Operational Liaison Meeting 2012

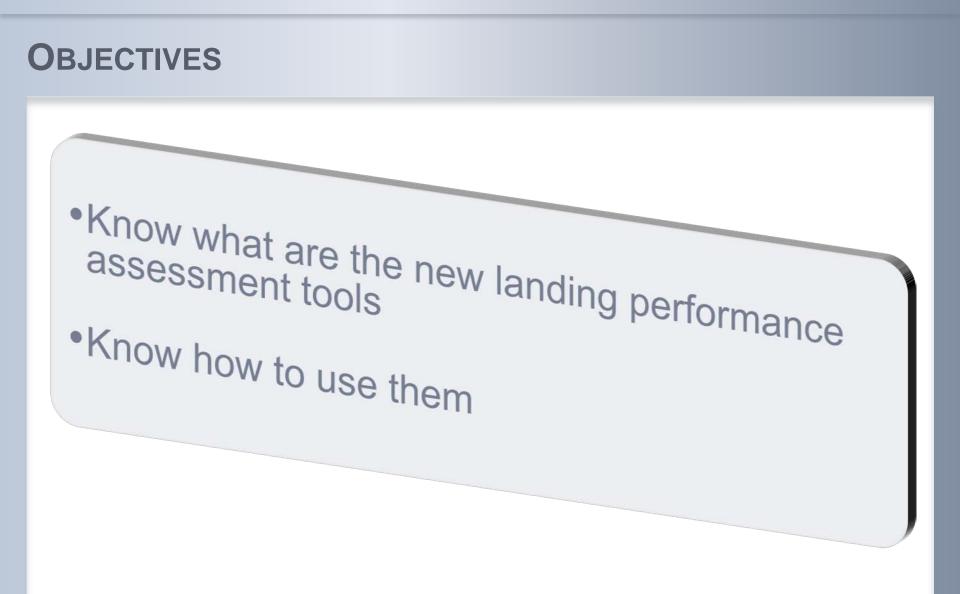
In flight landing performance

New tools to assess your landing performance

Presented by STLL











1	BACKGROUND
2	WHAT IS NEW?
3	FACTORED LANDING DISTANCE
4	FLYSMART WITH AIRBUS
5	WHERE AND WHEN?





1	BACKGROUND	
2	WHAT IS NEW?	
3	FACTORED LANDING DISTANCE	
4	Flysmart with Airbus	
5	WHERE AND WHEN?	



- A third of major accidents of large commercial transport aircraft are runway excursions
- Many involve difficulties for the flight crew to realistically assess the landing performance





- Currently, Actual Landing Distance (ALD) is the reference to determine in flight landing performance
- ALD are defined by regulations and based on flight tests.



Thus, ALD are not representative of daily operations



- Following runway excursions, the FAA mandated the **TALPA/ARC*** to find a strong industry consensus.
- The purpose was to elaborate common tools to better assess the in-flight landing performance



Dispatchers



Airports



Pilots

All users need to share a common performance reference

* Takeoff and Landing Performance Assessment / Aviation Rulemaking Committee



- Following runway excursions, the FAA mandated the **TALPA/ARC*** to find a strong industry consensus.
- The purpose was to elaborate common tools to better assess the in-flight landing performance
- The committee submitted:
 - The Runway Condition Assessment Matrix (RCAM)
 - Landing distances figures more representative of daily operations
- The references to be used for dispatch are unchanged

* Takeoff and Landing Performance Assessment / Aviation Rulemaking Committee





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WHAT IS NEW?

- The Runway Condition Assessment Matrix (RCAM)
- New landing performance without failure
- New landing performance with failure





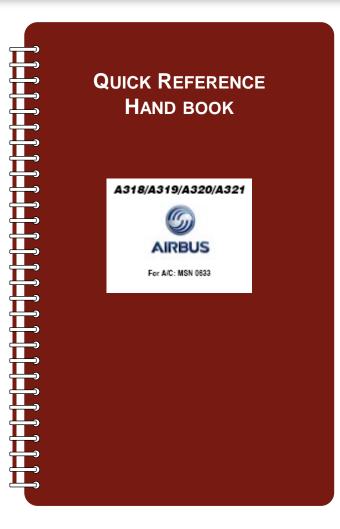
BACKGROUND



WHAT IS NEW?

- The Runway Condition Assessment Matrix (RCAM)
- New landing performance without failure
- New landing performance with failure











Code	Runway Condition	Deceleration And Directional Control Observation	Reported Braking Action	Max Crosswind (Gust included) ⁽¹⁾					
6	Dry	-	Dry	45kt	AIRBUS MARATINAT	Јант реягори, ксе		мисаль 1/4 23 англ н	
	Damp Wet			45kt	Runway Conditio for	on Assessmen Landing	t Mati		
	3 mm (1/8") or less of	Fraking deceleration is normal f	0		Runway Condition	Deceleration And Directional Control Observation	Reported Braking Action	Max Crosswind (Gust included) ⁽¹⁾	
5	Slush Dry Snow	he wheel braking effort applied Directional control is normal.	Good	27kt	Dry Damp Wet	-	Dry	45kt 32kt	
 Dry Snow Wet Snow Frost 			instruct pres	3 mm (1/8*) or less of • Slush • Dry Snow • Wet Snow Front	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.		27kt		
	Braking deceleration and	Good		Compacted Snow (OAT at or below -15°C)	Braking deceleration and controllability is between Good and Medium.	Good to Medium	27kt		
4 Compacted Snow (OAT at or below –15°C		controllability is between Good and Medium.	to Medium	27kt	Slippery when wet Compacted Snow (OAT at or above –15°C More than 3 mm /5 200 mm (5°)	Braking deceleration is	Medium	20i4:	
					 Wet Snow – max 30 mm (1 1/8") 				

The purpose is to provide all users with an unique reference to share:

- The Runway Condition,
- The Reported Braking Action (and associated Code),
- The recommended Maximum Crosswind,
- Additional information.



 How to use the Runway Condition Assessment Matrix - 1st example Runway Condition: 2 mm of Slush



Code	Runway Condition	Runway Condition Deceleration And Directional Control Observation			
6	Dry	-	Dry	45kt	
	Damp Wet			45kt	
5	3 mm (1/8") or less of • Slush • Dry Snow	Braking deceleration is normal for the wheel braking effort applied Directional control is normal.	Good	27kt	
	Wet Snow Frost				
4	Compacted Snow (OAT at or below –15°C)	Braking deceleration and controllability is between Good and Medium.	Good to Medium	27kt	

Use all existing information to assess the landing performance

With the **Runway Condition** only:

Use directly the corresponding Braking Action and Maximum Crosswind



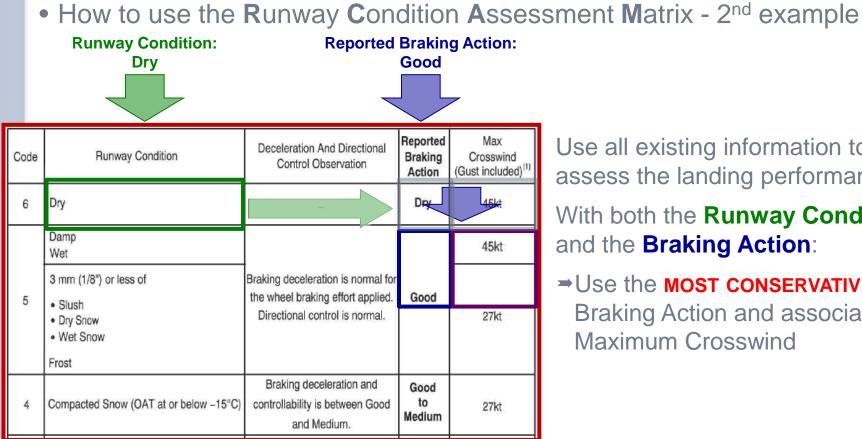
• How to use the Runway Condition Assessment Matrix - 2nd example Runway Condition:

Code	Runway Condition	Deceleration And Directional Control Observation	Reported Braking Action	Max Crosswind (Gust included) ⁽¹⁾
6	Dry	-	Dry	45kt
5	Damp Wet 3 mm (1/8") or less of • Slush • Dry Snow • Wet Snow Frost	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good	45kt 27kt
4	Compacted Snow (OAT at or below –15°C)	Braking deceleration and controllability is between Good and Medium.	Good to Medium	27kt

Use all existing information to assess the landing performance With both the **Runway Condition**



Dry



Use all existing information to assess the landing performance

With both the **Runway Condition** and the Braking Action:

→ Use the **most conservative** Braking Action and associated Maximum Crosswind





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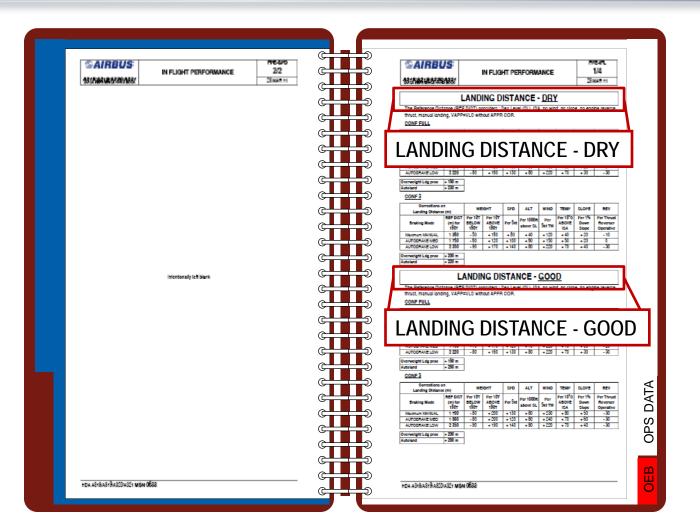
WHAT IS NEW?

