A318/A319/A320/A321

PERFORMANCE TRAINING MANUAL

STANDARD PERFORMANCE PART OF TRANSITION COURSE WITH FOVE TOOL

Rtr: U0Q2SP0

This document must be used
for training purpose only.

Under no circumstances
should this document be used as a reference.

AIRBUS
Training & Flight Operations Support and Services

1, rond-point Maurice Bellonte
31707 Blagnac Cedex
FRANCE

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■ U0Q2SP0

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1. COURSE CONTENTS

CONTENTS:

1.1. Schedule of the Course

Documentation Overview

FCOM VOL 2 - Flight Preparation
FCOM VOL 3 - Flight Operations

QRH Section 2
Performance Training Manual:

- Provides documentation for use during this course,
- Summary of the course and examples used are available for future reference,
- Extracts of FCOM are provided and these will be used for LOFT and EVAL.

Computer Flight Plan

Description of relevant information on CFP
Gross error check of fuel calculation with FMGS

LPC utilisation

LPC presentation
Weight & balance
TakeOff calculation
Landing calculation

Flight Operations

Fuel Calculation
Cruise Optimization
Go-Around
Single Engine Operations

LPC Application exercises

Additional Performance

Performance Review

1.2. Course Objectives

- The main objective of this course is to present the AIRBUS performance documentation:
  - Flight Crew Operating Manual, FCOM.
- To do so, the following will be reviewed:
  - Basic regulations,
  - Aircraft performance.
- By the end of this course, you will know:
  - What kind of information you can get in the AIRBUS documentation,
  - Where to find this information,
  - How to use the information.
- More particularly, you will know:
  - How to determine the Max. TOW and the corresponding speeds,
  - How to determine the "Flexible Temperature" (or assumed temperature),
  - How to determine the landing distance and approach speed,
  - How to determine the aircraft loading & balance.

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2. OPERATIONS DOCUMENTS

CONTENTS:

2.1. Computerized Flight Planning Paris/Cairo/Louxor

```
PLAN 7417 COMPUTED 13:58Z          FLIGHT          CONST 30KT/ISA 0
20214     A320  M78   KGS        LFPO TO HECA      ETD 15:49Z 06/09/04

     FLT/DAY  DEP/ARR     F.TIME   NAM   ROUTE     AVG WIND/AVG TEMP
AI123   /06   ORY/CAI      03:58  1672   ORYCAICBT   P030 /  M53


++++ INFO    ++++ MAX PAYLOAD AVAILABLE: 18220 KGS
                  PAYLOAD LIMITED BY MLWT

           E.FUEL  A.FUEL  E.TME   NM    NAM  FL
DEST  HECA 010495  ... ..  03:58  1791  1672  350
RESV  0.05 000525  ... ..  00:12
ALT   HELX 001998  ... ..  00:48  0276  0276  390
HOLD       001257  ... ..  00:30
XTR        000000  ... ..  00:00  CAPT.SIGN . . . . . .
TOF        014275  ... ..  05:28
TAXI       000140  ... ..
BLOCK      014415  ... ..  05:28  BLOCK FUEL. . . . . .


FUEL BURN ADJUSTMENT FOR 1000KGS INCREASE/DECREASE IN TOW : 0134KGS

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
           E.MASS  CORR.   LIMIT  OPS  STRUC.  REASONS FOR OP.LIMIT
BASIC WT   042500  ... ..
EPLD       018220  ... ..
EZFW       060720  ... ..  ZFW  ... .. 061000 /. . . . . .
TOF        014275  ... ..
ETOW       074995  ... ..  OTOW ... .. 077000 /. . . . . .
EB/O       010495  ... ..
ELAW       064500  ... ..  LAW  ... .. 064500 /. . . . . .
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
FL 350/SIT 370
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ROUTES TO ALTERNATES

ALTERNATE : LXR HELX - LUXOR
ROUTE     : Direct
FL        : 390

HECA DCT HELX


WP  NAME   CO-ORDINATES          WP  NAME   CO-ORDINATES
..  LFPO   N48 43.4  E002 22.8   ..  BUBLI  N48 46.3  E004 09.0
..  LUVAL  N48 17.6  E005 09.2   ..  LANVI  N48 18.7  E005 47.8
..  EPL    N48 19.1  E006 03.6   ..  T-O-C  N48 10.5  E006 37.5
..  LASAT  N48 09.5  E006 41.1   ..  BEGAR  N47 54.5  E007 35.0
..  TRA    N47 41.4  E008 26.2   ..  KUDES  N47 31.3  E008 51.4
..  DINAR  N47 31.7  E009 02.3   ..  BAMUR  N47 32.7  E009 32.6
..  ALGOI  N47 26.9  E010 29.3   ..  PITAR  N47 01.8  E010 40.8
..  BZO    N46 27.8  E011 19.3   ..  BABAG  N45 23.2  E013 07.6
..  PEVAL  N45 18.7  E013 14.9   ..  NAKIT  N45 11.3  E013 26.9
..  PUL    N44 53.6  E013 55.1   ..  TIBLA  N43 04.5  E016 00.4
..  AIOSA  N41 55.7  E017 14.9   ..  ENOXA  N41 12.1  E017 40.1
..  BRD    N40 36.7  E018 00.2   ..  TIGRA  N40 03.4  E019 00.0
..  KRK    N39 26.6  E020 04.4   ..  PARNA  N39 15.7  E020 25.8
..  GARTA  N38 59.1  E020 58.1   ..  ELVAS  N38 31.5  E021 50.5
..  IXONI  N38 18.9  E022 13.9   ..  PIKAD  N38 03.7  E022 41.9
..  KOR    N37 55.8  E022 56.2   ..  MIL    N36 44.7  E024 31.1
..  ALIKI  N35 55.5  E025 20.9   ..  ATLAN  N35 50.9  E025 25.6
..  SIT    N35 04.0  E026 11.7   ..  PAXIS  N33 57.1  E027 20.0
..  GESAD  N32 56.7  E028 20.0   ..  OTIKO  N31 34.3  E029 36.5
..  T-O-D  N31 27.4  E029 42.6   ..  AXD    N31 11.2  E029 57.0
..  MENKU  N31 05.5  E030 18.0   ..  HECA   N30 06.7  E031 24.8

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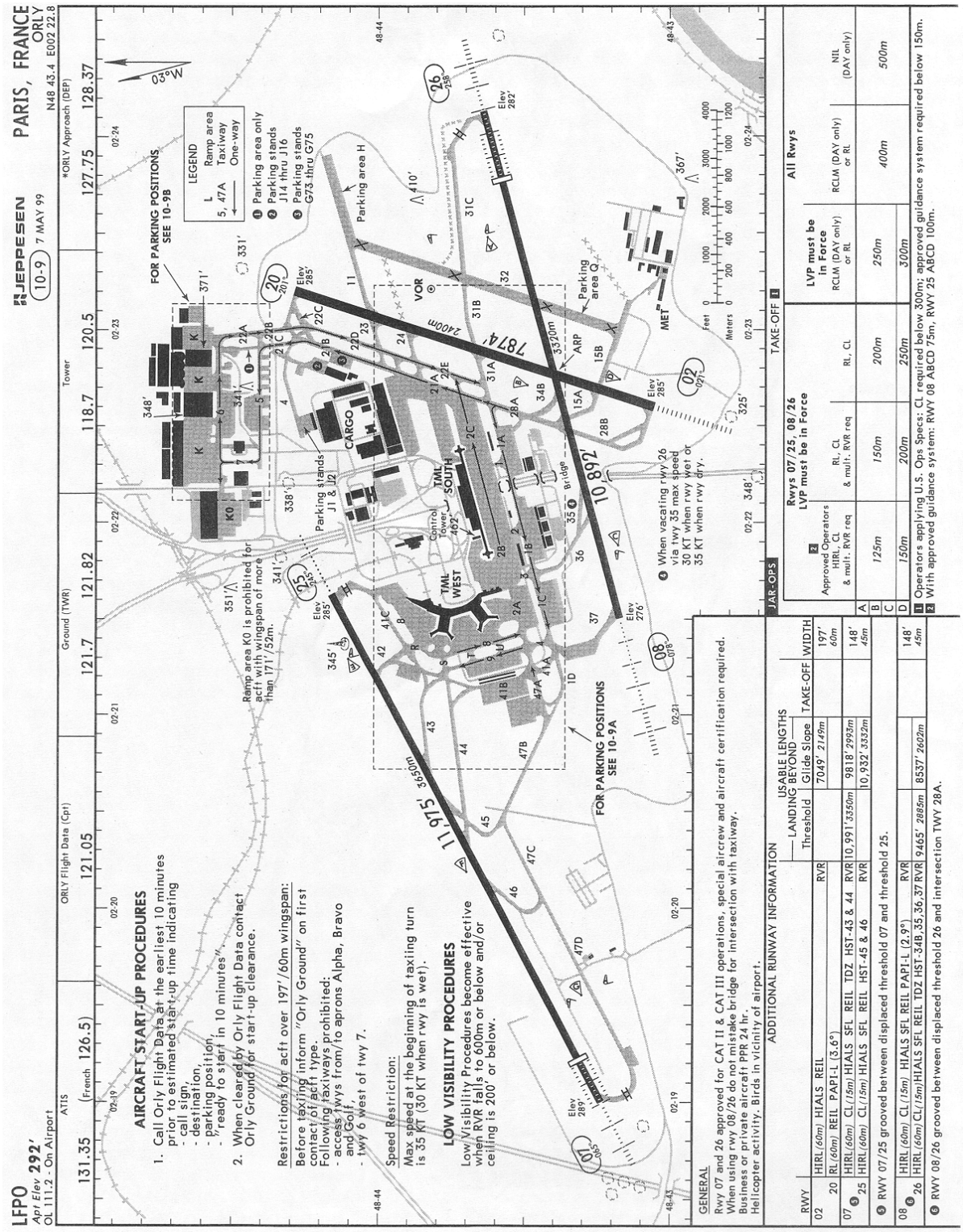
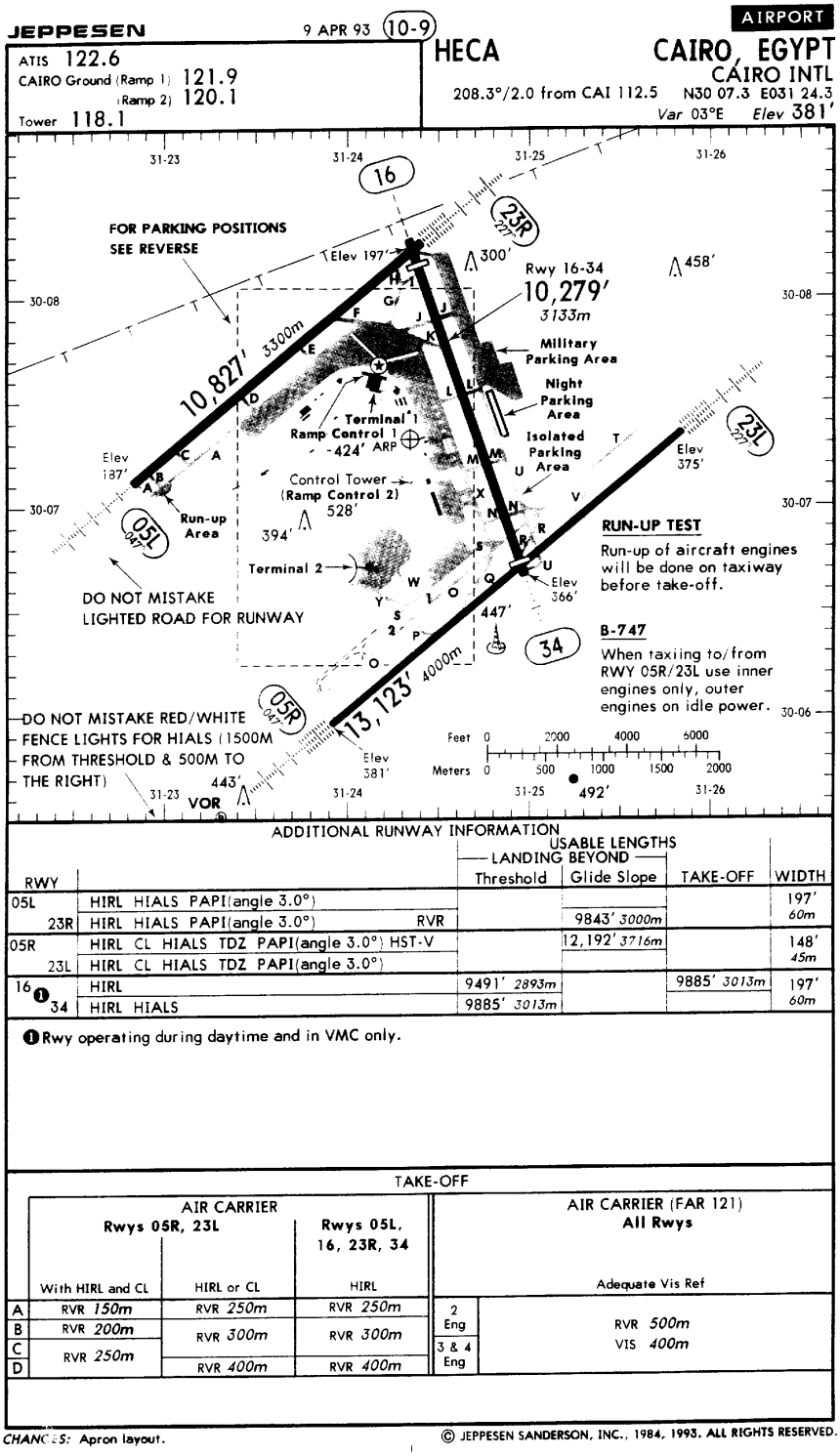
2.2. Paris Orly Airport Chart



2.3. Cairo Airport Chart



ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS — LANDING BEYOND — Threshold	Glide Slope	TAKE-OFF	WIDTH
05L	HIRL HIALS PAPI(angle 3.0°)				197' 60m
23R	HIRL HIALS PAPI(angle 3.0°) RVR		9843' 3000m		
05R	HIRL CL HIALS TDZ PAPI(angle 3.0°) HST-V		12,192' 3716m		148' 45m
23L	HIRL CL HIALS TDZ PAPI(angle 3.0°)				
16 ❶ 34	HIRL	9491' 2893m		9885' 3013m	197' 60m
	HIRL HIALS	9885' 3013m			

❶ Rwy operating during daytime and in VMC only.

TAKE-OFF

	AIR CARRIER Rwys 05R, 23L: With HIRL and CL	AIR CARRIER Rwys 05R, 23L: HIRL or CL	AIR CARRIER Rwys 05L, 16, 23R, 34: HIRL	AIR CARRIER (FAR 121) All Rwys: Adequate Vis Ref
