CONSEQUENCES OF FLIGHT DECK AUTOMATION

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CONSEQUENCES OF FLIGHT DECK AUTOMATION

• HUMAN BEING-------------------------------MACHINE

• HUMAN BEING....A/P------------------------MACHINE

• HUMAN BEING....A/P---COMPUTERS--------MACHINE

• COMPUTERS HAVE THEIR OWN LAWS
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• THREE MAIN CLUSTERS FOR OUR ANALYSIS
  - MACHINE
  - HUMAN BEHAVIOUR
  - SAFETY
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• MACHİNE

• INCREASİNG COMPLEXİTY

• SHORT TIME FOR TYPE RATING

• SUPERFİCİAL KNOWLEDGE: ONLY WHAT PILOT CAN SEE AND TOUCH

• LEARNING BY FLYİNG
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• MACHINE

• EFIS

• FMS

• DISPLAYAIS: HUD, PFD, ND, ENG. AND WARNING DISPLAY...

• AUTO FLIGHT SYSTEM (A320 Air Inter)

• FLIGHT CONTROLS (A320 Alsace)
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• MACHINE

• PROTECTIONS

• RECONFIGURATIONS (A/P DISENGAGED)

• ALL TYPE OF APPROACHES

• ACCURACY

• RELIABILITY
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• MACHINE

• ENHANCED GPWS (Avianca MAD)

• TCAS (B757/Tupolev 154)

• COMMUNICATION SYSTEMS (English proficiency B747.-New York)

• DATA LINK (Decreases situational awareness, use of national languages)
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• HUMAN BEHAVIOUR

• PSYCOMOTOR SKILLS PLUS COGNITIVE SKILLS

• HUMAN MACHINE INTERPHASE (ALOT OF MONITORING, LESS DOING)

• CREW COORDINATION: CRM

• COCKPIT PREPARATION WORKLOAD
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• HUMAN BEHAVIOUR

• EASY FLIGHT WHEN A/P ENGAGED

• OVERCONFIDENCE ON THE MACHINE

• COMPLACENCY......LOSS OF SITUATIONAL AWARENESS

• FOLLOW THE GREEN LINE: NO ROW DATA
<table>
<thead>
<tr>
<th>Category</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Crew</td>
<td>74</td>
<td>55%</td>
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<tr>
<td>Airplane</td>
<td>23</td>
<td>17%</td>
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<tr>
<td>Weather</td>
<td>17</td>
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<td>Misc./Other</td>
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<td>Airport/Air Traffic Control</td>
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<td>5%</td>
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<tr>
<td>Maintenance</td>
<td>4</td>
<td>3%</td>
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<tr>
<td><strong>Total with known causes</strong></td>
<td><strong>134</strong></td>
<td><strong>89%</strong></td>
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<tr>
<td><strong>Unknown or awaiting reports</strong></td>
<td><strong>49</strong></td>
<td><strong>11%</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>183</strong></td>
<td><strong>100%</strong></td>
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</tbody>
</table>

*As determined by the investigating authority, percent of accidents with known causes.
CONSEQUENCES OF FLIGHT DECK AUTOMATION

- HUMAN BEHAVIOUR

- IS THE HUMAN BEING THE WEAKEST LINK?

- EVOLUTION OF MACHINES COMPARED WITH EVOLUTION OF HUMAN BEINGS (Pilots studies, programmes)

- JUDGEMENT AND DECISION MAKING

- HUMAN CAPACITIES AND LIMITATIONS
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• SAFETY

• CFITs (Avianca MAD, Cali)

• UPSETS

• IRONIES OF AUTOMATION (Prof. Earl Wiener)

• WORKLOAD IN EMERGENCIES (A330.- RIO/PARIS)
<table>
<thead>
<tr>
<th>Model</th>
<th>Hull Losses (H.L.)</th>
<th>HFL with Fatalities</th>
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<tbody>
<tr>
<td>707/720</td>
<td>151</td>
<td>73</td>
</tr>
<tr>
<td>727</td>
<td>90</td>
<td>52</td>
</tr>
<tr>
<td>DG-8</td>
<td>75</td>
<td>51</td>
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<tr>
<td>DG-9</td>
<td>89</td>
<td>47</td>
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<td>BAG 1-11</td>
<td>27</td>
<td>12</td>
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<tr>
<td>737-100/200</td>
<td>89</td>
<td>45</td>
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<td>F-28</td>
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<tr>
<td>747-100/200/300/SP</td>
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<td>DC-10/MD-10</td>
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<td>12</td>
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<td>L-1011</td>
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<td>3</td>
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<tr>
<td>A300</td>
<td>12</td>
<td>3</td>
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<tr>
<td>MD-80/90</td>
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<td>12</td>
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<tr>
<td>767</td>
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<tr>
<td>757</td>
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<td>BAe 146, RJ-70-85/100</td>
<td>9</td>
<td>6</td>
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<tr>
<td>A310</td>
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<td>6</td>
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<td>737-300/400-500</td>
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<tr>
<td>A300-600</td>
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<td>8</td>
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<tr>
<td>F-100/F-70</td>
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<td>3</td>
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<tr>
<td>747-400</td>
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<td>A330</td>
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<tr>
<td>777</td>
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<tr>
<td>737-600/700-800/900</td>
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<td>2</td>
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<tr>
<td>717</td>
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<tr>
<td>CRJ-700-900</td>
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<tr>
<td>EMB-170-175/190</td>
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<tr>
<td>**A380</td>
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<td>0</td>
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</tbody>
</table>