- The Runway Condition Assessment Matrix (RCAM)
- New landing performance without failure
- New landing performance with failure

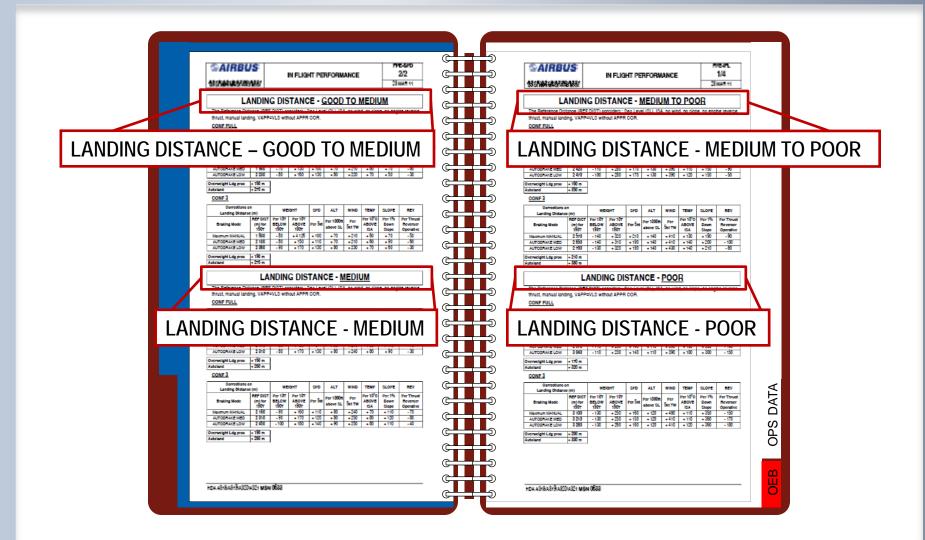


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LANDING DISTANCE · DRY

The Reference Distance (REF DIST) considers : Sea Level (SL), ISA, no wind, no slope, no engine reverse thrust, manual landing, VAPP=VLS without APPR COR.

CONF FULL

Corrections of Landing Distance	WE	IGHT	SPD	ALT	WIND	TEMP	SLOPE	REV	
Braking Mode	REF DIST (m) for 190T	Per 10T BELOW 190T	Per 10T ABOVE 190T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
Maximum MANUAL	1 310	- 40	+ 140	+ 70	+ 40	+ 120	+ 40	+ 20	- 10
AUTOBRAKE MED	1 670	- 50	+ 120	+ 100	+ 50	+ 150	+ 50	+ 20	0
AUTOBRAKE LOW	2 220	- 80	+ 160	+ 130	+ 80	+ 220	+ 70	+ 30	- 30

Overweight Ldg proc + 160 m

Autoland + 230 m

CONF 3

Corrections on Landing Distanc <u>e (m)</u>		WE	IGHT	SPD	ALT	WIND	TEMP	SLOPE	REV
Braking Mode	REF DIST (m) for 190T	Per 10T BELOW 190T	Per 10T ABOVE 190T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
Maximum MANUAL	1 360	- 50	+ 160	+ 80	+ 40	+ 120	+ 40	+ 20	- 10
AUTOBRAKE MED	1 750	- 60	+ 120	+ 100	+ 60	+ 150	+ 50	+ 20	0
AUTOBRAKE LOW	2 350	- 90	+ 170	+ 140	+ 80	+ 220	+ 70	+ 40	- 30

Overweight Ldg proc + 200 m Autoland + 220 m

Braking Action

Landing Configurations

Braking Modes (Manual or Auto brake)

The REF DIST (Provided at fixed landing weight)



LANDING DISTANCE - DRY

The Reference Distance (REF DIST) considers : Sea Level (SL), ISA, no wind, no slope, no engine reverse Narust, manual landing, VAPP=VLS without APPR COR.

CONF FULL

	Corrections o	ori 🗕	
	Landing Distance	e (m)	
	Braking Mode	REF D	The REF DIST considers: Sea Level, ISA, no wind,
	braking mode		no slope, no engine reverse thrust, manual landing,
Ma	aximum MANUAL	1 31	no slope, no engine reverse unusi, manual landing,
AL	JTOBRAKE MED	1 67	VAPP = VLS
AL	JTOBRAKE LOW	2 22	
Over	weight Ldg proc	+ 160 m	
Auto	land	+ 230 m	

CONF 3

Corrections o Landing Distance		WE	IGHT	SPD	ALT	WIND	TEMP	SLOPE	REV
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Maximum MANUAL	1 360	- 50	+ 160	+ 80	+ 40	+ 120	+ 40	+ 20	- 10
AUTOBRAKE MED	1 750	- 60	+ 120	+ 100	+ 60	+ 150	+ 50	+ 20	0
AUTOBRAKE LOW	2 350	- 90	+ 170	+ 140	+ 80	+ 220	+ 70	+ 40	- 30

Overweight Ldg proc + 200 m Autoland + 220 m



SLOPE

Per 1%

Down

Slope

+20

+ 20

+40

REV

Per Thrust

Reverser

Operative

- 10

0

- 30

LANDING DISTANCE DRY

The Reference Distance (REF DIST) considers : Sea Level (SL), ISA, no wind, no slope, no engine reverse thrust, manual landing, VAPP=VLS without APPR COR.

Correction Landing Dista		WE	IGHT	SPD	ALT	WIND	TEMP	SLOPE	REV
Braking Mode	REF DIST (m) for 190T	Per 10T BELOW 190T	Per 10T ABOVE 190T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
Maximum MANUA	1 310	- 40	+ 140	+ 70	+ 40	+ 120	+ 40	+ 20	- 10
AUTOBRAKE MED) 1670	- 50	+ 120	+ 100	+ 50	+ 150	+ 50	+ 20	0
AUTOBRAKE LOW	/ 2 220	- 80	+ 160	+ 130	+ 80	+ 220	+ 70	+ 30	- 30
Overweight Ldg prod Autoland	+ 160 m + 230 m								
CONF 3		-							

Braking Action

Landing Configurations

Braking Modes (Manual or Auto brake)

The REF DIST

(Provided at fixed landing weight)

Corrections (Weight, SPD, ALT, WIND...)

Additional corrections (Overweight procedure, Autoland)



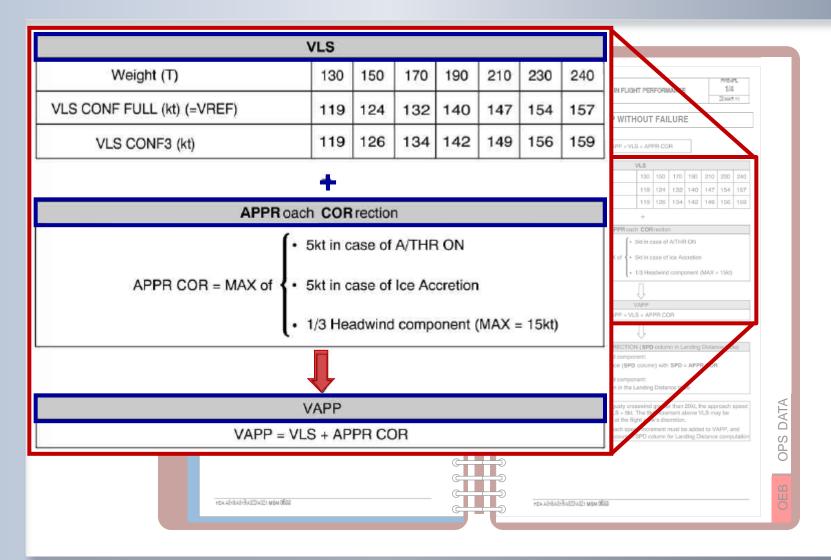
Corrections o Landing Distanc		WE	IGHT	SPD	ALT	WIND	TEMP	
Braking Mode	REF DIST (m) for 190T	Per 10T BELOW 190T	Per 10T ABOVE 190T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	
Maximum MANUAL	1 360	- 50	+ 160	+ 80	+ 40	+ 120	+ 40	
AUTOBRAKE MED	1 750	- 60	+ 120	+ 100	+ 60	+ 150	+ 50	
AUTOBRAKE LOW	2 350	- 90	+ 170	+ 140	+ 80	+ 220	+ 70	
Overweight Ldg proc	+ 200 m							

