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

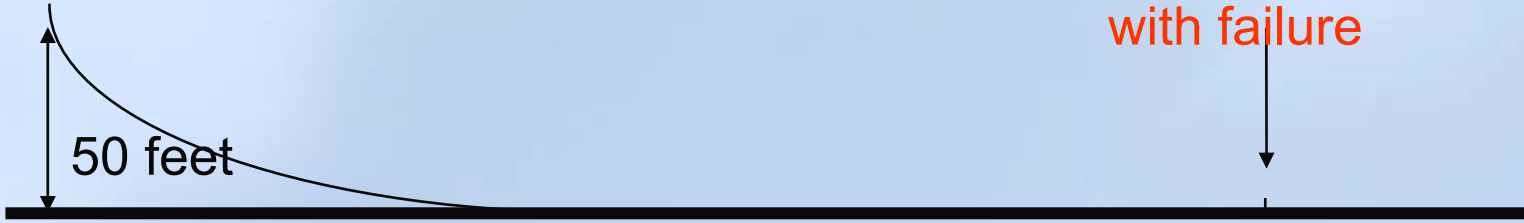
Introduction

- 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.

Landing Distance Determination

- 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



With Failure

Actual landing dist x ldg dist factor

A330	IN FLIGHT PERFORMANCE	REV 16 SEQ 010	4.03

LANDING DISTANCE WITHOUT AUTOBRAKE

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

R

ACTUAL LANDING DISTANCE (METERS)							
WEIGHT (1000 KG)			130	150	170	190	210	230
RUNWAY CONDITION	DRY		820	860	980	1110	1260	1430
	WET		1050	1070	1170	1290	1420	1580
	COVERED WITH	6.3 MM (1/4INCH) WATER	1410	1460	1660	1870	2060	2300
		12.7 MM (1/2INCH) WATER	1340	1390	1570	1770	1950	2150
		6.3 MM (1/4INCH) SLUSH	1380	1420	1570	1750	1950	2130

Landing Distance Determination ...

- The ECAM displays

  "LDG DIST PROC.....APPLY"

- Refer to the QRH

A330	ABNORMAL PROCEDURES	REV 15 / SEQ 100	2.25

LDG CONF/APPR SPD/ LDG DIST FOLLOWING FAILURES

	A330	FAILURE	FLAPS LEVER POSITION FOR LDG	△ VREF APPR SPD INCREMENT	MULTIPLY LDG DIST CONF FULL BY
	ELEC	EMER CONFIG	3	–	1.1
R		DC BUS 1+2 FAULT	NORM (1)	–	1.1
R		DC BUS 2 FAULT	NORM (1)	–	1.1
R		. If ice accretion : DC ESS BUS FAULT/DC ESS SHED	NORM (1)	10	1.2

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).

R	F/CTL	RUDDER JAM	2	20	1.3*
		RUDDER JAM (engine out)	2	25	1.4*
		ALTN/DIRECT LAW	3	–	1.1*
R		PRIM 1+3, 2+3 FAULT	NORM (1)	–	1.1
		PRIM 1+2+3 FAULT	3	–	1.2
R	SPLR	ONE/TWO SPLRS per wing	NORM (1)	–	NEGLIGIBLE
R		THREE/FOUR SPLRS per wing	NORM (1)	–	1.1
R		FIVE/ALL SPLRS per wing	NORM (1)	–	1.2

R (1) If CONF 3 is used when "NORM" is indicated in the table, multiply the
R resulting landing distance by an additional factor of 1.1

Contents ...

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}**.

VAPP Determination with a Failure ...

ECAM Display:

- The ECAM displays a speed increment, when necessary:
  - For the A320 family:
    - **ECAM displays a ΔV_{REF} to be added to V_{REF}**
    - For slat / flap failures the $V_{REF} + \Delta V_{REF}$ is equal to the V_{LS} on PFD.
  - For the A330/A340:
    - **ECAM displays a ΔV_{LS} to be added to the V_{LS}** of the landing configuration.
    - No ΔV_{LS} for slat / flap failures, since the V_{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_{APP}.

