The Principles of Flight Data Monitoring
Tuesday 7th November 2017

- Welcome
- Fire exits
- Agenda
Tuesday 7th November 2017

09:00       Introduction
09:15       FDM Principles & Process
10:30       Coffee Break
11:00       Fundamentals of Safety Management
12:00       Buffet Lunch
13:00       Flight Data Recording and Data Transfer
14:00       Coffee Break
14:30       Introduction to Flight Data Connect
15:30       Data Sharing
16:00       Close

Questions?
An Introduction to Flight Data Monitoring
Flight Data Monitoring isn’t very good
Flight Data Monitoring isn’t very good

...at giving the full picture

...but excellent at giving detail in a small area at a time
Flight Data Hardware
Lots of Acronyms!
Recorded parameters
Recorded Parameters

Logical Frame Layout
- Defines where the parameters are stored in the data stream
- Defines how to convert the data to engineering units

Data Frame
- A template applied to the data to provide an input standard for analysis

Analysis
- Data can now be checked
Altitude

- Pressure altitude 1013 mB / hPa
Altitude Radio & Altitude AAL

- Altitude Radio typically negative on ground
- Altitude AAL with respect to local airfield (not actual QFE)
Accelerations
Normal G, Lateral G, Longitudinal G
Roll and Heading

Roll (deg)

Heading (deg)

Time
Heading

Altitude (ft)

Heading (deg)

Time
Sample Rate & Quantisation

- Data is sampled periodically
- Measurement steps may be evident

**Air Temperature**

- Time
- Temperature (degC)

Actual Temperature

- Actual Temperature
Flight Data Process
The data card is removed from the aircraft...

...and inserted into a Data Transfer Unit where the raw flight data is securely transmitted to FDS

A few minutes

2 hours of flying
~ 1 MB
Upon receipt, a backup is created and archived.

The data is processed.

Flights, graphs, weather, in-browser visualisation and other information is available in POLARIS.

Within 1 hour

trending at 4 minutes
Flight Data Analysts check the event data for validity and post comments as necessary.

Within 1 working day
The Achieved Flight File
Sources of information

- **Recorded Flight Data**
  - Anywhere from 8 to 2000+ parameters

- **Quick Access Recorder**
  - A/c registration
  - Date and Time

- **Achieved Flight Record**
  - Location
  - Runway
  - Weight
  - Flight Number
  - Pilots
## Flight Data Summary: 2016-01-01 - 2016-02-29

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**Note:** Includes flights which are of type Commercial, Line Training, Training, Ferry or Positioning.

**Flight Coverage:** 1100 flown, 1052 analysed → 95%

### Flight Data Summary Legend

- **●** – Equal number of flights analysed and flights flown
- **●●** – More flights analysed than ops files received
- **●●●** – Fewer flights analysed than ops files received
Events
What is an Event?

Instances where the aircraft or the aircraft systems have operated outside of limits.

Those limits could be set either by your company or the aircraft manufacturer.

**Example technique**

Initiate the flare as the aircraft is descending through 20 feet.

**What we can measure**

Maximum and minimum pitch from 20ft to touchdown.
Key Point Values

- Measured for every aircraft, for every flight
- Over 1,000 different KPVs available
Key Point Values

Key Point Value Statistics: Pitch 20ft to Touchdown Max
Key Time Instances

KTI
Determine the touchdown point

KPV
Measure the maximum and minimum pitch

Event
Pitch at Touchdown
Phases and KTI's

- Transition to forward flight
- Transition from forward flight
- Standard runway approach
- ARDA offshore approach
- etc…
Sloping ground or takeoff?

<table>
<thead>
<tr>
<th>Landing Gear</th>
<th>Altitude (ft)</th>
<th>Pitch (deg)</th>
<th>Collective (%)</th>
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<tbody>
<tr>
<td>Ground</td>
<td>0</td>
<td>3.5</td>
<td>40</td>
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</table>
What is an Event?

- Defined in your Analysis Specification

- To identify **What** happened, and **When**

- The operator's has the responsibility to find out **Why**
Types of Event

- Safety
  - Pilot actions
- Maintenance
  - Airframe or system limit
- Fuel
  - Fuel Efficient Flying
Severity of Event

- Level 1: Auto validated
- Level 2: Validated by an analyst
- Level 3: Most severe

All events are available on the website
Safety Events

Event begins when the flap handle is moved.

Event ends when the flap handle is moved.
Maintenance Events

Event begins when the flap (or slat) surface starts to extend
Event ends when the flap (or slat) surface has retracted fully

Flap including Transition

Flap Surface
## Analysis Specification

### Pitch

| TPX001 | Pitch high at 35ft during takeoff | — | > 16.6 deg | > 17.0 deg |
| TPX002 | Pitch high 35-400ft | > 20.0 deg | > 22.0 deg | > 25.0 deg |
| TPX003 | Pitch high 400-1800ft | > 20.0 deg | > 22.0 deg | > 25.0 deg |
| TPX004 | Pitch low at 35ft during takeoff | — | — | < 12.0 deg |
| TPX005 | Pitch rate (negative) during takeoff | < 6.0 deg/s | < -5.5 deg/s | < -1.0 deg/s |
| TPX006 | Pitch high at lift-off | B767-300ER | — | > 10.5 deg | > 11.0 deg | > 11.5 deg |
| | B767-200ER | — | > 7.5 deg | > 9.0 deg | > 8.5 deg |
| TPX012 | Pitch low 35-400ft | < 12.0 deg | < 10.0 deg | < 8.0 deg |

![Graph showing distribution of pitch values](image-url)
Event Conditions

- Non standard approaches
- Airport or runway specific
- Aircraft specific
  (engine / mod state)

Bardufoss, Norway

Lukla, Nepal
### Patches

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<tr>
<th>Part</th>
<th>Condition</th>
<th>Minimum</th>
<th>Maximum</th>
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<td>LXX100</td>
<td>Unstable approach</td>
<td>—</td>
<td>≤ 1000 ft</td>
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<tr>
<td></td>
<td>Late Stability</td>
<td>—</td>
<td>≤ 500 ft</td>
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<td>FSA999</td>
<td>Airspeed (VMO) exceeded</td>
<td>≥ 250 kt</td>
<td>≥ 255 kt</td>
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<td></td>
<td>ATR-42 Mod. 1739</td>
<td>≥ 230 kt</td>
<td>≥ 235 kt</td>
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<td>LMX000</td>
<td>Landing weight high at touchdown</td>
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<tr>
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<td>≥ 62500 kg</td>
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<td>≥ 61000 kg</td>
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<tr>
<td>A320-200</td>
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<td>—</td>
<td>≥ 64500 kg</td>
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What does an analyst do?

Examine the flight data

- Check the quality of the data
- Check that all the conditions for each triggered event have been met

Validate Events

- Validate events according to customer wishes

Customer Contact

- Inform the customer of any aircraft problems
- Be available to answer any questions from the customer
Coffee Break Question....

What new Key Point Values would you create for your flights?