Overweight Ldg proc + 200 m Autoland + 220 m

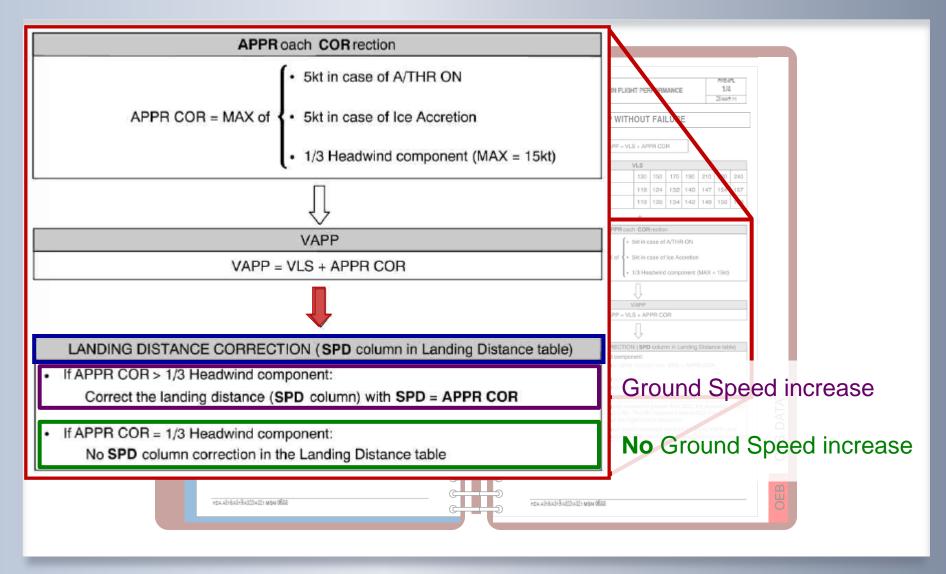
CONF FULL



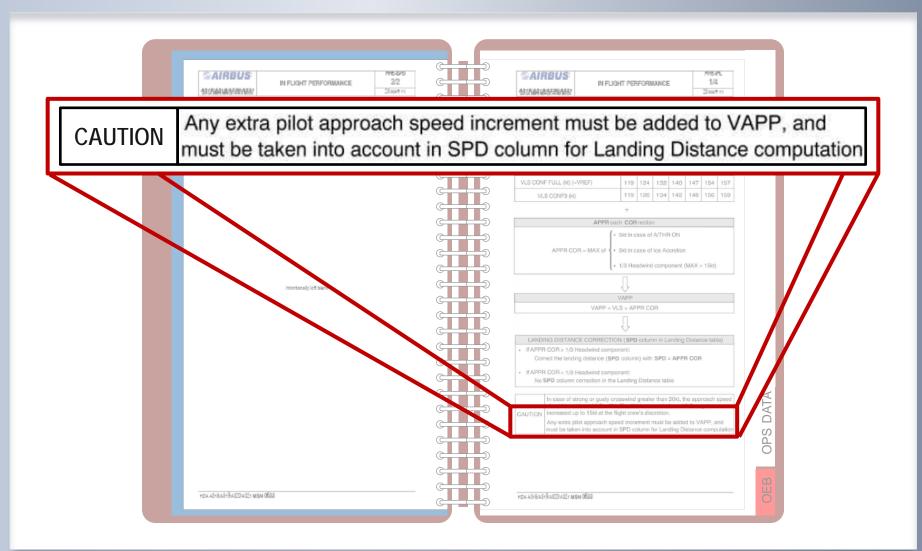














Landing data

- Aircraft
- Runway Condition
- Reported Braking Action
- Runway Slope
- Wind / OAT
- Airport pressure altitude
- Estimated Landing Weight
- Landing configuration
- A/THR
- A/BRK
- Credit for all thrust reversers

2 mm of Slush Good to Medium 1% UP 12 kt headwind / - 5°C Sea Level 170 t CONF FULL ON MED

A330

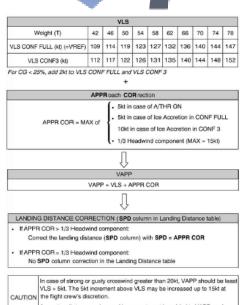


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Code	Runway Condition	Deceleration And Directional Control Observation	Reported Braking Action	Max Crosswind (Gust included) ⁽²
6	Dry	-	Dry	38kt
	Damp Wet			38kt
5	3 mm (1/8") or less of • Slush • Dry Snow • Wet Snow Frost	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good	30kt
4	Compacted Snow (OAT at or below –15°C)	Braking deceleration and controllability is between Good and Medium.	Good to Medium	25kt
3	Slippery when wet Compacted Snow (OAT at or above -15°C) More than 3 mm (1)8°) depth of: - Dry Snow - max 130 mm (1)8°) • Wet Snow - max 130 mm (1)8°)	Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be noticeably reduced.	Medium	20kt
2	Between 3 mm (1/8*) and 12.7 mm (1/2*) ef: • Water • Slush	Braking deceleration and controllability is between Medium and Poor. Potential for Hydroplaning exists.	Medium to Poor	20kt
1	loe (cold & dry)	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor	15kt
0	Wet ice Water on top of Compacted Snow Dry Snow or Wet Snow over Ice	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nii	-

(1) In case of AUTOLAND, max crosswind limited to 20kt





Any extra pil of approach speed increment must be added to VAPP, and must be taken into account in SPD column for Landing Distance computation



LANDING DISTANCE - GOOD TO MEDIUM

The Reference Distance (REF DIST) considers : Sea Level (SL), ISA, no wind, no slope, no engine reverse thrust, manual landing, VAPP=VLS without APPR COR.

CONF FULL

Corrections o Landing Distance		WE	IGHT	SPD	ALT	WIND	TEMP	SLOPE	REV
Braking Mode	REF DIST (m) for 190T	Per 10T BELOW 190T	Per 10T ABOVE 190T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
Maximum MANUAL	1 820	- 60	+ 130	+ 100	+ 70	+ 200	+ 60	+ 60	- 40
AUTOBRAKE MED	1 980	- 70	+ 130	+ 100	+ 70	+ 210	+ 60	+ 70	- 60
AUTOBRAKE LOW	2 230	- 80	+ 160	+ 130	+ 80	+ 220	+ 70	+ 50	- 30
Overweight Ldg proc	+ 160 m								
Autoland	+ 270 m								

CONF 3

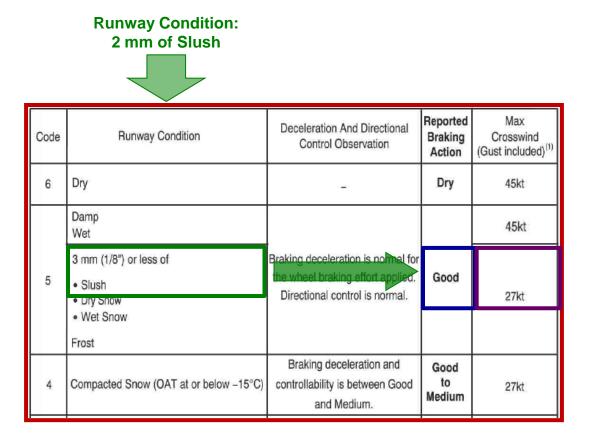
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Braking Mode	REF DIST (m) for 190T	Per 10T BELOW 190T	Per 10T ABOVE 190T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
Maximum MANUAL	1 930	- 80	+ 4 126	+ 100	+ 70	+ 210	+ 60	+ 70	- 50
AUTOBRAKE MED	2 100	- 80	+ 150	+ 110	+ 70	+ 210	+ 60	+ 90	- 60
AUTOBRAKE LOW	2 360	- 90	+ 170	+ 130	+ 80	+ 230	+ 70	+ 60	- 30
Overweight Ldg proc	+ 190 m	1							
Autoland	+ 270 m								

Step 3 Calculate the Landing Distance



Runway Condition: 2 mm of Slush

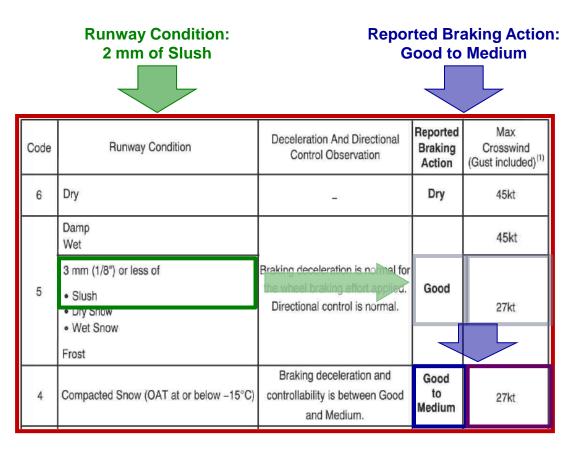
• Step 1 - Identify the Braking Action





Runway Condition: **2 mm of Slush** Reported Braking Action: **Good to Medium**

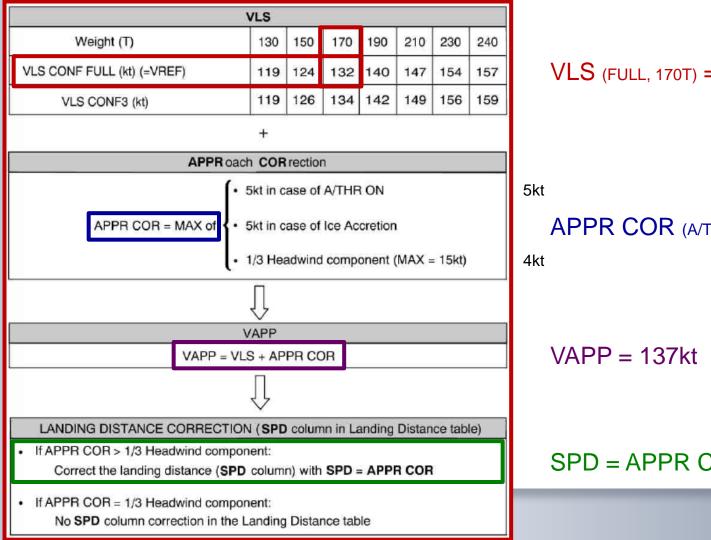
• Step 1 - Identify the Braking Action





Estimated Landing Weight : 170 t Landing configuration: CONF FULL A/THR: ON - Wind / OAT: 12 kt headwind / - 5°C

• Step 2 - Determine the VAPP



VLS (FULL, 170T) = 132kt



SPD = APPR COR = 5kt



From step 1: Good to Medium From step 2: VAPP = 137kt and SPD = 5kt CONF FULL, LW = 170T and A/BRK: MED

• Step 3 - Calculate the Landing Distance

LANDING DISTANCE - GOOD TO MEDIUM

CONF FULL

Corrections of Landing Distance		WE	GHT	SPD	ALT	WIND	ТЕМР	SLOPE	REV
Braking Mode	REF DIST (m) for 190T	Per 10T BELOW 190T	Per 10T ABOVE 190T	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
Maximum MANUAL	1 820	- 60	+ 130	+ 100	+ 70	+ 200	+ 60	+ 60	- 40
AUTOBRAKE MED	1 980	- 70	+ 130	+ 100	+ 70	+ 210	+ 60	+ 70	- 60
AUTOBRAKE LOW	2 230	- 80	+ 160	+ 130	+ 80	+ 220	+ 70	+ 50	- 30

REF DIST (190T) = **1980 m**

WEIGHT correction $(170T) = -70 \times 2 = -140 \text{ m}$ SPD correction (SPD = 5kt) = +100 mALT correction (Sea Level): NO CORRECTION WIND correction (12kt headwind): NO CORRECTION TEMP correction $(\Delta ISA = -20^{\circ}C)$: NO CORRECTION SLOPE correction (1% UP): NO CORRECTION REV correction $= -60 \times 2 = -120 \text{ m}$

Landing Distance = 1820 m



EXAMPLE WITHOUT FAILURE - WHAT IF MEL ITEM(S)?