A	RVR 150m	RVR 250m	RVR 250m	2 Eng: RVR 500m, VIS 400m
B	RVR 200m	RVR 300m	RVR 300m	3 & 4 Eng: RVR 500m, VIS 400m
C	RVR 250m			
D		RVR 400m	RVR 400m	

CHANGES: Apron layout.

Priority Address(es)

QU ▸ CAIKDXX ▸ ▸ ▸

Originator: ● ORYKLOXY ▸ Recharge/Date/Time: / ▸ Initials: JP LDM

Flight: AI-3214 ● A/C Reg: F-BELA ● Version: 24F114Y ● Crew: 2/5/ ● Date: 24/11/04

LOADSHEET & LOADMESSAGE
Passenger aircraft
ALL WEIGHTS IN KILOGRAMS

			ZERO FUEL	TAKE-OFF	LANDING
BASIC WEIGHT	41375	MAXIMUM WEIGHT FOR	61000		64500
Crew	545				
Pantry	580	Take-off Fuel	11500	Trip fuel	9500
DRY OPERATING WEIGHT	42500	ALLOWED WEIGHT FOR TAKE-OFF (Lowest of a, b orc)	a 72500	b 75500	c 74000
Take-off Fuel	11500	Operating Weight	54000		
OPERATING WEIGHT	54000	ALLOWED TRAFIC LOAD	18500		

Dest.	M	A/F	CH	INF	Cab Bag		Total	Distribution Weight 1	3	4	5	0	Remarks PAX F	PAX Y	PAD F	PAD Y
—						Tr										
						B										
						C								.PAX/ / /		.PAD/ / /
						M										
.	/	/	/	.	.T			.1/	.3/	.4/	.5/	.0/				
—						Tr										
						B										
						C								.PAX/ / /		.PAD/ / /
						M										
.	/	/	/	.	.T			.1/	.3/	.4/	.5/	.0/				
—						Tr										
C						B	3000	600	1050	1250	100					
A						C	4800	2600	1150	950	100			.PAX/ 18 /104/		.PAD/ 2 / 3 /
I						M	200				200					
.	118/		/ 4 /	.	.T		8000	.1/3200	.3/2200	.4/2200	. 5/400	.0/				

Total Passenger Weight	10052	ALLOWED TRAFIC LOAD	18500	SI ▸
TOTAL TRAFIC LOAD	18052		18052	
Dry operating Weight	42500	UNDERLOAD BEFORE LMC	448	
ZERO FUEL WEIGHT (LMC)	60552	LAST MINUTE CHANGE		
Max. 61000 ±		Dest / Specification / Cpt / +/- / Weight		
Take-off Fuel	11360			
TAKE-OFF WEIGHT (LMC)	71912			
Max. 75500 ±				
Trip Fuel	9500			
LANDING WEIGHT (LMC)	62412			
Max. 64500 ±		LMC Total +/-		

Check LMC Total with Underload

Notes

Balance	Seating Cond.
TOW = 36,3 %	OA = 15
	OB = 60
LAW= 38,1 %	OC = 47

Total Passengers = 122

Prepared by: JP
Approved by: FG

Priority Address(es): QU ▸ CAIKDXX ▸ ▸ ▸

Originator: ■ ORYKLOXY ▸ Recharge/Date/Time: / ▸ Initials: JP LDM

Flight: AI-3214A ■ A/C Reg: F-BELA ■ Version: 24F114Y ■ Crew: 2/5/ Date: 24/11.04

LOADSHEET & LOADMESSAGE
Passenger aircraft
ALL WEIGHTS IN KILOGRAMS

		ZERO FUEL	TAKE-OFF	LANDING
BASIC WEIGHT	41375	MAXIMUM WEIGHT FOR	61000		64500
Crew	545	Take-off Fuel +	11500	Trip fuel +	10000
Pantry	580				
DRY OPERATING WEIGHT	42500	ALLOWED WEIGHT FOR TAKE-OFF (Lowest of a, b or c)	a 72500	b 75500	c 74500
Take-off Fuel +	11500	Operating Weight −	54000		
OPERATING WEIGHT	54000	ALLOWED TRAFIC LOAD	18500		

Dest.	No. of Passengers M	A/F	CH	INF	Cab Bag		Total	Distribution Weight 1	3	4	5	0	Remarks PAX F	Y	PAD F	Y
—						Tr										
						B										
						C							.PAX/ / /		.PAD/ / /	
						M										
.	/	/	/	.	.T			1/	3/	4/	5/	0/				
—						Tr										
						B										
						C							.PAX/ / /		.PAD/ / /	
						M										
.	/	/	/	.	.T			1/	3/	4/	5/	0/				
—						Tr										
C						B	3250	700	1100	1250	200					
A						C	4950	2600	1150	1000	200		.PAX/ 13 /104/		.PAD/ 2 / 3 /	
I						M	117				117					
.	118/	/	4	/	.	.T	81710	.1/3300	.3/2250	.4/2250	. 5/517	.0/				

Total Passenger Weight +	10052	ALLOWED TRAFIC LOAD	18500	SI ▸	
TOTAL TRAFIC LOAD =	18369		18369		
Dry operating Weight +	42500	UNDERLOAD BEFORE LMC =	31		
ZERO FUEL WEIGHT LMC	60869	LAST MINUTE CHANGE			
Max. ±	=	Dest	Specification	Cpt	+/-	Weight
61000 ±	=					
Take-off Fuel +	11500					
TAKE-OFF WEIGHT LMC	72369					
Max. ±	=					
75500 ±	=					
Trip Fuel −	10000					
LANDING WEIGHT LMC	62369					
Max. ±	=					
64500 ±	=	LMC Total +/-				

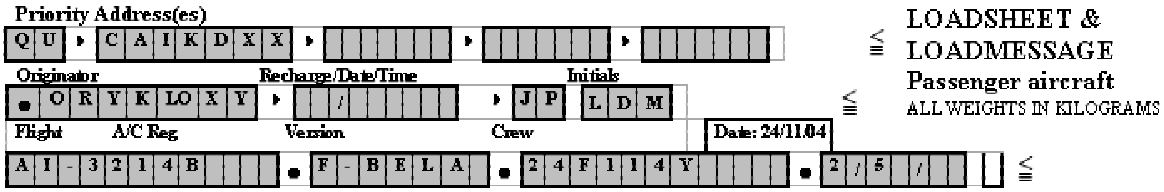
Check LMC Total with Underload

Notes

Balance	Seating Cond.