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

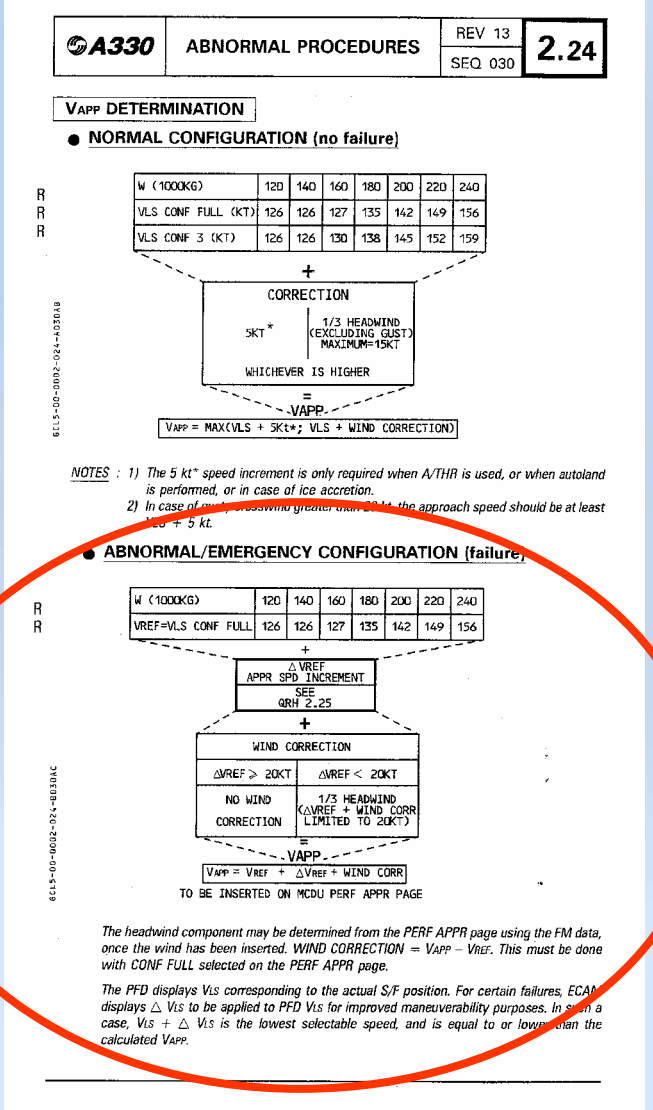
VAPP Determination with a Failure ...

Preparing the Approach:

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

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

- Use the QRH



A330 | ABNORMAL PROCEDURES | REV 13 | SEQ 030 | 2.24

VAPP DETERMINATION

● NORMAL CONFIGURATION (no failure)

W (1000KG)	120	140	160	180	200	220	240
VLS CONF FULL (KT)	126	126	127	135	142	149	156
VLS CONF 3 (KT)	126	126	130	138	145	152	159

R R R

+

CORRECTION

5KT*	1/3 HEADWIND (EXCLUDING GUST) MAXIMUM=15KT

WHICHEVER IS HIGHER

=

VAPP

VAPP = MAX(VLS + 5Kt*; VLS + WIND CORRECTION)

6CLS-00-0002-024-A03AB

NOTES : 1) The 5 kt* speed increment is only required when A/THR is used, or when autoland is performed, or in case of ice accretion.

2) In case of [illegible] crosswind greater than [illegible] the approach speed should be at least VLS + 5 kt.

● ABNORMAL/EMERGENCY CONFIGURATION (failure)

W (1000KG)	120	140	160	180	200	220	240
VREF=VLS CONF FULL	126	126	127	135	142	149	156

R R

+

ΔVREF APPR SPD INCREMENT SEE QRH 2.25

+

WIND CORRECTION

ΔVREF ⩾ 20KT	ΔVREF < 20KT
NO WIND CORRECTION	1/3 HEADWIND (ΔVREF + WIND CORR LIMITED TO 20KT)

=

VAPP

VAPP = VREF + ΔVREF + WIND CORR

TO BE INSERTED ON MCDU PERF APPR PAGE

6CLS-00-0002-024-AB39AC

The headwind component may be determined from the PERF APPR page using the FM data, once the wind has been inserted. WIND CORRECTION = VAPP – VREF. This must be done with CONF FULL selected on the PERF APPR page.

The PFD displays VLS corresponding to the actual S/F position. For certain failures, ECAM displays Δ VLS to be applied to PFD VLS for improved maneuverability purposes. In such a case, VLS + Δ VLS is the lowest selectable speed, and is equal to or lower than the calculated VAPP.