• MEL item(s) that impact(s) the landing performance must also be taken into account in-flight.

CORTRAINING ONLY A330/A340 MASTER MINIMUM EQUIPMENT LIST	MMEL OPERATIONAL PROCEDURES 27 - FLIGHT CONTROLS 27-64 - Spoiler Hydraulic Actuation				
27-64-01A	Spoiler (one pair inoperative)				
	ance computation ng distances by 1.02				
nding Distance (with MEL 27-64-01A) = Landing Distance (without failure) $x 1.02$					





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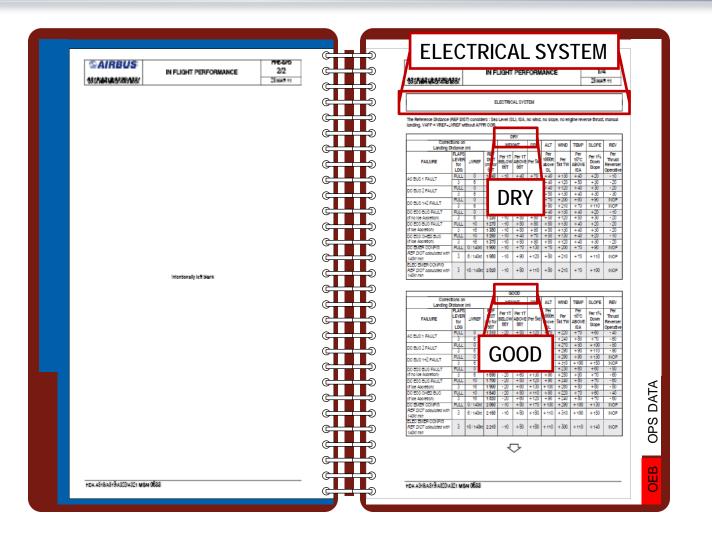
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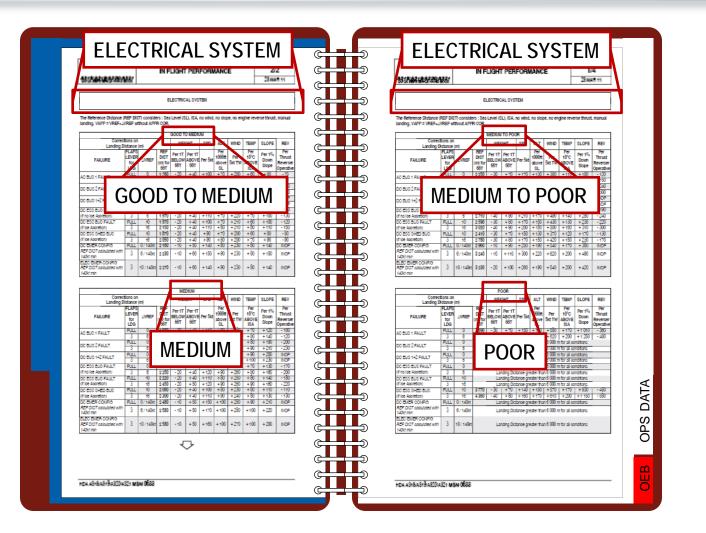


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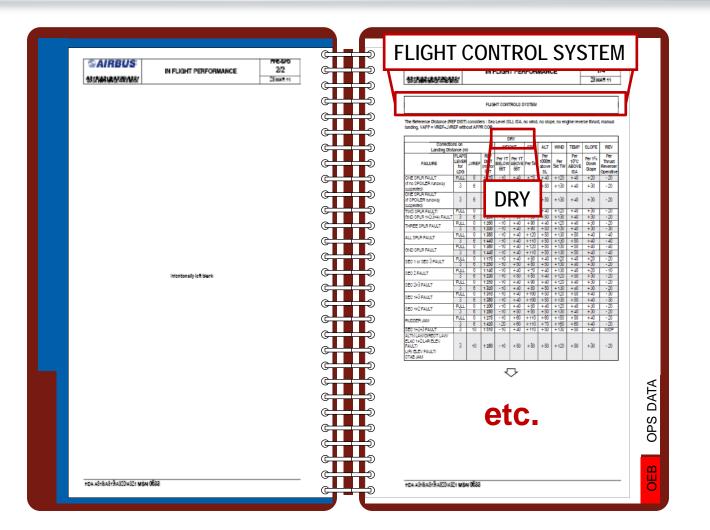














ELECTRICAL SYSTEM

The Reference Distance (REF DIST) considers : Sea Level (SL), ISA, no wind, no slope, no engine reverse thrust, manual landing, VAPP = VREF+ Δ VREF without APPR COR.

					RY						
Correct Landing D	tions on istance			WEIGHT		SPD	ALT	WIND	TEMP	SLOPE	REV
FAILURE	FLAPS LEVER for LDG		HEF DIST (m) for 190T	Per 10T BELOW 190T	101	Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
DC BUS 1+2 FAULT	FULL	0	1 410	- 50	+ 130	+ 90	+ 50	+ 130	+ 40	+ 20	INOP
000001+21 A0L1	3	5	1 490	- 50	+ 150	+ 90	+ 50	+ 130	+ 40	+ 20	INOP
DC BUS 2 FAULT	FULL	0	1 410	- 50	+ 130	+ 90	+ 50	+ 130	+ 40	+ 20	- 10
JO DOG ZTROLI	3	5	1 490	- 50	+ 150	+ 90	+ 50	+ 130	+ 40	+ 20	- 10
DC ESS BUS FAULT	FULL	10	1 480	- 40	+ 150	+ 80	+ 50	+ 130	+ 40	+ 20	- 10
if Ice Accretion)	3	15	1 560	- 50	+ 160	+ 80	+ 50	+ 130	+ 40	+ 20	- 20
DC ESS BUS SHED	FULL	10	1 480	- 40	+ 150	+ 80	+ 50	+ 130	+ 40	+ 20	- 10
if Ice Accretion)	3	15	1 560	- 50	+ 160	+ 80	+ 50	+ 130	+ 40	+ 20	- 20
EMER CONFIG	3	5	1 490	- 50	+ 150	+ 90	+ 50	+ 130	+ 40	+ 20	INOP

Aircraft System

Braking Actions

Failure titles

FLAPS lever positions and $\Delta VREF$

The REF DIST (Provided at fixed landing weight)



The Reference Distance (anding, VAPP = VREF+∆			ers : Sea		CAL SYS GL), ISA, 1		, no slop	pe, no en	gine reve	rse thrust	, manual	
Correc	tions on			D	RY							
EXAMPLE The REF DIST considers: Sea Level, ISA, no wind, FAILURE I The REF DIST considers: Sea Level, ISA, no wind, no slope, no engine reverse thrust, manual landing, VAPP = VREF + Δ VREF												
DC BUS 2 FAULT	FULL 3	5	1 490	- 50	+ 150	+ 90	+ 50	+ 130	+ 40	+ 20	- 10	
DC ESS BUS FAULT	FULL	10	1 480	- 40	+ 150	+ 80	+ 50	+ 130	+ 40	+ 20	- 10	
(if Ice Accretion)	3	15	1 560	- 50	+ 160	+ 80	+ 50	+ 130	+ 40	+ 20	- 20	
DC ESS BUS SHED (if Ice Accretion)	FULL 3	10 15	1 480	- 40 - 50	+ 150 + 160	+ 80	+ 50	+ 130	+ 40	+ 20	- 10 - 20	
EMER CONFIG	3	5	1 490	- 50	+ 150	+ 90	+ 50	+ 130	+ 40	+ 20	INOP	



ELECTRICAL SYSTEM

The Reference Distance (REF DIST) considers : Sea Level (SL), ISA, no wind, no slope, no engine reverse thrust, manual landing, VAPP = VREF+ Δ VREF without APPR COR.