TOW = 35,8 %	OA = 18
	OB = 58
LAW= 37,7 %	OC = 46

Total Passengers = 122

Prepared by: JP Approved by: FG



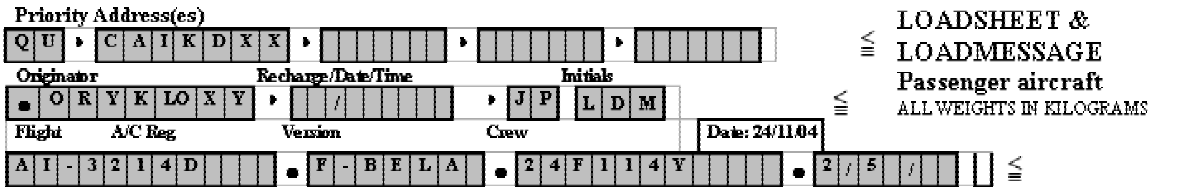
		ZERO FUEL	TAKE-OFF	LANDING
BASIC WEIGHT	41375			
Crew	545	MAXIMUM WEIGHT FOR	61000	64500
Pantry	580	Take-off Fuel +	13343	Trip fuel + 9728
E / Wdev	100			
DRY OPERATING WEIGHT	42600	ALLOWED WEIGHT FOR TAKE-OFF (Lowest of a, b or c)	a 74343	b 75500 c 74228
Take-off Fuel +	13343	Operating Weight −		55943
OPERATING WEIGHT	55943	ALLOWED TRAFIC LOAD		18285

Dest.	No. of Passengers M	A/F	CH	INF	Cab Bag		Total	Distribution Weight 1	3	4	5	0	Remarks PAX F	Y	PAD F	Y
—						Tr										
						B										
						C							.PAX/ / /		.PAD/ / /	
						M										
.	/	/	/	.		.T		.1/	.3/	.4/	.5/	.0/				
—						Tr										
						B										
						C							.PAX/ / /		.PAD/ / /	
						M										
.	/	/	/	.		.T		.1/	.3/	.4/	.5/	.0/				
—						Tr										
C						B	2250	1600	350	200	100					
A						C	3050	1400	1150	300	200		.PAX/ 10 /100/		.PAD/ 2 / 3 /	
I						M	1825				182					
.	105/		15	/	.	.T	5482	.1/3000	.3/1500	.4/ 500	.5/482	.0/				

Total Passenger Weight +	8995	ALLOWED TRAFIC LOAD	18285	SI ▸	
TOTAL TRAFIC LOAD =	14477	→	− 14477		
Dry operating Weight +	42600	UNDERLOAD BEFORE LMC =	3808		
ZERO FUEL WEIGHT LMC	57077	LAST MINUTE CHANGE			
Max. ±		Dest	Specification	Opt	+/-	Weight
61000 ±	=					
Take-off Fuel +	13343					
TAKE-OFF WEIGHT LMC	70320					
Max. ±						
75500 ±	=					
Trip Fuel −	9728					
LANDING WEIGHT LMC	60592					
Max. ±						
64500 ±	=	LMC Total +/-				

Check LMC Total with Underload

Notes	
Balance	Seating Cond.
TOW = 33,1 %	OA = 10
	OB = 50
LAW= 35,9 %	OC = 50
Total Passengers = 110	
Prepared by:	Approved by:
JP	FG



			ZERO FUEL	TAKE-OFF	LANDING
BASIC WEIGHT	41375				
Crew	00545	MAXIMUM WEIGHT FOR	61000		64500
Pantry	00580	Take-off Fuel +	13343	Trip fuel +	09728
E / Wdev	00100				
DRY OPERATING WEIGHT	42600	ALLOWED WEIGHT FOR TAKE-OFF (Lowest of a, b or c)	a 74343	b 75500	c 74228
Take-off Fuel +	13343	Operating Weight −			55943
OPERATING WEIGHT	55943	ALLOWED TRAFIC LOAD			18285

Dest.	No. of Passengers M	A/F	CH	INF	Cab Bag		Total	Distribution Weight 1	3	4	5	0	Remarks PAX F	Y	PAD F	Y
—						Tr										
						B										
						C							.PAX/ / /		.PAD/ / /	
						M										
.	/	/	/	.	.T			.1/	.3/	.4/	.5/	.0/				
—						Tr										
						B										
						C							.PAX/ / /		.PAD/ / /	
						M										
.	/	/	/	.	.T			.1/	.3/	.4/	.5/	.0/				
—						Tr										
C						B	2250	1600	350	200	100					
A						C	3050	1400	1150	300	200		.PAX/ 10 /100/		.PAD/ 2 / 3 /	
I						M	1820				182					
.	106/	15	/	.	.T		5482	.1/3000	.3/1500	.4/ 500	.5/482	.0/				
	107	5					5522	3000	1500	500	522		10	102	2	3

Total Passenger Weight +	09163	ALLOWED TRAFIC LOAD	18285	SI ▸	
TOTAL TRAFIC LOAD =	14685		14685		
Dry operating Weight +	42600	UNDERLOAD BEFORE LMC =	03600		
ZERO FUEL WEIGHT LMC	57285	LAST MINUTE CHANGE			
Max. ±		Dest / Specification / Cpt / +/- / Weight			
61000 ±		▫▫ Passengers OB +	1680		
Take-off Fuel +	13343	▫▫ Luggage S +	0400		
TAKE-OFF WEIGHT LMC	70628				
Max. ±					
75500 ±					
Trip Fuel −	09728				
LANDING WEIGHT LMC	60900				
Max. ±		LMC Total +/-	208		
64500 ±					

Check: LMC Total with Underload

Notes	
Balance	Seating Cond.
TOW = 33,2 %	OA = 10
	OB = 52
LAW= 36,1 %	OC = 50
Total Passengers = ~~140~~ 112	
Prepared by: JP	Approved by: FG

3. F.O.V.E. PRESENTATION

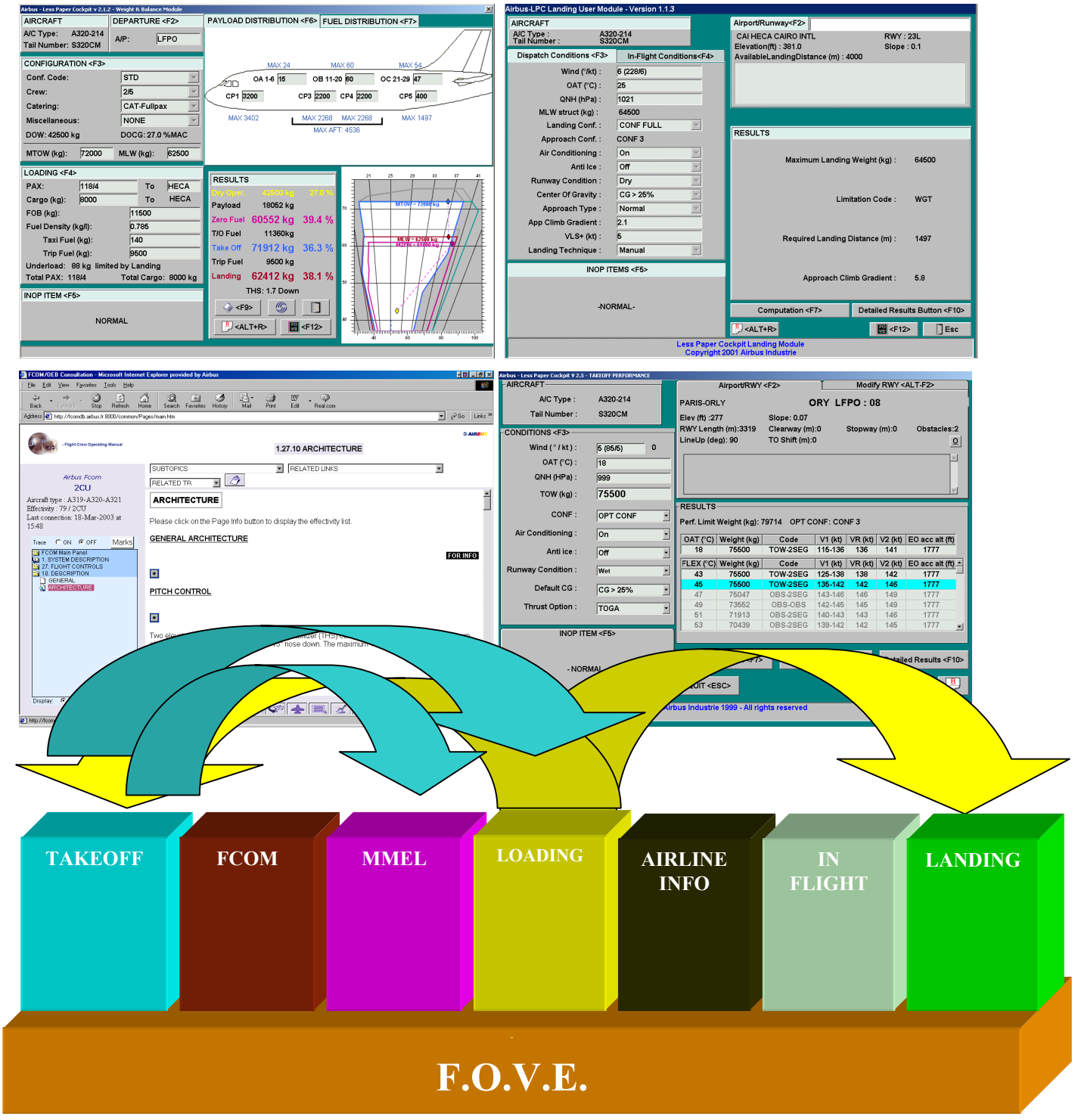
CONTENTS:

3.1. The Technical Approach

- Several applications have been developed with regard to Flight Operations.
- Common information is used by these applications.
- A flow of data is used from one application to another one.
- Need to streamline the Flight Operations applications.

