CASS 2007 Presentation

“Flight Data Monitoring as a Safety Management Tool”

Captain Bryon Mask
What is an FDA Program?

A program designed to enhance safety through the controlled, automated recording and analysis of flight data generated during routine line operations.
Flight Data Monitoring

• A flight data monitoring (FDM) program involves the regular downloading, replay and analysis of data recorded during the airline’s operation.

• The results of the analysis can be used by many departments within an airline – for example: Operations, Safety, Training, and Engineering each with their own specific needs and wants.

• The FDM office manages all data and addresses all security and reporting issues.
Teledyne’s End-to-End FDM Solution
In developing an FDM program, a critical consideration is data.

- Basic programs collect limited data and retain it just long enough to review it.

- Comprehensive Programs collect and retain data to permit detailed safety, trend and operational analysis. They also support advanced commercial market studies and research and permit in-depth reviews such as aircraft performance, fuel use and airport operations studies.
FDA Principles

The safe flight envelope - Normal, Detect and Alert zones

- **Normal operation**
  - Measurement Analysis
  - Storage and analysis of parameter measurements from normal operational flying.

- **Detect events**
  - Operational envelope based on flight control parameters

- **Alert events**
  - Exceedance Monitoring
  - Exception reports produced by comparison of a range of operational parameters with predefined DETECT and ALERT levels.

- **Alert level** fixed by operational limitations
- **Detect level** set as an arbitrary margin from ALERT level

www.teledynecontrols.com
The Swiss frame on the A320 enables Air Canada to create 196 events from the 1760 available parameters.

<table>
<thead>
<tr>
<th>Expanded Event Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 250 Kts CAS Below 10,000 ASL</td>
</tr>
<tr>
<td>Speedbrakes extended - Thrust above Idle</td>
</tr>
<tr>
<td>Seatbelt light not on In-Range check</td>
</tr>
<tr>
<td>Energy Management in Descent</td>
</tr>
<tr>
<td>Early Flap Selection</td>
</tr>
<tr>
<td>Flap/Slat Speed Exceeded in Descent</td>
</tr>
<tr>
<td>Fuel low during flight</td>
</tr>
<tr>
<td>Approach not activated in Landing Config</td>
</tr>
<tr>
<td>Gear Operation Limit (Ext)</td>
</tr>
<tr>
<td>Flap/Slat Speed Exceeded in Approach</td>
</tr>
<tr>
<td>Descent Rate High above 2000 Feet</td>
</tr>
<tr>
<td>Descent Rate High between 2000 and 1000 AGL</td>
</tr>
<tr>
<td>Descent Rate High between 1000 and 500 ft</td>
</tr>
<tr>
<td>Descent Rate High between 500 and 50 ft</td>
</tr>
<tr>
<td>Descent Rate High below 50 Ft</td>
</tr>
<tr>
<td>Terminal Area Speed Limit Exceeded</td>
</tr>
<tr>
<td>Approach Speed high at 1000 Ft AGL -A/T OFF</td>
</tr>
</tbody>
</table>
Event Set

Analysis of flight data for

EXAMPLE: Pitch attitude at take-off

0 Deg.
**Example Event Set – High Rate of Descent events:**

<table>
<thead>
<tr>
<th>Event Description</th>
<th>“Info” level</th>
<th>“Detect” Level</th>
<th>“Alert” Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descent Rate High between 2000 and 1000 AGL</td>
<td>descent rate &gt; 1700 ft/min ≥ 3 secs</td>
<td>descent rate &gt; 1800 ft/min ≥ 3 secs</td>
<td>descent rate &gt; 1900 ft/min ≥ 3 secs</td>
</tr>
<tr>
<td>Descent Rate High between 1000 and 500 ft</td>
<td>descent rate ≥ 1300 ft/min ≥ 3 secs</td>
<td>descent rate ≥ 1400 ft/min ≥ 3 secs</td>
<td>descent rate ≥ 1600 ft/min ≥ 3 secs</td>
</tr>
<tr>
<td>Descent Rate High between 500 and 50 ft</td>
<td>descent rate ≥ 1100 ft/min ≥ 3 secs</td>
<td>descent rate ≥ 1300 ft/min ≥ 3 secs</td>
<td>descent rate ≥ 1400 ft/min ≥ 3 secs</td>
</tr>
</tbody>
</table>
Landing Flap Selection