VAPP Determination with a Failure ...

- Determine V_{REF} (= V_{LS} CONF FULL) on the table for expected landing weight.
- Determine ΔV_{REF} on the abnormal configuration table.

● **ABNORMAL/EMERGENCY CONFIGURATION (failure)**

W (1000KG)	120	140	160	180	200	220	240
VREF=VLS CONF FULL	126	126	127	135	142	149	156

+

ΔVREF APPR SPD INCREMENT
SEE QRH 2.25

+

WIND CORRECTION	
ΔVREF ⩾ 20KT	ΔVREF < 20KT
NO WIND CORRECTION	1/3 HEADWIND (ΔVREF + WIND CORR LIMITED TO 20KT)

=

VAPP

$V_{APP} = V_{REF} + \Delta V_{REF}$ + WIND CORR

TO BE INSERTED ON MCDU PERF APPR PAGE

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

max 20 knots, unless ΔV_{REF} > 20 knots

VAPP Determination with a Failure ...

- 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.

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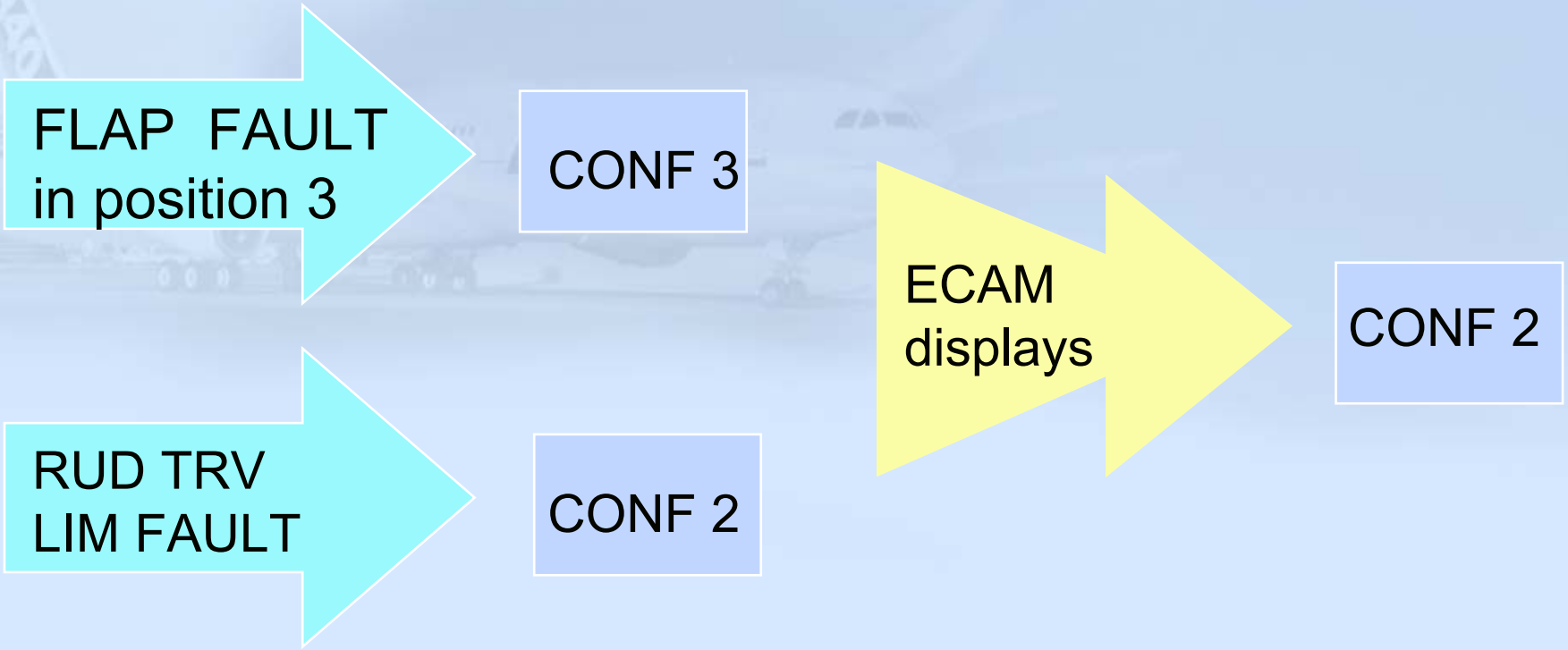
Multiple Failures

- 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.

