THE FUTURE PILOT FOR THE FUTURE SKY

Frederik Mohrmann, NLR
HPE IN OPERATIONS
HOW DOES THE HPE CONCEPT WORK IN AN OPERATIONAL SCENARIO?

WHERE ARE THE PERFORMANCE LIMITS OF THE HPE MODEL?

HOW CAN WE SUPPORT THE HPE EFFECTIVELY?
**ELEC AC BUS 1 FAULT**

AC BUS 1 normally supplies the AC ESS BUS and, through TR1, the DC ESS BUS. In case of an AC BUS 1 FAULT both the AC and DC ESS BUS will be lost and therefore the AC ESS BUS FAULT and the DC ESS BUS FAULT will be displayed on the ECAM. However, both AC and DC ESS BUS can be recovered by switching the AC ESS FEED pushbutton to ALTN as displayed in the AC ESS BUS FAULT ECAM procedure.

- BLOWER ............................................. OVRD
  The avionics ventilation system is in the closed circuit configuration.
- WHEEL N.W. STEER FAULT

**VENT EXTRACT FAULT**

- EXTRACT .......................................... OVRD

**ENG 1 EPR MODE FAULT**

Refer to associated procedure

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**ELEC AC BUS 1 FAULT (CONT'D)**

**STATUS**

- LDG DIST PROC .......... APPLY
- Cab Zone at fixed temp
- Due to the loss of the galley fan, the Pack 1 controller, and
- the primary zone controller channel. (See associated
- procedures).

**CAT 2 ONLY**

**INOPSYS displayed on ECAM**

- R.L. HYD
- SPLR 3
- ADR 3
- RA 1
- CAPT TAT
- L.WSHLD HEAT
- L.WNW4D HEAT
- CAT 3
- L.R. TK PUMP 1
- CTR TK PUMP 1
- VENT BLOWER
- GALLEY FAN
- MAC 3
- CRG VENT
- GND COOL
- LAV DET
- PACK 1 REGUL
- MAIN GALLEY
- B L.ECC PUMP
- BSCU CH 1
- FUEL
- * F/CTRL

Other inoperative systems

- Left cabin fan
- Radar 1
- Sbyt Pitol/AOA
- ACARS
- Brake fans 5, 6, 7 and 8
- HUD

**Note:** The warning may be caused by a sub BUS failure. Consequently, only a part of the above-listed systems may be lost.
INITIAL APPROACH

GO AROUND WITH LIMITED FUEL

AC BUS 1 FAILURE & PF MISTAKES

SECOND GO AROUND (WIND SHIFT)

LANDING WITH LOW FUEL, WINDSHEILD FROZEN
SCENARIO
DESIGN

PHYSIO METRICS
& MENTAL
REPRESENTATION

PERFORMANCE
METRICS

EXPERIMENT

RESULTS

OUR NEXT
STEPS
ICAO DOC 9995
EVIDENCE BASED TRAINING
(COMPETENCY BASED TRAINING)

Situational Awareness

Problem Solving & Decision Making

Application of Procedures

HPE-sensitive
Single-pilot
PM relevant
 Observable
### Situation Awareness

<table>
<thead>
<tr>
<th>General</th>
<th>Descend &amp; Approach 27</th>
<th>Go around</th>
<th>AC BUS FAULT</th>
<th>Second LAPA calc (RWY)</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Exceeds</td>
<td>Develops what-if scenarios and plans for contingencies, including further anticipation of the far future.</td>
<td>Interprets and what-if scenarios, options, updates throughout the descent.</td>
<td>Interprets wind shift and PF errors. Interprets wind shift and PF errors, suggesting courses of action.</td>
<td>With AC fault, verifiable landing distance, realises it is a GM-B type problem and its consequences.</td>
<td>Throttle (wind) and observations in flight progress, combines with technical status of the aircraft. QIHU awareness. Selects takeoff in flight. Mentions CATI landing.</td>
</tr>
<tr>
<td>2 Meet</td>
<td>Has an awareness of the aircraft state in its environment (including people), projects to near future and anticipates changes.</td>
<td>Mentions fuel status, fuel status, and PF errors.</td>
<td>Verbalises consequences for landing.</td>
<td>Accepts additional inputs from ATC without actively seeking new information. QIHU awareness. Mentions CATI landing.</td>
<td>Acknowledges runway state, fuel state, weather, Mentions potential nose wheel steering problem.</td>
</tr>
<tr>
<td>3 Below</td>
<td>Spends time searching for irrelevant information, incomplete assessment of the situation.</td>
<td>Mentions fuel status, fuel status, and PF errors.</td>
<td>Does not notice one of the three events.</td>
<td>Does not notice fuel, and/or landing.</td>
<td>Requires extra time to complete the picture of the situation.</td>
</tr>
<tr>
<td>4 Unsatisfactory</td>
<td>Does not or incorrectly identify the state (changes), does not seek update.</td>
<td>No mention of fuel status.</td>
<td>Does not notice two of three events, or all.</td>
<td>Misses two of the three issues or all.</td>
<td>Misses urgency of the situation.</td>
</tr>
</tbody>
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### Decision Making

