PREPARING THE APPROACH
in case of failure
Preparing the Approach in case of failure

Contents

- Introduction
- Landing Distance Determination
- Approach Speed Determination
- Multiple Failures
- Landing Configuration on the MCDU
- Selected or Managed Speed?
- Use of the AP and A/THR
- Conclusion
**Introduction**

- Aircraft automation (A/P, A/THR, managed speed…) is designed to assist crews in their daily operations.

- As some automation may be unavailable or not recommended in failure cases, pilots have to adapt customary approach procedures to adjust to the situation.

- Airbus policy in flying the approach is similar for all its aircraft models. However, some aircraft specificities necessitate slightly different procedures for the A320, than for the A330/A340:
  - Aircraft automation is, therefore, not systematically used in the same way on the A320, A330, and A340.
In case of failure (hyd., conf., braking…), a landing distance factor should be applied. A landing distance factor applies to the actual landing distance with full manual braking.

- In case of failure (hyd., conf., braking…), a landing distance factor should be applied.
- A landing distance factor applies to the actual landing distance CONF FULL with full manual braking.
- Check that the runway length is compatible with the landing distance.
**Landing Distance Determination**

The actual landing distance is the distance to come to a complete stop from a point 50 feet above the landing surface. No margin is included in this distance.

**Configuration Full**

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Actual Landing Distance (Meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>130</td>
</tr>
<tr>
<td>Dry</td>
<td>820</td>
</tr>
<tr>
<td>Wet</td>
<td>1050</td>
</tr>
<tr>
<td>6.3 MM (1/4INCH) Water</td>
<td>1410</td>
</tr>
<tr>
<td>12.7 MM (1/2INCH) Water</td>
<td>1340</td>
</tr>
<tr>
<td>6.3 MM (1/4INCH) Slush</td>
<td>1380</td>
</tr>
</tbody>
</table>

Preparation of the Approach in case of failure

Aircraft stop with failure

Actual landing dist x ldg dist factor
Landing Distance Determination ...

- The ECAM displays "LDG DIST PROC .......... APPLY"

- Refer to the QRH

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### A330 ABNORMAL PROCEDURES

**LDG CONF/APPR SPD/ LDG DIST FOLLOWING FAILURES**

<table>
<thead>
<tr>
<th>A330</th>
<th>FAILURE</th>
<th>FLAPS LEVER POSITION FOR LDG</th>
<th>VREF APPR SPD INCREMENT</th>
<th>MULTIPLY LDG DIST CONF FULL BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>EMER CONFIG</td>
<td>3</td>
<td>-</td>
<td>1.1</td>
</tr>
<tr>
<td>R</td>
<td>DC BUS 1 + 2 FAULT</td>
<td>NORM (1)</td>
<td>-</td>
<td>1.1</td>
</tr>
<tr>
<td>R</td>
<td>DC BUS 2 FAULT</td>
<td>NORM (1)</td>
<td>-</td>
<td>1.1</td>
</tr>
<tr>
<td>R</td>
<td>ELEC</td>
<td>If ice accretion: DC ESS BUS FAULT/DC ESS SHED</td>
<td>NORM (1)</td>
<td>10</td>
</tr>
</tbody>
</table>
Landing Distance Determination ...

Recent QRH change:

To take into account a landing in CONF 3, when CONF 3 or FULL can be used (the landing distance factor assumes that CONF full is used, if no specific landing configuration is required).

<table>
<thead>
<tr>
<th>F/CTL</th>
<th>RUDDER JAM (engine out)</th>
<th>ALTN/DIRECT LAW</th>
<th>PRIM 1+3, 2+3 FAULT</th>
<th>PRIM 1+2+3 FAULT</th>
<th>ONE/TWO SPLRS per wing</th>
<th>THREE/FOUR SPLRS per wing</th>
<th>FIVE/ALL SPLRS per wing</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>2</td>
<td>3</td>
<td>NORM (1)</td>
<td>3</td>
<td>NORM (1)</td>
<td>NORM (1)</td>
<td>NORM (1)</td>
</tr>
<tr>
<td>R</td>
<td>20</td>
<td></td>
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<tr>
<td></td>
<td>1.3*</td>
<td></td>
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<td>1.4*</td>
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<tr>
<td></td>
<td>1.1*</td>
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<td>1.1</td>
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</tr>
<tr>
<td></td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) If CONF 3 is used when “NORM” is indicated in the table, multiply the resulting landing distance by an additional factor of 1.1.
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VAPP Determination with a Failure

- The approach speed increment improves handling characteristics.