Flight Operations Versatile Environment

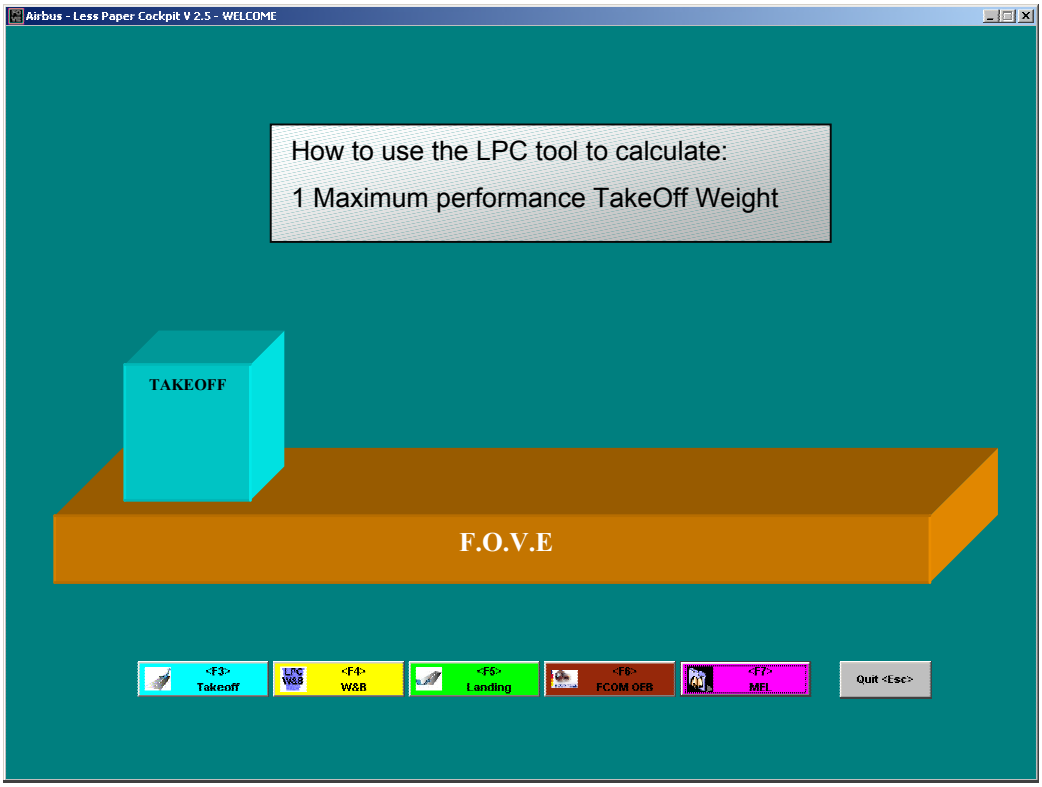
3.1.1. F.O.V.E. Description`



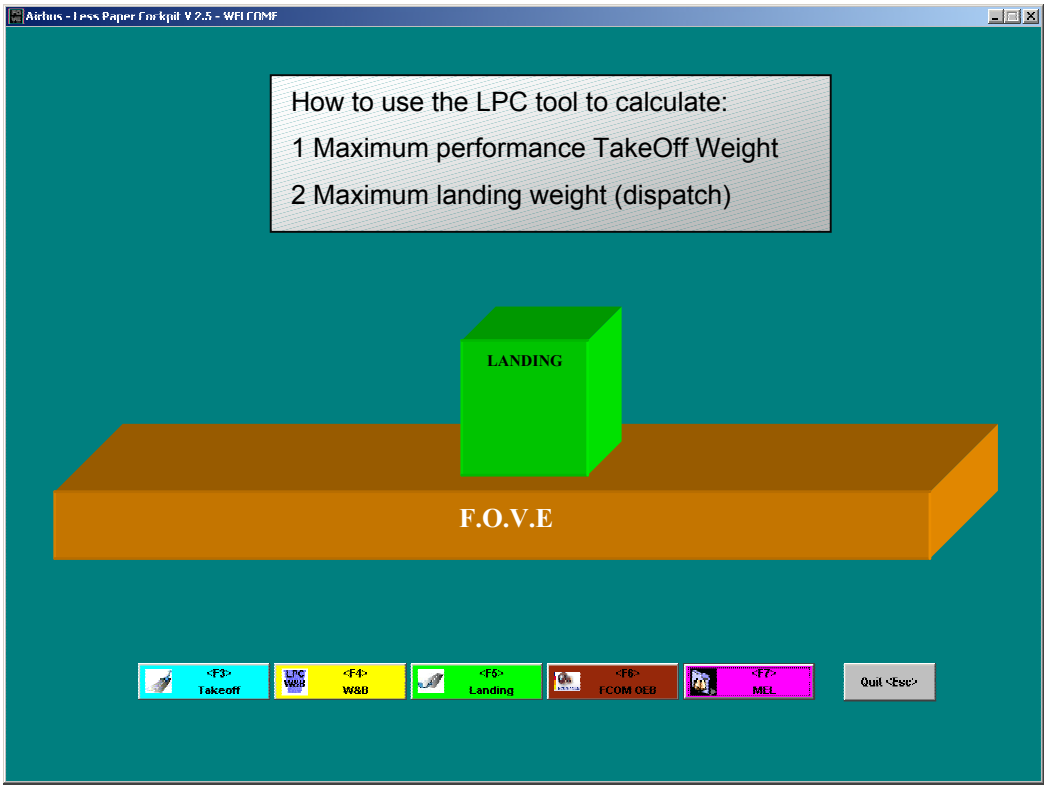
3.1.2. Tool Presentation

On this banner you choose the various LPC module: Weight & Balance, TakeOff, Landing, MEL and FCOM. You can also go back to the entry page (alt+P) or exit the LPC tool completely (alt + E).

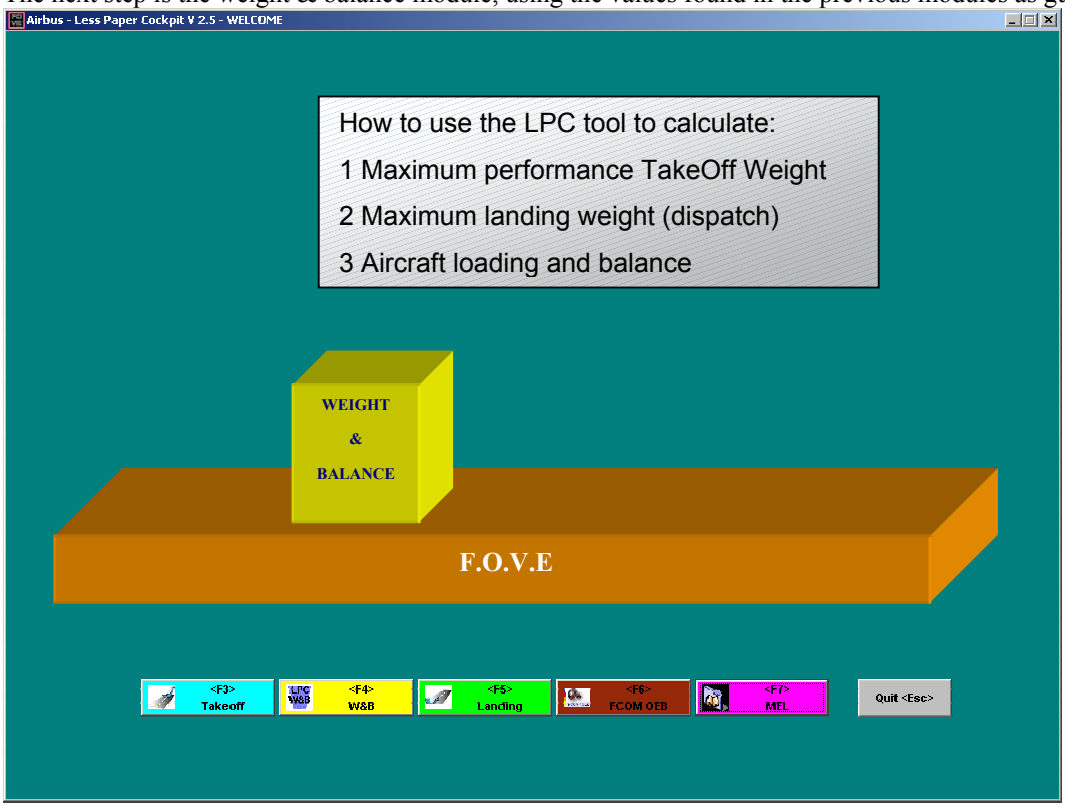
We will first run the TakeOff module to determine a maximum performance TakeOff Weight.



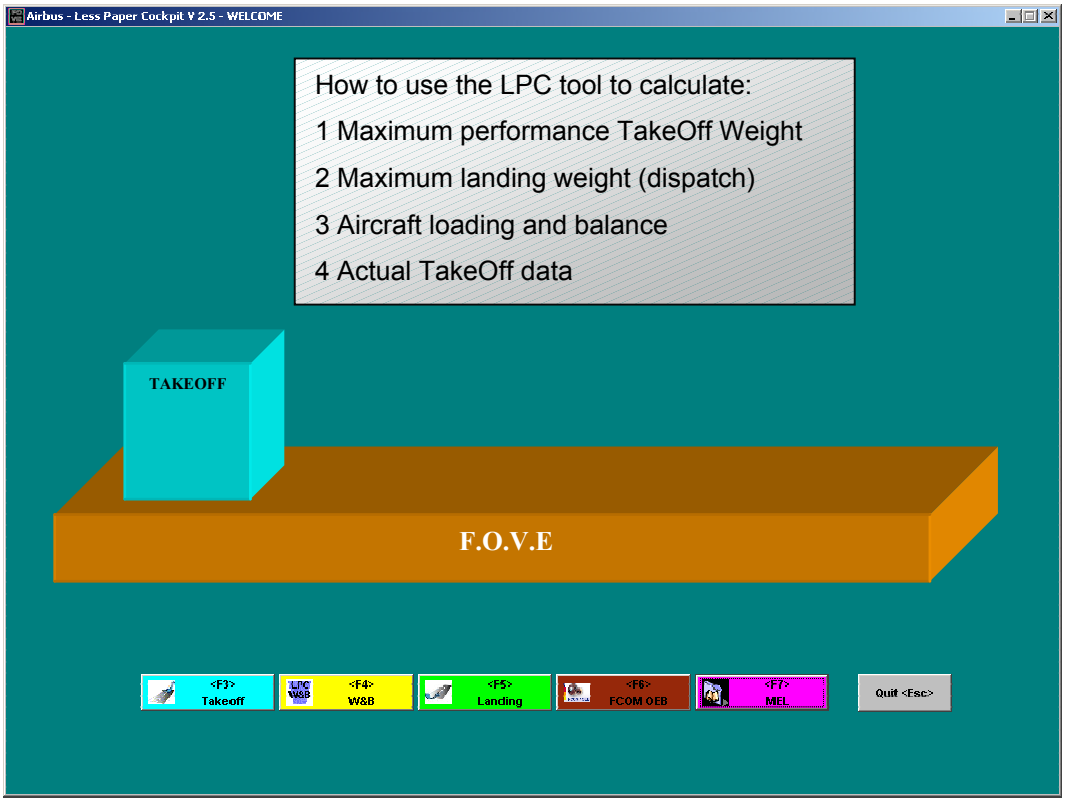
Then the landing module to check for any landing limitation.



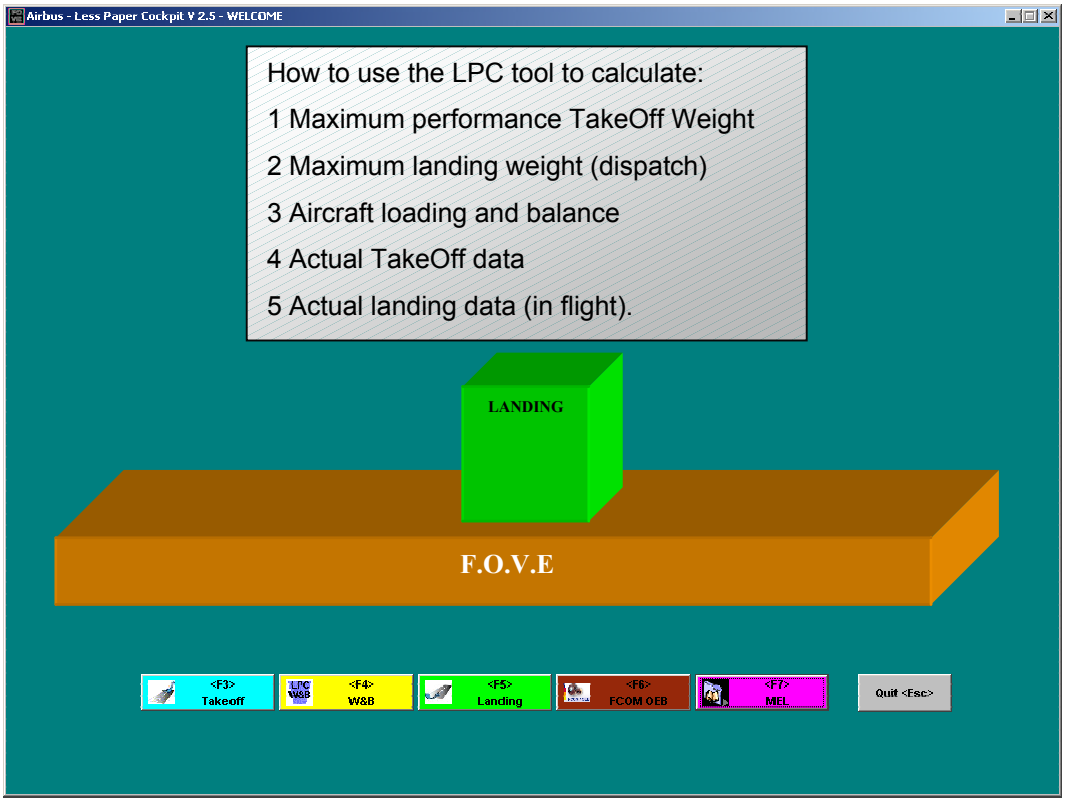
The next step is the weight & balance module, using the values found in the previous modules as guidelines.



Latter on we will calculate the actual TakeOff…



…and actual landing data.



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4. A320 LPC TAKEOFF PRESENTATION

CONTENTS:

4.1. Introduction

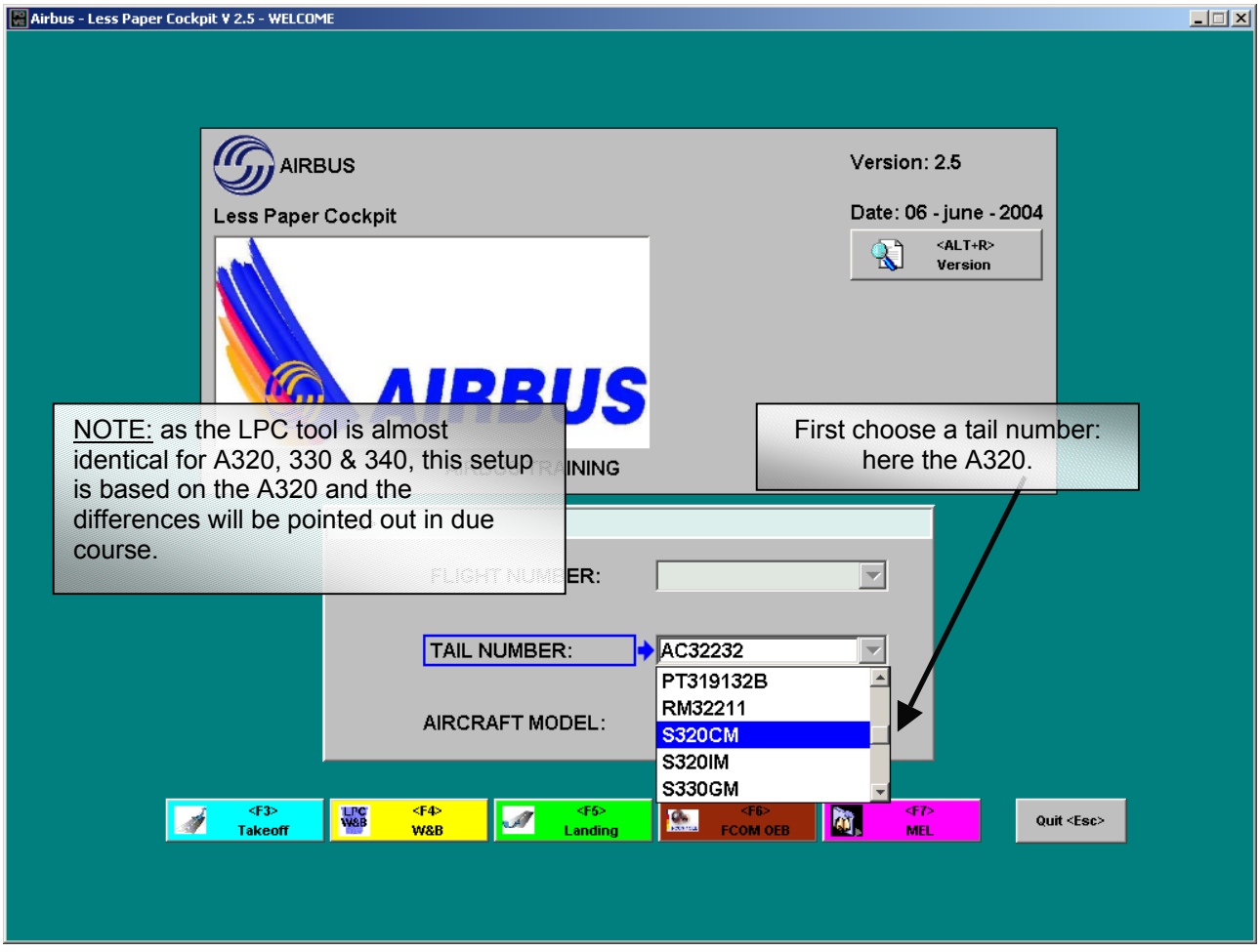
On your laptop, when you click on the LPC icon, or when you press the F3 key you reach this screen.

The LPC is customized to each aircraft and its characteristics. The first step is to choose a tail number, here the A320 with CFM 56-5B4 engines.

NOTE: As the LPC tool is almost identical for A320, 330 & 340, this presentation is based on the A320 and the differences will be pointed out in due course.

As it is difficult to use a mouse in a cockpit, the LPC tool is designed for keyboard inputs.

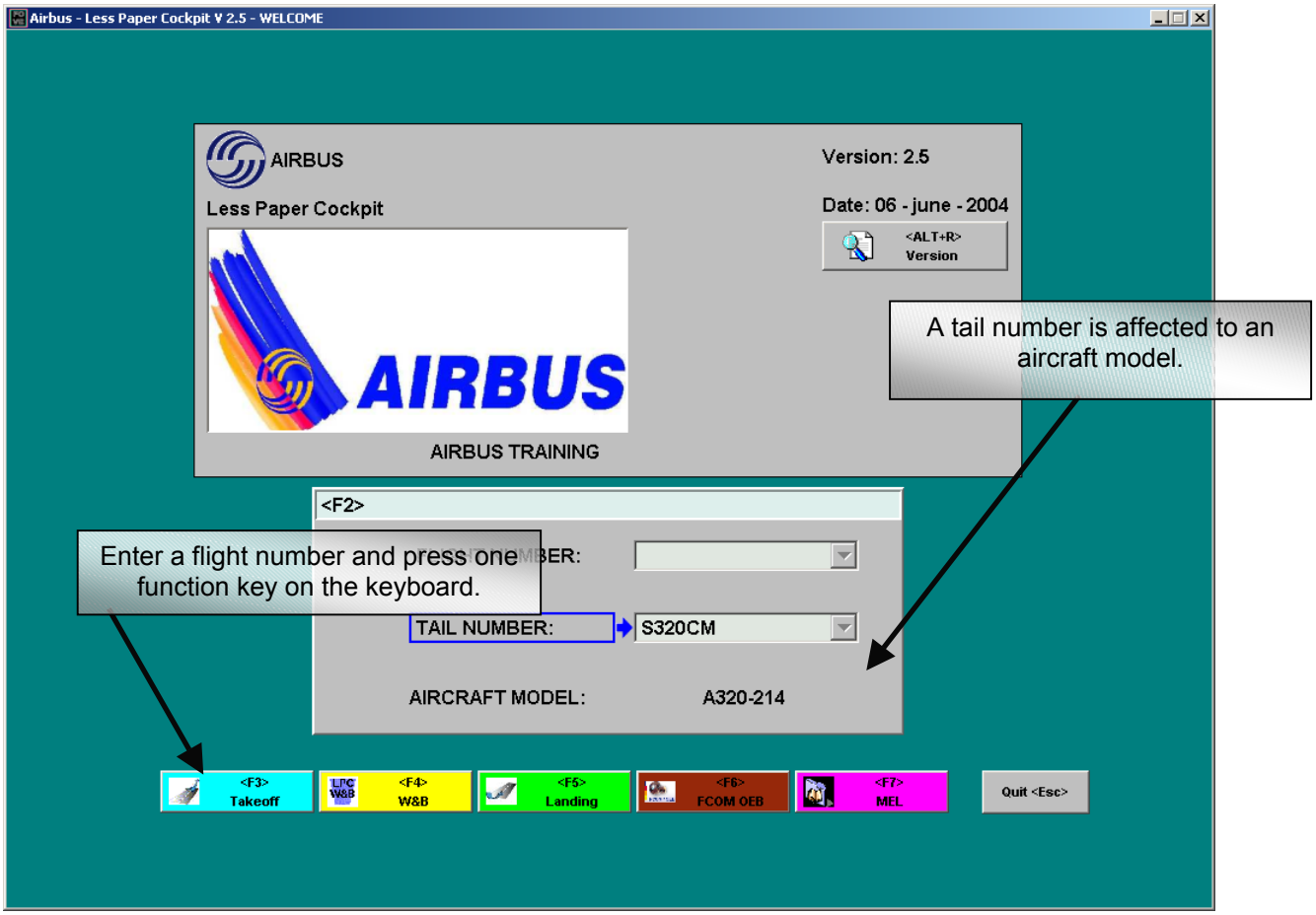
NOTE: Tail number S330RM is for an A330-243 and S340CM is for an A340-313. These tail numbers are used for the complete course AND the performance test.



Choosing a tail number automatically changes the aircraft model. Here an A320 with CFM 56-5CB4 engines is an A320-214.

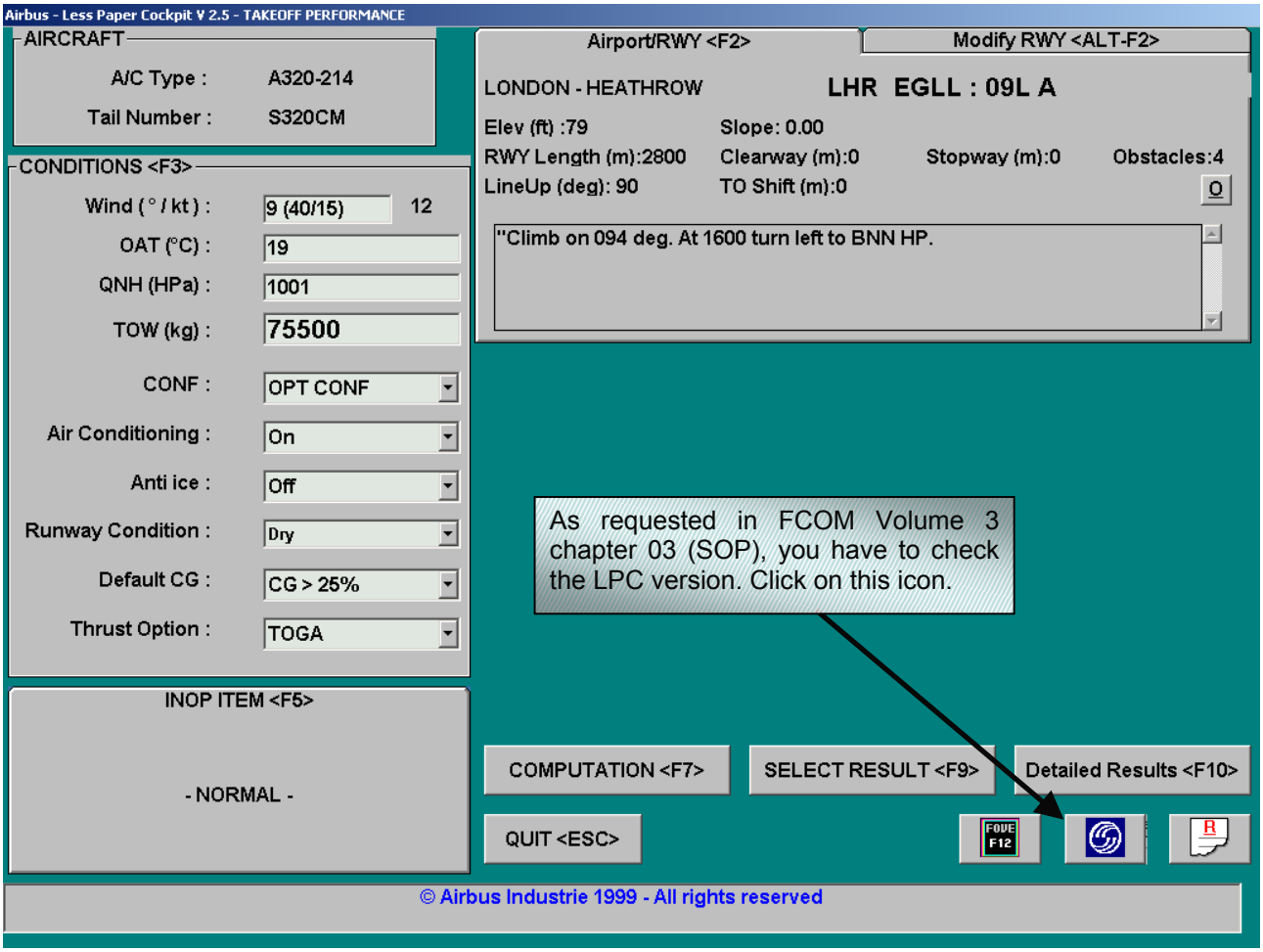
Depending on the setup decided by your company administrator, you may enter a flight number, which will automatically input the departure and destination airport in the LPC.

If no flight number is entered, you have to select the departure and destination airport. We will now see how to do it.



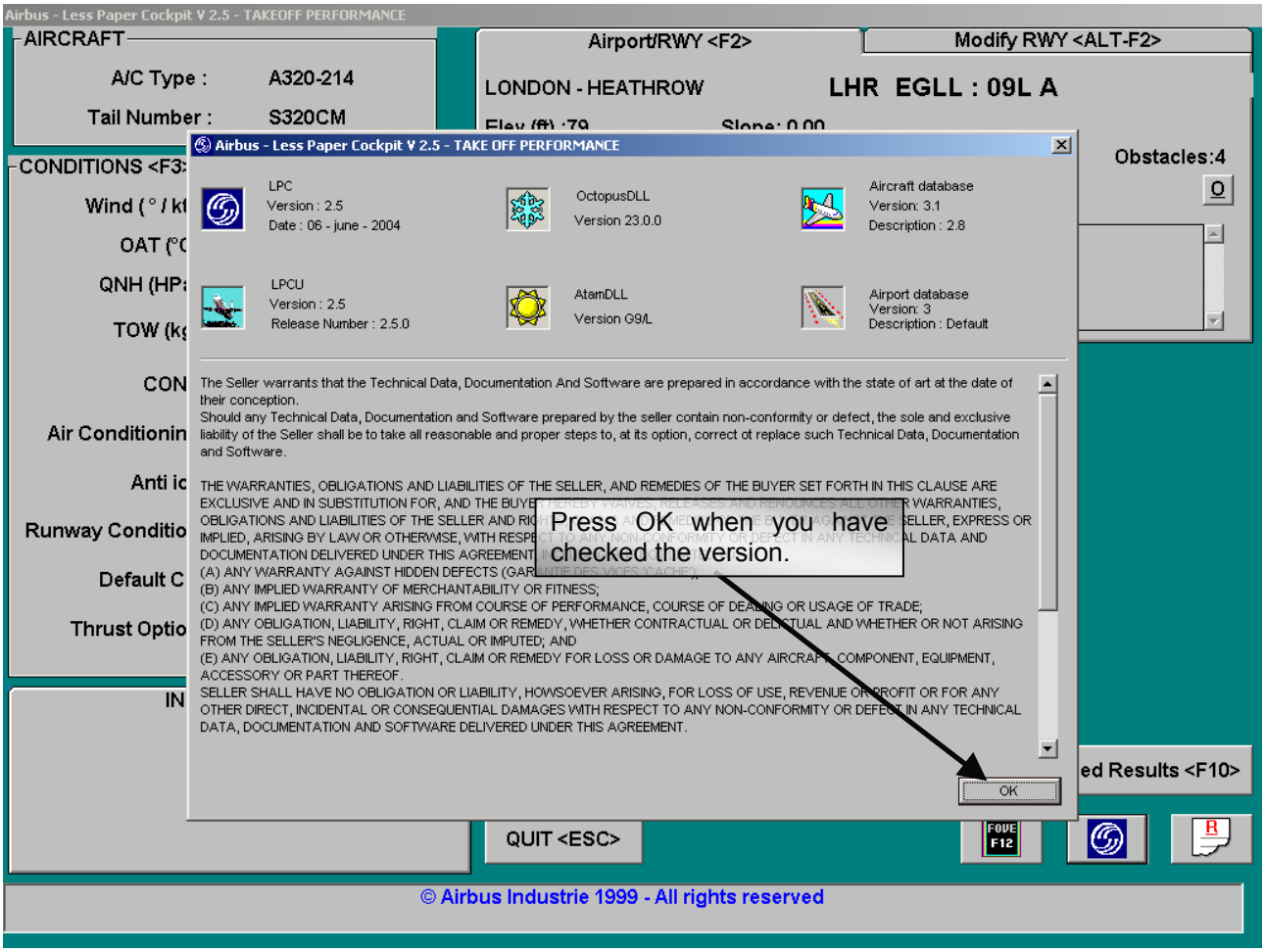
4.2. Data Entry

As requested in the FCOM, the first thing to do is to check that the proper software version is loaded in your computer. Click on the Airbus logo.



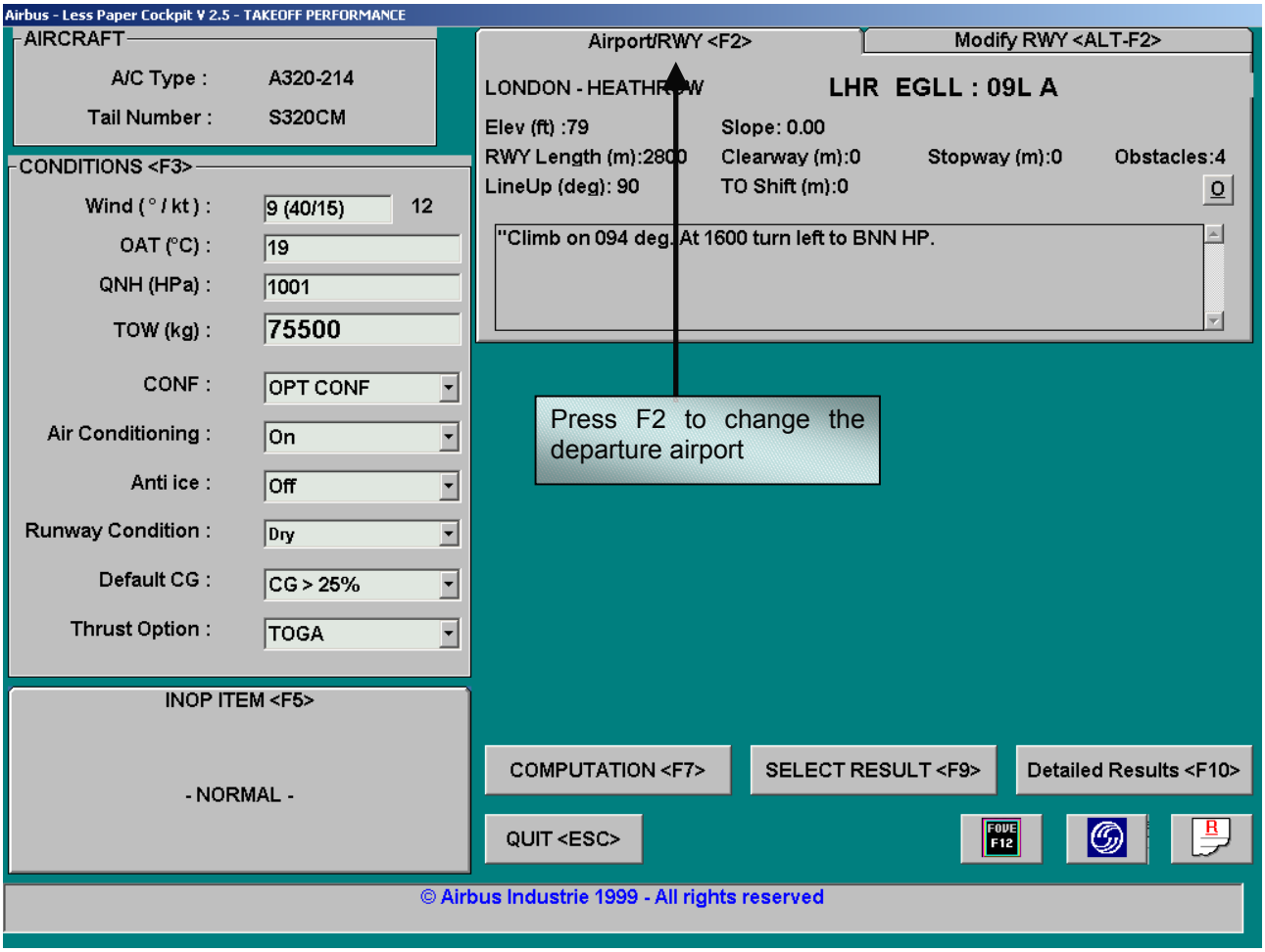
Check that the software version is in accordance with your company documentation.

Press the Escape key when you have finished.

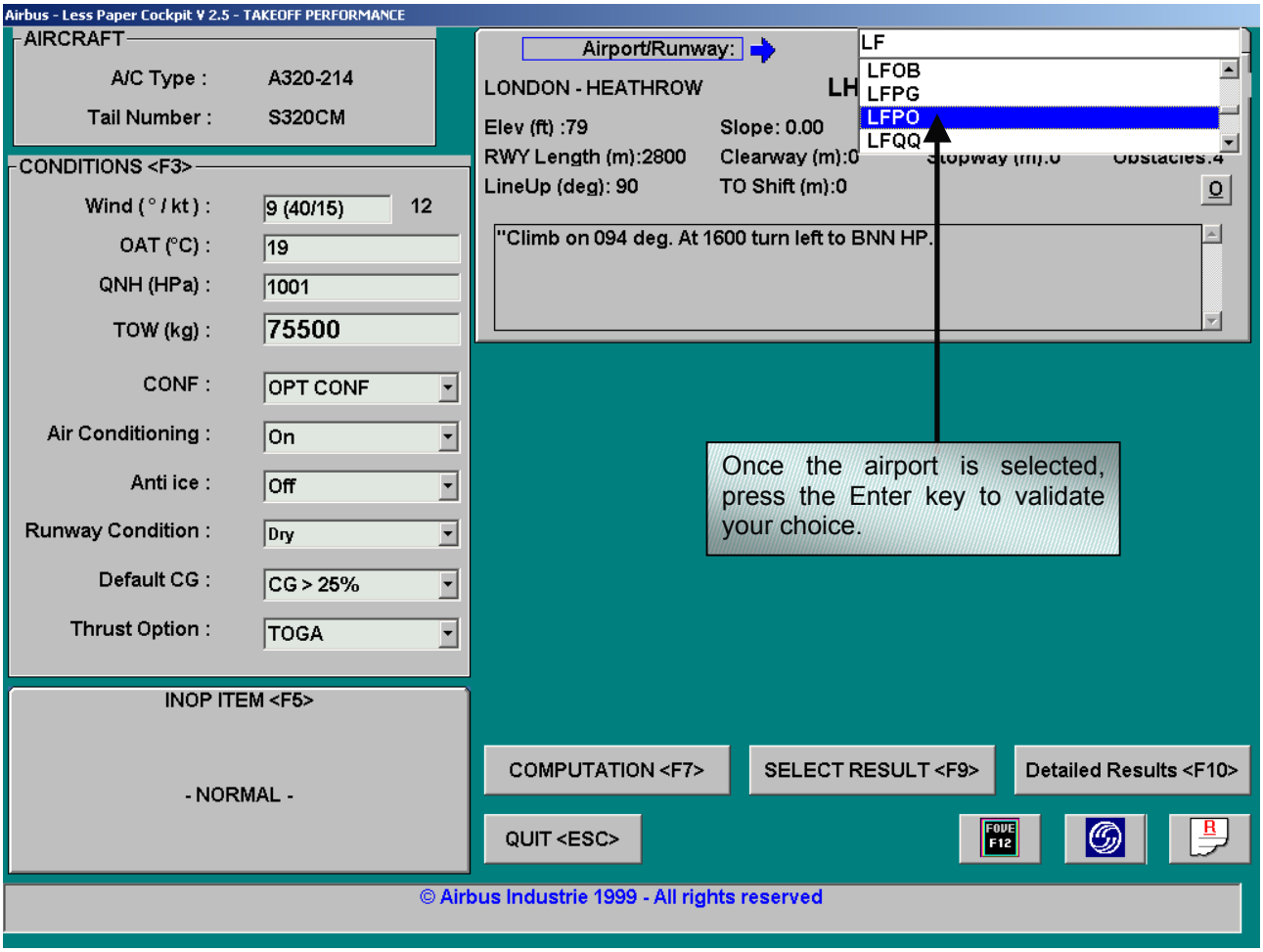


The LPC memorizes the last entry. As you can see, the previous flight was from London.

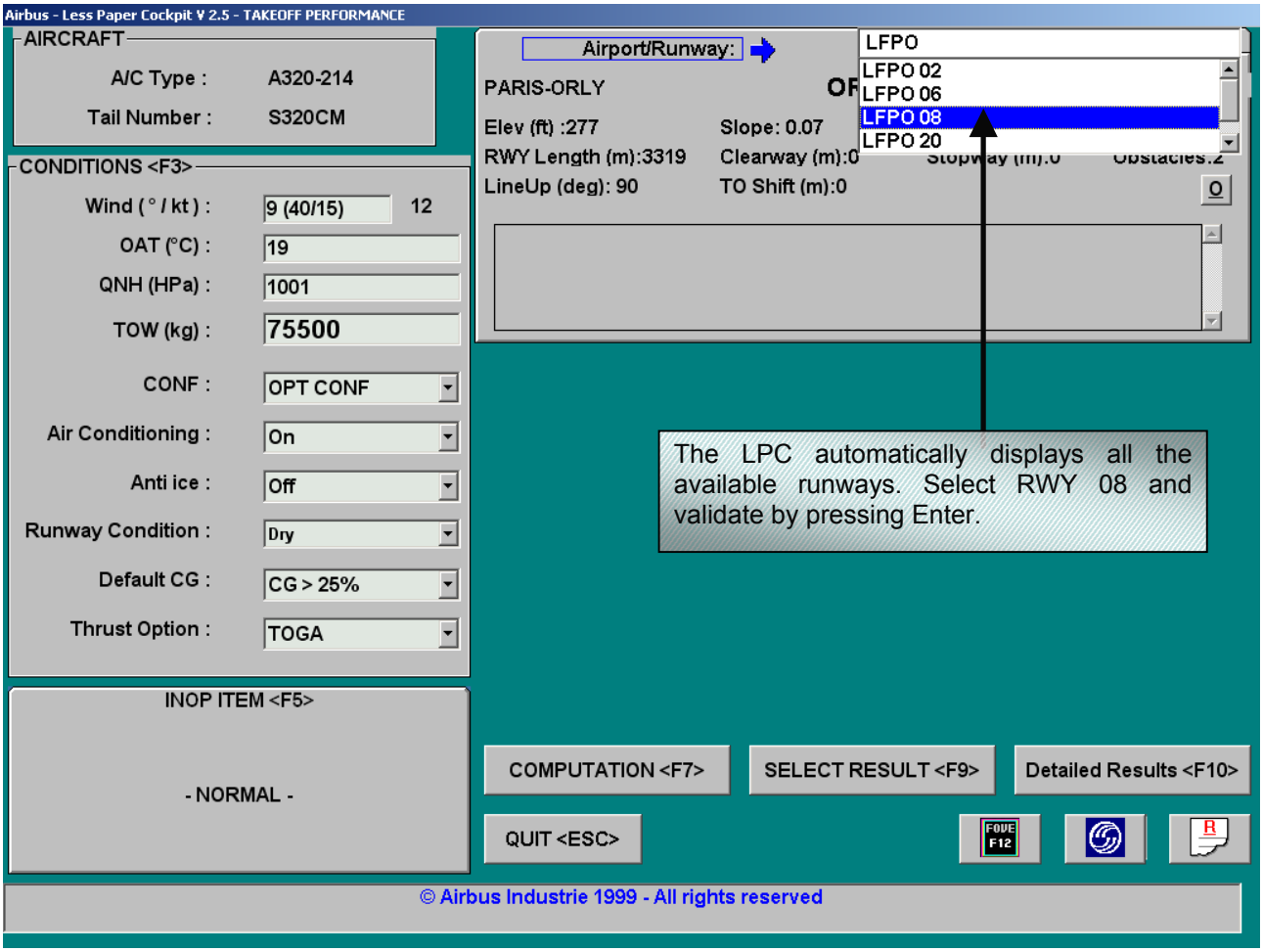
Press F2 to change the departure airport to LFPO Paris-Orly.



You can use either the scroll down menu (with the up/down arrows) or type the airport code. Once this is done, press enter to validate your choice.

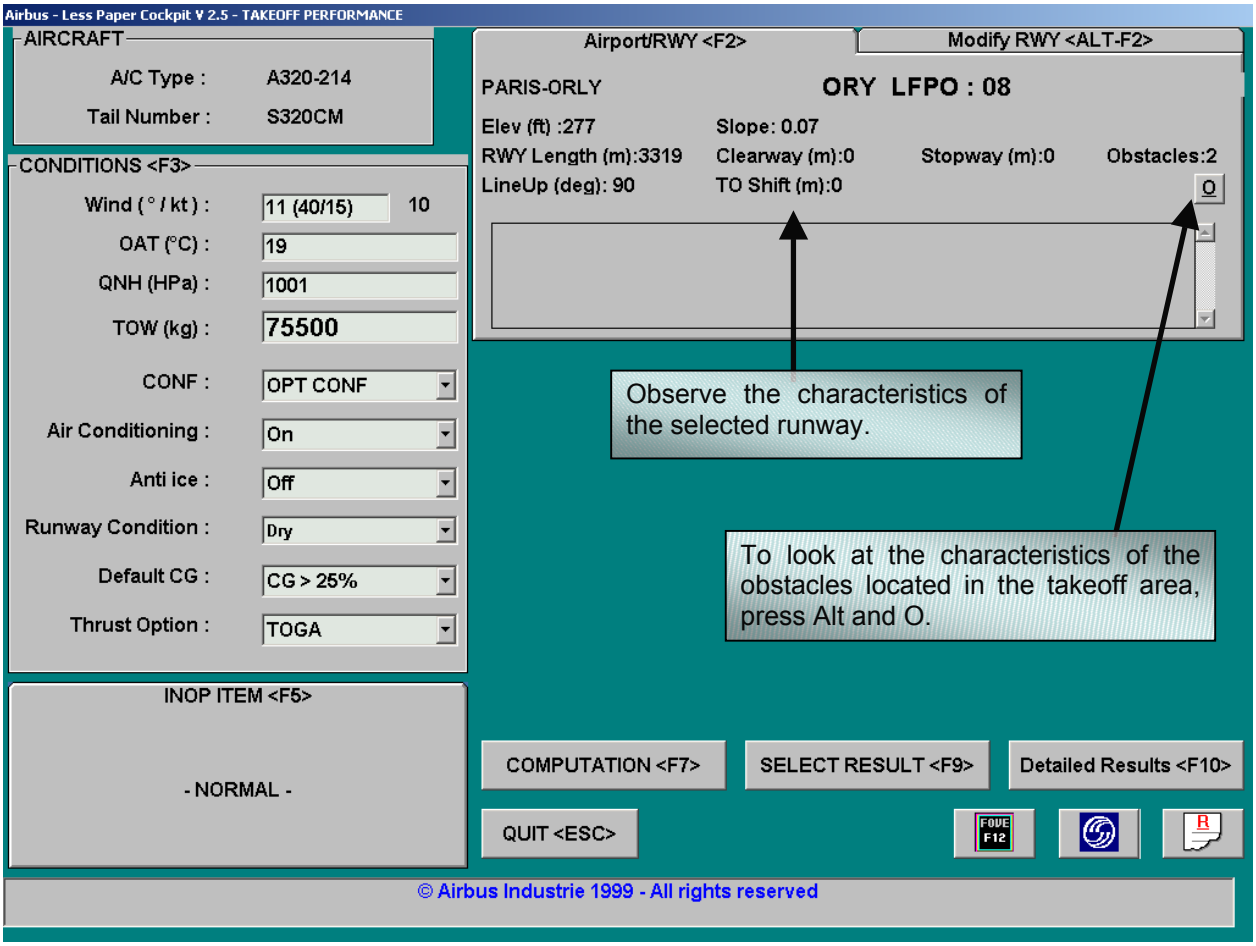


The next step is to choose the runway used for TakeOff. Today it's runway 08. Again validate your choice by pressing Enter.

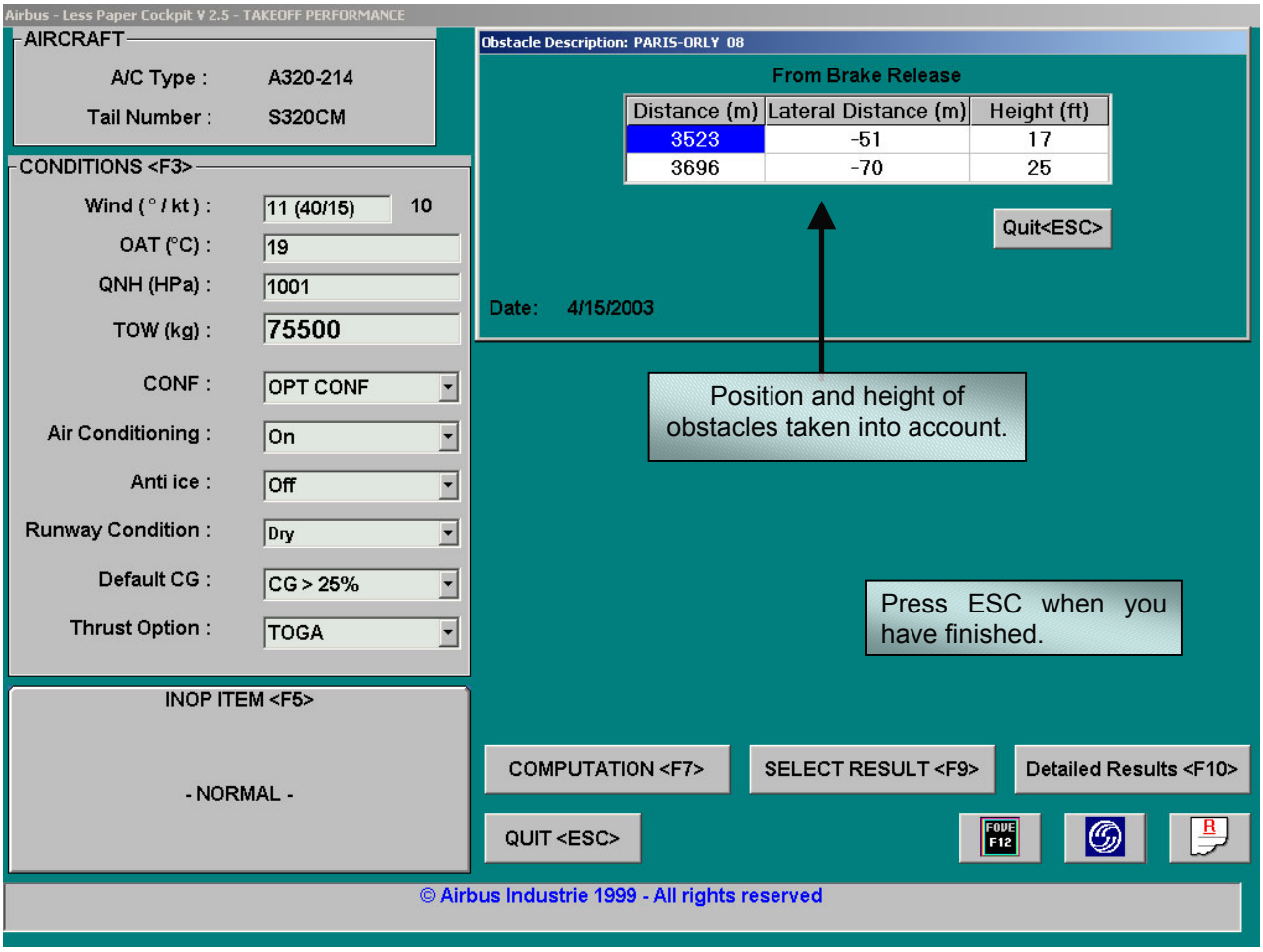


The characteristics of the selected runways, as entered in the database, are displayed: runway length, clearway, stopway and line up: either 90 deg or back tracking. The distance lost when the aircraft lines up, either from a taxiway or by back tracking is automatically taken into account in the calculation.

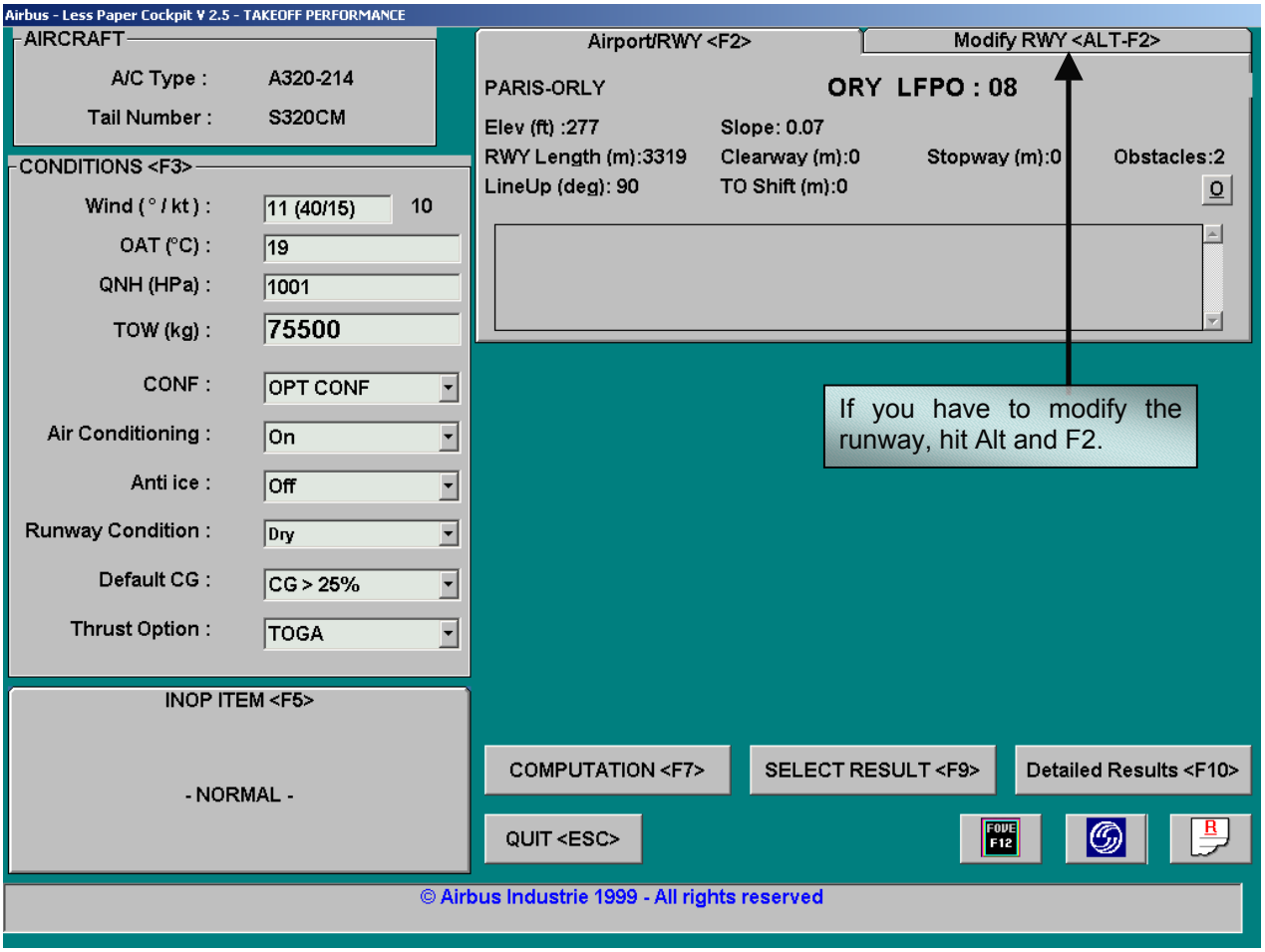
To look at the characteristics of the obstacles in the TakeOff area, Press Alt and O.