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<tbody>
<tr>
<td>1 Exceeds</td>
<td>Anticipates future states, effects and results, is proactive.</td>
<td>Demonstrates knowledge (Realises it is a GM-B type issue) of AC BUS fault consequences.</td>
<td>Demonstrates knowledge (Realises it is a GM-B type issue) of AC BUS fault consequences.</td>
<td>Anticipates possible weather deterioration in relation to landing runway.</td>
<td>Prepares for potential contingencies. Requests full help of emergency vehicles. Prepares cabin certificate for landing, etc.</td>
</tr>
<tr>
<td>2 Meet</td>
<td>Evaluates potential problems, identifies risks, considers alternatives and selects the best course of action. Continuously resees progress and adjust plans.</td>
<td>Understands the consequences once read from ECAM/OM. Realises it is a GM-B type issue.</td>
<td>Understands the consequences once read from ECAM/OM. Realises it is a GM-B type issue.</td>
<td>Combines technical follow with changes weather situation, decided on landing 09.</td>
<td>Accepts information and identifies the criticality of the situations: low fuel, relatively short runway, low weather conditions.</td>
</tr>
<tr>
<td>3 Below</td>
<td>Evaluates the problem poorly. Makes decisions based on incomplete information.</td>
<td>Does not combine the consequence with operational status (landing 02, potentially too short).</td>
<td>Does not combine the consequence with operational status (landing 09, potentially too short).</td>
<td>Misses elements, e.g. briefs go-around i.e. dedicating to landing 09.</td>
<td>Misses elements, e.g. briefs go-around i.e. dedicating to landing 09.</td>
</tr>
<tr>
<td>4 Unsatisfactory</td>
<td>Does not identify there is a problem. Does not indicate what must be done. Does not adjust plan where necessary.</td>
<td>Proposes course of action not taking into account both anomalies.</td>
<td>Proposes course of action not taking into account both anomalies.</td>
<td>Does not decide on runway 09 as best option for landing.</td>
<td>Suspects wrong actions, e.g. not using maximum stopping performance, possibly making a go-around.</td>
</tr>
</tbody>
</table>

### Application of Procedures

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<tr>
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<th>Go around</th>
<th>AC BUS FAULT</th>
<th>Second LAPA calc (RWY)</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Exceeds</td>
<td>Identifies and applies at the correct moment the procedures according to published operating instructions.</td>
<td>Mentions threats and errors, defines mitigating measures.</td>
<td>Determines knowledge of AC BUS fault procedure, anticipates time available vs procedure length.</td>
<td>Correctly calculates LAPA, at an early stage, identifies consequences early. Uses Mayday call.</td>
<td>Mentions threats and errors, defines mitigating measures. All preparations and checklists completed well in time.</td>
</tr>
<tr>
<td>3 Below</td>
<td>Applies in general the procedures according to published operating instructions. Unecessarily steps procedure steps.</td>
<td>Misses steps, caught by approach checklist.</td>
<td>Misses actions, gear, flaps, ATC</td>
<td>Slow in call for ECAM actions</td>
<td>Misses steps, caught by checklist or ECAM status.</td>
</tr>
<tr>
<td>4 Unsatisfactory</td>
<td>Follows the wrong procedure. Skips important procedure steps. Omit following the procedure in such a way that the result is influenced negatively.</td>
<td>Misses essential threats (RWY length, weather, fuel)</td>
<td>Forgets to fly the aircraft, misses procedure steps (status page, OM ref)</td>
<td>Incorrect calculation, wrong result.</td>
<td>Misses essential threats (runway length, runway state, fuel status, weather) in the briefing.</td>
</tr>
</tbody>
</table>

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**SAFETY | FUTURE SKY**

**10 March, 2017 | 11**
ONLINE TOOL
SCENARIO DESIGN

PHYSIO METRICS & MENTAL REPRESENTATION

RESULTS

PERFORMANCE METRICS

EXPERIMENT

OUR NEXT STEPS
ECG, HR
Breath rate
Impedance
Activity

ECG
SpO₂

CBT Circadian rhythm monitoring

[Image of a tablet displaying monitoring signals]
AVES SIMULATOR
@ DLR

ONLINE ASSESSMENT
@ NLR
PILOT FLYING (CAPTAIN)

SCRIPTED ROLE

PILOT MONITORING (FIRST OFFICER)

CANDIDATE PILOT
Three competencies

Situational Awareness
- Develops realistic scenarios and plans for contingencies, including future anticipation of the far future.
- Has an awareness of the aircraft state and its environment (including people), projects to near future and anticipates.
- Spots time searching for irrelevant information, incomplete assessment of the situation.
- Does not or incorrectly identify the state (changes), does not seek updates.

