Human Factors in Flying Displays Workshop, Feb 2017 - Summary Notes

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Workshop Agenda

Human Factors in Flying Displays Workshop – Challenges & Solutions

SARG, Aviation House, Gatwick

17th February 2017

AGENDA	
09.30 - 09.45	Welcome • Purpose of the day • Desired outcomes • Facilitator introductions
Morning Session: Understanding the challenges of HF for Display Pilots & Flying Display Directors	
09.45 – 10.45	Human Factors in Flying Displays – What are we talking about? • Introduction by facilitators: A model of the Human Factors influences Discussion in 2 groups: • Mapping FDD tasks on to the HF model • Mapping DP tasks on to the HF model Review
10.45 – 10.55	Coffee
10.55 – 12.00	Personal qualities & characteristics of Display Pilots & Flying Display Directors • 'There are no old pilots…' – what makes a good Display Pilot? • 'Controlling the show…' – what makes a good Flying Display Director? • Where is the boundary between confidence & arrogance? Review
12.00 – 12.45	Lunch
Afternoon Session: Enhancing HF for Display Pilots & Flying Display Directors	
12.45 – 13.30	Case Study: Display accident • Challenge: Learning the 'hard way' versus learning from good practice and success
13.30 – 14.45	Risk awareness • Can all human risks be avoided? • Using HF to manage the residual hazards – 'red flag thinking' Discussion in 2 groups: • What are the HF red flags for FDDs? • What are the HF red flags for DPs? Review
14.45 – 14.55	Tea
14.55 – 16.10	Using Human Factors to safeguard displays • Influencing success by sharing best practice • HF resources to aid pilots and FDDs • Other practical actions that could be taken
16.10 – 16.30	Summary of the day Conclusions & Next steps

1. Purpose of the Workshop & Attendees

1.1. Objectives

The workshop held at Civil Aviation Authority's Safety and Airspace Regulation Group (SARG), Aviation House, Gatwick on 17th February 2017 had the objective of bringing together Flying Display Directors (FDDs) and Display Pilots (DPs) to gain a better understanding of the Human Factors (HF) issues that can impact the organisation of and participation in flying displays.

The desired outcomes of the workshop were:

1. To understand better the key Human Factors issues and challenges that influence flying displays and display flying
2. To explore the HF strengths and weaknesses evident in display flying in the UK
3. To generate ideas of how to enhance Human Factors in Flying Displays
4. To suggest practical ways in which FDDs and Display Pilots can use HF 'tools' and 'solutions'

1.2. Attendees

Around 35 FDDs and Display Pilots attended the workshop. A number of those present were also Display Authorisation Evaluators (DAE). Participants had experience in both civil and military display flying and the level of experience and expertise of the audience was generally high.

1.3. Purpose of this Document

This document provides a summary of the topics covered in the HF workshop. The slide set used is included in Appendix A.

2. Morning Session: Understanding the challenges of HF for Display Pilots & Flying Display Directors

2.1. Overview of Morning Session

The morning session of the workshop aimed to explore the HF influences on those organising and flying in flying displays. This was based on the perception that although Human Factors were familiar to both FDDs and Display Pilots as a general concept, there has been very little work previously looking at the direct HF impacts relevant to these roles.

2.2. Human Factors Recap

The session started with a brief overview of Human Factors as a discipline. It was declared that HF is the 'science' that underpins our work to support and enhance Human Performance in aviation (and other domains).

A useful definition of Human Factors is:

> The goal of Human Factors is to make the interaction between the human and the system such that it:
>
> - Enhances "system" performance
> - Reduces risks & thus increases safety
> - Increases user acceptance, job satisfaction

Whilst Human Performance can be considered as:

> Simply speaking, it is the capacity that we have to do tasks (both physical and mental) and also the limitations we have. Human performance is important not just in aviation but in sport and many aspects of daily life.

It was proposed that to achieve effective Human Performance, three things are needed:

- The right tools – what you work with
- The right capability – what gives you the skills you need
- The right environment – what impacts you at work

2.3. A Human Factors Model for Flying Displays

A framework model was proposed to the workshop participants in order to initiate a discussion about the key HF aspects of flying displays. The attendees were split up in to two groups so that the FDDs and Display Pilots could separately brainstorm how HF influences what they do.

The HF model was based on the premise that both FDDs and Displays Pilots have to:

- Maintain their knowledge and skills
- Prepare for displays
- Run or fly in displays
- Carry out certain tasks after a display

The HF model attempts to map certain factors on to this structure. The workshop considered:

- HF aspects that have a direct impact (e.g. workload, decision making, planning, etc.)
- HF aspects over which FDDs and Display Pilots have some (but not total) control (e.g. aircraft and equipment, risks and hazards, etc.)
- HF aspects over which FDDs and Display Pilots have no control (e.g. mistakes by others, technical problems, etc.)
- Contextual aspects of the tasks being carried out (e.g. rules, physical environment, etc.)

Considerable input was provided to this activity by attendees which provided detail and examples from display planning and display flying.

2.4. Personal Qualities & Characteristics of Display Pilots & Flying Display Directors

This session looked at the professional and personal characteristics of both Display Pilots and FDDs and was based on the premise that these qualities are likely to play a significant role in the way these roles are performed. As part of this session, we explored the boundary between confidence and arrogance.

3. Afternoon Session: Enhancing HF for Display Pilots & Flying Display Directors

3.1. Overview of Afternoon Session

The purpose of the second half of the workshop was to explore how Human Factors could be used within the display flying community to help augment performance and enhance safety. It is clear that there is already a fairly good understanding of the importance of HF across Display Pilots and FDDs but it is likely that further benefit could be derived from additional targeted HF input.