Obstacles as entered in the database and taken into account for TakeOff calculations. The lateral distance is negative for obstacles located on the LH side of the TakeOff trajectory and positive for obstacles on the RH side.



If the runway characteristics have to be modified (work in progress, line up at an intermediate taxiway…) press Alt and F2.

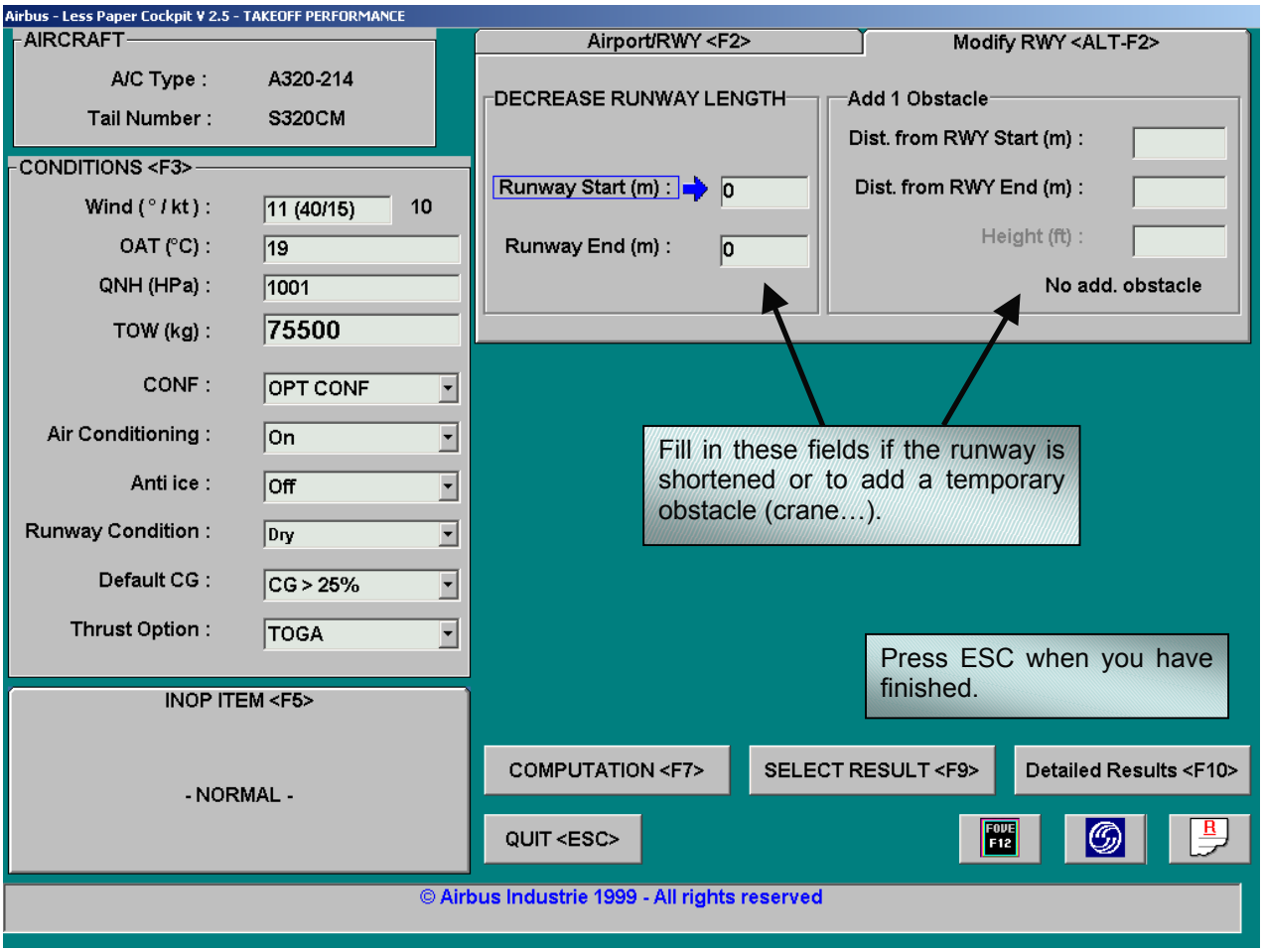


Runway start is used to enter a TakeOff shift, for example when lining up at an intermediate taxiway.

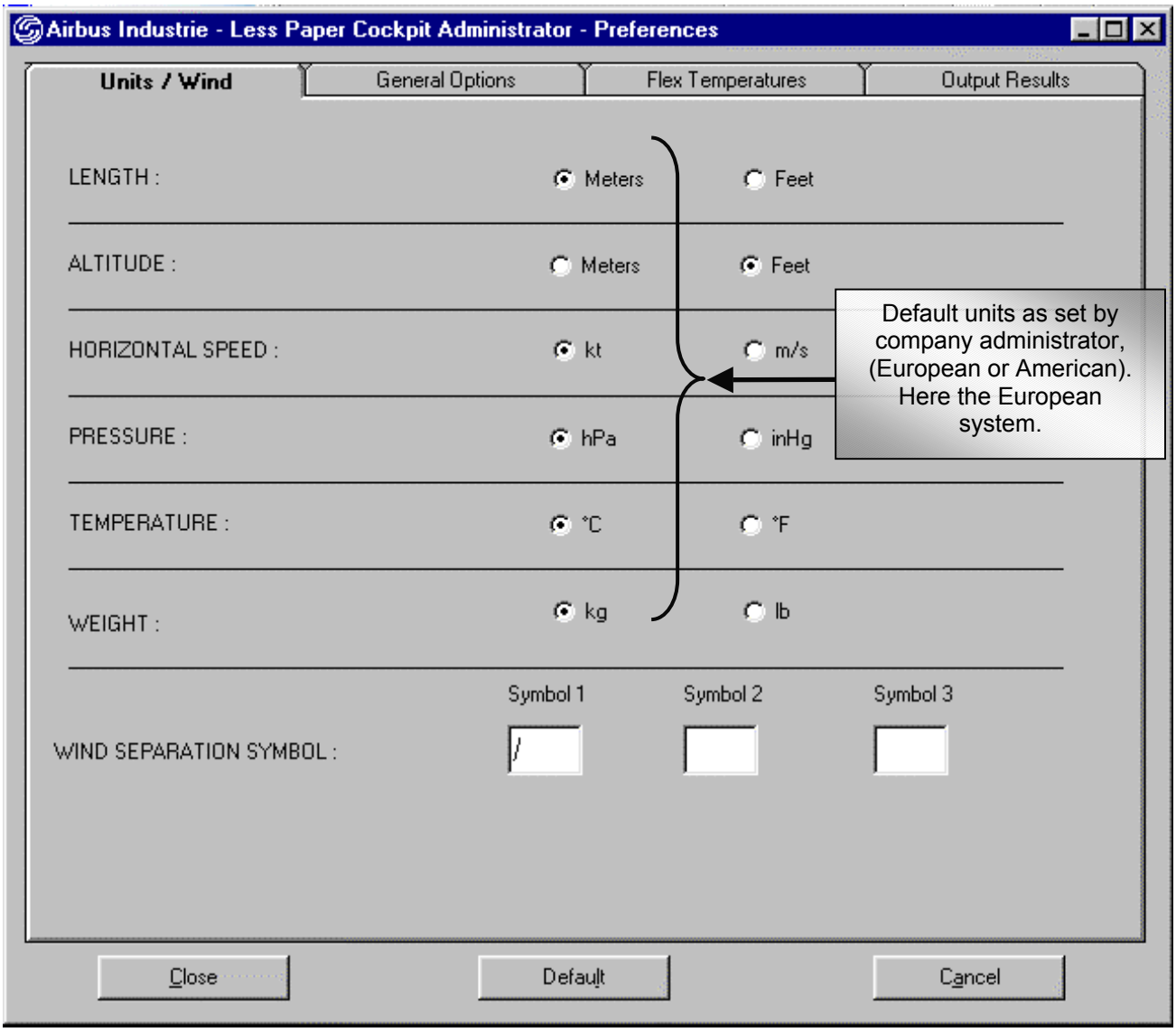
Runway end is used to shorten the far end of the runway. Work in progress being a typical example.

Obstacles can be added, in case of NOTAM for example. Distance can be entered from brake release point or runway end.

For runway length decrease, enter distance as published. Line up allowance will be automatically subtracted.



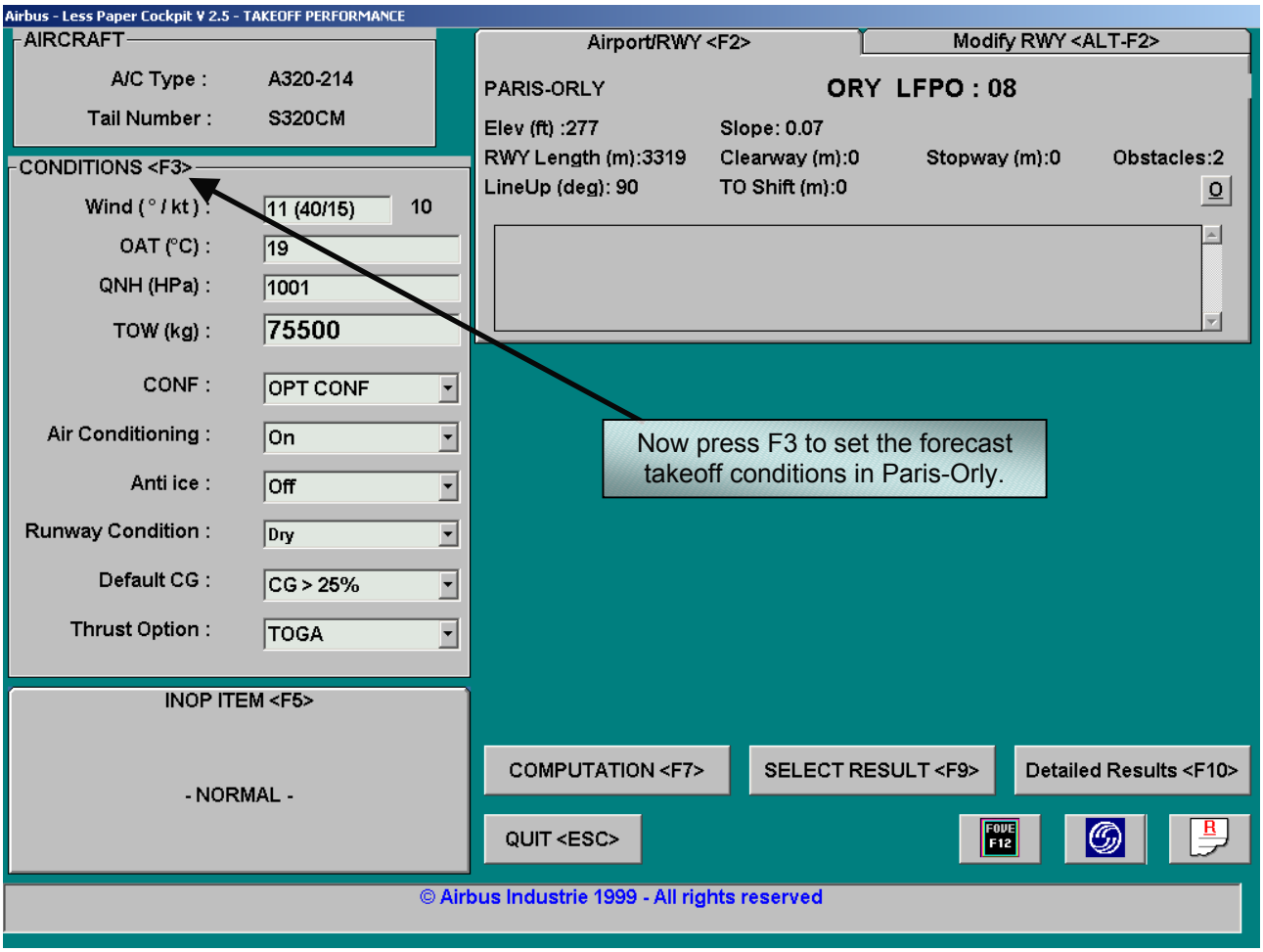
The LPC company administrator sets on this screen the unit system, used by your computer, either European or American. (This screen is available in administrator mode only).



Using the weather condition forecast for the TakeOff time, we will run the TakeOff module to determine a maximum performance TakeOff Weight.

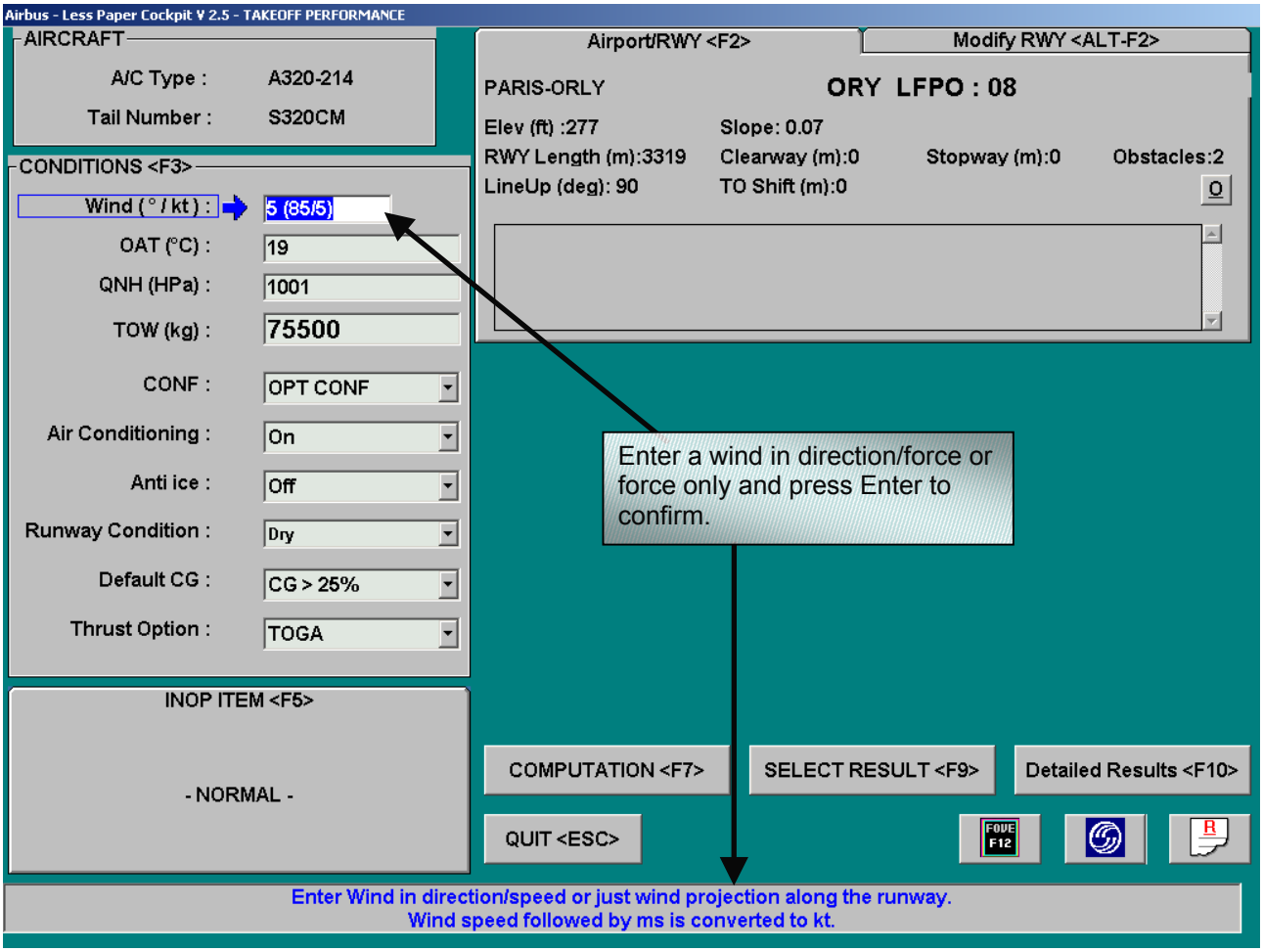
I.E. the maximum payload that can be taken on this flight.

Press F3 to enter the weather data, beginning by the wind.



Read the note at the bottom of the screen. Enter wind direction and force or just wind force. Units can be kt or m/s.

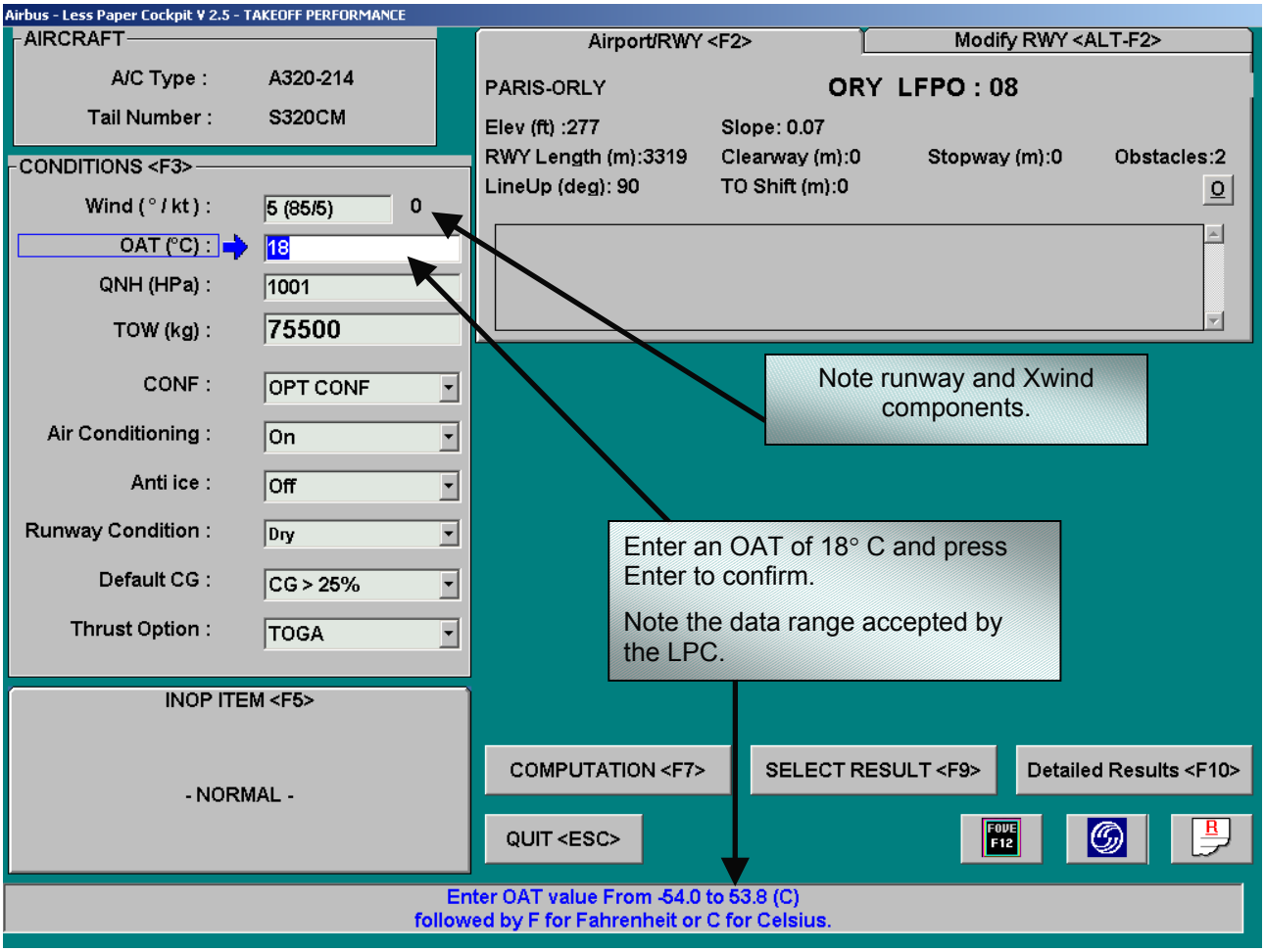
Enter a wind 085/5 kt and press enter to confirm.



Note runway wind component (5 kt) and crosswind component (0). A tailwind will be entered with a minus sign: - 6 kt for example.

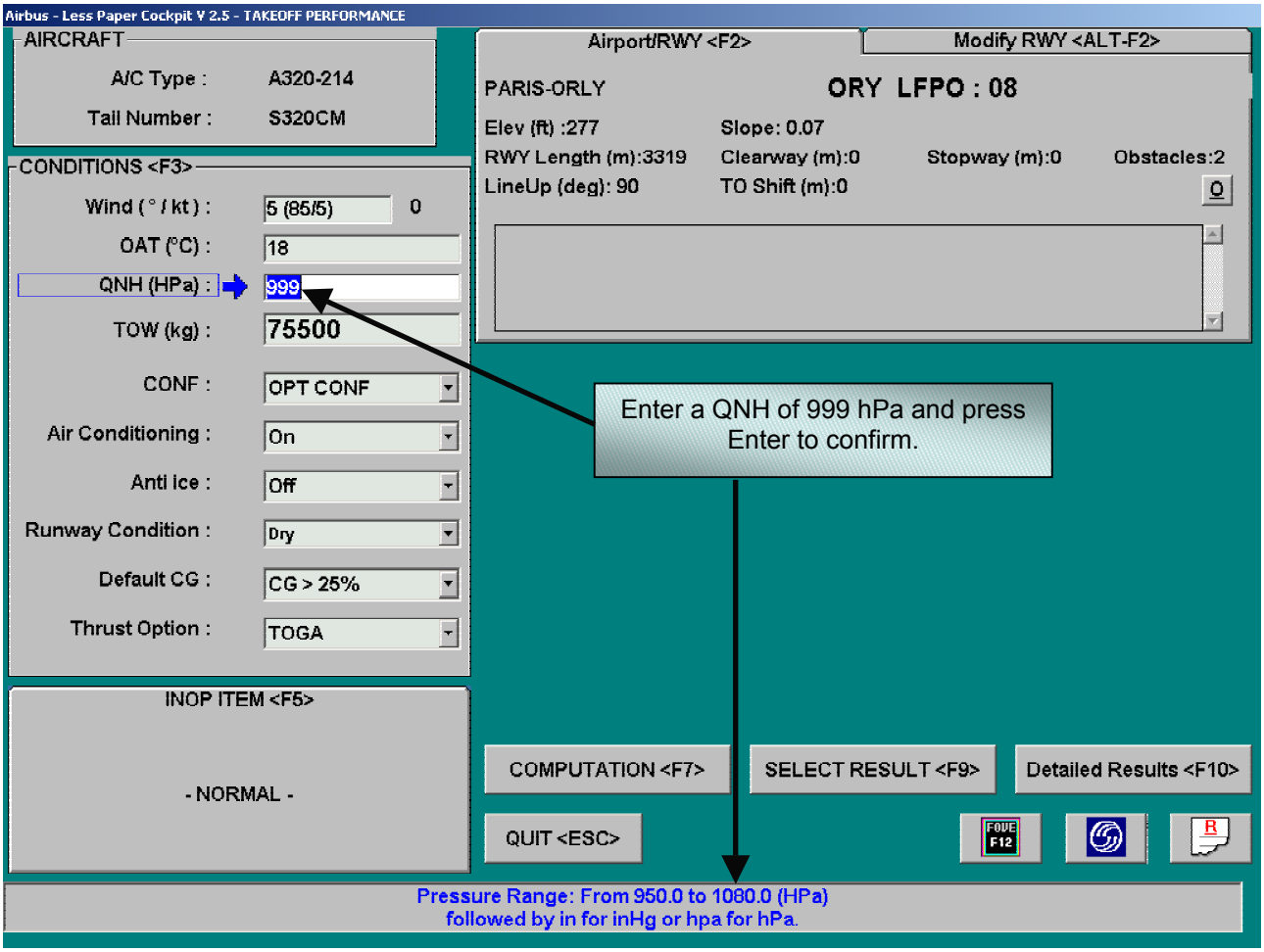
Read the note at the bottom of the screen and note the range of temperature value accepted by the LPC tool. OAT can be entered in Centigrade or Fahrenheit.

Enter an OAT of 18°C and press enter to confirm.



Read the note at the bottom of the screen. QNH in hPa or inches of mercury.

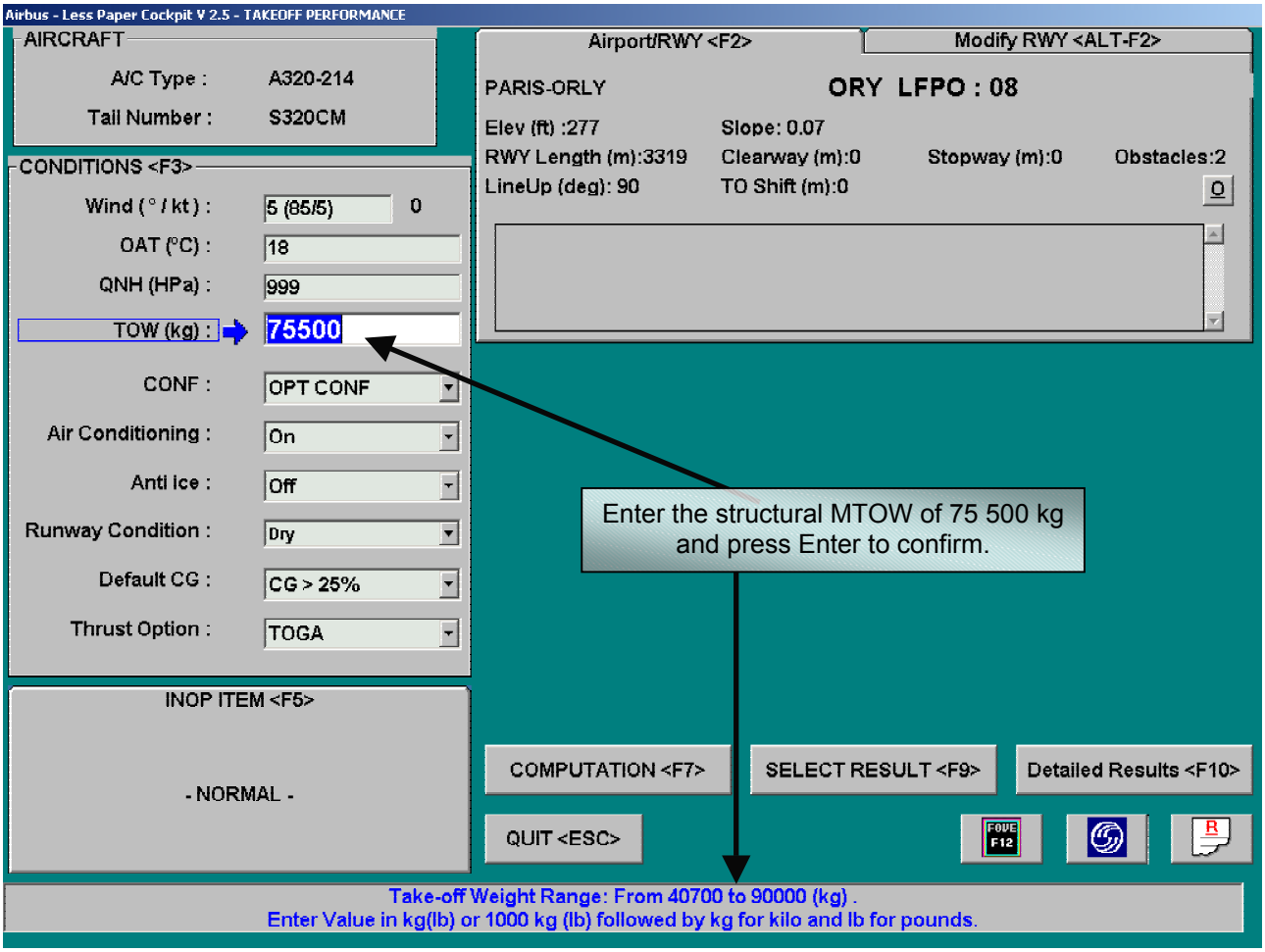
Enter a QNH of 999 hPa and press enter to confirm.



Read the note at the bottom of the screen. TOW in kg or lb.

Enter the maximum structural TakeOff weight of 75 500 kg and press enter to confirm.

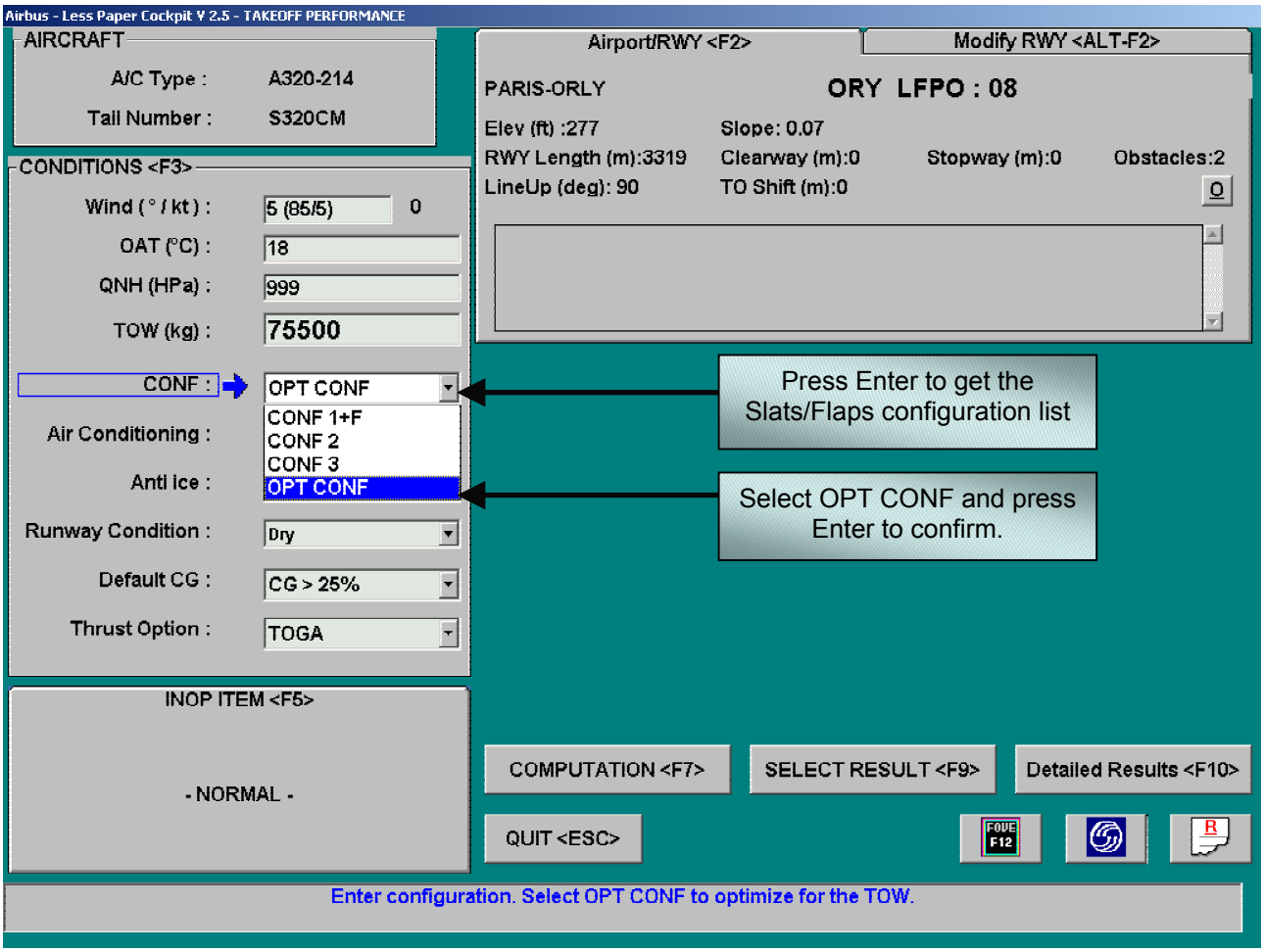
If you don't remember of the maximum structural takeoff weight value, you type a * and the tool recall the value.



Press enter to review the Slats/Flaps configurations available.

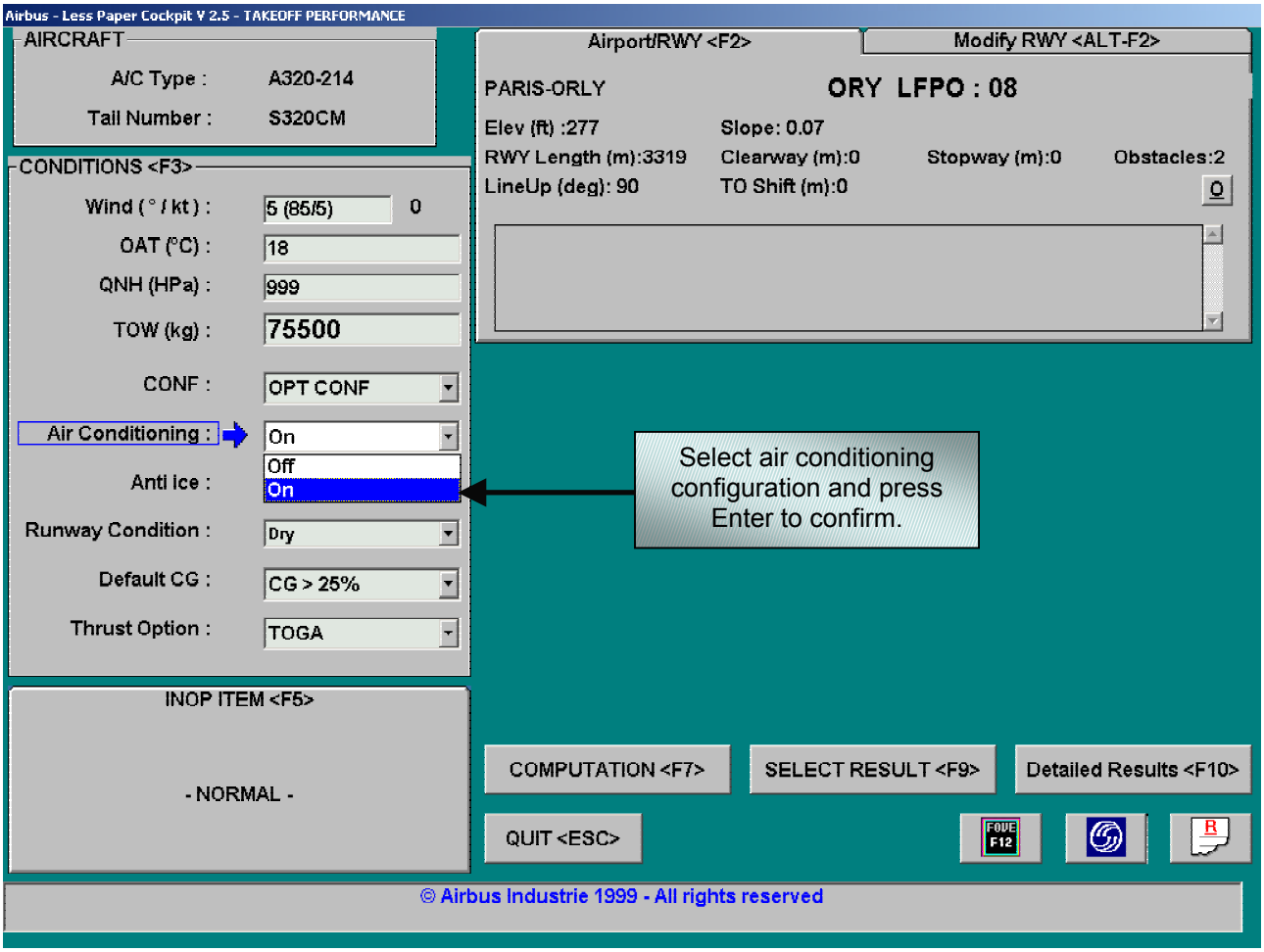
You can impose a configuration by selecting it or let the LPC choose the configuration giving the best performance by selecting Optimum Configuration.

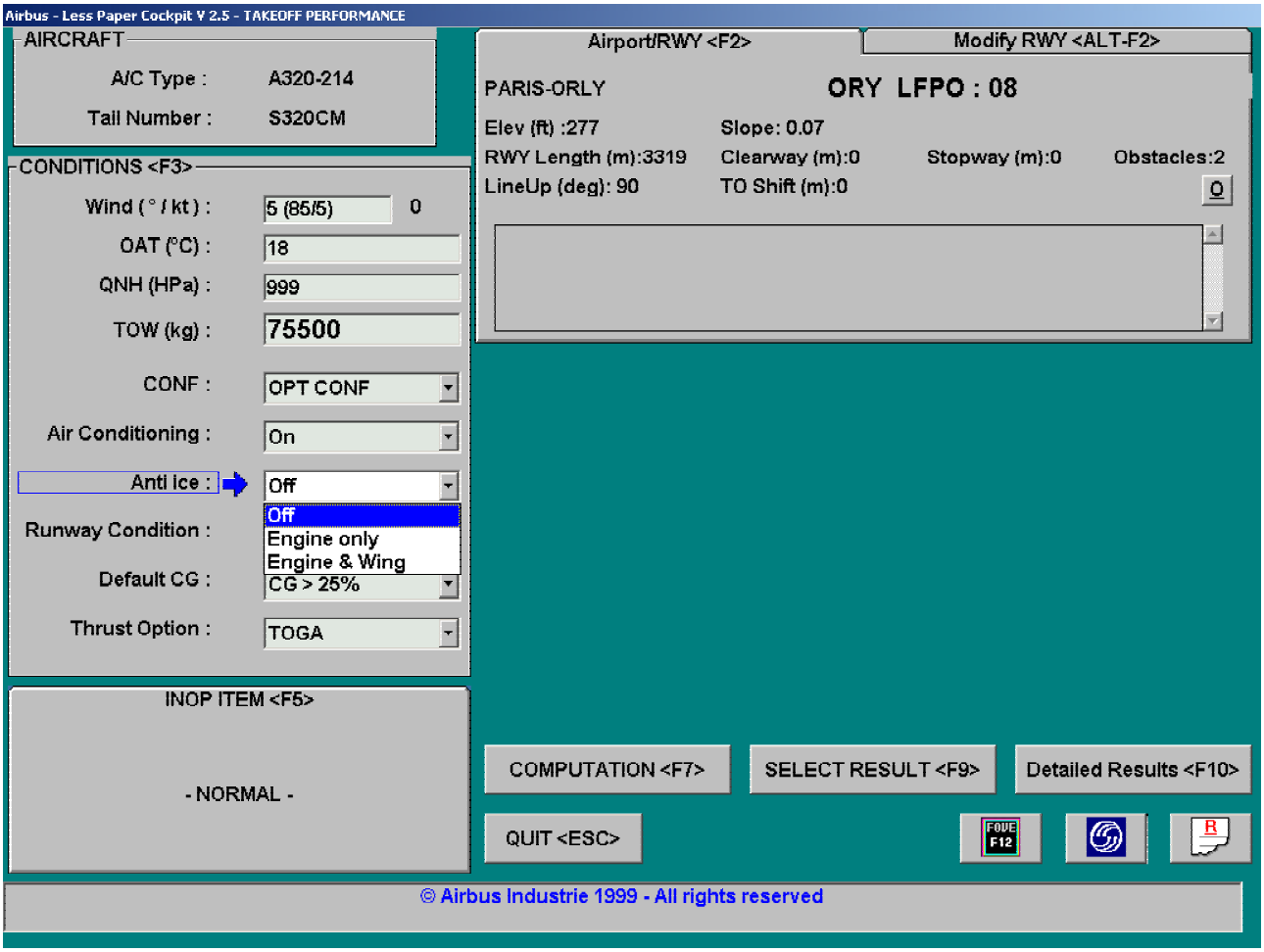
Then press enter to confirm your choice.



Air conditioning is usually selected ON, but can be switched OFF if a maximum performance TakeOff is needed.

Select On and press enter to confirm.




Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Off
Engine only
Engine & Wing
Runway Condition :
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
LineUp (deg): 90
TO Shift (m):0
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
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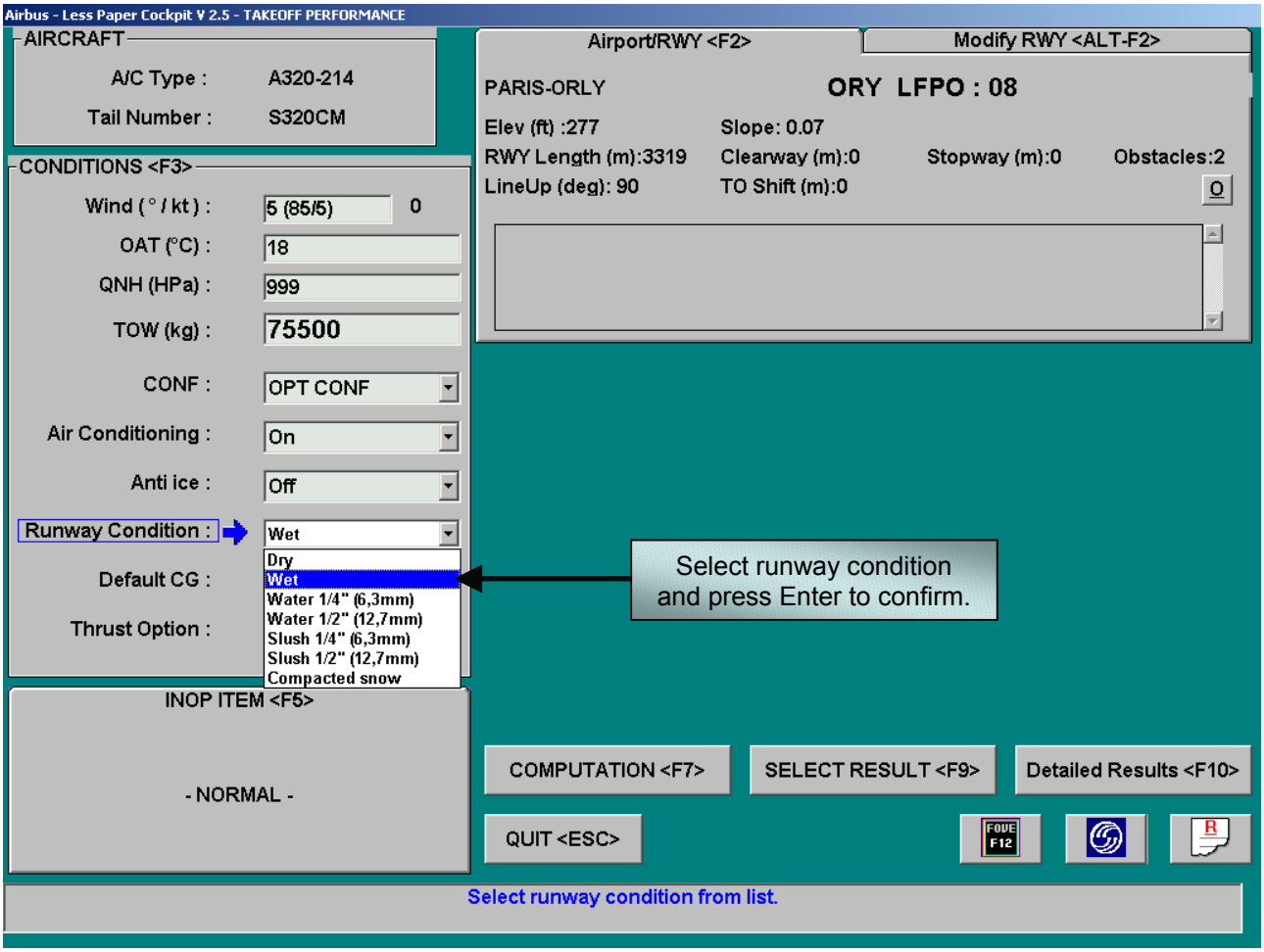
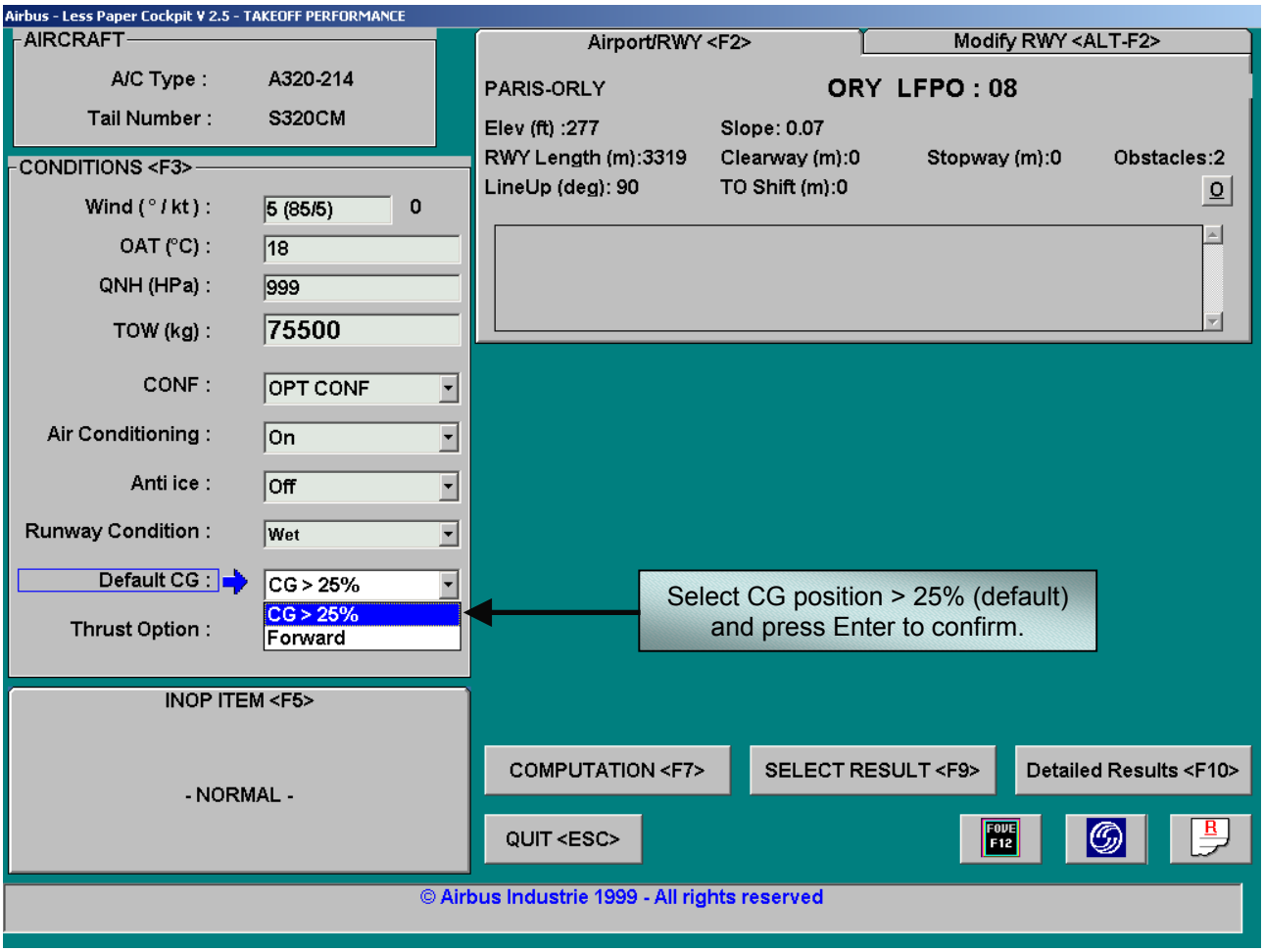
Depending on the runway condition, you can choose dry, wet or various contaminants: water (1/4 and 1/2 in) slush (1/4 and 1/2 in) or compacted snow.

Choose wet and press enter to confirm.



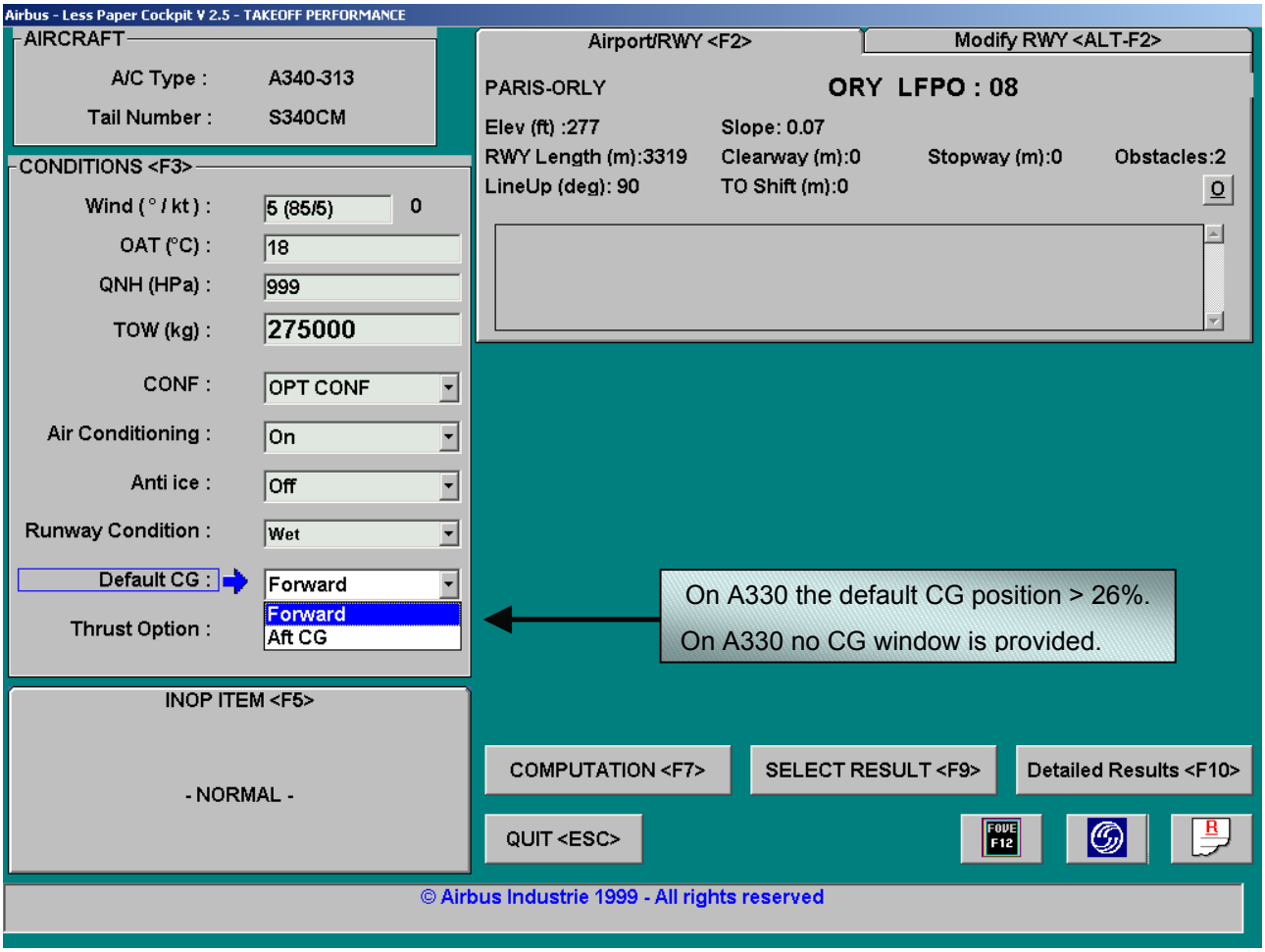
2 CG positions are taken into account: on A320, normal CG position is above 25%. Either the actual CG position is rear to 25% of the M.A.C. or is forward.

Choose greater than 25% and press enter to confirm.