- The ECAM displays the appropriate speed increment.

- When an abnormal configuration is detected and reached (actual slats/flaps position), the PFD displays the correct $V_{LS}$. 
ECAM Display:
- The ECAM displays a speed increment, when necessary:
  - For the A320 family:
    - ECAM displays a $\Delta V_{\text{REF}}$ to be added to $V_{\text{REF}}$
    - For slat / flap failures the $V_{\text{REF}} + \Delta V_{\text{REF}}$ is equal to the $V_{\text{LS}}$ on PFD.
  - For the A330/A340:
    - ECAM displays a $\Delta V_{\text{LS}}$ to be added to the $V_{\text{LS}}$ of the landing configuration.
    - No $\Delta V_{\text{LS}}$ for slat / flap failures, since the $V_{\text{LS}}$ takes into account the actual slat / flap position.
**VAPP Determination with a Failure ...**

**Preparing the Approach:**

During approach preparation, the pilot determines the $V_{\text{APP}}$.

In the event of failure, since the $V_{\text{LS}}$ (or $V_{\text{REF}}$) are unknown from the PFD:
Preparing the Approach: 

During approach preparation, the pilot determines the $V_{\text{APP}}$. In the event of failure, since the $V_{\text{LS}}$ (or $V_{\text{REF}}$) are unknown from the PFD:

- Use the QRH
VAPP Determination with a Failure ...

- Determine $V_{REF} (= V_{LS} \text{ CONF FULL})$ on the table for expected landing weight.

- Determine $\Delta V_{REF}$ on the abnormal configuration table.

$V_{APP} = V_{REF} + \Delta V_{REF} + \text{WIND correction}$

max 20 knots, unless $\Delta V_{REF} > 20$ knots
Note that, on the A330 and A340, $V_{LS} + \Delta V_{LS}$ can also be used when $V_{LS}$ is shown on the PFD, and once the appropriate landing configuration is reached.
Multiple Failures

- Very remote probability. The QRH provides all of the necessary data, just in case.

- In case of multiple failures, the ECAM automatically takes into account the appropriate landing configuration and approach speed increment.
Multiple Failures ...

- The less extended configuration should be used.

A330 EXAMPLE

FLAP FAULT in position 3

CONF 3

RUD TRV LIM FAULT

CONF 2

ECAM displays

CONF 2
Multiple Failures ...

- The highest approach speed increment should be used.

R ELEV FAULT

SLATS FAULT in position 0

$V_{REF} + 10$

$V_{REF} + 25$

ECAM displays

$V_{REF} + 25$

A321 EXAMPLE
Multiple Failures ...

Landing Distance:

• The landing distance is increased for two reasons, either due to:
  ■ An increase in approach speed, and/or...
  ■ A braking degradation (brake failure, loss of ground spoilers…).

• If multiple failures only affect approach speed, or braking capability, the highest landing distance factor should be used. Otherwise, the landing distance factors must be multiplied.
Multiple Failures ...

- Take the highest landing distance factor, when all landing distance factors are marked with an asterisk (*).

**Use of the QRH Table - A321 Example**

- **Conf 3**
  - $V_{REF} + 10$
  - Ldg dist x 1.3*

- **Conf 3**
  - $V_{REF} + 25$
  - Ldg dist x 1.35*

Landing distance factors due to a common reason ($V_{APP}$):

- Take the highest landing distance factor.

- **Conf 3**
  - $V_{REF} + 25$
  - Ldg dist x 1.35
Preparing the Approach in case of failure

**Multiple Failures ...**

- Multiply the landing distance together, if one landing distance factor is not marked with an asterisk (*).