3.2. Case Study

The afternoon session started with a case study that proposed that it may be beneficial to promote learning amongst Display Pilots and FDDs from good practice and success, rather than focusing on the relatively few 'safety events' that occur. As an example of how this could be used, we showed how NATS uses 'Day-to-day Safety Observations' to look at how our normal working environment may have 'warmed up' over time without us noticing. The observations use trained peer observers to pick out the good techniques that are used every day to keep the ATC operation safe. In some ways, this may be similar to what DAEs currently do but there may be an opportunity to develop a version of 'Day-to-day Safety Observations' within the display flying community.

3.3. Risk Management

Human Factors and/or human performance is cited as a causal factor in the majority of aircraft accidents. This session considered what the HF-related safety risks may be, with the aim of discussing how additional HF work might help to address these. We proposed that HF risks probably fell in to a number of categories:

- Decision making / planning
- Perception
- Memory
- Actions

It was also suggested that violations / rule breaking were an additional type of HF risk. The discussion looked at how confident Display Pilots and FDDs were in their own risk identification and management and also how external risks are communicated and taken account of.

The session then considered how HF could be used to help manage residual risks by considering 'red flags', i.e. personal or more generic factors that should be considered to be a powerful signal that a risk has become a problem.

3.4. Using Human Factors to Safeguard Displays

This session identified three possible ways in which HF could be used to further safeguard flying displays:

- Influencing success by sharing best practice
- HF resources to aid Display Pilots and FDDs
- Other practical actions that could be taken

The main mechanism currently in place for sharing best practice appears to be information put out by organisations such as the CAA and BADA. However, there is probably benefit from a periodic HF bulletin, especially if its distribution was wide and attracted the attention of Display Pilots and FDDs that do not currently 'get involved' in education and information activities.

A one-off 'Best Practice Guide' for FDDs and Display Pilots was also proposed and discussed. This was considered to have some utility, but again would need to attain wide distribution.

The final suggestion was for the CAA to set up an on-line 'practical HF knowledge base' and explore the usefulness of additional focused HF training for FDDs and Display Pilots.

Appendix A: Workshop Slides

Desired Outcomes

1. To understand better the key Human Factors issues and challenges that influence flying displays and display flying
2. To explore the HF strengths and weaknesses evident in display flying in the UK
3. To generate ideas of how to enhance Human Factors in Flying Displays
4. To suggest practical ways in which FDDs and DPs can use HF 'tools' and 'solutions'