					RY						
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DC BUS 1+2 FAULT	FULL	0	1 410	- 50	+ 130	+ 90	+ 50	+ 130	+ 40	+ 20	INOP
	3	5	1 490	- 50	+ 150	+ 90	+ 50	+ 130	+ 40	+ 20	INOP
DC BUS 2 FAULT	FULL	0	1 410	- 50	+ 130	+ 90	+ 50	+ 130	+ 40	+ 20	- 10
JO DOG ZTROLI	3	5	1 490	- 50	+ 150	+ 90	+ 50	+ 130	+ 40	+ 20	- 10
DC ESS BUS FAULT	FULL	10	1 480	- 40	+ 150	+ 80	+ 50	+ 130	+ 40	+ 20	- 10
if Ice Accretion)	3	15	1 560	- 50	+ 160	+ 80	+ 50	+ 130	+ 40	+ 20	- 20
DC ESS BUS SHED	FULL	10	1 480	- 40	+ 150	+ 80	+ 50	+ 130	+ 40	+ 20	- 10
if Ice Accretion)	3	15	1 560	- 50	+ 160	+ 80	+ 50	+ 130	+ 40	+ 20	- 20
EMER CONFIG	3	5	1 490	- 50	+ 150	+ 90	+ 50	+ 130	+ 40	+ 20	INOP

Aircraft System

Braking Actions

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FLAPS lever positions and $\Delta VREF$

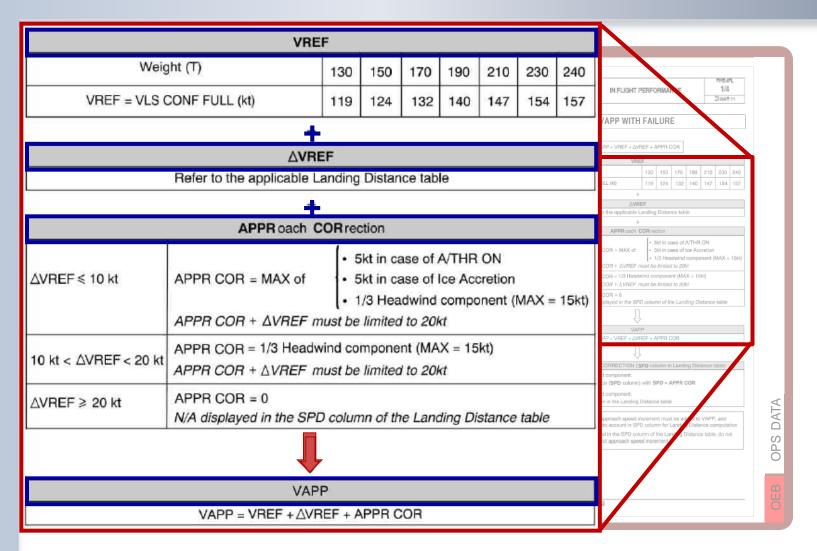
The REF DIST (Provided at fixed landing weight)

Corrections (Weight, SPD, ALT, WIND...)

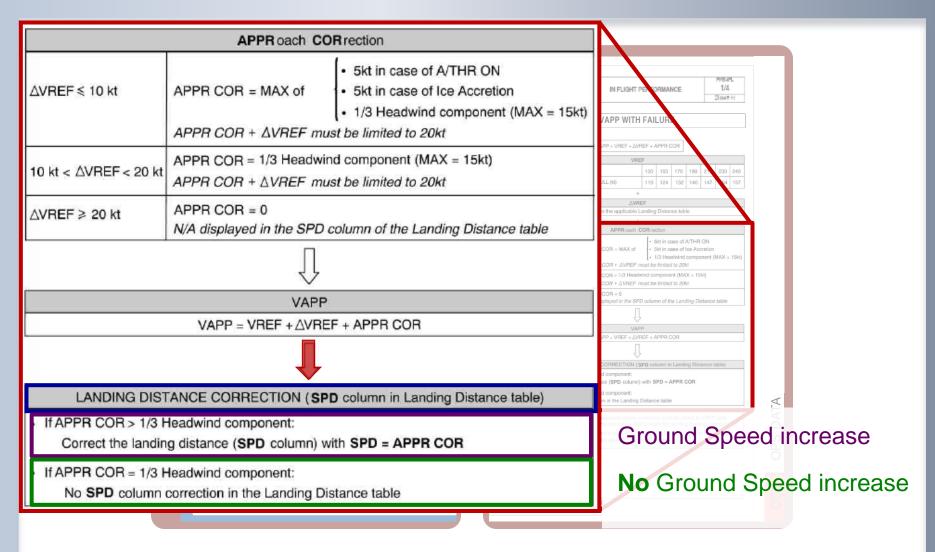




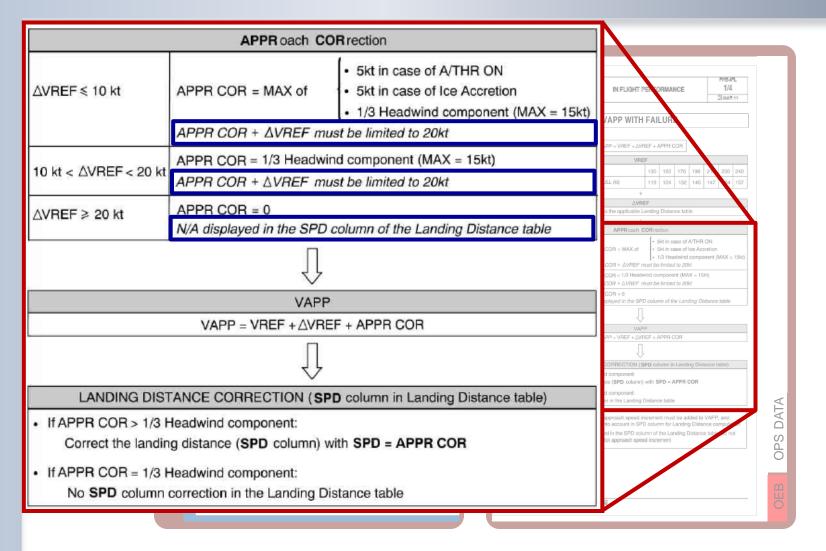




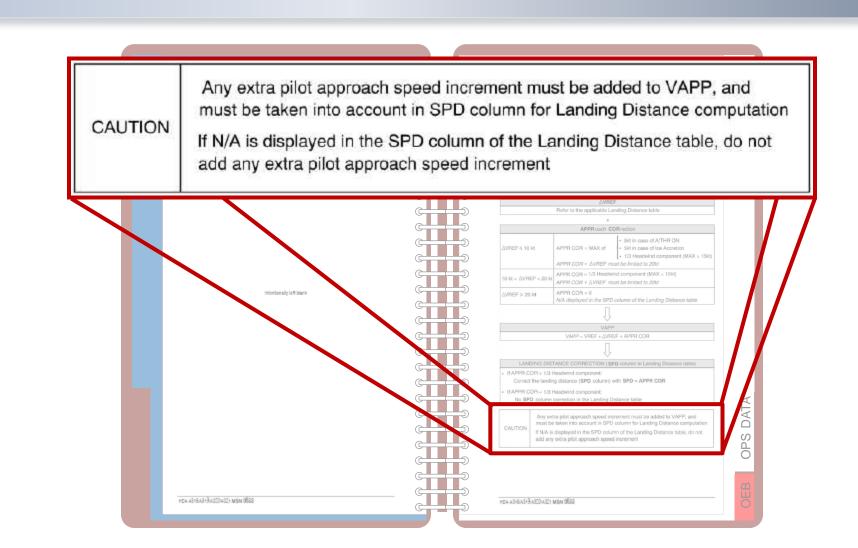














Landing data

- Aircraft
- Runway Condition
- Reported Braking Action
- Wind / OAT
- Airport pressure altitude
- Estimated Landing Weight
- A/THR
- In-Flight failure
- Credit for all available thrust reversers

A330 Compacted snow Good 12 kt headwind / - 15°C 1000ft 190 t ON

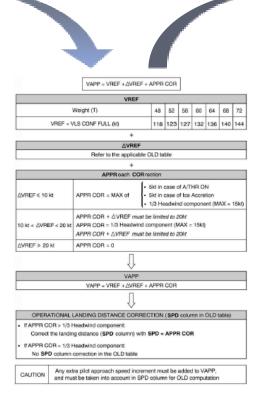
ENG 1 SHUTDOWN (no damage)



Code	Runway Condition	Deceleration And Directional Control Observation	Reported Braking Action	Max Crosswind (Gust included) ⁽²⁾
6	Dry	-	Dry	38kt
	Damp Wet			38kt
5	3 mm (1/8") or less of • Slush • Dry Snow • Wet Snow Frost	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good	30kt
4	Compacted Snow (OAT at or below -15°C)	Braking deceleration and controllability is between Good and Medium.	Good to Medium	25kt
3	Slippery when wet Compacted Snow (OAT at or above -15°C) More than 3 mm (1/8°) depth of: • Dry Snow - max 130 mm (5') • Wet Snow - max 130 mm (1/8')	Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be noticeably reduced.	Medium	20kt
2	Between 3 mm (1/8*) and 12.7 mm (1/2*) of: • Water • Slush	Braking deceleration and controllability is between Medium and Poor. Potential for Hydroplaning exists.	Medium to Poor	20kt
1	los (cold & dry)	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor	15kt
0	Wet lice Water on top of Compacted Snow Dry Snow or Wet Snow over lice	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nii	-

(1) In case of AUTOLAND, max crosswind limited to 20kt







ENGINE SYSTEM

The Reference Distance (REF DIST) considers : Sea Level (SL), ISA, no wind, no slope, no engine reverse thrust, manual landing, VAPP = VREF+_VREF without APPR COR.

