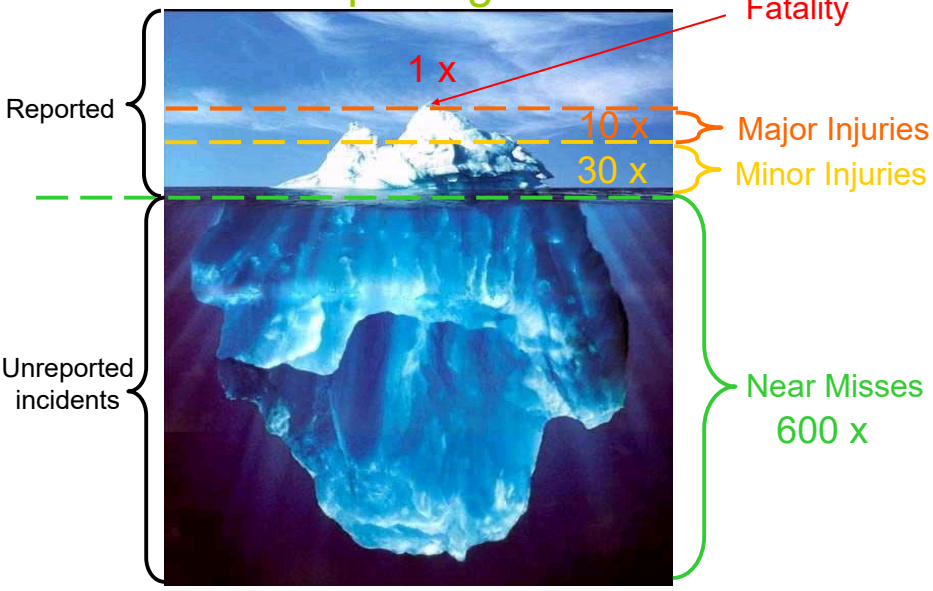
Error Management

- Variety of interventions at different levels:
  - Individual & Team
  - Task & Work Place
  - Organization

  - Briefing
  - New Procedure
  - Engineer out

- 3 most important parts of a EMS programme:
  - Remove error prompting situations
  - Improve defences
  - Report near miss events.

Occurrence Reporting



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Error Management System

- Effective EMS relies on good Safety Culture
- What do we mean by Safety Culture?

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What is Safety Culture?

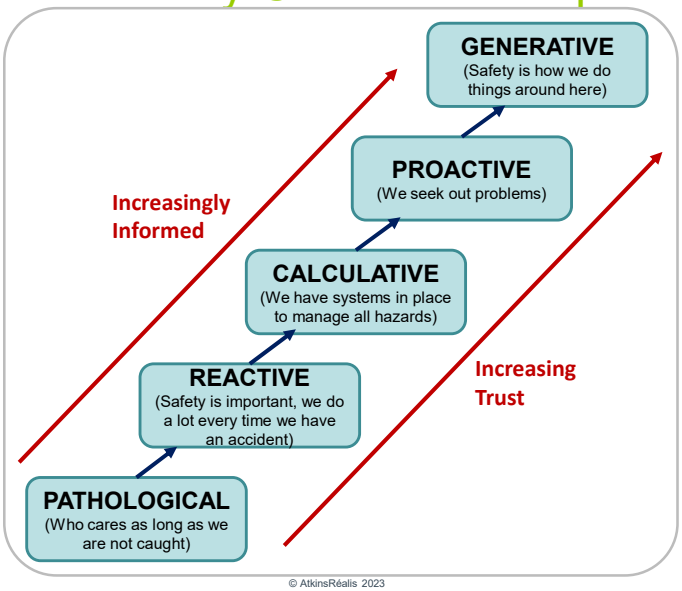
- Definitions:

  "The product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management" [UK HSE]

  "An Engaged Air Safety Culture is that set of enduring values and attitudes, regarding Air Safety issues, shared by every member, at every level, of an organization. It refers to the extent to which each individual and each group of the organization: seeks to be aware of the risks induced by its activities; is continually behaving so as to preserve and enhance safety; is willing and able to adapt when facing safety issues; is willing to communicate safety issues; and continually evaluates safety related behaviour" [MAS].

  "Doing the right thing - even when no one is watching" (NHS, 2000 – C. S. Lewis [Integrity ….])

Stages of Safety Culture Development



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Elements of Safety Culture

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What is a Just Culture?