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Agenda

09.30 - 09.45	Welcome
Morning Session: Understanding the challenges of HF for Display Pilots & Flying Display Directors	
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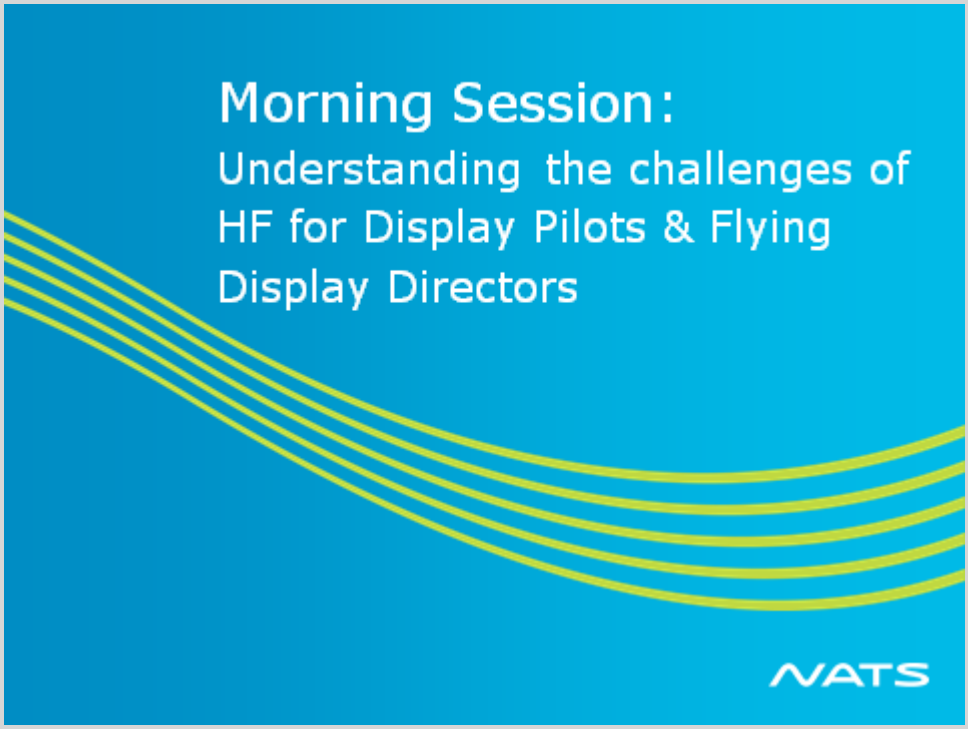
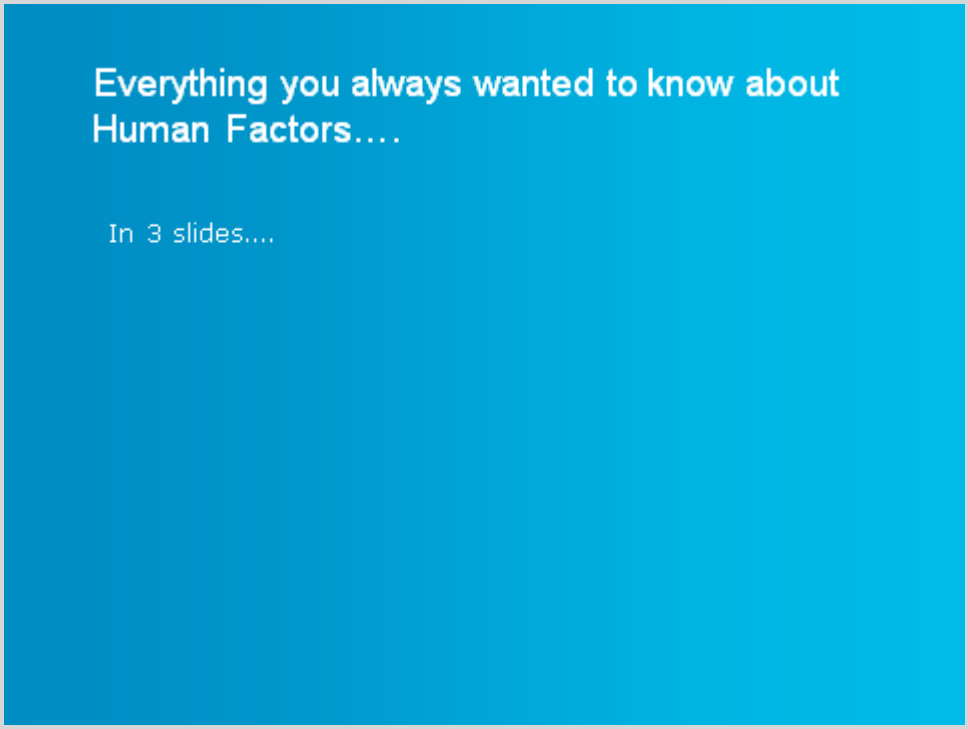
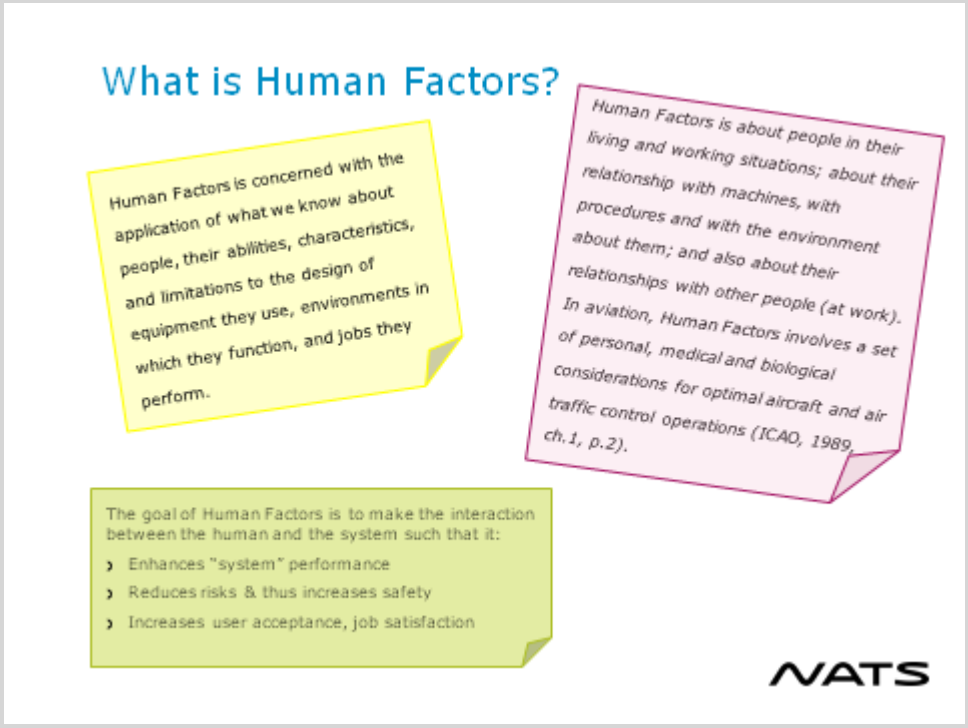
Slide 5




Everything you always wanted to know about Human Factors....
In 3 slides....


What is Human Factors?
Human Factors is concerned with the application of what we know about people, their abilities, characteristics, and limitations to the design of equipment they use, environments in which they function, and jobs they perform.
Human Factors is about people in their living and working situations; about their relationship with machines, with procedures and with the environment about them; and also about their relationships with other people (at work). In aviation, Human Factors involves a set of personal, medical and biological considerations for optimal aircraft and air traffic control operations (ICAO, 1989, ch.1, p.2).
The goal of Human Factors is to make the interaction between the human and the system such that it:
Enhances "system" performance
Reduces risks & thus increases safety
Increases user acceptance, job satisfaction
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A few HF-related clichés...

- Believe your instruments
- Think ahead of your airplane
- He who sees first, lives longest
- Learn from the mistakes of others. You won't live long enough to make all of them yourself.
- Flying is not dangerous; crashing is dangerous

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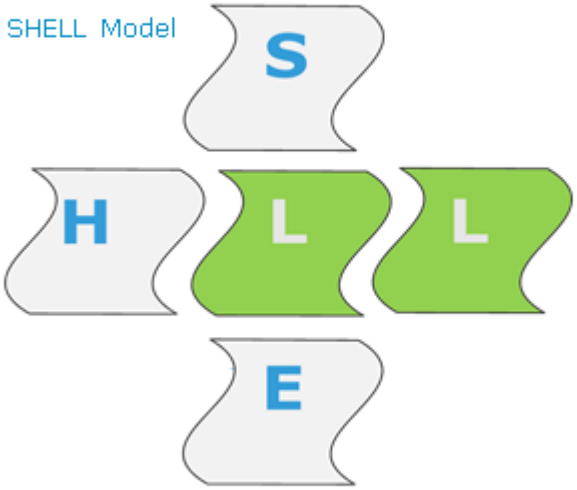
What is Human Factors?