				GOOD T	o medil	JM					
Correct Landing Di)		WEIGHT		SPD	ALT	WIND	TEMP	SLOPE	REV
FAILURE	FLAPS LEVER for LDG		REF DIST (m) for 190T	Per 10T BELOW 190T		Per 5kt	Per 1000ft above SL	Per 5kt TW	Per 10 ¹ C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative
SHUTDOWN (If no damage)	3	5	2 080	- 80	+ 150	+ 120	+ 80	+ 210	+ 70	+ 90	- 70
SHUTDOWN (If damage without ice Accretion)	3	5	2 080	- 80	+ 150	+ 120	+ 80	+ 210	+ 70	+ 90	- 70
SHUTDOWN (If damage with loe Accretion)	3	10	2 180	- 80	+ 150	+ 130	+ 80	+ 220	+ 80	+ 90	- 80
THR LEVER FAULT/ DISAGREE	3	5	2 040	- 70	+ 140	+ 110	+ 80	+ 220	+ 60	+ 80	- 40
REV UNLOCKED (with buffet)	2	25	2 420	- 80	+ 150	N/A	+ 90	+ 210	+ 80	+ 90	- 90

Step 3 Calculate the Landing Distance



Runway Condition: Compacted Snow

• Step 1 - Identify the Braking Action

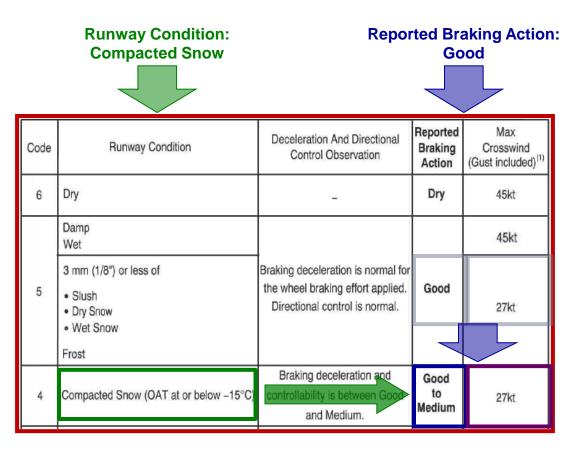


Code	Runway Condition	Deceleration And Directional Control Observation	Reported Braking Action	Max Crosswind (Gust included) ⁽¹⁾
6	Dry	-	Dry	45kt
	Damp Wet			45kt
5	3 mm (1/8") or less of • Slush • Dry Snow • Wet Snow	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good	27kt
4	Frost Compacted Snow (OAT at or below –15°C)	Braking deceleration and controllability is between Goor and Medium.	Good to Medium	27kt



Runway Condition: **Compacted Snow** Reported Braking Action: **Good**

• Step 1 - Identify the Braking Action





Estimated Landing Weight : **190 t** A/THR: **ON** Wind / OAT: **12 kt headwind / - 15°C**

• Step 2 - Determine the VAPP

	VRE	F								
Weig	ght (T)	130	150	170	190	210	230	240		
VREF = VLS (CONF FULL (kt)	119	124	132	140	147	154	157		
+										
	∆VRE	F								
	Refer to the applicable La	anding	Distan	ice tab	le					
	+									
	APPR oach C	ORrec	ction							
$ \Delta VREF \le 10 \text{ kt} $ APPR COR = MAX of $ APPR COR = MAX \text{ of } $ $ Skt \text{ in case of A/THR ON} $ $ 5kt \text{ in case of Ice Accretion} $ $ 1/3 \text{ Headwind component (MAX = 15kt)} $ $ APPR COR + \Delta VREF \text{ must be limited to 20kt} $										
10 kt < ∆VREF < 20 kt	APPR COR = 1/3 Headwind component (MAX = 15kt) APPR COR + $\triangle VREF$ must be limited to 20kt									
∆VREF ≥ 20 kt	APPR COR = 0 N/A displayed in the SPD column of the Landing Distance table									
	Ũ									
	VAPI	2								
	VAPP = VREF +∆VR	EF + A	PPR C	OR						
	Û									
LANDING DIST	ANCE CORRECTION (S	PD col	umn in	Landi	ng Dist	ance ta	able)			
 If APPR COR > 1/3 F Correct the landing 	Headwind component: g distance (SPD column)	with S	PD = A	PPR	COR					
	leadwind component: correction in the Landing [Distanc	e table							

VREF (190T) = 140kt

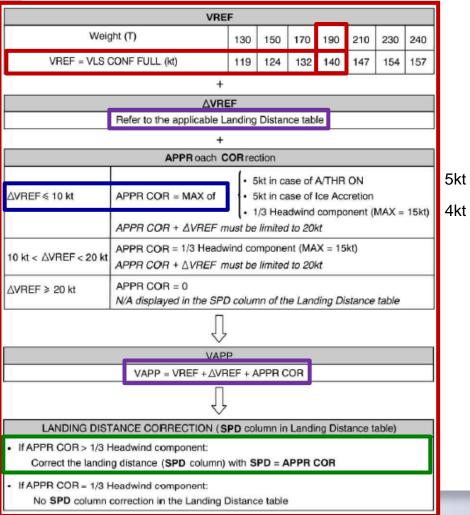
 $\Delta VREF = 5kt$

Corrections on Landing Distance (m)											
FAILURE	FLAPS LEVER for LDG	∆VREF	REF DIST (m) for 190T								
SHUTDOWN (if no damage)	3	5	2 080								



Estimated Landing Weight : **190 t** A/THR: **ON** Wind / OAT: **12 kt headwind / - 15°C**

• Step 2 - Determine the VAPP



VREF (190T) = 140kt

 $\Delta VREF = 5kt$

APPR COR (A/THR) = 5kt

VAPP = 150kt

SPD = APPR COR = 5kt



From step 1: Good to Medium From step 2: VAPP = 150kt and SPD = 5kt Estimated Landing Weight : **190 t**

• Step 3 - Calculate the Landing Distance

ENGINE SYSTEM												
GOOD TO MEDIUM												
Corrections on Landing Distance (m)					WEIGHT		SPD	ALT	WIND	TEMP	SLOPE	REV
FAILURE FAILURE FAILURE FOR LEVER for LDG FLAPS AVREF (m) for 190T		DIST (m) for	Per 10T BELOW 190T		Per 5k	Per 1000ft above SL	Per 5kt TW	Per 10°C ABOVE ISA	Per 1% Down Slope	Per Thrust Reverser Operative		
SHUTDOWN (if no damage)		3	5	2 080	- 80	+ 150	+ 120	+ 80	+ 210	+ 70	+ 90	- 70

FLAPS LEVER for LDG: CONF 3 REF DIST (190T) = 2080 m Weight correction (190T): NO CORRECTION SPD correction (SPD = 5kt) = + 120 m ALT correction (1000ft) = + 80 x 1 = + 80 m REV correction = - 70 x 1 = - 70 m