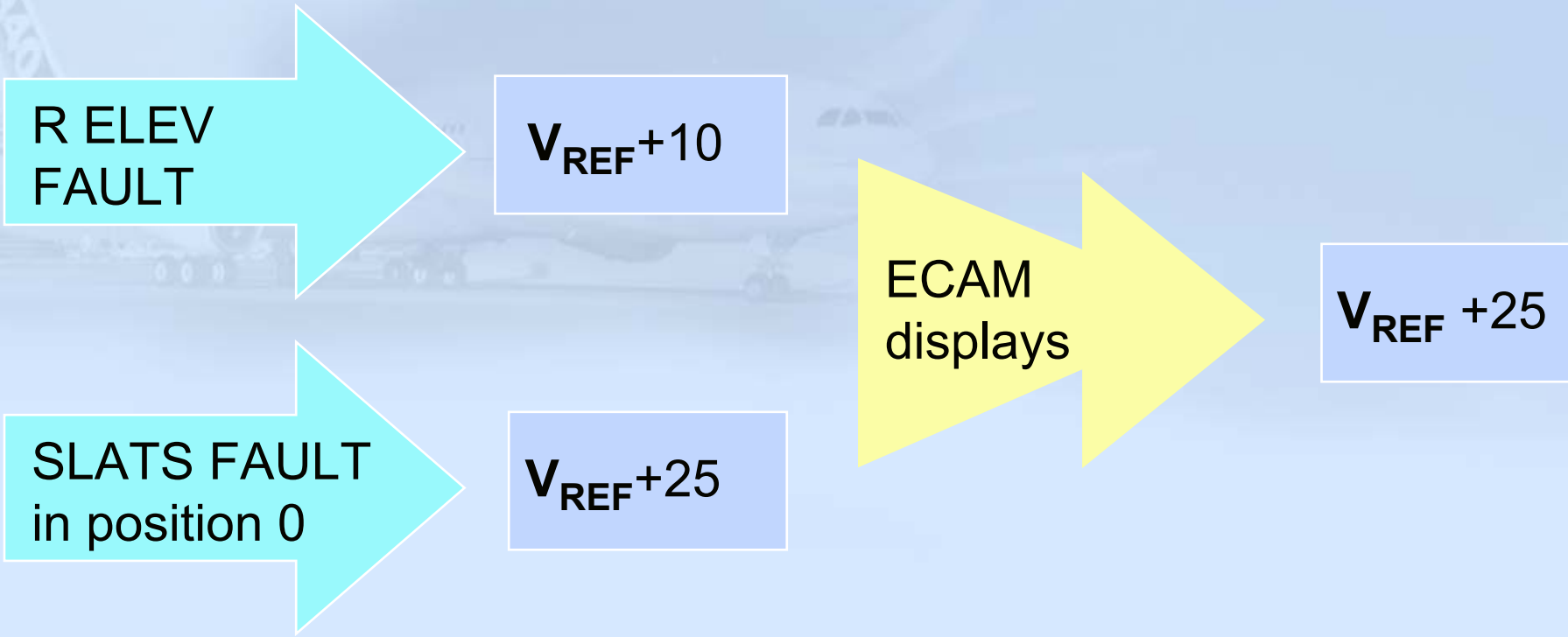
A330 EXAMPLE



Multiple Failures ...

- The highest approach speed increment should be used.

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 (*).

ALTN LAW

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

SLATS LOCKED in clean

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

Use of the QRH Table - A321 Example

Multiple Failures ...

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

R ELEV FAULT

Conf 3
V_{REF} + 10
Ldg dist x 1.2*

BRK ANTISKID FAULT

—
—
Ldg dist x 1.5

Landing distance factors due to independent reasons:

Multiply the landing distance factors

Conf 3
V_{REF} + 10
Ldg dist x 1.8

Use of the QRH Table - A321 Example

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Landing Configuration on the MCDU

- If CONF 3 is used for landing,
  it affects the $\mathbf{V_{APP}}$ 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...

