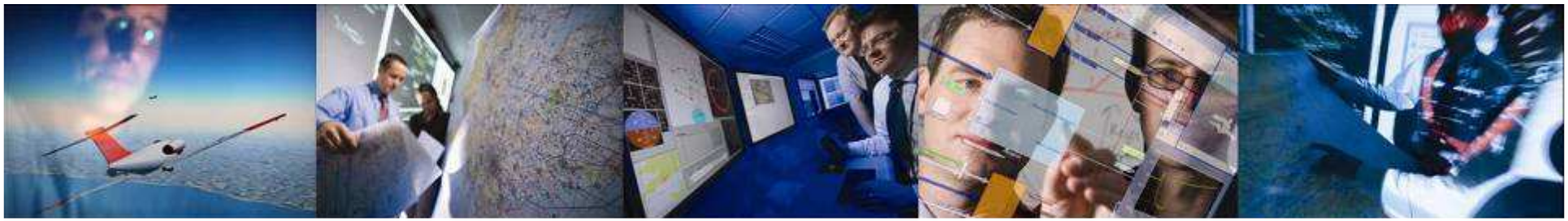
# Human Factors

Chris Noonan





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# Human Factors Challenge

- To replicate the necessary pilot tasks on the ground meeting the regulatory demands
- Despite the pilot not being onboard the pilot will be the ultimate decision maker and be legally responsible for the actions of the aircraft.
- Therefore the piloting interface and task need to be redefined. The task will move away from the traditional piloting skills and more towards a commander's type role (supervisory).
- How far the piloting task will migrate to supervision is one of the major issues that is being researched and addressed.

# Human Factors and the Systems Approach

- Human Factors is an important part of the overall system design process of any product or service.
- In UAS development it is particularly important because the exact role of the human has not been clearly defined at sub system or system level.
- The systems approach is ensuring that these choices are evaluated and that each part of the system is correctly integrated and human skills and needs are considered.
- ASTRAEA is not solely concentrating on the pilot interface. Other issues such as boredom, crew resource management and qualifications are also being considered.

# Example of Work Undertaken


**Multiple touch screen concept been investigated:**

- **Allows Information to be easily accessible**
- **Allows separation of concerns in terms of safety levels**
- **Centre screen has keyboard and mouse to allow easy editing of data**

# Human Factors Assessment

**Evaluate concepts & philosophies of human interaction with a variable autonomy system:**

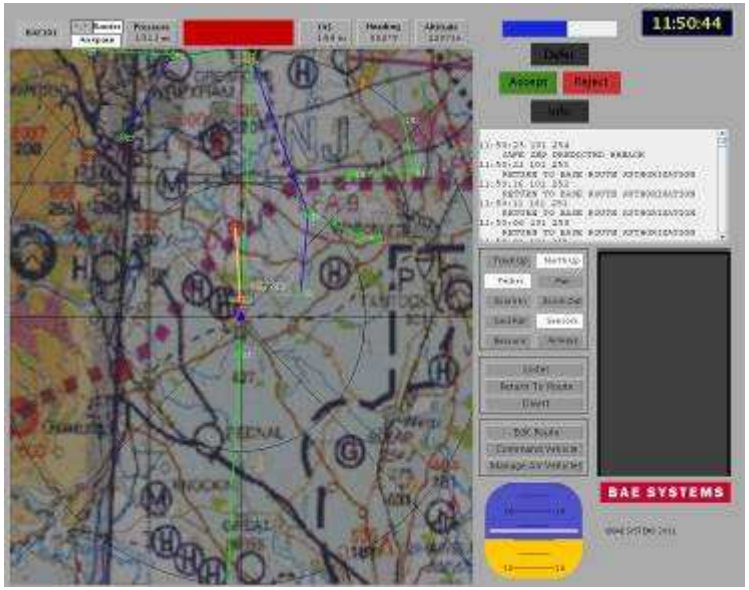
- **Sense & Avoid**
- **UAV parameter override**
- **Vehicle handover**
- **Command & Control delay**

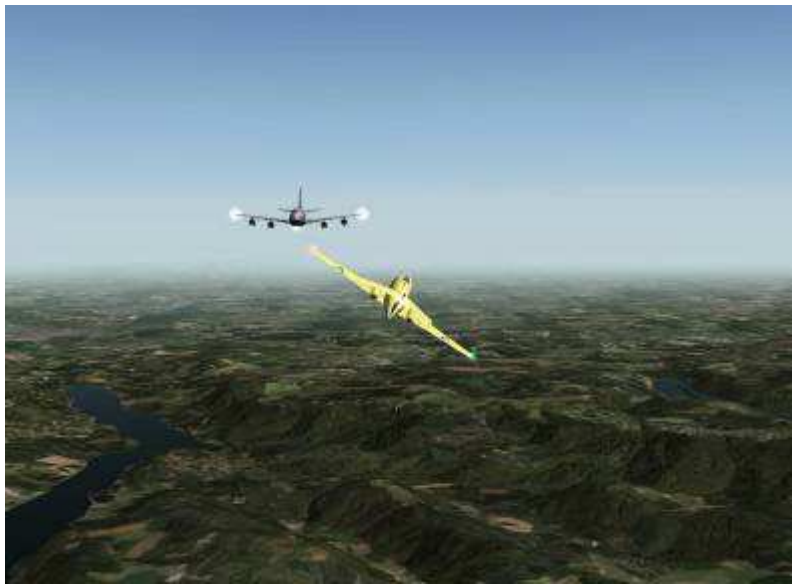
**Impact on Ground Control Station operator:**

- **Trust**
- **Situation Awareness**
- **Operator performance.**

# Assessment Approach

- High fidelity integrated Synthetic Environment facility
- Integrated Sense & Avoid and autonomy systems
- Experienced UAS aircrew and Flight Test Engineers
- Fully qualified Air Traffic Control Officers



# Assessment Results

## Sense & Avoid

- Sense & Avoid concept transparent to Air Traffic Control
- Ground Control Station operator interaction with Sense & Avoid acceptable
- Trust & Situation Awareness results varied

## UAV parameter override

- Override concept for flight parameters acceptable
- Operators used the override functionality regularly

# Assessment Results cont.

## Handover/Takeover

- Handover/Takeover supported between two remote Ground Control Station operators
- Shift handover in a single Ground Control Station supported
- Trust & Situation Awareness results good

## Command & Control

- Little impact on operator performance with Line Of Sight delay
- Beyond Line Of Sight delay was more challenging.

# Concluding Remarks

- Human Factors is an important issue in the development of UAS.
- The systems approach ensures that the human needs are being addressed and that the technology is being matched to human abilities.
- Further synthetic environment assessments and flight trials planned in 2011 & 2012 to address Human Factors issues identified to date
- Collaboration with the CAA will ensure that the Human Factors knowledge generated within ASTRAEA contributes to evolving regulations.