The SHELL Model



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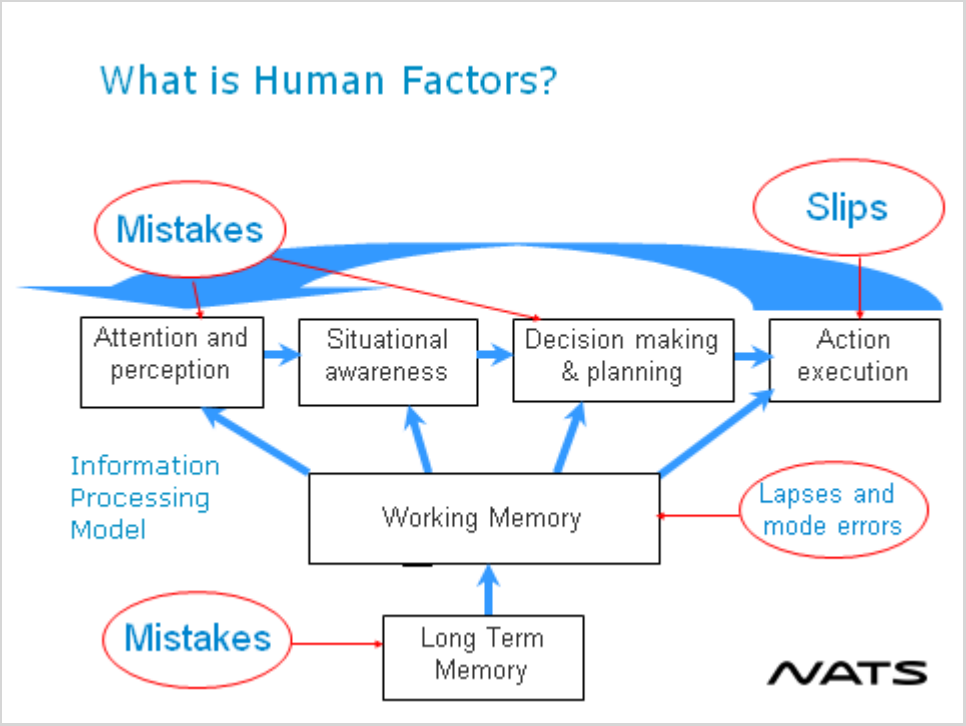
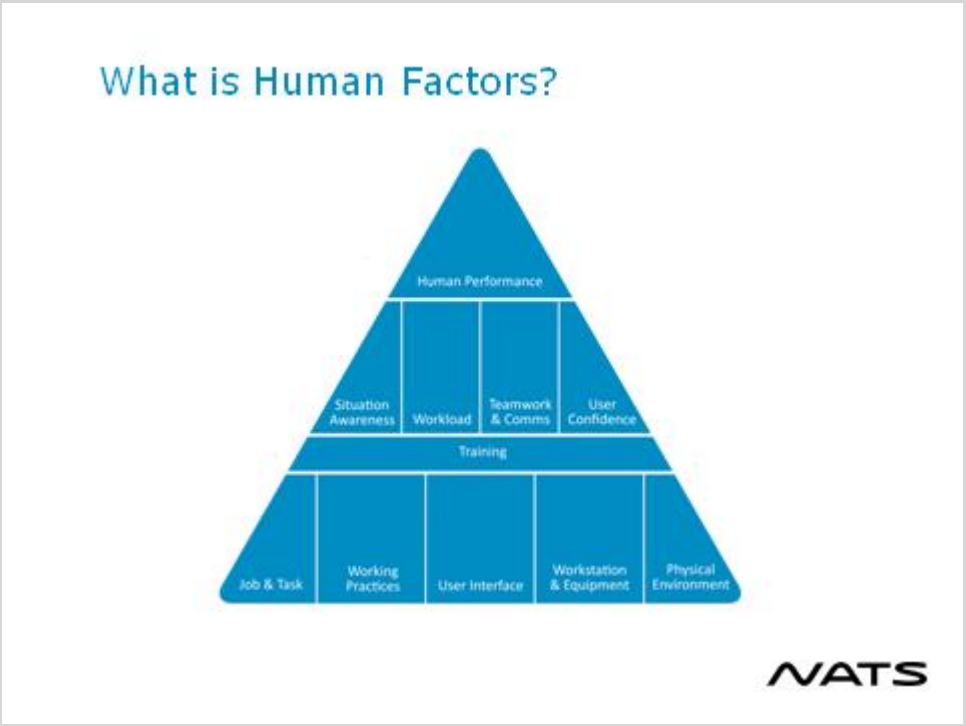

What is Human Factors?
Mistakes
Slips
Attention and perception
Situational awareness
Decision making & planning
Action execution
Information Processing Model
Working Memory
Lapses and mode errors
Mistakes
Long Term Memory
NATS


What is Human Factors?
Human Performance
Situation Awareness
Workload
Teamwork & Comms
User Confidence
Training
Job & Task
Working Practices
User Interface
Workstation & Equipment
Physical Environment
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What is Human Performance?

