Human Factors and Organizational Issues

Human Performance presentation
PF04 Flight Crew Performance

• Checklists and brief completed before release
• Copilot made 0.8 Mach callout
• At 0.82 Mach, copilot stated “unlocking” and then moved feather lock handle to unlocked position
• Both pilots stated “pitch up”
# PF04 Flight Crew Procedures

<table>
<thead>
<tr>
<th>PILOT</th>
<th>COPilot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WK2 release</strong></td>
<td></td>
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<tr>
<td>Action: Vehicle control</td>
<td>Action: Ignite rocket motor</td>
</tr>
<tr>
<td>Verbal command: “Fire”</td>
<td></td>
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<tr>
<td><strong>0.8 Mach</strong></td>
<td>Verbal call: “0.8 Mach”</td>
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<tr>
<td>Action: Trim stabilizer</td>
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<tr>
<td><strong>Transonic bobble</strong></td>
<td>Verbal call: “Stabs (degrees)”</td>
</tr>
<tr>
<td><strong>1.4 Mach</strong></td>
<td>Action: Unlock feather</td>
</tr>
</tbody>
</table>

**Verbal call:**
- “Stabs (degrees)"
- “0.8 Mach”

**Action:**
- Unlock feather
- Ignite rocket motor
- Vehicle control
- Trim stabilizer
PF04 Flight Crew Training

- **SS2 simulator**
  - Normal and non-normal procedures
  - Full mission rehearsals
- **WhiteKnightTwo aircraft**
  - Simulated glide through touchdown
- **Extra EA-300L aerobatic airplane**
  - G tolerance training
  - Upset recovery training
PF04 Flight Crew Preparations

- PF04 flight readiness reviews
- Town hall meeting
- No issues related to pilot procedures for feather system
Stressors Contributing to Copilot’s Error

• Memorization of tasks
  - Flight test data card not referenced

• Time pressure
  - Complete tasks within 26 seconds
  - Abort at 1.8 Mach if feather not unlocked

• Operational environment
  - No recent experience with SS2 vibration and loads
Lack of Consideration for Human Error

• System not designed with safeguards to prevent unlocking feather
• Manuals/procedures did not have warning about unlocking feather early
• Simulator training did not fully replicate operational environment
• Hazard analysis did not consider pilot-induced hazards
FAA/AST Preapplication Consultation

- Scaled first met with AST in March 2010
- SS2 designed and manufactured before preapplication consultation
- System safety analysis in progress
FAA/AST Experimental Permit Evaluation

- January 2012 – Scaled submitted application
- Review within 120 days
- One point of contact between AST and Scaled
- AST staff questions filtered by AST management
- Pressure to approve applications
- May 2012 – SS2 initial permit approved
FAA/AST Safety Inspections

• Safety inspection plans completed before each launch
• Inspectors assigned to launch activity and not operator