Introduction

“Data does not become information until it has been understood in the mind of the pilot.”
Flight!
RPAS – a refresher

Operator Tasks
- Aviate
- Navigate
- Communicate
- Manage systems

OODA Loop
- Observe - Gather information
- Orient - Put Information in context
- Decide - Decide correct action
- Act - Perform Action
UAS Architecture changes with increasing size

Multi-Board Demon

Federated Avionics Global Hawk

Single Board Picopter
USAF RPAS Class A Mishap Rate

- General Aviation Rate 1.2/100,000 fh
- Boeing 737 Rate 0.13/100,000 fh
RPAS Information flow timescales
Flight Data Problems

10Hz 16bit ADC ~ 1.2Mb per Minute
30+ Channels ~ 36Mb per minute
Flight 7hrs+ ~ 2.1Gb per hour ~ 14.4Gb
Multiple aircraft - Different versions
Multiple Tb per day
The Immune system

B-Cells

T-Cells
Feature space

Example 2-dimensional feature space
- aircraft velocity
- load factor
### Feature space with AIS

#### AIS Learning
Self/Non-Self discrimination
Learning operational rules from flight data

1. Flight mishap cases within feature space
2. Non mishap Self within feature space
3. Simplified rule for aircraft on-board use
RPAS AIS structure discussion

- Aircraft Simulation
  - Comms
    - Telemetry
      - Comms
        - Flight History & maintenance data
          - Better power & processing
        - GCS AIS
          - Flight History & maintenance records
            - "Fresh" data
              - Limited power & processing
              - Better bandwidth
            - On-Board FOQA
              - On Board AIS
Conclusions

• RPAS need to improve their mishap rate and the lessons learned integrated into future designs
• Machine Learning may be a solution
  • But not suitable for FMS deployment
• Integrated Vehicle Health management has many opportunities in RPAS
• Linux and Open Source have a major role to play
Any Questions?

j.g.pelham@cranfield.ac.uk