<table>
<thead>
<tr>
<th>Conf 3</th>
<th>V_{REF} + 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ldg dist x 1.2*</td>
<td></td>
</tr>
</tbody>
</table>

**Landing distance factors due to independent reasons:**

- Multiply the landing distance factors

<table>
<thead>
<tr>
<th>Conf 3</th>
<th>V_{REF} + 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ldg dist x 1.8</td>
<td></td>
</tr>
</tbody>
</table>

**Use of the QRH Table - A321 Example**

- R ELEV FAULT
  - V_{REF} + 10
  - Ldg dist x 1.2*

- BRK ANTISKID FAULT
  - Ldg dist x 1.5
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Landing Configuration on the MCDU

- If CONF 3 is used for landing, it affects the $V_{\text{APP}}$ computation and the GPWS “TOO LOW FLAPS”.
Landing Configuration on the MCDU ...

A320 Family:

- The GPWS does not receive the landing configuration selected on the MCDU.
Landing Configuration on the MCDU ...

A320 family...

- The GPWS does not receive the landing configuration selected on the MCDU.
- When CONF 3 is required, the ECAM displays:
  - GPWS LDG FLAP 3 ........................................ON

in order to avoid the “TOO LOW FLAPS” warning.
Landing Configuration on the MCDU ...

A330/A340:

- The GPWS receives the landing configuration selected on the MCDU, and automatically inhibits the FLAP mode when CONF 3 is selected on the MCDU.
Landing Configuration on the MCDU ...

A330/A340...

- The GPWS receives the landing configuration selected on the MCDU, and automatically inhibits the FLAP mode when CONF 3 is selected on the MCDU.

- A “TOO LOW FLAPS” GPWS warning would occur on the A330/A340, if CONF FULL is selected on the MCDU, and the landing is performed in CONF 3.

Note:
The ECAM requests that GPWS be set to OFF, when CONF 2 is required.
Preparing the Approach in case of failure

**Landing configuration on MCDU**

- Select conf FULL on MCDU and read VREF to determine VAPP.

- For approach:
  - select CONF FULL on MCDU for landing in CONF FULL, (or for landing in CONF 2 on A330/A340).
  - select CONF 3 on MCDU for landing in CONF 3.

This enables the use of managed speed in most of cases.
Selected or Managed Speed?

- **Managed speed** can be used if the landing CONF and the CONF on the MCDU are the same.
  - This will avoid any case of managed speed approach in CONF 3 being limited to F speed (where F is greater than $V_{APP}$).

- **Selected speed** should be used, if:
  - The landing CONF and the CONF on the MCDU are different, or
  - Selected speed is required by the procedure: Typically in the case of a slats/flaps failure.
**Selected or Managed Speed? ...**

- Why should managed speed not be used, if the landing CONF and the CONF on the MCDU differ?

- CONF FULL is selected on the MCDU.
- CONF 3 is selected on the flap lever.
- The aircraft will remain at F speed, as long as CONF 3 is selected, and cannot decelerate down to $V_{APP}$. 

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**Preparing the Approach in case of failure**

CONF 3 is selected on the flap lever.
Managed or selected speed?

Key points, in case of failure:

- In order to determine VAPP, select initially CONF FULL to read VREF.
- Select Conf FULL or 3 on MCDU
- Managed speed can be used for landing in conf FULL or 3 (if no slat/flap failure).
- Selected speed in case of slat/flap failure.
Selected or Managed Speed? ...

In some cases, managed speed cannot be used down to landing:

- Overweight landing on the A320 family:
  - Once in CONF 1, if the target speed (S) is higher than \( V_{FE} \) CONF 2, the crew must use selected speed to decelerate below \( V_{FE} \) CONF 2.
  - Once in CONF 2, the crew can use managed speed again.
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Use of the AP and A/THR

● The AP and A/THR may be used, if available, provided the ECAM procedure does not request their disconnection.

● AP behavior must be closely-monitored:
  - Pitch / Roll Authority may be reduced.
  - Gains are not tuned for failure cases:

  *Example: For slat/flap failures, the AP may be used down to 500 feet AGL.*
Use of the AP and A/THR ...

- The A/THR has to be disconnected, in some cases at very high weight to decelerate below characteristic speeds:

  - In an A321 overweight landing at 90,000 kg, the A/THR has to be deselected to decelerate below $V_{FE \text{ CONF1}}$ (which is equal to $V_{LS \text{ CONF clean}}$).

  Afterwards, the A/THR may be re-engaged.
Conclusion

- Recommendations on the:
  - Selection of CONF on the MCDU.
  - Use of managed or selected speed...

  will be published in the FCOM/QRH’s July 2002 Revision.

- Guidelines will also be given during training.