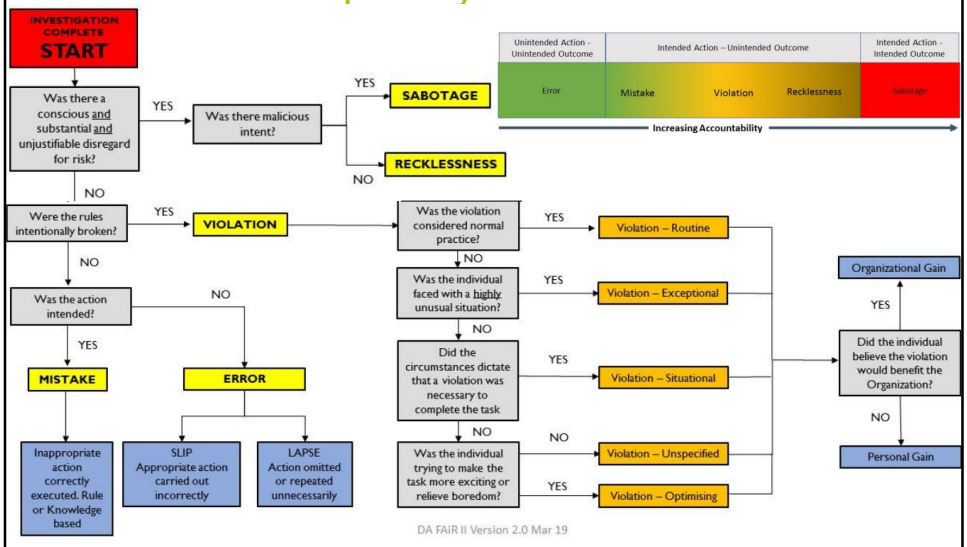
A Set of Beliefs

- Aware that even best people make mistakes
- Aware that best people will develop unhealthy norms
- Intolerance of reckless/dangerous conduct
- Expectation that risks and errors will be reported
- Take responsibility for actions
- That with 'buy in' safety will improve

A Set of Duties

- To admit "I have made a mistake"
- To highlight observed risk
- To resist risky behaviour
- Take part in 'learning from experience'
- Avoid unnecessarily risky behaviour
- Managers/Supervisors demonstrating commitment to Just Culture and prioritisation of safety.

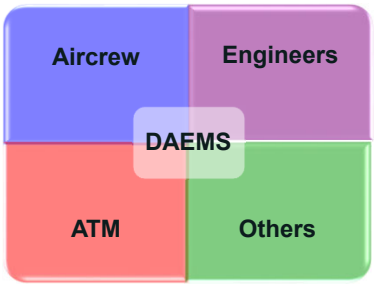
Just Culture Culpability Model – DA FAIR II



[Source: MAS]

Defence Aviation Error Management System (DAEMS)

DAEMS originally provided a way to report and manage those 'potential issues' that 'could' have become a link in an accident chain – now part of regular In-Form error management business.



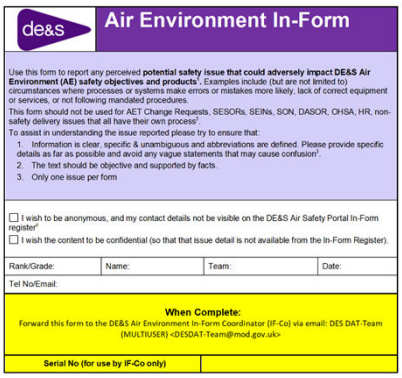
"The 4 Worlds"

DE&S Air Environment In-Forms

TAA & Commodity DTL ensure that:

- In-Forms should be used to report any perceived Potential Safety Issue (PSI) that could adversely impact DE&S Air Environment (AE) safety objectives and products
- An In-Form can be raised by any person in the DE&S AE, regardless of function or role and no authority is required for an In-Form to be submitted
- The In-Form can be completed, printed and sent through the mail or completed electronically (as a pdf) and emailed to the In-Form Coordinator (IF-Co). Also, the In-Form originator has the option to remain anonymous.

[AET Tool 5H1]



de&s **Air Environment In-Form**

Use this form to report any perceived **potential safety issue that could adversely impact DE&S Air Environment (AE) safety objectives and products**[1]. Examples include (but are not limited to) circumstances where processes or systems make errors or mistakes more likely, lack of correct equipment or services, or not following mandated procedures.

This form should not be used for AET Change Requests, SESORs, SEINs, SON, DASOR, OHSA, HR, non-safety delivery issues that all have their own process[2].

To assist in understanding the issue reported please try to ensure that:

1. Information is clear, specific & unambiguous and abbreviations are defined. Please provide specific details as far as possible and avoid any vague statements that may cause confusion[3].
2. The text should be objective and supported by facts
3. Only one issue per form

☐ I wish to be anonymous, and my contact details not be visible on the DE&S Air Safety Portal In-Form register[4].

☐ I wish the content to be confidential (so that that issue detail is not available from the In-Form Register).

Rank/Grade:	Name:	Team:	Date:
Tel No/Email:			

When Complete:

Forward this form to the DE&S Air Environment In-Form Coordinator (IF-Co) via email: DES DAT-Team (MULTIUSER) <DESDAT-Team@mod.gov.uk>

Serial No (for use by IF-Co only)	

[AET Tool 5H2]

Additional Information

- Def Stan 00-251 Human Factors for Designers of Systems
- MAA Manual of Air Safety - MAS
- AET Tool 5H1 & 5H2
- CAP 737 Flight-crew human factors handbook
- CAP 1367 Aircraft Maintenance Incident Analysis
- **Books**
  - “Managing Maintenance Error: a Practical Guide” J Reason and A Hobbs, (2003), Ashgate Publishing
  - “Human Factors Methods” Stanton et al (2005), Ashgate Publishing
  - “Human Error” Reason, James (1990), Cambridge University Press
  - “Human Factors for Engineers” (2004) Institute of Electrical Engineers
  - “Whack a Mole – The Price We Pay For Expecting Perfection” – David Marx (2009), By Your Side Studios, Plano, Canada.

Have we achieved the learning objectives?

- To get an oversight into Human Error management and how it affects safety management
- To introduce available systems and processes for Human Error Management.

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Questions?