Simply speaking, it is the capacity that we have to do tasks (both physical and mental) and also the limitations we have. Human performance is important not just in aviation but in sport and many aspects of daily life.

The NATS Human Performance Framework is based on the principle that for effective performance, 3 things have to be in place:

- The right tools – what you work with
- The right capability – what gives you the skills you need
- The right environment – what impacts you at work

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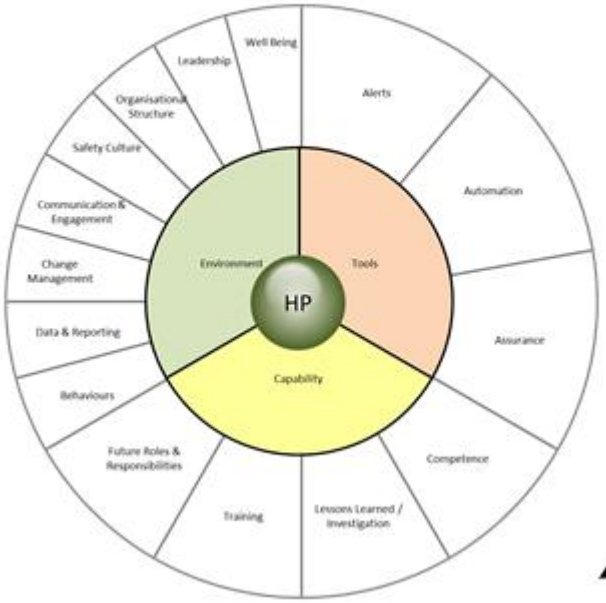
What is Human Performance?



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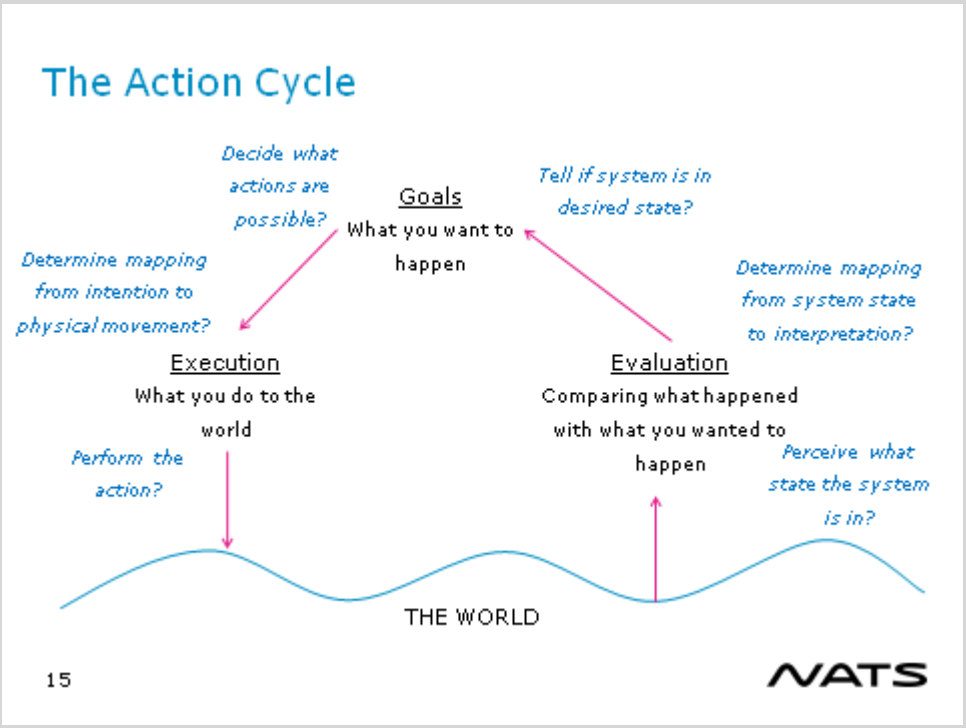
The Action Cycle
Decide what actions are possible?
Goals
What you want to happen
Tell if system is in desired state?
Determine mapping from intention to physical movement?
Determine mapping from system state to interpretation?
Execution
What you do to the world
Evaluation
Comparing what happened with what you wanted to happen
Perform the action?
Perceive what state the system is in?
THE WORLD
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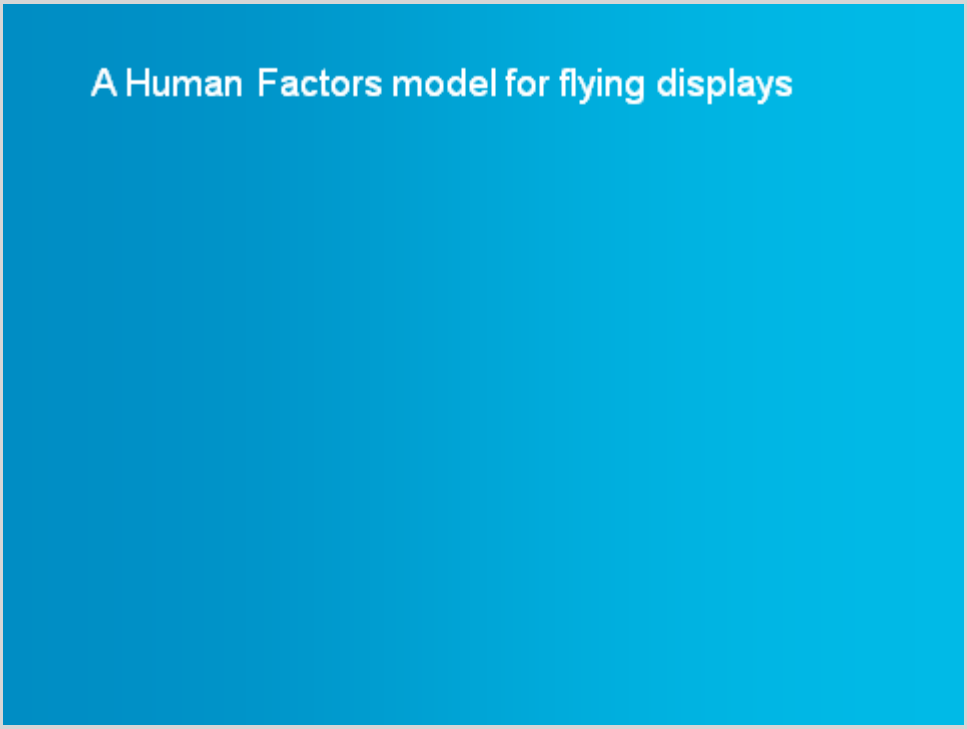
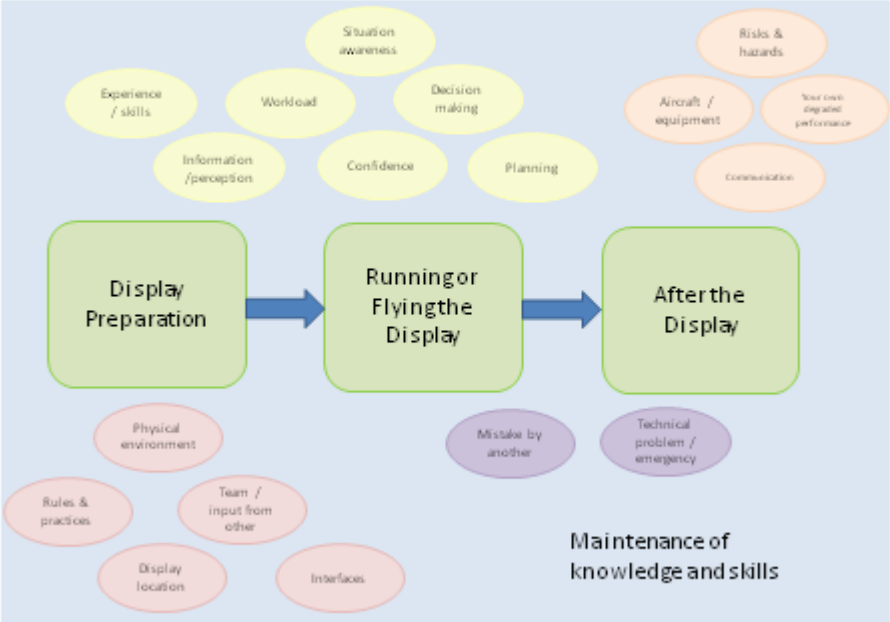