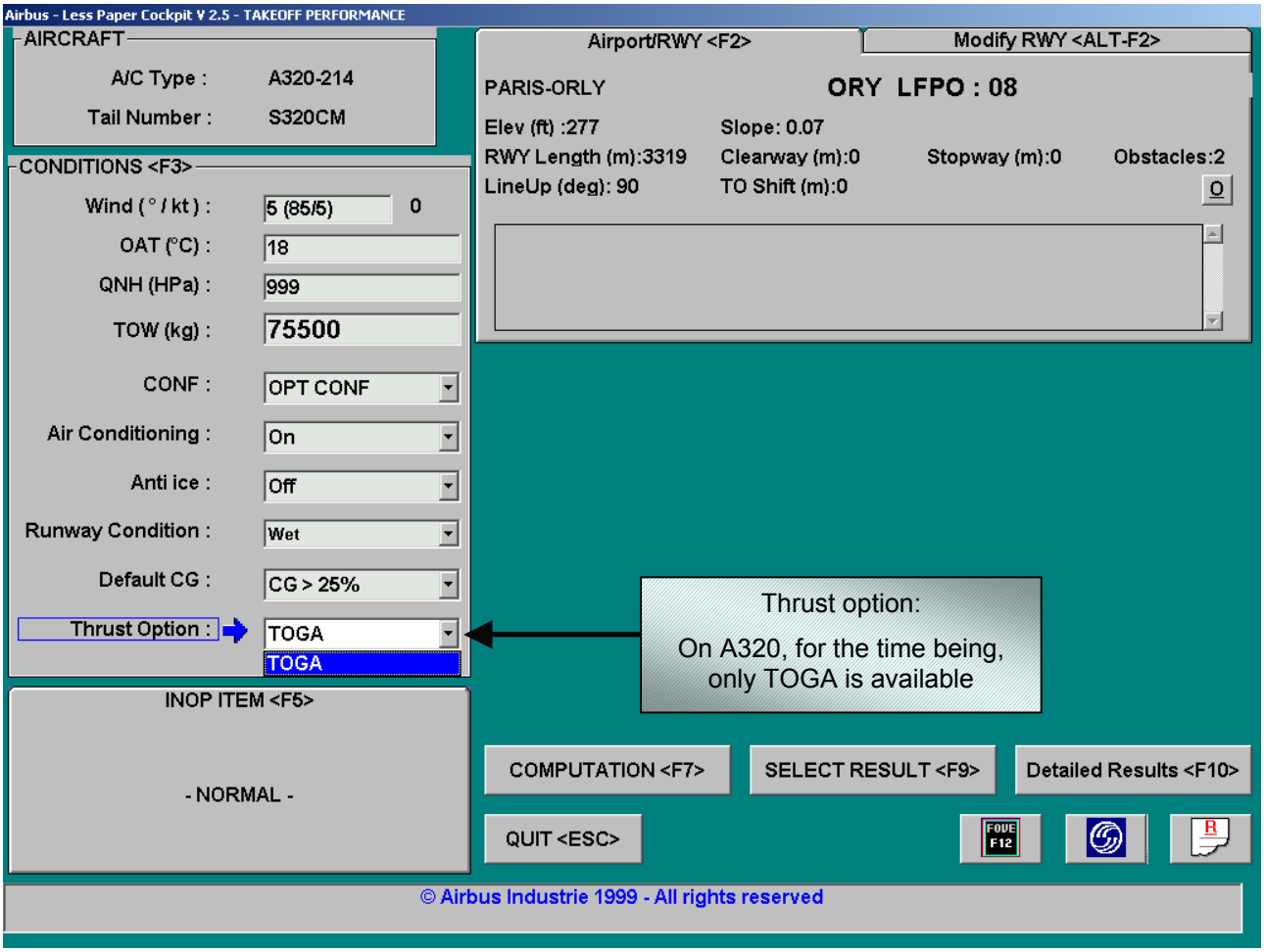


On A340, we have two positions AFT CG which is > 26% and forward position.

On A330 no CG window is provided, as TakeOff performances are not affected by the CG position.



For the time being, on A320 only TOGA is available.



On A330 & A340, in addition to TOGA, 6 levels of derated thrust are available in steps of 4%.

Optimum derate works as the OPT CONF for the flaps.

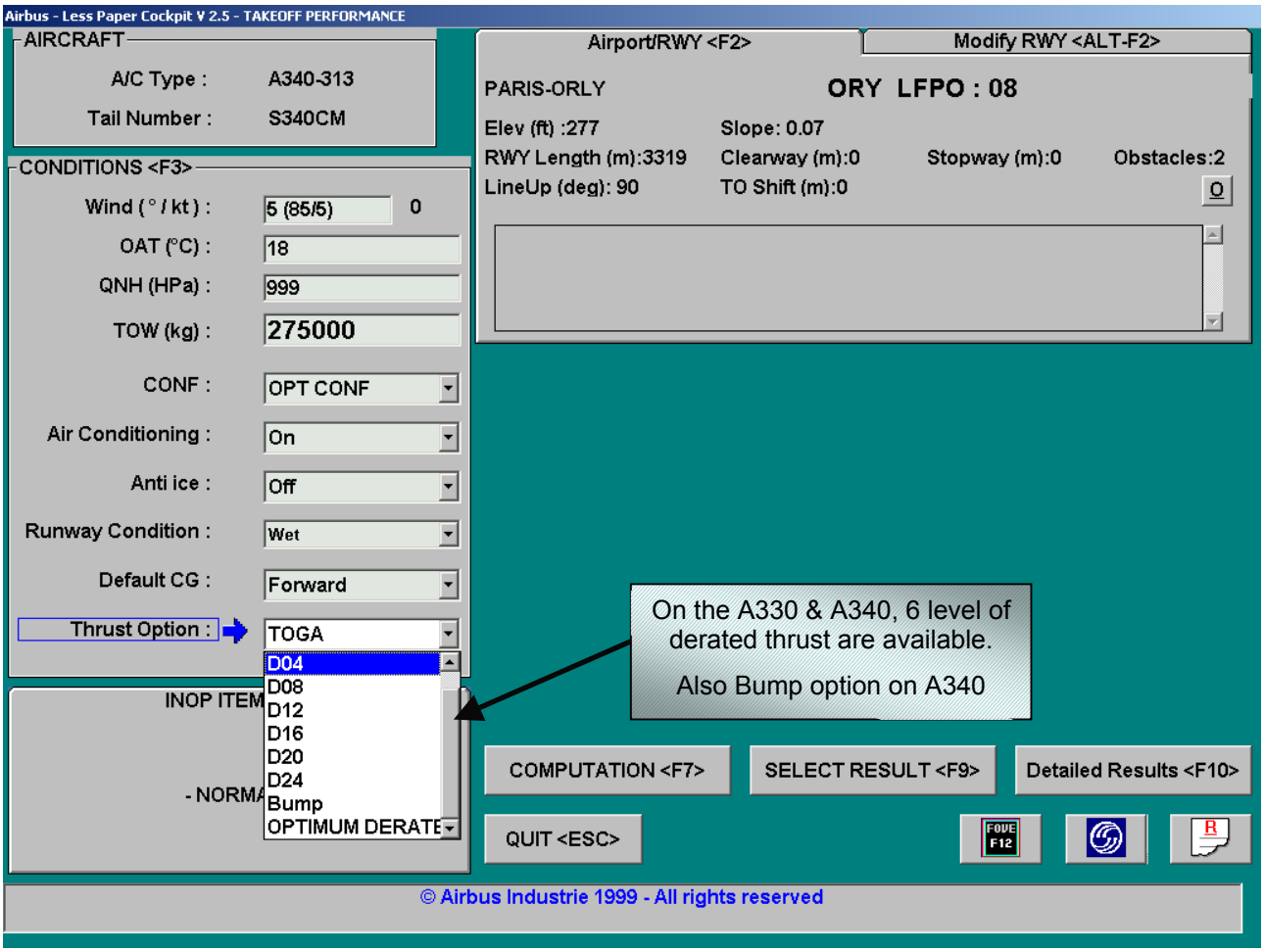
It enables the LPC to choose the derate level giving the highest TOW.

NOTE: Derate is particularly useful on short or contaminated runways.

More details on this will be provided later.

On the A340 the thrust BUMP would appear below the optimum derate.

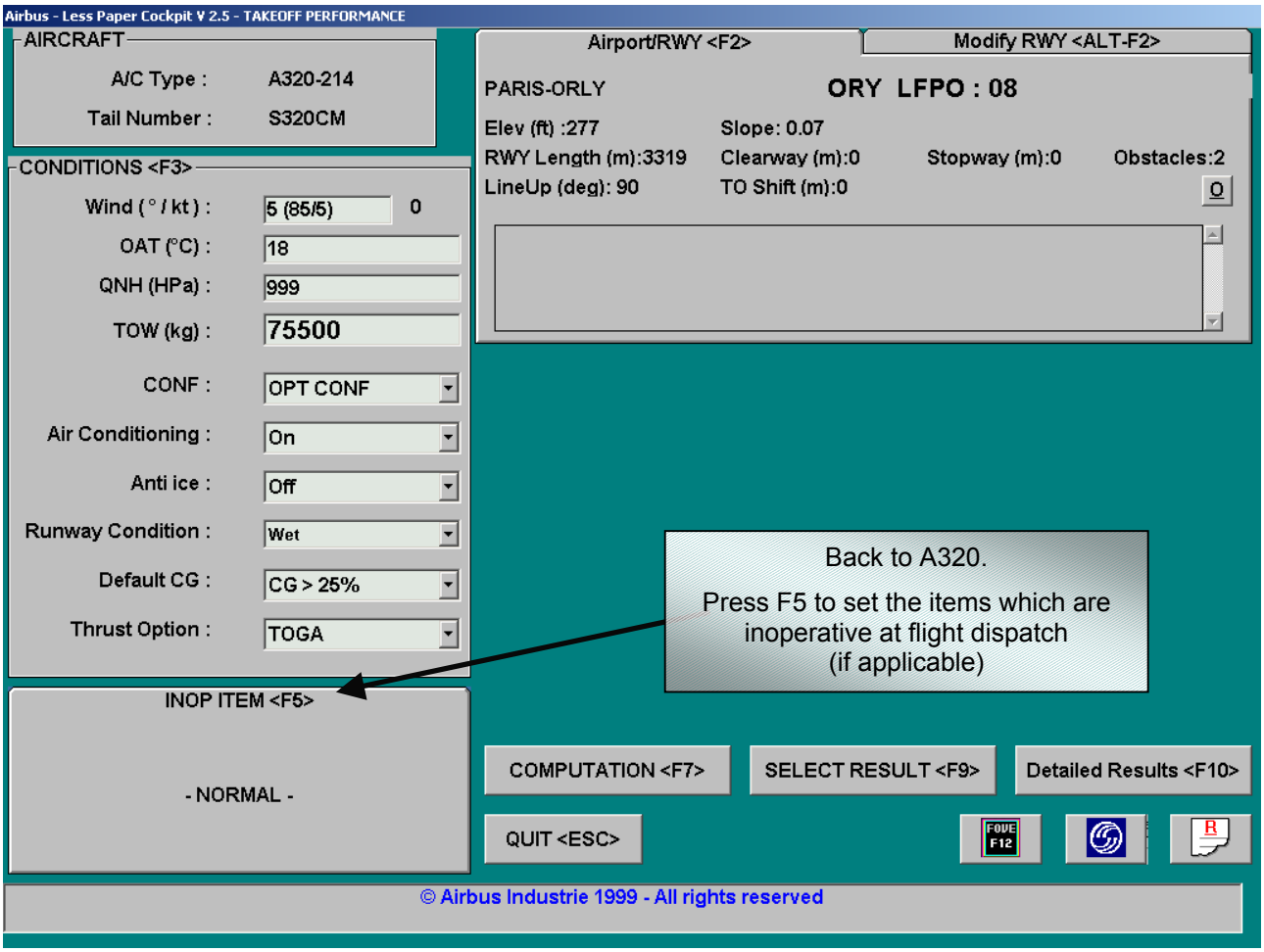
This option gives approximately 4% of extra thrust during TakeOff.



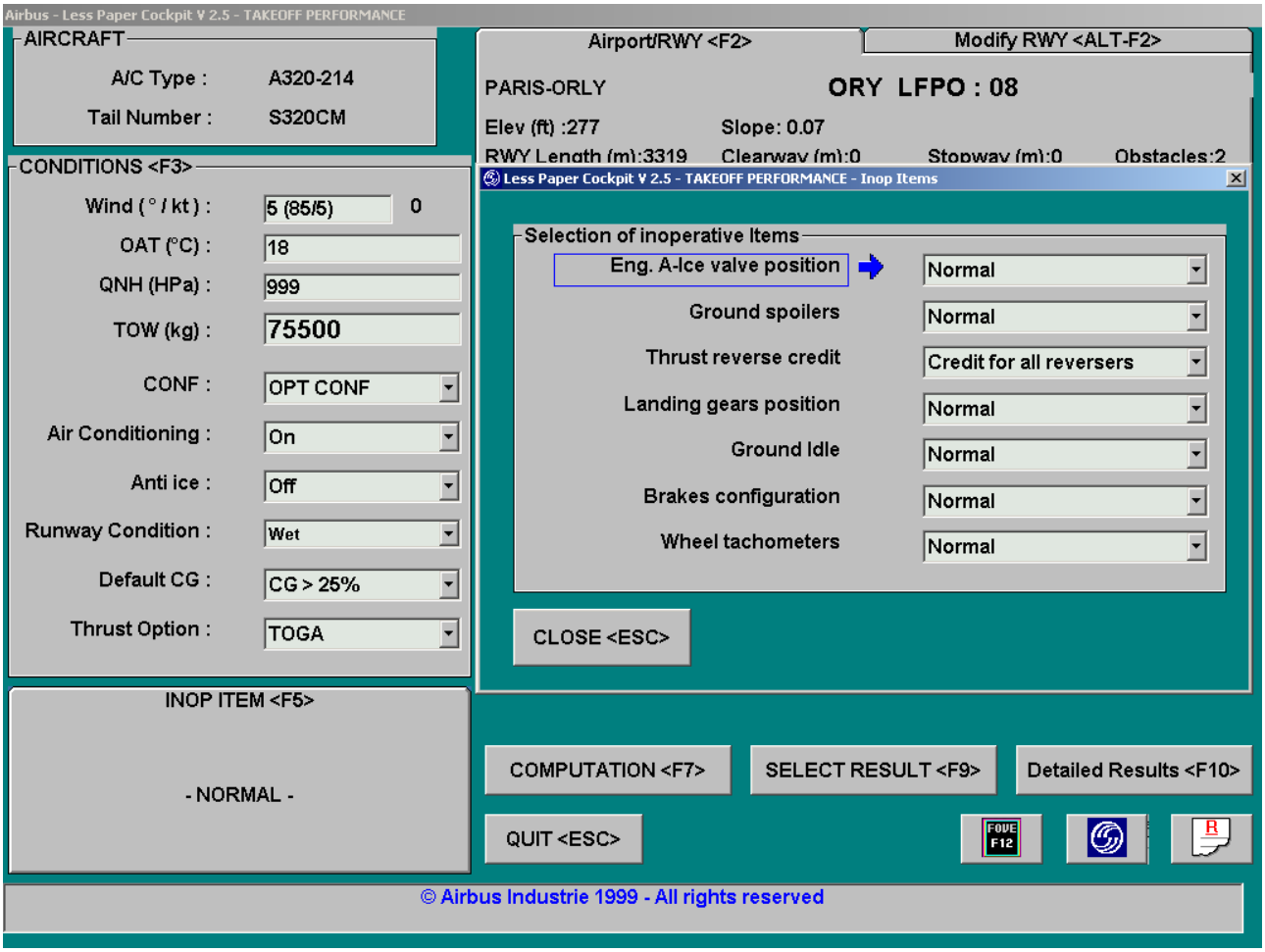
4.3. Inoperative Items

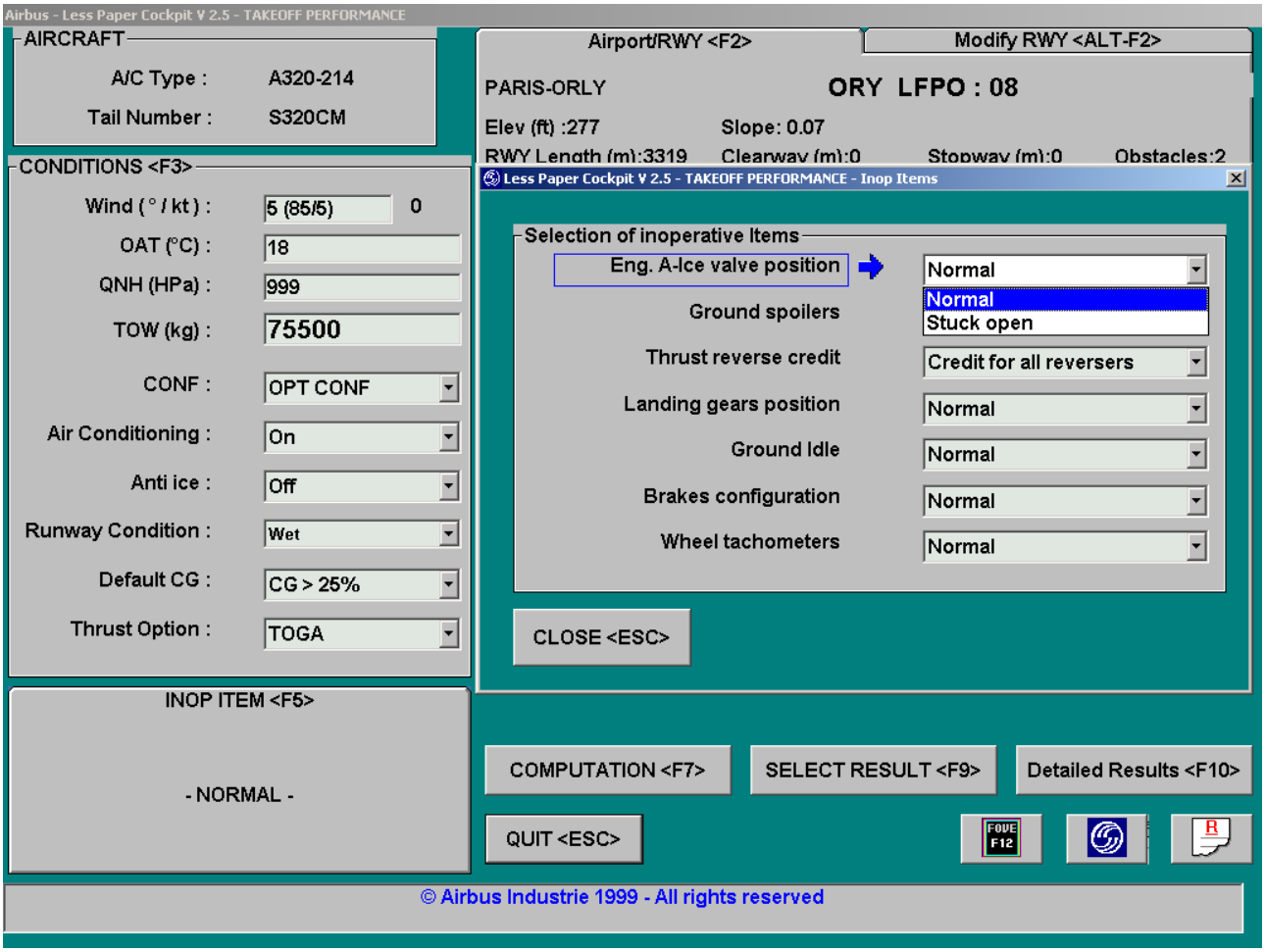
To calculate the TakeOff data, the LPC can take into account the failure before the flight of some systems: brakes, spoilers, reverses… which have an effect on TakeOff performance.

Press F5 to enter them into the LPC .



Engine anti-ice, ground spoilers and braking system condition can be entered.




Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Condition : Wet
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE - Inop Items
Selection of inoperative Items
Eng. A-Ice valve position
Normal
Stuck open
Ground spoilers
Normal
Thrust reverse credit
Credit for all reversers
Landing gears position
Normal
Ground Idle
Normal
Brakes configuration
Normal
Wheel tachometers
Normal
CLOSE <ESC>
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
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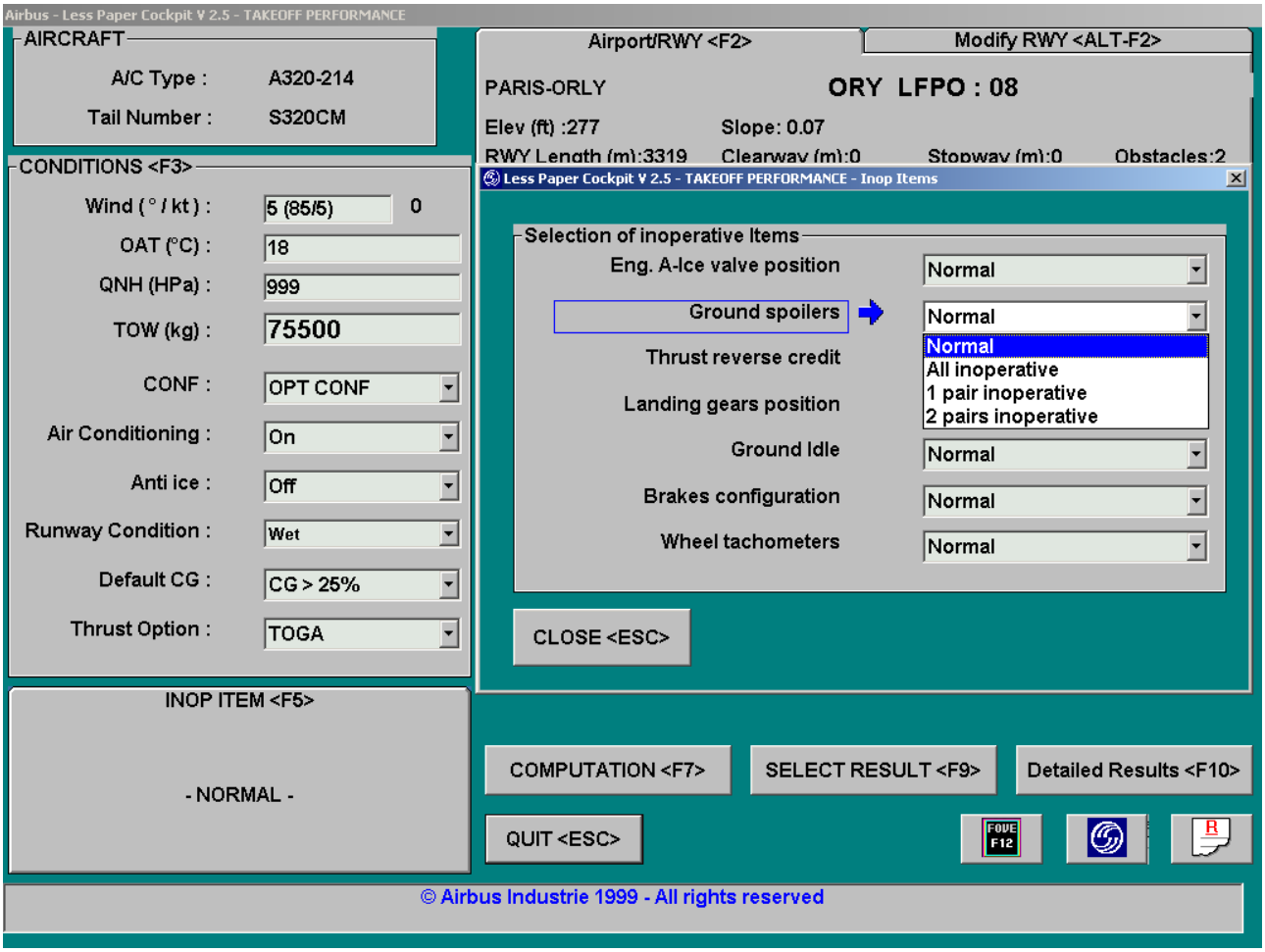
Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Condition : Wet
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE - Inop Items
Selection of inoperative Items
Eng. A-Ice valve position
Normal
Ground spoilers
Normal
Thrust reverse credit
Landing gears position
Ground Idle
Normal
Brakes configuration
Normal
Wheel tachometers
Normal
Normal
All inoperative
1 pair inoperative
2 pairs inoperative
CLOSE <ESC>
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
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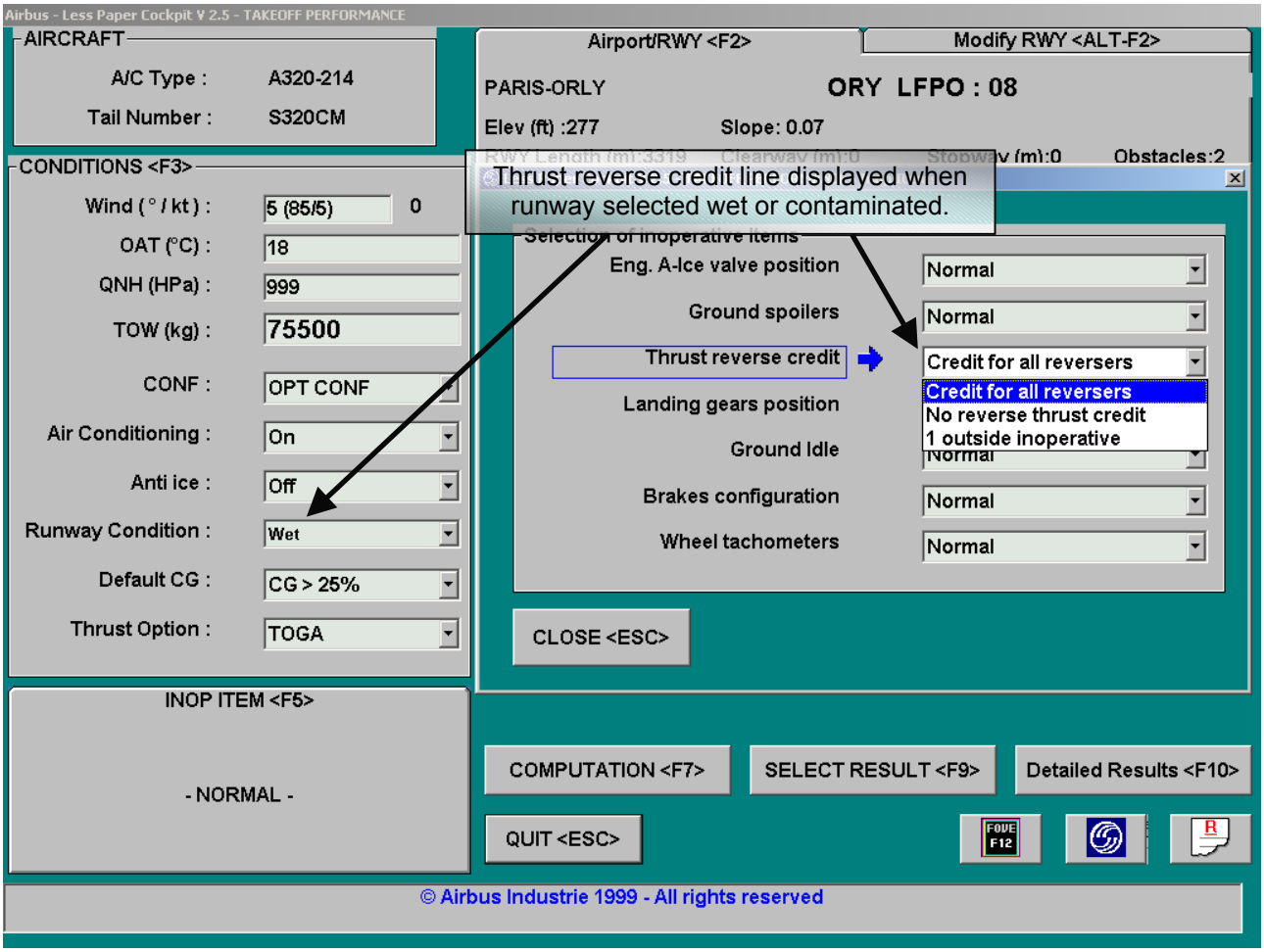
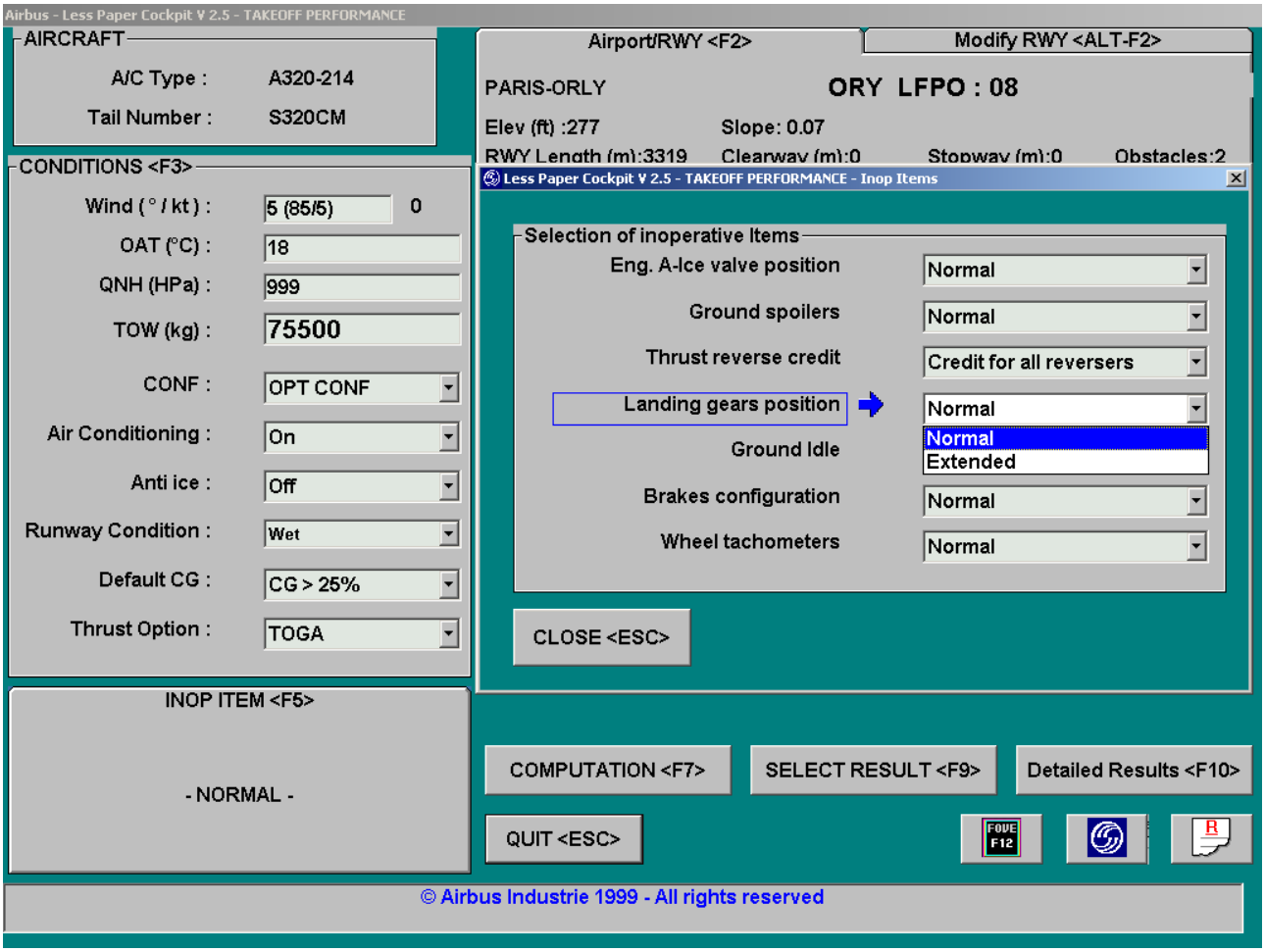
Note that the thrust reverse credit line is not displayed when a dry runway is selected, as the reversers are not taken into account in this condition.




Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Condition : Wet
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE - Inop Items
Selection of inoperative Items
Eng. A-Ice valve position
Normal
Ground spoilers
Normal
Thrust reverse credit
Credit for all reversers
Landing gears position
Normal
Normal
Extended
Ground Idle
Brakes configuration
Normal
Wheel tachometers
Normal
CLOSE <ESC>
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
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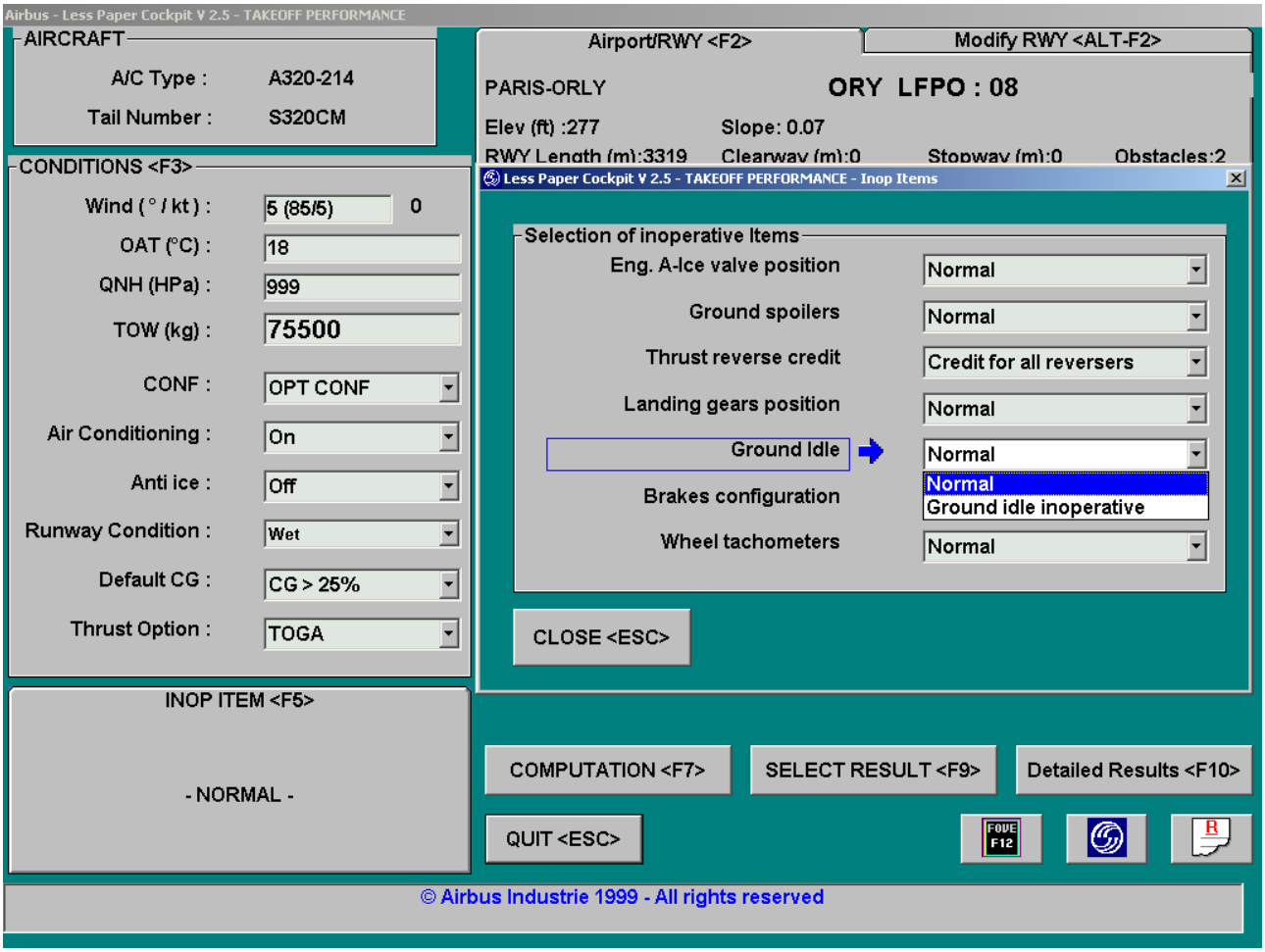
Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Condition : Wet
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE - Inop Items
Selection of inoperative Items
Eng. A-Ice valve position
Normal
Ground spoilers
Normal
Thrust reverse credit
Credit for all reversers
Landing gears position
Normal
Ground Idle
Normal
Normal
Ground idle inoperative
Brakes configuration
Wheel tachometers
Normal
CLOSE <ESC>
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
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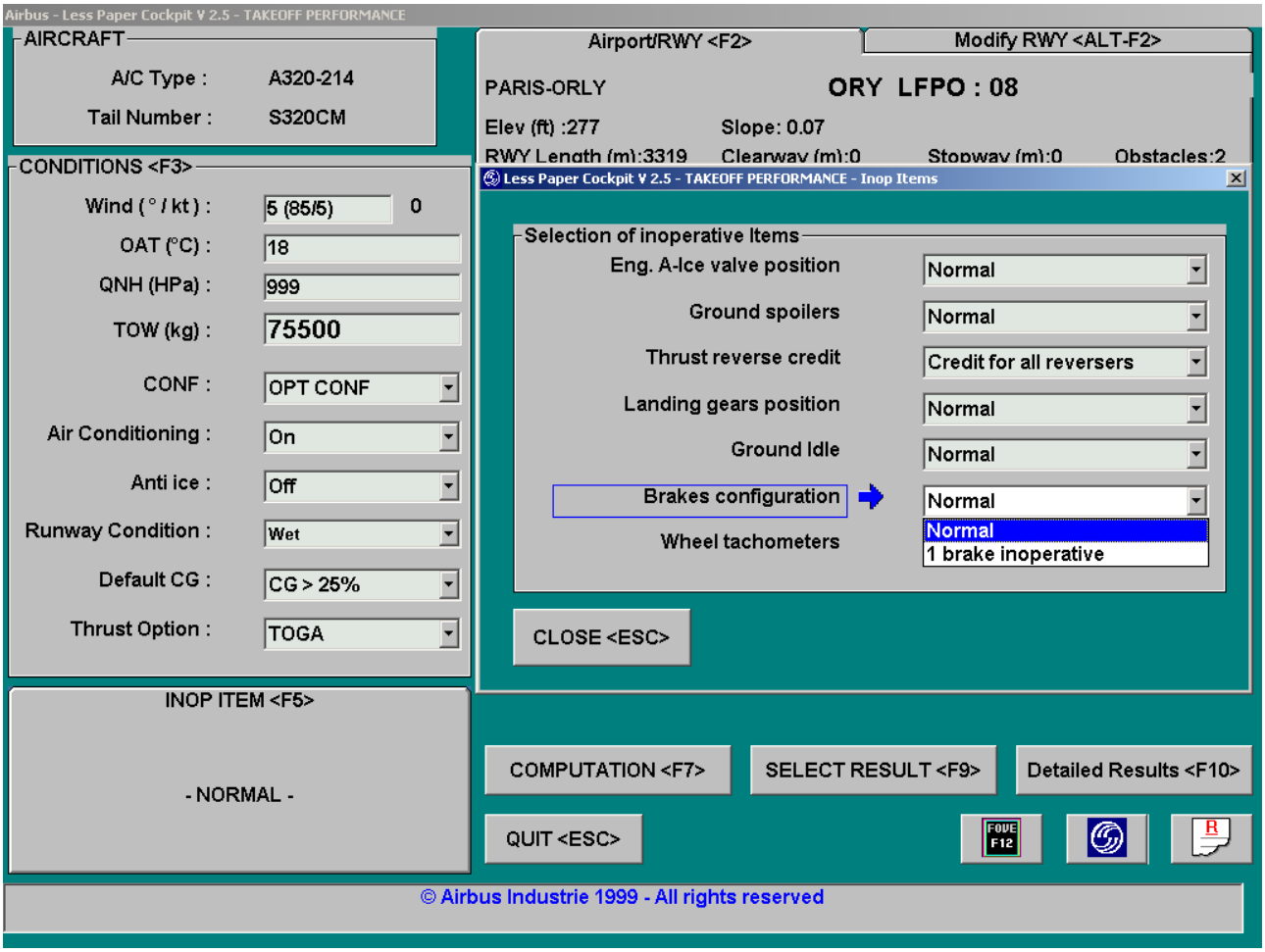
Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Condition : Wet