Landing Distance = 2210 m



WHAT IS NEW? - STANDARD OPS PROCEDURES

SAIRBUS	L PROCEDURES	4/10 00CT 11	AIRBUS NORMAL PROCEDURES S/10 S
T.	AXI		Continued from the previous age
PF	PNF		
Taxi clearance obtained:	TAXI CLEARANCE	OUTAIN	
PARKING BRAKE	F ELAPOED TIME	AS RORD	NORMAL PROCEDURE
THRUST LEVERS			
RAKES. CHEC PLT CTL. CHEC	K BRAKES PRESS	CHECK 0	
ATC clearance obtained:		OHEUK	
AT & Genarice domined.	ATO CLEARANCE	CONFIRM	
	TO DATA.	OHEOK	AT 8 SPEED: FLAPS 0. ORDER FLAPS 0. SELECT
	FMOS F-PLNSPD	OHEOK	FLAPO 0
	FOU ALTIHDO. BOTH FD.		EXTERIOR LIGHTS
RET INST & FMA. OHEO	KELT INST & FMA	OHEOK	PACKD 2 (f opplicable) ON
	RADAR and PREDICTIVE WINDSHEAR S		
		AS RORD	AFTER TAKEOFF
		CONFIRMISET	
TERR ON NO \land	D TERR ON ND 🤏	AS RORD	PF PNF
TO BRIEFING. CONFIR	AUTO BRK	MAX	APU CLEEDMASTER switch AS RORD
TO BRIEFING. CASIN REPORT.	BEODIVE (CM1)		ENG MODE selector AG RORD
	TO CONFIG.	PREDO	T0A0 ≪
	TO MEMO	ECK NO BLUE	ANTI IDE
EFORE TO GL DOWN TO THE LINE			AFTER TO/CUMB OL DOWN TO THE LINE
BEFORE	TAKEOFF		CLIMB
PF	PNF		PF PNF
	TAKEOFFILINE UP OLEARANCE	OBTAIN	MODU. PERF OLD MODU. F-PLN
	TCAS 4	Té or TARA	FOURMOS SET IF AP ON FOURMOS SET IF AP OFF
APPROACH CLEAR OF TRAI		-	+At transition attitude:
	PACKS 1+2	AD RORD	BARD REF
	EXTERIOR LIGHTS		AFTER TO DUME OL BELOW THE LINE RADAR TILT
SLIDING TABLE 考			ALTION TO THE ADDRESS ADDRE
	DRAKE TEMP (If fans 🗐 running)	OHEDK	LAND LIGHTS
	D BRAKE FANS (If fans 🚿 running)	OFF	SEAT DELTS
	ENO MODE selector	AS RORD	ERS OPTION
EFORE TAKEOFF OIL BELOW THE LINE			
		C C	SED F-PLN AS RORD PERMIT
	EOFF		OPTIMAX ALT OHEDK
TAK			
			CRUISE
PF	PNF		
PF IAKEOFF ANNOUND			
PF ANNOUND RAKED. RELEAD		C C	
PF TAKEOFF ANNOLINO SRAKED RELEAD THRUGT LEVERD TOGATLE The Captain places hand on	t t X thrust levers until V1	C C	COAM MEMORY'S PADES
PF ANDOFF ANNOUND FRAKED FRUTLEVERS FRUTLEVE	C C X thrust levers until V1 R	C C	
PF TAVEOFF ANNOUND IPAVED REL 040 IPAVED REL 040 IPAVED TODAFLE ITODAFLE TODAFLE IPACITIONAL CONTROL USE RUDDE INFORMO OTAFLE	t trust levers until V1 R DHRONO		COMM MEMORY PADED. PRVEW COMM MEMORY PADED. PRVEW FULL MANTOR FULL MANTOR MANTOR MANA ADDRAVY
PF TAX20FF ANNOUND FRANCE PRELEAS HINUT LEVERS TOANLES JRECTIONAL CONTROL TOB ANLES HARONO OTAR MA ANNOUND	t trust levers until V1 R DHRONO	OHEDK	COMM MEMORY 0 PAGED REVEW FULL FULL MAINTER NAV ACOURACY. AGUET NAV ACOURACY. AGUET AGUET
PF TAVEOFF ANNOUND IPAVED REL 040 IPAVED REL 040 IPAVED TODAFLE ITODAFLE TODAFLE IPACITIONAL CONTROL USE RUDDE INFORMO OTAFLE	r Innust levers until V1 TOHRONO PEPOND N1 (EPR) THRUST OCT		COMM MEMORY PADED. PRVEW COMM MEMORY PADED. PRVEW FULL MANTOR FULL MANTOR MANTOR MANA ADDRAVY
PF ANNOUND FANDOFF ANNOUND FANDE PELEAD FRADE The Capital placement SECTIONAL CONTROL Unit Hunde HHORO Unit Hunde HHOROHO HARA ANNA ANNOUND	с михтенета илё V1 орново. нерово. и (EPR). Пибра Сест. неровово. неровово. нерово.	UHEDK OHEDK ANNOLINDE DOAN	Ссим немонгото явлее: якисян р ним переяела: очеток ним ассимаку
PF AVECOPF APROVID PARKED RELEAS INHUGE LUESS TODALE INHUGE LUESS INHUGE LUES INHUGE LUESS APROVING ALM APROVING ALM ALL APROVING ALM ALL APROVING	E Trust levers until V1 TCHROND PFOND N1 (EPR) THRUST OCT PFDEND PARAMETERO. ONE HUNDRED INTOTO		COMM MEMORY 0 PAGED REVEW FULL FULL MAINTER NAV ACOURACY. AGUET NAV ACOURACY. AGUET AGUET
PF ANNOUND ANDOFF ANNOUND MALE DATE RELEAD INFORMATION The Capital space hand on spectroval, control SPECTOVAL, CONTROL The Capital space hand on spectroval, control SPECTOVAL, CONTROL SPECTOVAL, CONTROL SPECTOVAL, CONTROL SPECTOVAL	E Trust levers until V1 TCHROND PFOND N1 (EPR) THRUST 02 FFDEND FARAMETERO. ONE HUNDRED INTOTO		COMMENSIONS PARCE FOUR FUR FU
	E Trust levers until V1 TCHROND PFOND N1 (EPR) THRUST 02 FFDEND FARAMETERO. ONE HUNDRED INTOTO	UHEDK OHEDK ANNOLINDE DOAN	ECAM LEGION 7 PAGE Relief PLAL NUM TO PLAL MONTOR
PF ANDORF ANNOUND FRAUE PRELED FRAUE The Capital plane TooAre INFORM Unit Rudo Second Unit Rudo Second Annound Second Second Secon	с ото levers until V1 оняроко втолко им. (сля остатоко ото никонер клюто ото никонер клюто и ланието на ото атоон.	OHEOK OHEOK ANNOLINCE ANNOLINCE ANNOLINCE ORDER	COM REMOVITY PAGES PRUFER PLA COMONOTY PAGES PLA COMONOTY PAGES Oversk PLA COMONOTY PAGES Oversk PLA COMONOTY PLA PLA
РР АНСОРР АНООЛО АНООЛО РЕЦЕФО ННОГО ЦСКРО. ПО АНТЕ ПРО СТИСКО. ПР Сарыбанска палаго НАПОГО ЦСКРО. ОК	с с правити Interes until V1 праволю отерии отер		ECOM LEGIONS PAGES PRICE PLUEL PROPOSED ONEDRY PLUEL MODIFIED ONEDRY PLUEL MODIFIED ONEDRY PLUEL MODIFIED ONEDRY PLUEL MODIFIED DESCENT PREPARATION PLUEL MODIFIED PF PLD ELEY OHEDRY LADING DATA PLD ELEY OHEDRY LADING DATA PLD PREPARE PREPARE
PF ANDORF ANNOUND FRAUE PRELED FRAUE The Capital plane TooAre INFORM Unit Rudo Second Unit Rudo Second Annound Second Second Secon	с с правити Interes until V1 праволю отерии отер	OHEOK OHEOK ANNOLINCE ANNOLINCE ANNOLINCE ORDER	COM REMOVITY PAGES PRUFER PLA COMONOTY PAGES PLA COMONOTY PAGES Oversk PLA COMONOTY PAGES Oversk PLA COMONOTY PLA PLA
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WHAT IS NEW? - STANDARD OPS PROCEDURES

DESCENT P	REPARATION
PF	PNF
LDG ELEV CHECK LANDING PERFORMANCE CONFIRM	LANDING DATAPREPARE
FMGS	FMGS PREPARE
AUTU DRK AS KURD	DESCENT CLEARANCE OBTAIN ANTI ICE AS RQRD
HARDER HOLE VERTICATION OF THE FOLL OPENIN OPENIN APPROACH OLERA OF THEFOL OPENIN OPENIN OPENIN ULDING TABLE *#	





1	BACKGROUND	
2	WHAT IS NEW?	
3	FACTORED LANDING DISTANCE	
4	Flysmart with Airbus	
5	WHERE AND WHEN?	



ADDITIONAL SAFETY MARGIN

- In-flight landing distance considers fixed flight parameters, without margin
- To cover variability in flying techniques and unexpected conditions at landing the flight crew should apply an appropriate margin to the inflight landing distances
- Airbus recommends to add a margin of 15% to the in-flight landing distance (except in emergency)

Factored Landing Distance = In-flight Landing Distance x 1.15



ADDITIONAL SAFETY MARGIN

- In-flight landing distance considers fixed flight parameters, without margin
- To cover variability in flying techniques and unexpected conditions at landing the flight crew should apply an appropriate bagin to the inflight landing distances
- Airbus recomment of Cold a margin of 15 ht Cold n-flight landing distance (e cold in emergency)

Factored Land Distance = In-flight Landing Distance x 1.15





1	BACKGROUND	
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Landing data

- Aircraft
- Runway Condition
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- Wind / OAT
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- Estimated Landing Weight
- A/THR
- In-Flight failure
- Credit for all available thrust reversers

A330 Compacted snow Good 12 kt headwind / - 15°C 1000ft 190 t ON

ENG 1 SHUTDOWN (no damage)



MENU 👻	LD	G PERF	FUNCTIONS	🗕 0 MSG		- CLR	A330T
				LE RVVY COMP	PUTATION <f2> MULTIPLE F</f2>	RWY COMPUTATION	<ctrl f2=""></ctrl>
	VIND ^{°/kt}	IN-FLIGHT		RT EDDE		RWY 10	
	OAT °C	-15	IN-FL	IGHT	SLOPE 0.0%	FUNCTIONS •	
G	NH hPa	1013					
RV	VY COND	4-Good to medi	ium 🔽				
	A-ICE	Off	-				
	LW T	190.0					
		2					
A	AIR COND	Off	-				
AP	PR TYPE	Normal	-				
GA GRAD	DIENT %	2.1					
	VPilot kt	0					
LDG TE	CHNIQUE	Manual - A/THR	?on <mark>→</mark>				
BF	RK MODE	Manual	_				
ECAM ALER	राऽ						
• <u>ENG</u> - E	NG 1 SHUT	DOWN					
ACFT S	TS <f5></f5>				COMPUTE <f8></f8>	CLEAR <f6></f6>	
							N 1

US

MENU - LDC	G PERF FUNC	TIONS - 0 MSC	6	- CLR	A330T
CONDITIONS <f3></f3>		SINGLE RWY COM	IPUTATION <f2> MULTIPLE</f2>	E RVVY COMPUTATION <ctrl< th=""><th>F2></th></ctrl<>	F2>
	IN-FLIGHT			RWY 10	
	-15 ISA -28	II ELEVN 1000 ft	SLOPE 0.0%	FUNCTIONS -	
QNH hPa	1013	N.A.			
RWY COND	4-Good to medium				
A-ICE	Off				
LW T	190.0	-			
	1	M	ost fields remain	similar to previo	us
AIR COND	Off 🔽		Flysmart with A	Airbus version	
APPR TYPE	Normal				
	2.1				
VPilot kt	0 Manual - A/THR on 🔻				
	Manual				
ECAM ALERTS					
• <u>ENG</u> - ENG 1 SHUT	DOWN				
ACFT STS <f5></f5>			COMPUTE <f8></f8>	CLEAR <f6></f6>	



MENU -	G PERF FUN	NCTIONS - 0 MSG		- CLR	A330T
CONDITIONS <f3></f3>		SINGLE RWY COMP	PUTATION <f2> MULTIPLE</f2>	RVVY COMPUTATION <cti< th=""><th>1F2></th></cti<>	1F2>
COMPUTATION WIND °/kt			/ERF	RWY 10	~
OAT °C		ELEVN 1000 ft	SLOPE 0.0%	FUNCTIONS 🔻	
QNH hPa	1013	N.A.			î
RWY COND	4-Good to medium				
A-ICE	6-Dry				
LW T	5-Good				
	4-Good to medium	Mo	st fields remain s		ous
AIR COND	3-Medium		Flysmart with A	irbus version	
APPR TYPE					
GA GRADIENT % VPilot kt			Selection of the I	Braking Action	
LDG TECHNIQUE	1-Poor				
BRK MODE					
	Manadi				
ECAM ALERTS					
• <u>ENG</u> - ENG 1 SHU	T DOWN				
ACFT STS <f5></f5>	•		COMPUTE <f8></f8>	CLEAR <f6></f6>	