A Human Factors model for flying displays

A Human Factors Model for Flying Displays



Link your tasks to the HF model – 2 Groups

- Think about what you do as an FDD or DP
- Draw out the specific Human Factors relating to the tasks you do in each part of the model
- For example…
  - … look at PLANNING and think of the HF aspects of planning for each of the 4 parts of the model
    - Display preparation - Have to give enough time to plan display
    - Running / flying the display – Have to consider back up plans and know when to use these
    - Etc.

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Task: Link your tasks to the HF model

- Two groups
- We'll take 10 mins at the end to review what you generate

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Personal qualities & characteristics of Display Pilots & Flying Display Directors

Why is this important?

- Qualities and characteristics cover your:
  - Motivation
  - Adaptability and flexibility
  - Acceptance of risk
  - Attention to detail
  - Ability to recognise your strengths and weaknesses
  - Attitude to criticism
  - Need to receive respect and admiration
- They make you what you are and are likely to play a significant role in your how you behave and perform

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What makes a good Display Pilot?

- "Don't be a show-off. Never be too proud to turn back. There are old pilots and bold pilots, but no old, bold pilots." – E. Hamilton Lee, 1949
- What does qualities and characteristics does a good Display Pilot have?

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What makes a good Flying Display Director?

- "Flexible is much too rigid, in aviation you have to be fluid" – *Verne Jobst*
- What does qualities and characteristics does a good Flying Display Director have?

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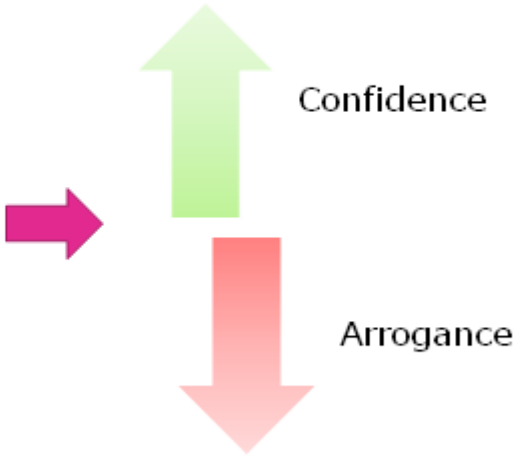
Where is the boundary between confidence & arrogance?

- What does confidence 'look like'?
- Where is the boundary?
- What does arrogance 'look like'?