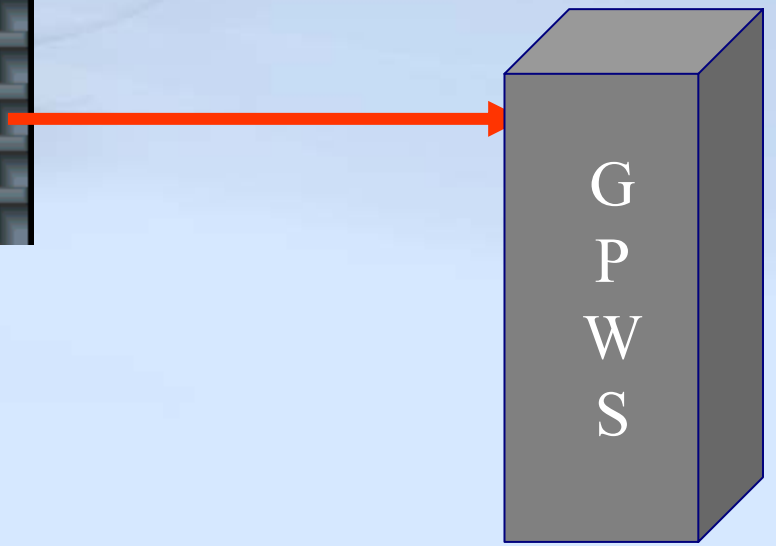
- The GPWS does not receive the landing configuration selected on the MCDU.
- When CONF 3 is required, the ECAM displays:
  - **GPWS LDG FLAP 3 .....ON**

  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.

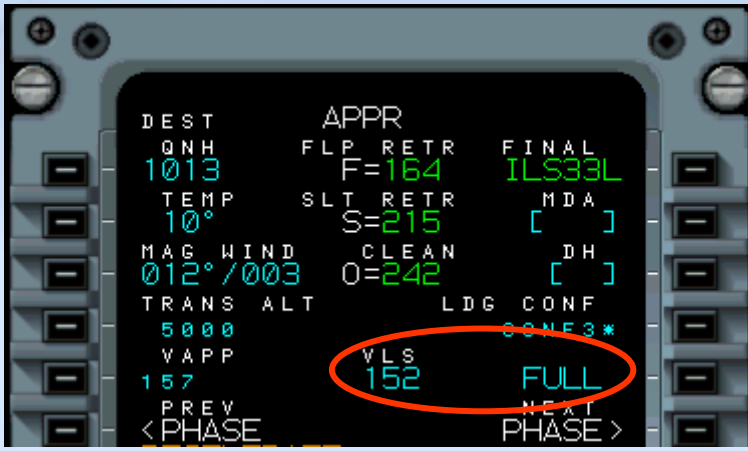
Note:

The ECAM requests that GPWS be set to OFF, when CONF 2 is required.

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.

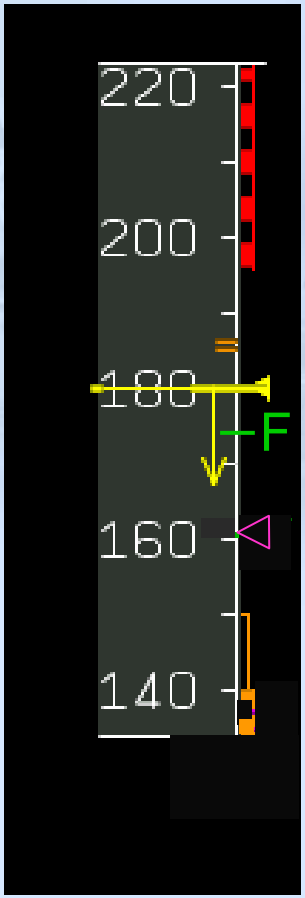
Contents ...

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}.

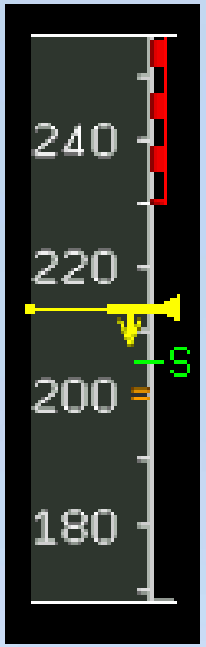
Managed or selected speed ?

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 $\mathbf{V_{FE}}$ CONF 2, the crew must use selected speed to decelerate below $\mathbf{V_{FE}}$ 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} CONF1 (which is equal to V_{LS} 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.**