NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Airbus Vertical Tail High Loads for In Service Events

(6 Pages)
Loads

- LE10 - Vertical tail high loads in service events
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- Process analysis
  - Identification of events with potential high loads development on vertical tail.
  - Individual review of each event information/data
  - Classification with reference to four categories:
    - Airplane “loss of control”
    - Systems malfunctions
    - Atmospheric disturbances (gust)
    - Others (inadvertent engine reverse deployment in flight,..)
  - Establishment of the necessary data for loads analysis (time history).
    - Controls deflection (rudder,…) and aircraft movement parameters (sidestep,…) using the “Kinetic/Ny integration” method.
- Loads analysis
- Decision on structural inspection (program, execution)
- Review of structural inspection feed-back (finding).
**Loads**

- **LE10 - Vertical tail high loads in service events.**
  - Event analysis principle
    - Kinetic/Ny Integration method used.
    - Process applied

![Diagram showing the flow of flight data, flight mechanic parameters, and loads](image)

**Diagram Overview:**
- **DFDR** (Flight Data Recording) Reading Post-treatment
- Flight Data → Kinetic Ny Integr → Loads
- Flight Mechanic Parameters → Beta → Loads Model
- Sideslip → Shear Bending Torque
- Airplane attitudes, Rudder deflection, Beta, and Loads are connected through the process.
## Loads

**LE10 - Vertical tail high loads in service events - A300-600**

<table>
<thead>
<tr>
<th>Event Date</th>
<th>Event Family</th>
<th>Event</th>
<th>Speed (KIAS)</th>
<th>Config</th>
<th>Event Description</th>
<th>Crew Rudder Input</th>
<th>Rudder Doublet Yes/No</th>
<th>Ny (g)</th>
<th>Mx Fin Root</th>
<th>Detailed Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 01</td>
<td>Operation</td>
<td>A</td>
<td>250</td>
<td>Clean</td>
<td>successive Rudder doublets to TLU</td>
<td>yes</td>
<td>yes</td>
<td>0.33</td>
<td>1.96 LL</td>
<td>Accident</td>
</tr>
<tr>
<td>May 97</td>
<td>Stall/ Loss of control</td>
<td>B</td>
<td>190-230</td>
<td>Clean</td>
<td>Stall &amp; Loss of control. Several Rudder doublets to TLU during recovery.</td>
<td>yes</td>
<td>yes</td>
<td>0.55 &amp; 0.7</td>
<td>1.53 LL (1st fully recorded doublet)</td>
<td>Beyond ULEstimate for subsequent doublets (DFDR data not recorded)</td>
</tr>
<tr>
<td>May 99</td>
<td>Operation</td>
<td>C</td>
<td>150</td>
<td></td>
<td>Rudder erk</td>
<td>yes</td>
<td>yes</td>
<td>0.33</td>
<td>1.11 LL</td>
<td>16 March 02 No Finding</td>
</tr>
<tr>
<td>Nov 99</td>
<td>System Failure</td>
<td>D</td>
<td>220-250</td>
<td>Slats retract</td>
<td>Rudder trim runaway in climb at slats retract</td>
<td>yes</td>
<td>no</td>
<td>0.33</td>
<td>0.81 L</td>
<td>No</td>
</tr>
<tr>
<td>Nov 99</td>
<td>System Failure</td>
<td>E</td>
<td>180-190</td>
<td>Slats retract</td>
<td>Rudder trim runaway in climb at slats retract</td>
<td>yes</td>
<td>no</td>
<td>0.21</td>
<td>0.61 L</td>
<td>No</td>
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<tr>
<td>Mar 99</td>
<td>Maintenance Error</td>
<td>F</td>
<td>180-190</td>
<td>Slats out</td>
<td>Rudder oscillations in go around at A/P disconnect</td>
<td>no</td>
<td>no</td>
<td>0.32</td>
<td>1.16 LL</td>
<td>13 March 02 No Finding</td>
</tr>
<tr>
<td>Nov 98</td>
<td>Others</td>
<td>G</td>
<td>100</td>
<td>Clean</td>
<td>inadvertent thrust deployment</td>
<td>no</td>
<td>no</td>
<td>0.21</td>
<td>0.86 LL</td>
<td>21 March 02 No finding</td>
</tr>
</tbody>
</table>

All cases reported/analysed show Ny < 0.3 g, less lower than the one coming from design analysis.
### Loads

#### LE10 - Vertical tail high loads in service events - A310

<table>
<thead>
<tr>
<th>EVENT DATE</th>
<th>Event Family</th>
<th>Event</th>
<th>Speed (Vcas)</th>
<th>Config</th>
<th>Event</th>
<th>Crew Rudder Input</th>
<th>Rudder Doublet</th>
<th>Ny (g)</th>
<th>Mx</th>
<th>FitRoot</th>
<th>Inspection</th>
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</thead>
<tbody>
<tr>
<td>FEB 91</td>
<td>Stall / Loss of control</td>
<td>H 50 - 300</td>
<td>Conf 2</td>
<td>Missed approach followed by 3 successive stalls in go-around / loss of control with repetitive rudder movements.</td>
<td>Yes</td>
<td>Yes</td>
<td>0.36</td>
<td>0.69</td>
<td>1.55LL</td>
<td>1.35LL</td>
<td>Done 3 April 02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I 190 - 225</td>
<td>Conf 3</td>
<td>Missed approach followed by stall in go-around.</td>
<td>Yes</td>
<td>No</td>
<td>0.37</td>
<td>1.12LL</td>
<td></td>
<td></td>
<td>Done 26 March 02</td>
</tr>
<tr>
<td>DEC 91</td>
<td>System failure</td>
<td>J 275</td>
<td>Clean</td>
<td>Rudder Trim runaway while AP engaged; lateral upset at AP disconnect</td>
<td>Yes</td>
<td>Yes</td>
<td>0.49</td>
<td>1.06LL</td>
<td></td>
<td></td>
<td>Done 28 March 02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K 290 - 425</td>
<td>Clean</td>
<td>Rudder Trim runaway while AP engaged; lateral upset at AP disconnect followed by overspeed.</td>
<td>Yes</td>
<td>No</td>
<td>0.32</td>
<td>0.8LL</td>
<td></td>
<td></td>
<td>No - Not recommended</td>
</tr>
</tbody>
</table>

**Gust**

All cases reported/analysed show Ny < 0.3g, less lower than the one coming from design analysis.