Altitude at which Landing Flap Set (3 or Full)
All flights, Oct 01 2005 to Mar 01, 2006

The FDA Program now has the ability to collect weather; it can tell if the approach conditions were VMC or IMC.
Web based reports

Use shall be in accordance with the title page of this presentation
Vision with Standard Parameter List
Vision Version 3.0 is completely integrated with Swiss Data Frame and the Service Provision.
Next Generation Dataframes
Overview of FDM Program Risk Analysis

- Flight Data analysis is a mirror of the airline operation so the program can be analyzed in order to reduce risk. Also it is necessary to:
  - understand risk and assess whether such risk is reasonable and supportable; and
  - When necessary, address risk.

- Objective: To reflect the results of line operations by sectors or fleets.
  - Flt ops management has to use this information to set baseline and identify areas of improvement.
Overview of FDM Program Risk Analysis cont’d

- Advise what steps have been taken to correct adverse trends; and then
- The program monitors changes to measure effectiveness of corrections.

➤ Risk is a factor but so is action and reaction.
Data Management Tools – Yesterday

- Limited Focus
  - Early generation jets had little automation or sophisticated systems.
  - Data Frame layouts had limited recorded parameters which hindered the ability to analyze data, therefore many “derived parameters” were built around mathematical models to assist in analysis.
  - Liability Issues associated with storing data provided a good reason not to save it, thus there was no capability to revisit archived data.
  - Human factors was still in its’ infancy.
  - Lack of Proactive safety culture which usually was identified after the accident took place.
Severity Assessment
- Made possible by the use of the rich data sources that are available today.
- Sophisticated aircraft systems that are not “pilot friendly” or automation that degrades basic piloting skills.
- Reporting Tools and Special Reports have been developed to provide feedback to the crews that help deal with such things as...

TCAS Commands
- Is it a Technology Issue?
  - Different versions of TCAS on different fleets or within similar fleets
- Is it a Training Issue?
  - Reaction to complex commands with minimum training provided.

Stable Approach Criteria
- Worldwide Airline Debate over final approach stabilization altitude.
- IMC or VMC.
Pilot Self Improvement Initiatives

- Study and Analysis are important but without feedback – it is all pointless. Specific types of feedback may include:
  - On-aircraft reports for crews - Pitch Report & Landing Report
  - Pilot Bulletins or Airline Magazine Articles
  - Pilot Awareness Kiosks
Retrospective Analysis

- Is an ability to mine your data, to ask complex questions of the database and to return to earlier flights and data within the database to support the research and responses

An example of what a User-defined FOQA Profile might be created for.

FAA Friday (March 22, 2002) published the immediate-adoptive airworthiness directive ordering special inspections of Airbus A300-600/A310s subjected to "extreme lateral loading" in flight, which the agency defined as exceeding 0.3g.”
We could do more, the tools and awareness have greatly improved on the industry side but….

 Regulations have not.

 Canada has no official or published FDM position.

 ICAO has not defined what FDM is or
  - What program elements must exist; and
  - How much of a fleet must be covered.
  - IATA example
Yes we are moving forward but at a snail’s pace. This can change . . .

- What is your Company’s / department’s position on FDM?
- Are you moving forward or are you in the FDM rut?
Challenges

- **Corporate Safety Culture**
  - Cost benefit analysis justification required to run program.

- **Government**
  - Protection of the data, pilot and airline from liability
  - Define the program and requirements to ensure meaningful exchanges of data amongst airlines for comparison purposes and special studies.
  - Ability for maintenance to use FDM data (QAR) to certify both aircraft and FDR serviceability.
  - Encourage Airlines to support the program.

- **Culture change – Reactive to Proactive**
  - Program can provide real time quality assurance that differentiates between simulator and line flying.
Technology may try to eliminate human error, but

Boeing 727

Airbus 320
Thank you for your attention