Problem solving and Decision making
- Anticipates future states, effects and risk, is proactive.
- Evaluates potential problems, identifies risk, considers alternatives and selects the best course of action. Continuously reviews progress and adjusts plans.
- Evaluates the problem poorly. Makes decisions based or incomplete information.
- Does not identify there is a problem. Does not indicate what must be done. Does not adjust plan where necessary.

Application of procedures
- Identifies and applies at the correct moment the procedures according to published operating instructions.
- Executes the prescribed procedures and operate the systems during normal and abnormal circumstances.
- Applies in general the procedures according to published operating instructions. Unnecessarily skips procedure steps.
- Follows the wrong procedure. Steps important procedure steps. Or follows the procedure in such a way that the result is influenced negatively.

Flight Scenario Video

Track your ratings

Play and Pause only

Test your sound (!)

Press icon to test
FOUR FLIGHT INSTRUCTORS

OVER THE SUMMER

ALL CREWS RATED
(4/10 MULTI-RATED)
Flight Session: Pilot 3, Competency: Situational Awareness

Instructor
- 6
- 7
- 8
- 11

Performance
- Exceeds -4
- Meets -3
- Below -2
- Unacceptable -1

Time
- 00:00:00
- 00:10:00
- 00:20:00
- 00:30:00
- 00:40:00
Pilot 10 DM (Data distribution spread, Resolution 2 min)
SCENARIO 1

Performance =

\[ 0.354 \times (25.935 \times \text{HR} + 41.075 \times \text{EYE} - 61.495) + 0.285 \times (28.928 \times \text{HR} + 44.242 \times \text{EYE} - 68.747) - 0.446 \times (-42.2185 \times \text{HR} + 31.697) + 0.313 \times (25.935 \times \text{HR} + 41.075 \times \text{EYE} - 61.495) \times (28.928 \times \text{HR} + 44.242 \times \text{EYE} - 68.747) \times (-42.2185 \times \text{HR} + 31.697) \]
Performance = PREDICTED PERFORMANCE

VALIDATE HPE EQUATION

SCENARIO 1

SCENARIO 2
<table>
<thead>
<tr>
<th>Inputs</th>
<th>Standard Phase</th>
<th>Initials</th>
<th>Pilot 1</th>
<th>Pilot 2</th>
<th>Pilot 3</th>
<th>Pilot 4</th>
<th>Pilot 5</th>
<th>Pilot 6</th>
<th>Pilot 7</th>
<th>Pilot 8</th>
<th>Pilot 9</th>
<th>Pilot 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td>Descent &amp; Approach 27</td>
<td>LAPA RWY27</td>
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<tr>
<td>fuel + Climb4000</td>
<td>Climb4000</td>
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<td>fuel + GoAround</td>
<td>GO Around</td>
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<td>fuel + BUS Failure + ECAM stat</td>
<td>ECAM PROCEDURE</td>
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<tr>
<td>fuel + New weather + Airports status</td>
<td>CONSIDER NEW AIRPORT (FUEL)</td>
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<tr>
<td>fuel + RWY27 not possible</td>
<td>RWY SHIFT (W/N)</td>
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<tr>
<td>Warning LAPA</td>
<td>Second LAPA calculation</td>
<td>LAPA RWY09 (Warning)</td>
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<tr>
<td>Limitations for landing? + Not automatic rollout possible + Air disengaged at 80°</td>
<td>OME (Knowledge about landing limitations)</td>
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<tr>
<td>PF visibility must be = 1</td>
<td>QHR (Awareness about PF visibility = 1)</td>
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<tr>
<td>“Ice on my window”</td>
<td>LANDING</td>
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</tbody>
</table>

Descent & Approach 27 | LAPA RWY27
GO Around | Climb4000
AC BUS Failure | ECAM PROCEDURE
AC BUS Failure | CONSIDER NEW AIRPORT (FUEL)
AC BUS Failure | RWY SHIFT (W/N)
Second LAPA calculation | LAPA RWY09 (Warning)
Approach | OME (Knowledge about landing limitations)
Approach | QHR (Awareness about PF visibility = 1)
LANDING
THE FUTURE PILOT
FOR THE FUTURE SKY....