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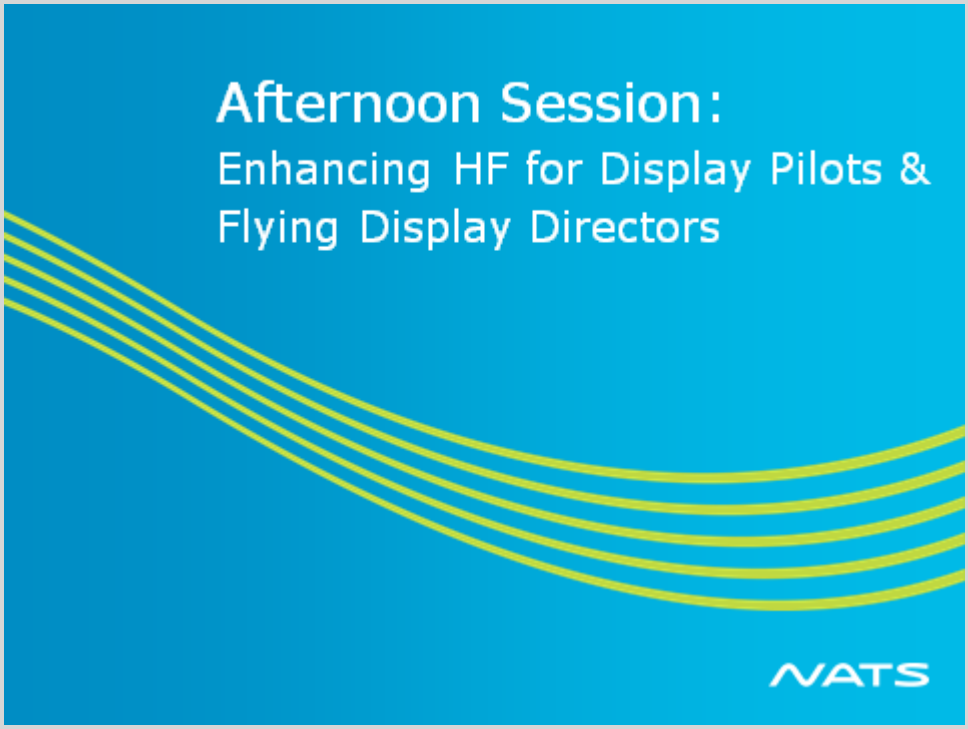
Afternoon Session:
Enhancing HF for Display Pilots &
Flying Display Directors
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A Human Factors Case Study

Case Study

- Challenge: Learning the 'hard way' versus learning from good practice and success
- Statistics suggest more than 80% of flying display accidents involve HF as a causal factor, e.g.
  - Loss of control
  - Pilot error

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HF is a common feature in incidents & accidents

- Aircraft Accident Report 6/2009 - Hawker Hurricane Mk XII (IIb), G-HURR, 15 September 2007
  - The pilot of G-HURR had agreed with the lead pilot during their briefing that he was not happy performing low level aerobatics in the Hurricane due to his lack of recency on the aircraft
  - The accident probably occurred as a result of the pilot attempting an unplanned rolling manoeuvre, in an attempt to follow the manoeuvre flown by the leading pilot

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HF is a common feature in incidents & accidents

- AAIB Bulletin: 2/2011 Extra EA300L, G-DUKK, 19 June 2010
  - The available evidence indicated that, in the week prior to the accident, the pilot practised his display in G-DUKK at least five times. However, these practices were not observed by any of his colleagues who had aerobatic experience.
  - The pilot had not followed the display routine that he normally practised and initiated recovery from a flat spin at a height lower than required

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Learning the 'hard way' versus learning from good practice and success

- In NATS, we have very few serious incidents

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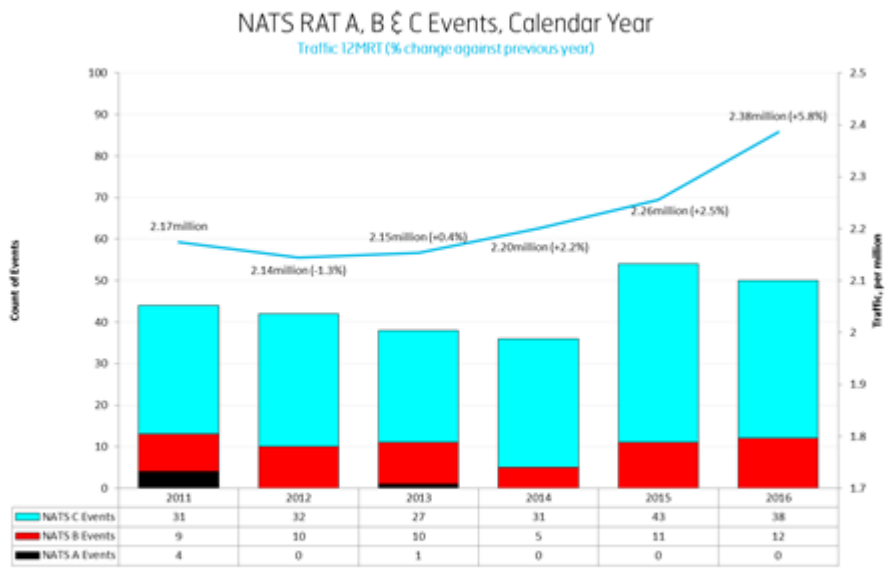

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Learning the 'hard way' versus learning from good practice and success

- In NATS, we have very few serious incidents
- We learn from incidents but the data set is small
- We think there is a great deal that can be learned from good practice and success
- We use something called 'Day-to-day Safety Observations'

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D2D – using success to improve

- When you put a frog in cold water and then slowly heat up the water, the frog will not notice the moment when the water becomes too hot. If you put a frog in hot water, it will jump out.
  - Our normal working environment may have 'warmed up' over time without us noticing.
  - The Day to Day Safety observations help us to find out how hot the safety water is before it is too late.

