UAS Human Factors

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Bio

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Future Flight Deck
The march of the Drones...

WW1 - Kettering Bug

WW2 – V1 and V2

K/VN - Ryan ‘Lightning Bug’
The march of the Drones...
Increasing technology doesn’t make HF go away

“Why do you need Human Factors with Unmanned Systems?”

Multidisciplinary approach

Understanding human performance and capability

Relationship between humans, equipment and activities

Particular emphasis on the nature of human interaction with technology

Release to Service and associated Safety Case

To improve interaction, usability, effectiveness and SAFETY
The Human and UAS

- Information and command - Controls and Displays
- Introducing degrees of automation > autonomy
- Training, Selection and Retention
- Public attitude and acceptance
Accident data from UAS

(Taken from: DOT/FAA/AM-04/24 A Summary of Unmanned Aircraft Accident/Incident Data: Human Factors Implications (Williams, 2004)

Shadow (RQ-7)

Pioneer (RQ-2)
Accident data from UAS

Hunter (RQ-5)

Predator (RQ-1)

Accident data from UAS

Huge diversity in not only platforms, but Ground Station, Ops and infrastructure.
Turning to Automation....

Why automate?

Good – Addresses bottlenecks, frees up Operator, safety fall back
Bad – Automation bias, automation surprise, mode confusion

Why Autonomy?

Increase Safety (direct intervention or avoidance)
Improve efficiency (less manpower, reduced emissions)
Dull, Dirty, Dangerous..
Multiple Vehicles / Goals (Tasks)
Increase operational effectiveness (e.g. persistence)
Reduced/Hostile comms environment
Cost

Manning the Unmanned
Automation Vs Autonomy
Frameworks of control

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<th>AUTOMATION PACT</th>
<th>OPERATOR AUTHORITY</th>
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<table>
<thead>
<tr>
<th>UAS AUTHORITY</th>
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<tbody>
<tr>
<td>Full UAS authority</td>
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<tr>
<td>Action unless revoked</td>
</tr>
<tr>
<td>Advice and, if authorised, action</td>
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7th International Conference on Research in Air Transportation
June 20-24, 2016 - Drexel University, Philadelphia, PA
Human-in-the-loop

Levels of Autonomous Control

- Automation
- Semi-Autonomous
- Variable Autonomy
- Adaptive Autonomy

It is important to ensure the user is engaged with the system and what it is doing (or going to do)

Putting the user in the centre of the design

Respond to commands

Monitor and Input

Monitor only
Current CONOPs

Compliance to current regulations enforce strict guidelines on the operation of sUAS:

**Dronecode: Rules for flying drones in UK**

- Not within 50m of people, vehicles or buildings
- No higher than 122m (400ft)
- Must be in line of sight at all times
- No further than 500m away from pilot

Source: Civil Aviation Authority (Images not to scale)

All companies wishing to operate sUAS have to file for a PFAW and remain within the requirements of the ANO.
Autonomy roadmaps

- Autonomy is a disruptive technology
- Primarily driven by Industry
- Regulators trying to catch-up with push from Industry
- Lack of agreement and understanding of Autonomy amongst all stakeholders
- Lack of standardisation or methods for verifying Autonomous s/w
- Difficult to generate real flight data that can be used towards building a representative safety case

Public Attitude and Acceptance
But first: Media can shape public attitude

Over the last ten years we have seen a plethora of headlines that slants the use of UAVs in a negative light.

'Liller robots': Are they really inevitable?

By Tim Bowler
Business reporter, BBC News

© 21 May 2014 | Business
An equal partnership

Automated machines are everywhere. Slowly becoming pervasive and in some cases ubiquitous. In 2014, robot sales across the world increased by 29% to 229,261 units in comparison to the previous year¹.

And possibly a shift in attitudes to intelligent systems?

Human-Autonomy Teaming

Human-Agent Mission Planning for Emergency Response (HAMPER)

Human-Agent collaboration

- UAV 1
- Search Box
- Agent Search Area
- Flight path already flown
- Flight path not designated by Agent manager yet
- Current flight path being flown
- Found entity
- Human team search area
What do we need to shape?

Automation/Autonomy is here

Strong desire to open National Air Space for routine UAV operations

Automation/Autonomy can play an important role, but needs to be integrated appropriately

System must be designed in order to provide right cues to the operator in order to facilitate safe flight

Training, Selection, Retention, Certification....

Public Attitude and engagement

And....
Human-Systems Integration
Remember, what we all do today shapes the future...

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