| Total      | 854                | 460                 |

Hull loss accident rate per million departures:
- Hull loss accident rate – total bar
- Hull loss with fatalities accident rate – lighter shaded portion

*The Comet, CV880/990, Caravelle, Concorde, Mercure, Trident and VC-10 are no longer in commercial service.
**These types have accumulated fewer than 1 million departures.
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• SUMMARY/MACHINE

• INCREASING COMPLEXITY

• ACCURACY AND RELIABILITY

• ALL TYPE OF APPROACHES

• EFFICIENCY

• INTEGRATION IN ATC SYSTEMS
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• SUMMARY/HUMAN BEHAVIOUR

• PILOTS MUST BE GOOD IN PSYCHOMOTOR AND COGNITIVE SKILLS

• THE SOPs, MORE THAN EVER, MUST BE RESPECTED

• CREW COORDINATION IS BASED ON CRM KNOWLEDGE AND TECHNIQUES

• THE HUMAN BEING MUST BECOME THE STRONGEST LINK OF THE CHAIN BECAUSE WHEN THINGS DON´T GO AS EXPECTED HE IS THE LAST BARRIER TO THE ACCIDENT
CONSEQUENCES OF FLIGHT DECK AUTOMATION

• **SUMMARY/SAFETY**

• **STATISTICS ARE ENOUGH ELOQUENT ABOUT THE HUGE INCREASE OF SAFETY DUE TO FLIGHT DECK AUTOMATION AND OTHER IMPROVEMENTS (HF AND CRM, NON TECHNICAL SKILLS, ATC, APP RADAR, MAINTENANCE..)**

• **BUT AIRCRAFTS DON´T FLY BY THEMSELVES, AT LEAST IN COMMERCIAL AIRLINES, AND**

• **CREW MEMBERS SHOULD RECEIVE THE APPROPRIATE TRAINING TO GET THEIR ATPL AND TYPE RRATING COURSES WITH A THOROUGH UNDERSTANDING OF NEW TECHNOLOGIES IN THE AVIATION SYSTEM AND THE FLIGHT DECK AUTOMATION**
CONSEQUENCES OF FLIGHT DECK AUTOMATION

- **SUMMARY/MD, BOEING, AIRBUS**

- **THE TECHNOLOGY IS USED TO ASSIST THE PILOT NATURALLY, WHILE GIVING THE PILOT THE FINAL AUTHORITY (MD)**

- **AUTOMATION IS A TOOL TO AID, NOT REPLACE, THE PILOTS (Boeing’s Automation Philosophy)**

- **THE PILOT IS THE FINAL AUTHORITY FOR THE OPERATION OF THE AEROPLANE (Airbus’s Automation Philosophy)**

- **BOTH CREW MEMBERS ARE ULTIMATELY RESPONSIBLE FOR THE SAFE CONDUCT OF THE FLIGHT (Airbus’s Automation Philosophy)**
AIRBUS OPERATIONAL GOLDEN RULES

Fleet a-320

- FLY THIS AIRCRAFT LIKE ANY OTHER AIRCRAFT

  • FLY, NAVIGATE, COMMUNICATE, in that order, and finally, MANAGE THE TASKS

  • WE HAVE TO CREATE AN OWN PROCEDURE, (not written) TO MONITOR THE FLIGHT OPERATION REVIEW: fuel, position, nearest suitable airport or airfield, fill the flight plan, check aircraft systems
AIRBUS OPERATIONAL GOLDEN RULES

• GOOD COMPREHENSION OF HOW NEW SYSTEMS AND NEW INSTRUMENTS WORK

• GOOD ATC COMMUNICATIONS (ACARS ?)

• DEVICES HAVE INFLUENCE IN THE PILOTS AND PILOTS HAVE INFLUENCE IN THE DEVICES

• ONE HEAD UP AT ALL TIMES
AIRBUS OPERATIONAL GOLDEN RULES

• CROSS CHECK THE ACCURACY OF THE FMS
• KNOW YOUR FMA AT ALL TIMES
• USE PROPER LEVEL OF AUTOMATION
• PRACTICE TASK SHARING AND BACK UP EACH OTHER
• WHEN THINGS DON´T GO AS EXPECTED-TAKE OVER. “YOU HAVE THE AIRCRAFT”