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What is D2D?

- Trained observers – ATCOs familiar with ops positions – carry out observations looking for the GOOD techniques that are used EVERY DAY.
- The observers are trained to be objective and non-judgemental, and during training they will trial the observation forms in a simulated and live setting before starting observations for real.
- All observations are **ANONYMOUS**.
- **Observations are about the techniques that keep the unit safe and NOT the person.**

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A useful approach?

- This technique has been very useful in NATS
- Is it similar to what Display Authorisation Evaluators do?

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Risk Awareness

Risk management

- 'Truly superior pilots are those who use their superior judgment to avoid those situations where they might have to use their superior skills.'

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Can all human risks be avoided?

- What are the main risk categories?

- These may be risks that you generate or risks you are exposed to generated by other parties

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Risk management

- Confidence in own risk perception and management
  - Performance strengths and limitations
  - Awareness – has anything changed?
  - …
- Ability to identify and manage external risks
  - Are these taken in to account?
  - Are known risks shared?
  - …

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Using HF to manage the residual hazards

- 'Red Flag Thinking'
  - 'Red Flags' – a mix of personal and generic factors
    - Personal – unique to you
    - Generic – impact most or all

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Using HF to manage the residual hazards

- The 'Rule of 3'
  - If aware of '3 bad things' – then act
    - Abandon plan
    - Change to fallback plan
    - Make a new plan

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What are the HF 'Red flags' for FDDs & DPs? – 2 Groups

'Pilots are very good at saying why they should fly, not why they should not...'

- Think of 'Red flags' that are generic
- Compare personal 'Red flags' – are there similarities?
- Bear in mind that 'Red flags' may be feelings rather than facts

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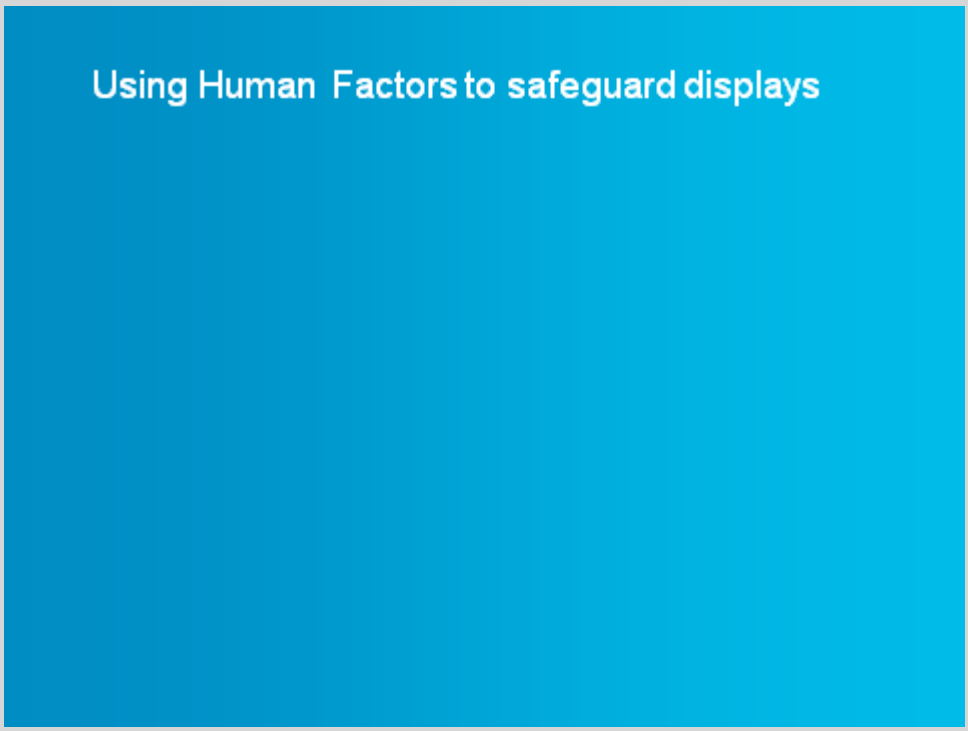

Using Human Factors to safeguard displays

- Influencing success by sharing best practice
- HF resources to aid pilots and FDDs
- Other practical actions that could be taken

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Influencing success by sharing best practice

- Best way to learn is through success
- What are the current mechanisms for sharing good / best practice – is this effective?
- How can the Display Authorisation Evaluators' (DAE) role be supported to pass on best practice?

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HF resources to aid pilots and FDDs

- What HF resources are currently available?
- Is this sufficient or does there need to be more?
- Would an HF focused "Best Practice Guide" for FDDs and DPs be useful?
- If so, how can we capture all the good stuff?

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Other practical actions that could be taken

- Provide a solid, practical HF knowledge base?
- Is further HF training useful?

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Summary of the day

Summary of the day

During the day, we have looked at:

- HF as it relates to the roles of the FDD and DP and mapped tasks on to an HF model
- The qualities and characteristics of FDDs and DPs and have considered what 'good looks like'
- A case study and discussed the recognition and management of HF risks, including 'Red flags'
- What HF activities might help to safeguard airshows and flying displays

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Conclusions & next steps

- Has the day reinforced your view of Human Factors in flying displays?
- Next steps
  - For Neil and Martin
  - For CAA
  - For the FDD and DP community

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