IRBUS S

FLT OPS STS

LDG PERF

US

MENU 👻	LDO	G PERF	FUNCT	IONS -	0 MSG				+ CLR	A330T	
CONDITIO	NS <f3></f3>			SINGLE	RWY COMPL	JTATION <f2></f2>	MULTIPLE	RWY COM	PUTATION<0	Ctrl F2>	
COMP	UTATION	IN-FLIGHT	_		EDDE /				10		
		HD12	[]	ERFURT	-	SLOPE	0.0%		CTIONS -		
		-15	ISA -28	LENGTH 2							
	NH hPa	1013		N.A.							1
RV		4-Good to med	ium 🔽								
	A-ICE	Off	<u> </u>								
	LW T	190.0			Mos	st fields r	emain s	similar	to previ	ious	
A	IR COND	Off	_				rt with A		•		
	PR TYPE	Normal	-								
GA GRAE	DIENT %	2.1				Selectior	of the	Brakin	a Actior	1	
	VPilot kt	0							97101101	·	
LDG TEC	CHNIQUE	Manual - A/THF	R on 🔽			Salacti	on of the				
BR	RK MODE	Manual - A/THF	R off			Oelecti					
		Manual - A/THF	R on								
• <u>ENG</u> -EI	NG 1 SHUT	Autoland -3.0									
ACFT ST	S <f5></f5>					COMPL	JTE <f8></f8>	CLEA	.R <f6></f6>		ĺ

FLT OPS STS

LDG PERF

MENU - LDG PERF FUNCT	IONS - 0 MSG	- CLR A330T
CONDITIONS <f3></f3>	SINGLE RWY COMPUTATION <f2> MULTIPLE RWY CO</f2>	DMPUTATION <ctrl f2=""></ctrl>
COMPUTATION IN-FLIGHT VIND °/kt HD12 []		10 🔽
OAT °C -15 ISA -28	ELEVN 1000 ft SLOPE 0.0%	JNCTIONS 🔻
QNH hPa 1013	N.A.	
RWY COND 4-Good to medium		
LW T 190.0	RWY 10 LW 190.0T	MLW(perf) 238.1T
AIR COND Off		
APPR TYPE Normal	LIMITATION CODE WGT	FLAPS LVR POS 🥥 3
GA GRADIENT % 2.1 VPilot kt 0	LD:1853 m FACTOR / INCREMENT: 1.15	
LDG TECHNIQUE Manual - A/THR on	FACTORED LD: 2131m STOP MARGIN: 469 m	VAPP: 149kt
BRK MODE Manual		
ECAM ALERTS		
• ENG - ENG 1 SHUT DOWN		MORE <f10></f10>
ACFT STS <f5></f5>	COMPUTE <f8> CLE</f8>	EAR <f6></f6>



1	BACKGROUND	
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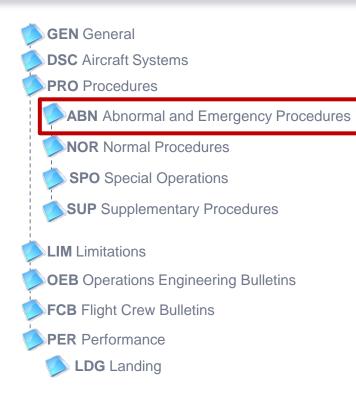
WHAT IS NEW? - SUMMARY

- The aim of the **TALPA/ARC*** was to elaborate common tools to better assess the in-flight landing performance
 - ➡ The Runway Condition Assessment Matrix (RCAM)
 - The New landing performance without failure
 - The New landing performance with failure

* Takeoff and Landing Performance Assessment / Aviation Rulemaking Committee



FCOM IMPACTS - REVISION MAY 2012

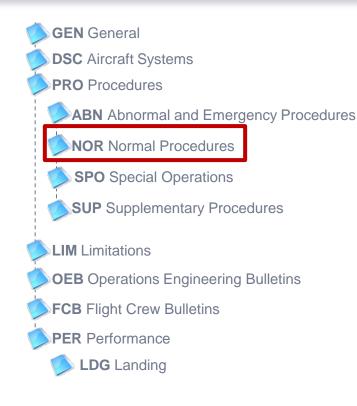


All references* to the landing distance penalty factors are removed

* Reference to the tables of landing distance penalty factors and the tables are removed



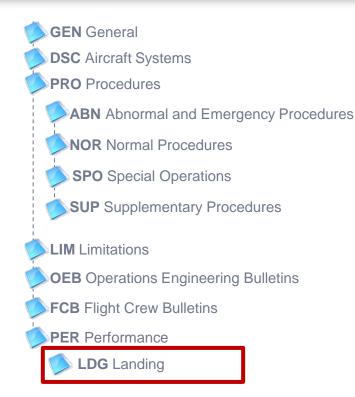
FCOM IMPACTS - REVISION MAY 2012



Descent Preparation updated



FCOM IMPACTS - REVISION MAY 2012



Introduction of: Definitions, Runway Condition Assessment Matrix



QRH IMPACTS - REVISION MAY 2012

GEN General

ABN Abnormal and Emergency Procedures

NP Normal Procedures

FPE In-Flight Performance

SPD Speeds

FPF Fuel Penalty Factors

IFL In-Flight Landing

MAT Runway Condition Assessment Matrix

VAP VAPP Determination

LD Landing Distance – Normal Operations

VAF VAPP Determination with Failure

24 Landing Distance with Electric System Failure

27 Landing Distance with Flight Control System Failure

XX

34 Landing Distance with Navigation System Failure

36 Landing Distance with Bleed System Failure

70 Landing Distance with Engine System Failure

OEI One Engine Inoperative
 AEO All Engines Operative
 CAB Flight Without Cabin Pressurization
 OPD Operating Data
 OPS Operational Data
 OEBPROC Operations Engineering Bulletins

All references to the landing distance penalty factors are removed

"Summaries" provide reference to the Landing Distance tables



QRH IMPACTS - REVISION MAY 2012



Descent Preparation updated



QRH IMPACTS - REVISION MAY 2012

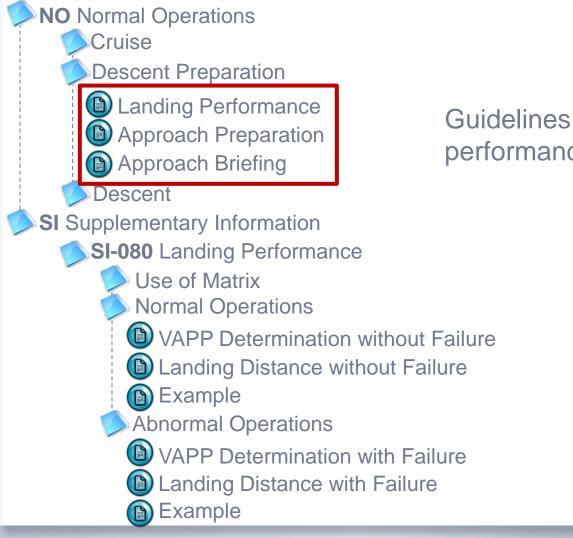
GEN General **ABN** Abnormal and Emergency Procedures **NP** Normal Procedures FPE In-Flight Performance **SPD** Speeds **FPF** Fuel Penalty Factors **IFL** In-Flight Landing MAT Runway Condition Assessment Matrix **VAP** VAPP Determination LD Landing Distance – Normal Operations **VAF** VAPP Determination with Failure 24 Landing Distance with Electric System Failure 27 Landing Distance with Flight Control System Failure XX 34 Landing Distance with Navigation System Failure 36 Landing Distance with Bleed System Failure 70 Landing Distance with Engine System Failure **OEI** One Engine Inoperative **AEO** All Engines Operative **CAB** Flight Without Cabin Pressurization **OPD** Operating Data **OPS** Operational Data **OEBPROC** Operations Engineering Bulletins

Introduction of the new landing performance assessment tools

Tables of Actual Landing Distances are removed



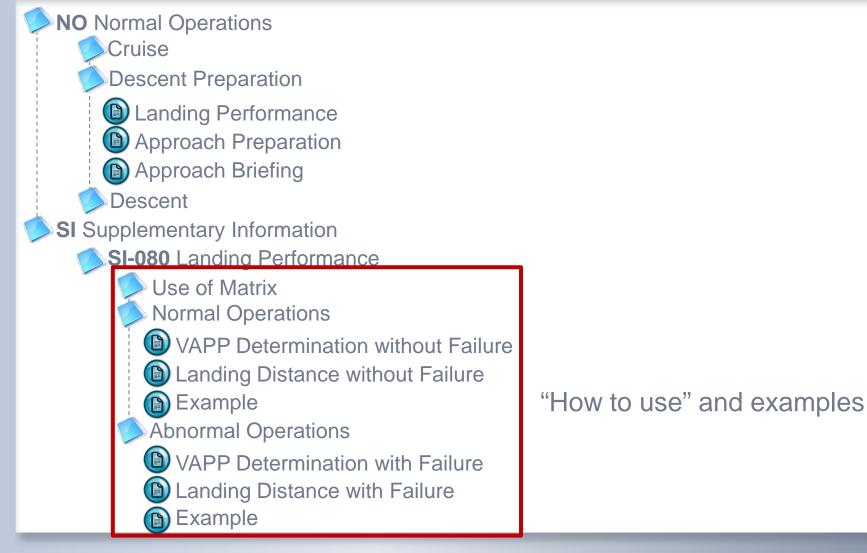
FCTM IMPACTS - REVISION MAY 2012



Guidelines on how to assess landing performance



FCTM IMPACTS - REVISION MAY 2012





AFM IMPACTS - REVISION JUNE 2012

Approval Data

General

Limitations

Emergency Procedures

Abnormal Procedures

- Normal Procedures
- Performance

Appendices and Supplements

- Master Configuration Deviation List
- Supplementary Performance

Reference to relevant file that enables landing distance computation is added

Landing distance with failure superseded the landing distance penalty factors



MMEL IMPACTS - REVISION JULY 2012

How to Use

MMEL Entries

MMEL Items

MMEL Operational Procedures

Clarify that landing distance penalty factors apply on Required Landing Distance and on In-Flight Landing Distance



FLYSMART IMPACTS

- Class 1 TBD
- Class 2 TBD
- Class 3 TBD





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