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE - Inop Items
Selection of inoperative Items
Eng. A-Ice valve position
Normal
Ground spoilers
Normal
Thrust reverse credit
Credit for all reversers
Landing gears position
Normal
Ground Idle
Normal
Brakes configuration
Normal
Wheel tachometers
Normal
1 brake inoperative
CLOSE <ESC>
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
FOVE F12
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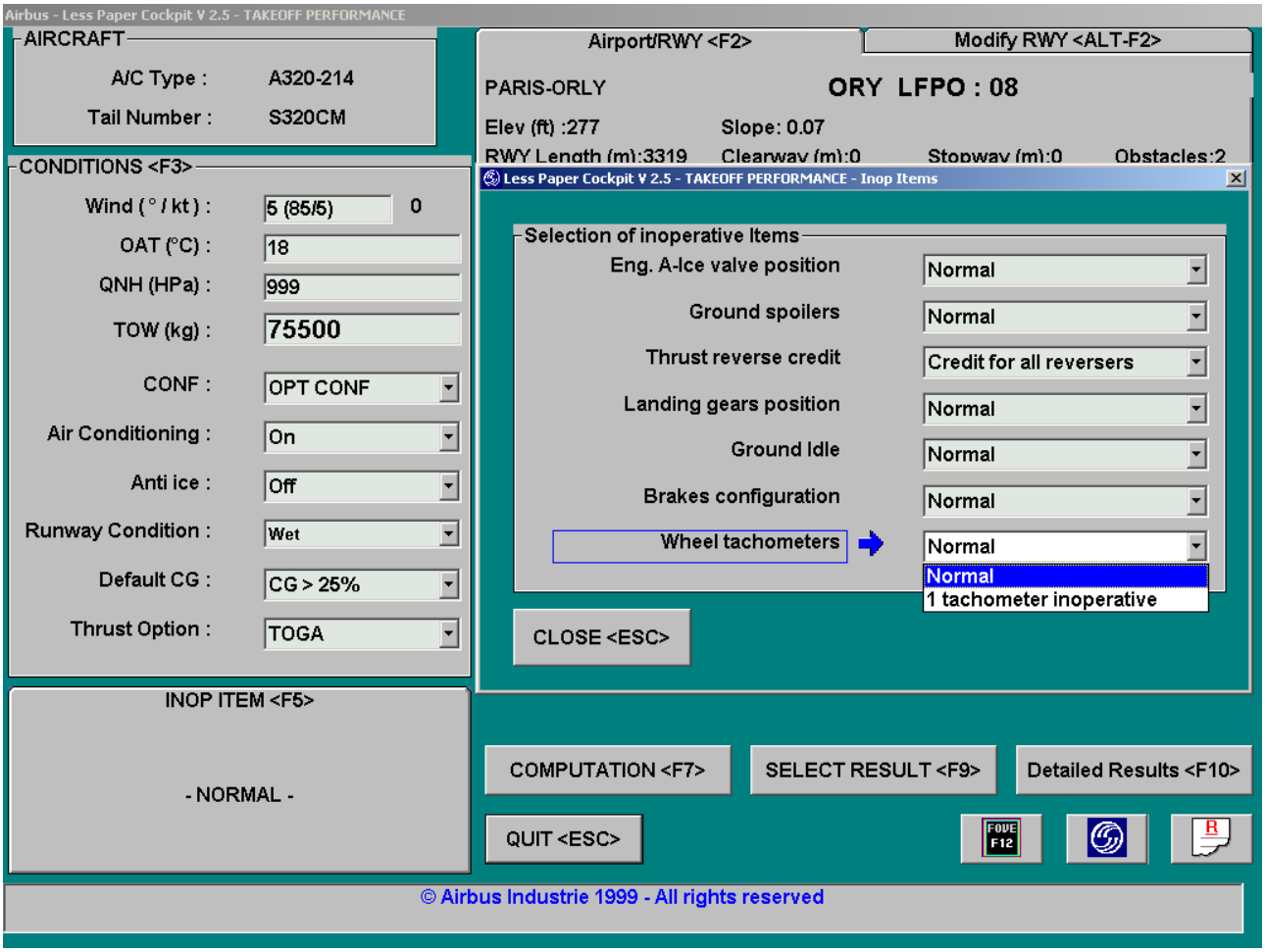
Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Condition : Wet
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE - Inop Items
Selection of inoperative Items
Eng. A-Ice valve position Normal
Ground spoilers Normal
Thrust reverse credit Credit for all reversers
Landing gears position Normal
Ground Idle Normal
Brakes configuration Normal
Wheel tachometers Normal
Normal
1 tachometer inoperative
CLOSE <ESC>
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
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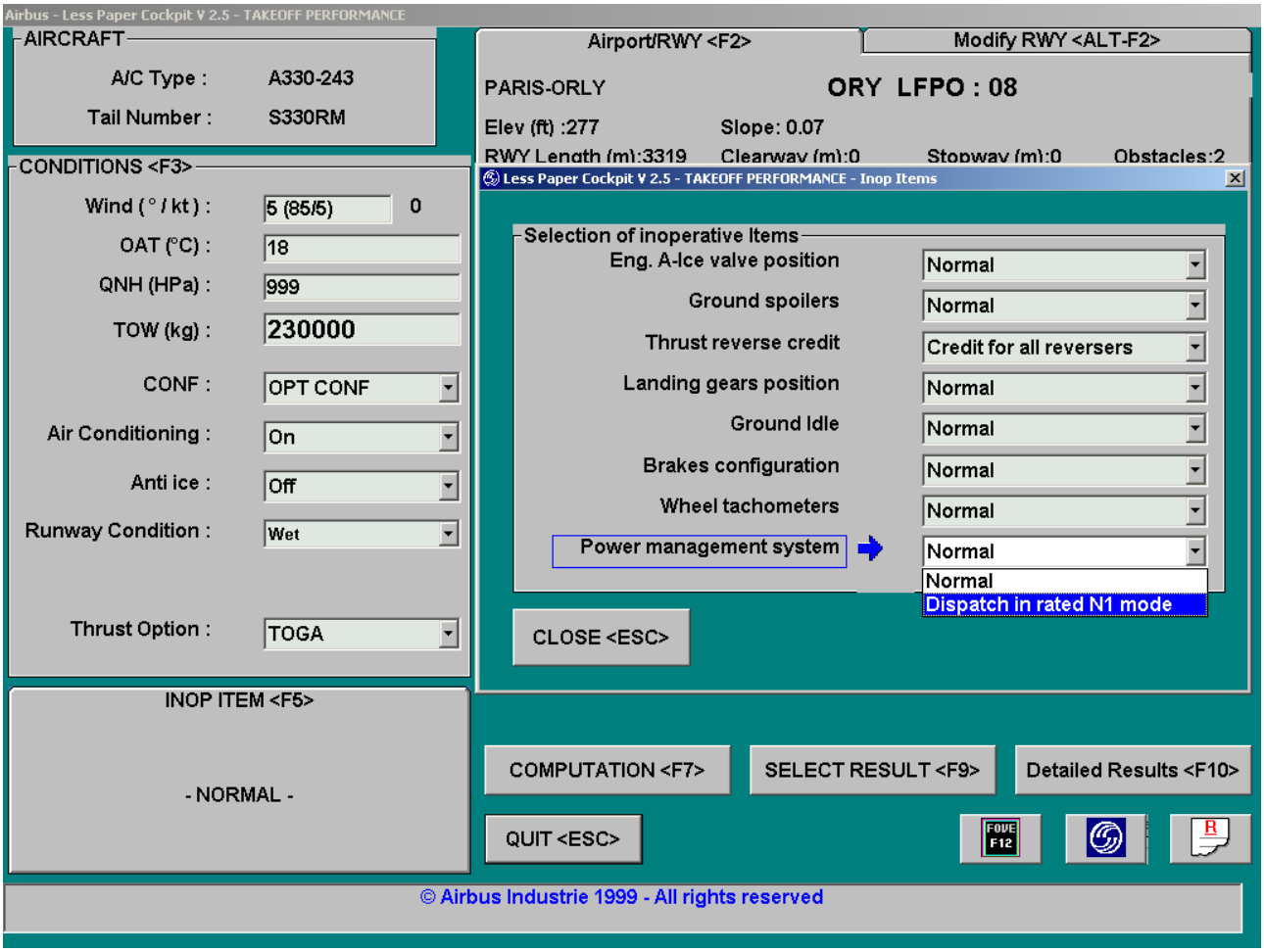
Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A330-243
Tail Number : S330RM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 230000
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Condition : Wet
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE - Inop Items
Selection of inoperative Items
Eng. A-Ice valve position Normal
Ground spoilers Normal
Thrust reverse credit Credit for all reversers
Landing gears position Normal
Ground Idle Normal
Brakes configuration Normal
Wheel tachometers Normal
Power management system Normal
Normal
Dispatch in rated N1 mode
CLOSE <ESC>
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
FOVE F12
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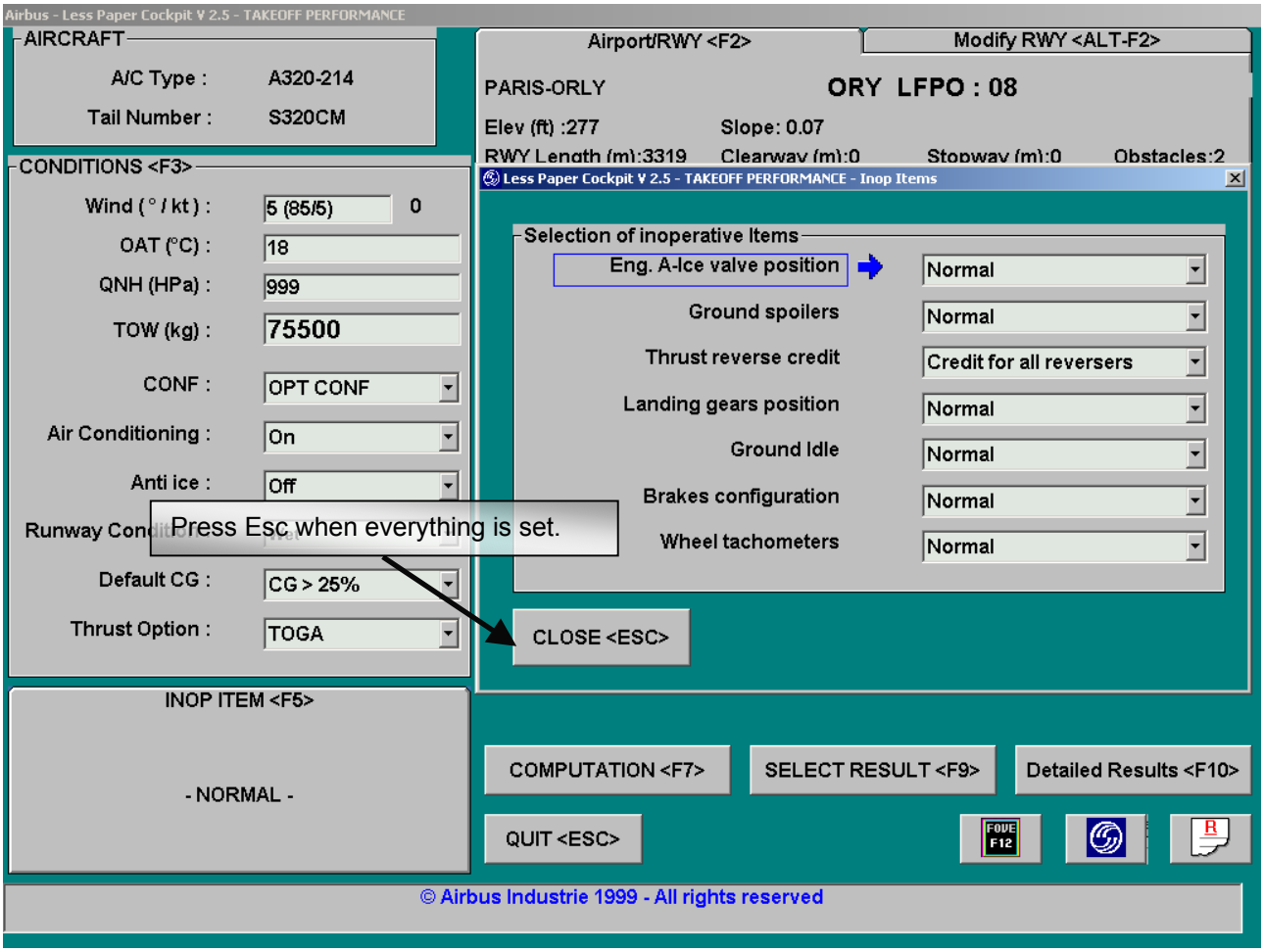
Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Cond
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
Stopway (m):0
Obstacles:2
Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE - Inop Items
Selection of inoperative Items
Eng. A-Ice valve position
Normal
Ground spoilers
Normal
Thrust reverse credit
Credit for all reversers
Landing gears position
Normal
Ground Idle
Normal
Brakes configuration
Normal
Wheel tachometers
Normal
Press Esc when everything is set.
CLOSE <ESC>
COMPUTATION <F7>
SELECT RESULT <F9>
Detailed Results <F10>
QUIT <ESC>
FOVE F12
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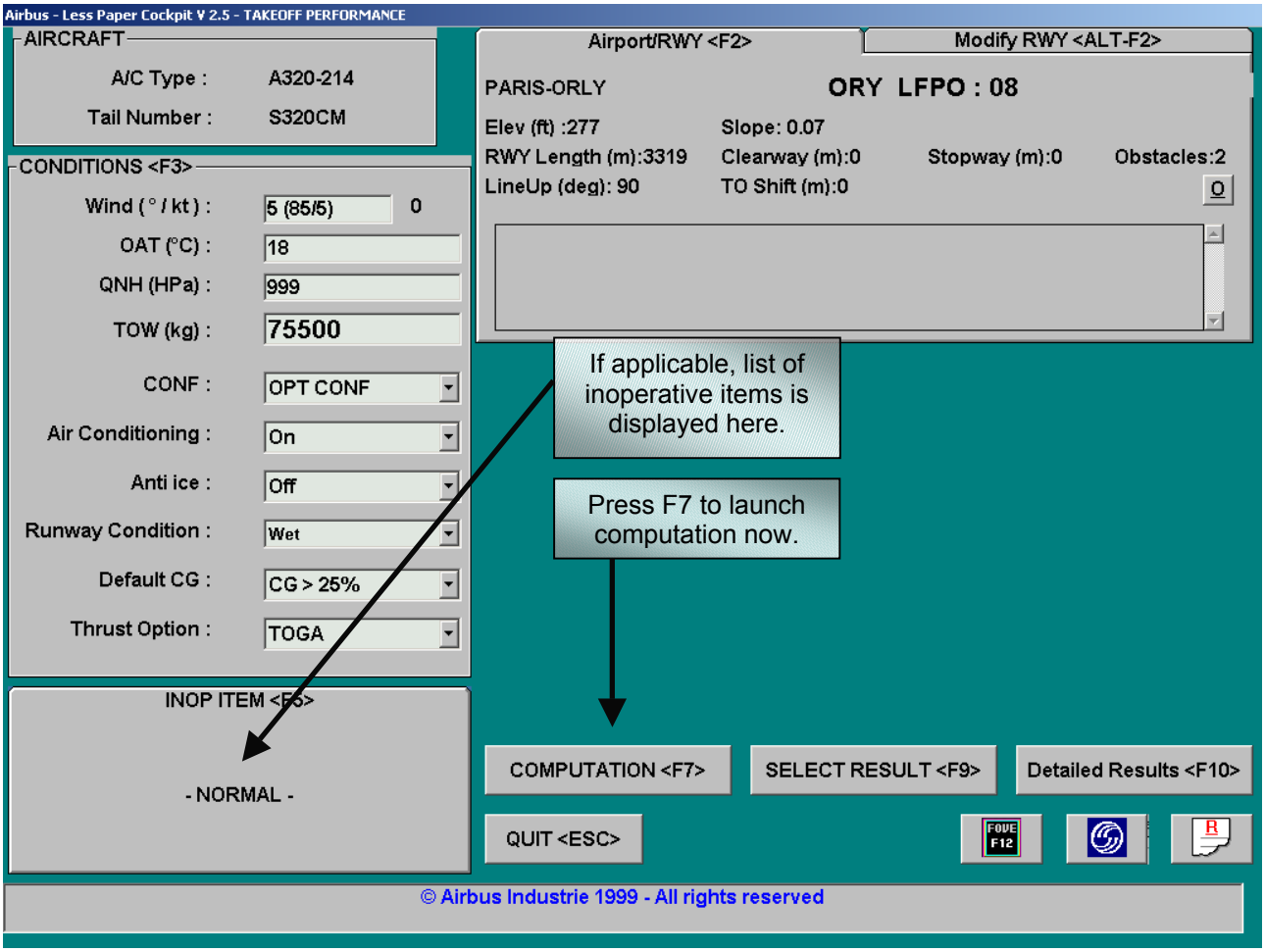
Note that if failures were entered, a list would appear instead of NORMAL.

As everything is set, the computation can be launched now.

Press F7.

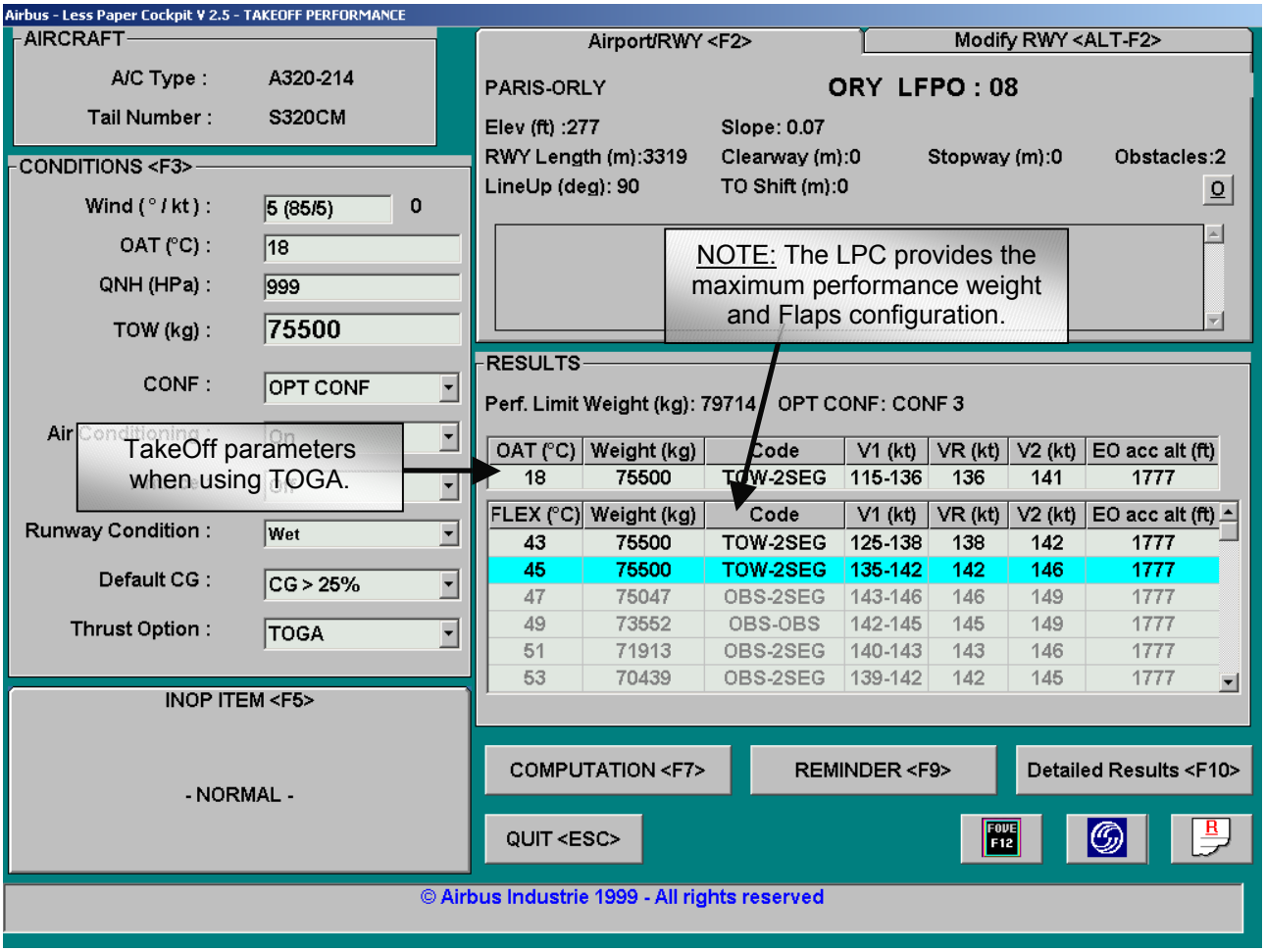


4.4. Results

LPC has calculated the TakeOff performance with TOGA selected.

Observe the limitations and TakeOff speeds.

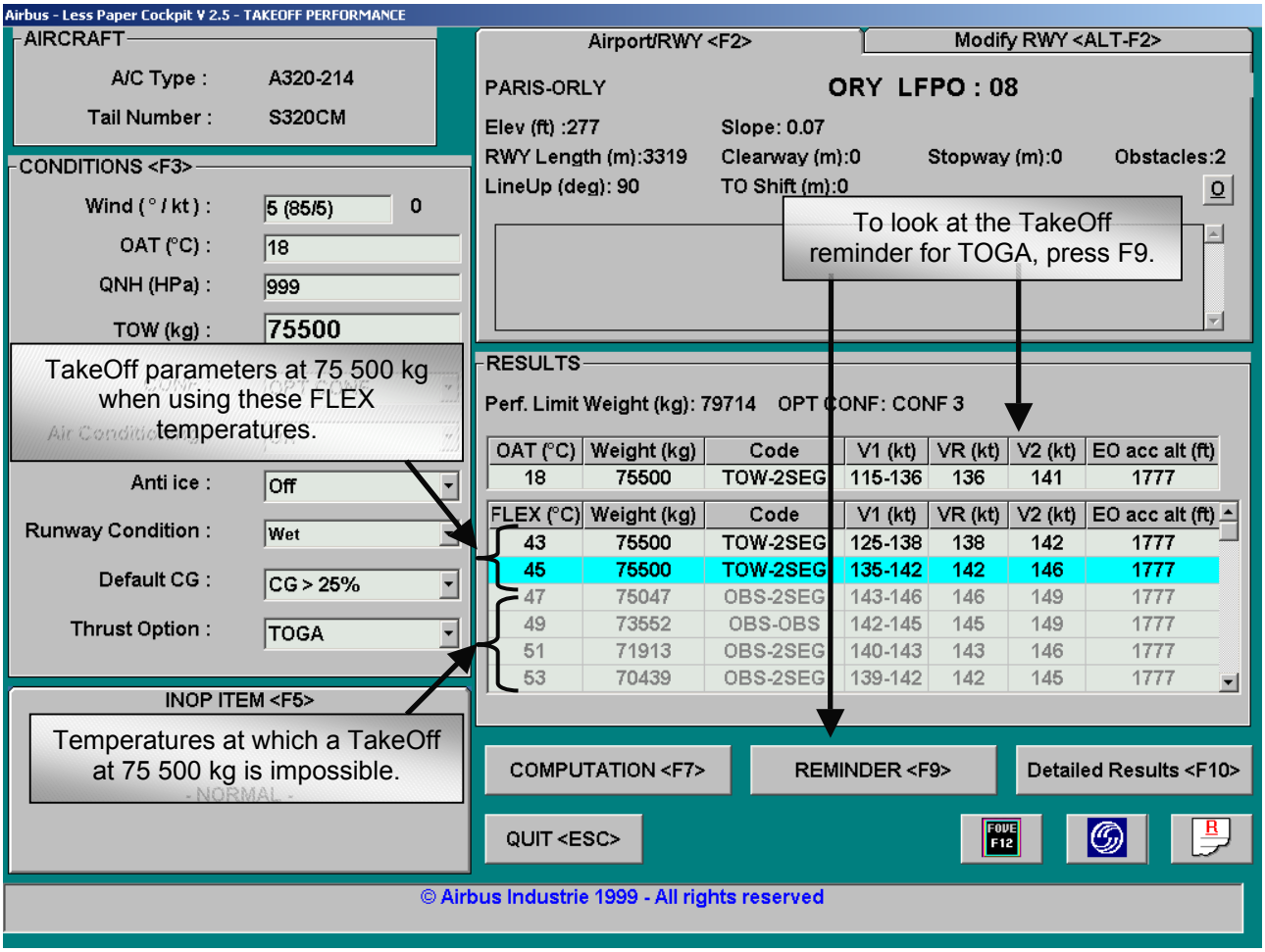
Note the maximum PERFORMANCE TakeOff Weight (79 714 kg) and the corresponding flaps setting of 3.



The lines for 43 and 45 are the TakeOff parameters when using these FLEX values.

Grey lines indicate that TakeOff is not possible at 75 500 kg using these FLEX/OAT values.

Press F9 to look at the TakeOff reminder.



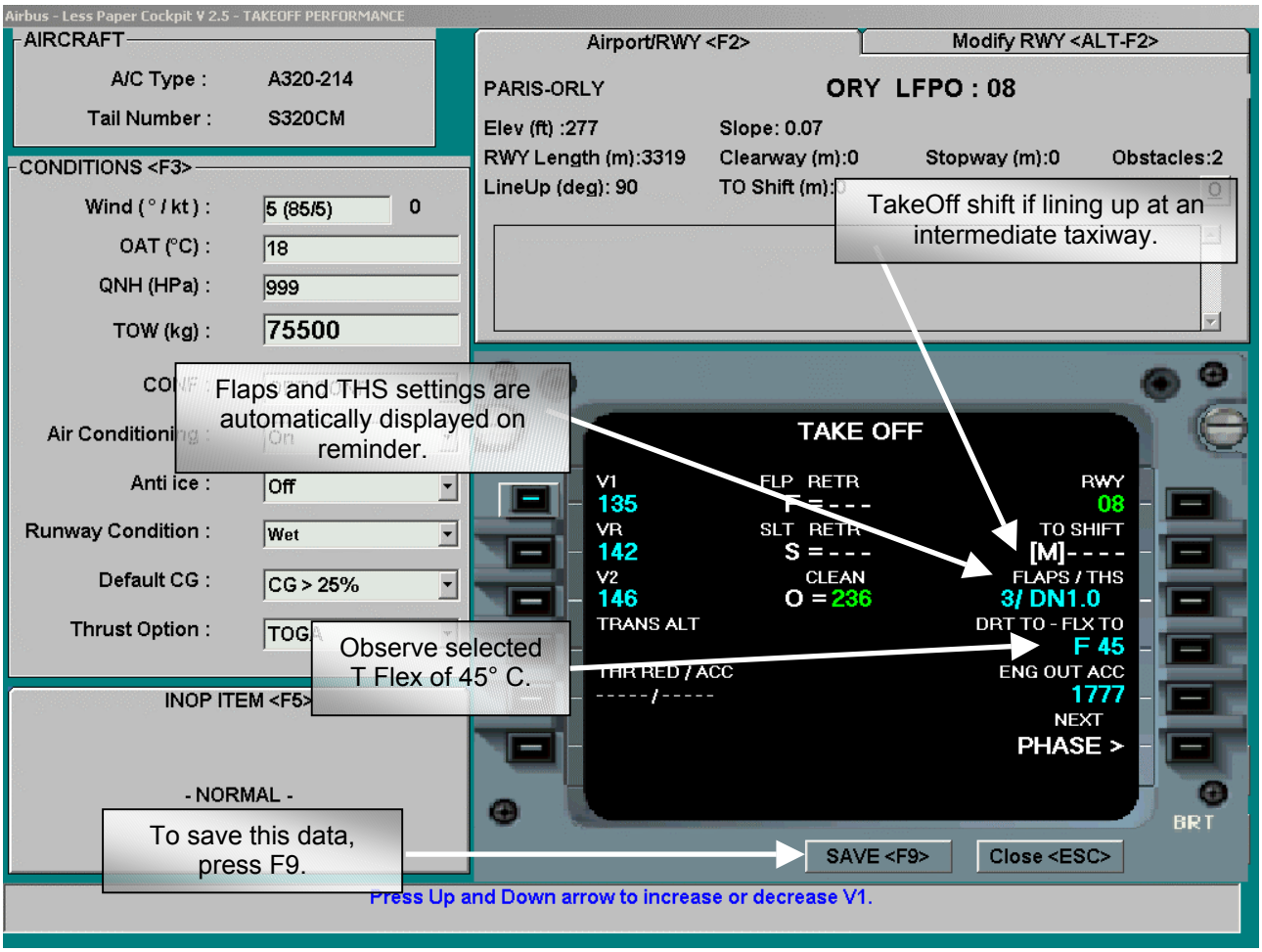
NOTE: A FLEX TakeOff can be selected by using the up/down arrows. We select the maximum FLEX temp for this weight of 45°C. Observe that the speeds are different.

On the RH side, there are fields for TO shift (line up at an intermediate taxiway) and derated or FLEX temperature (observe selected T Flex of 45°C).

The THS setting is only displayed when the Weight & Balance module has been completed.

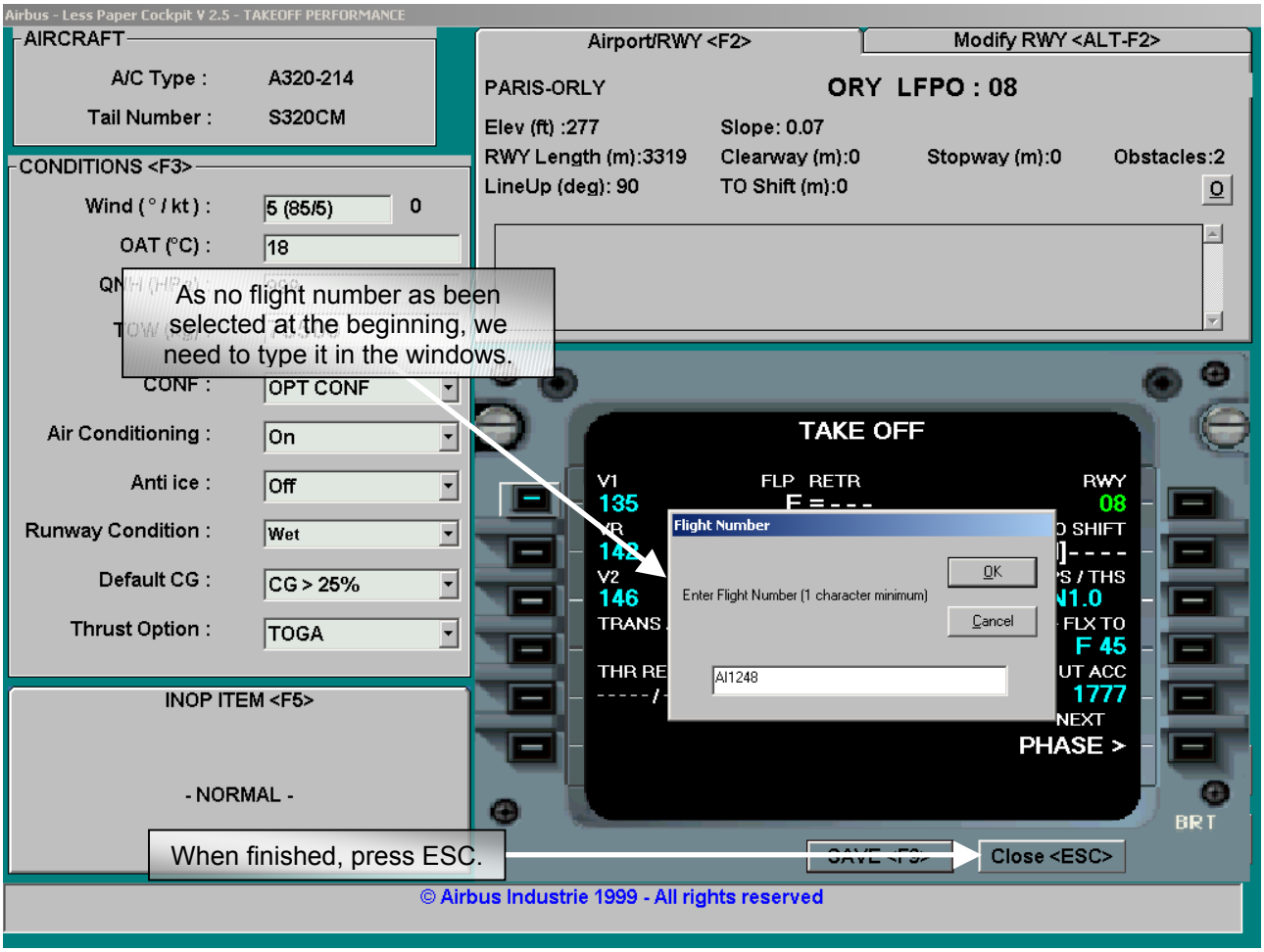
You have to enter this data in the FMGS PERF page.

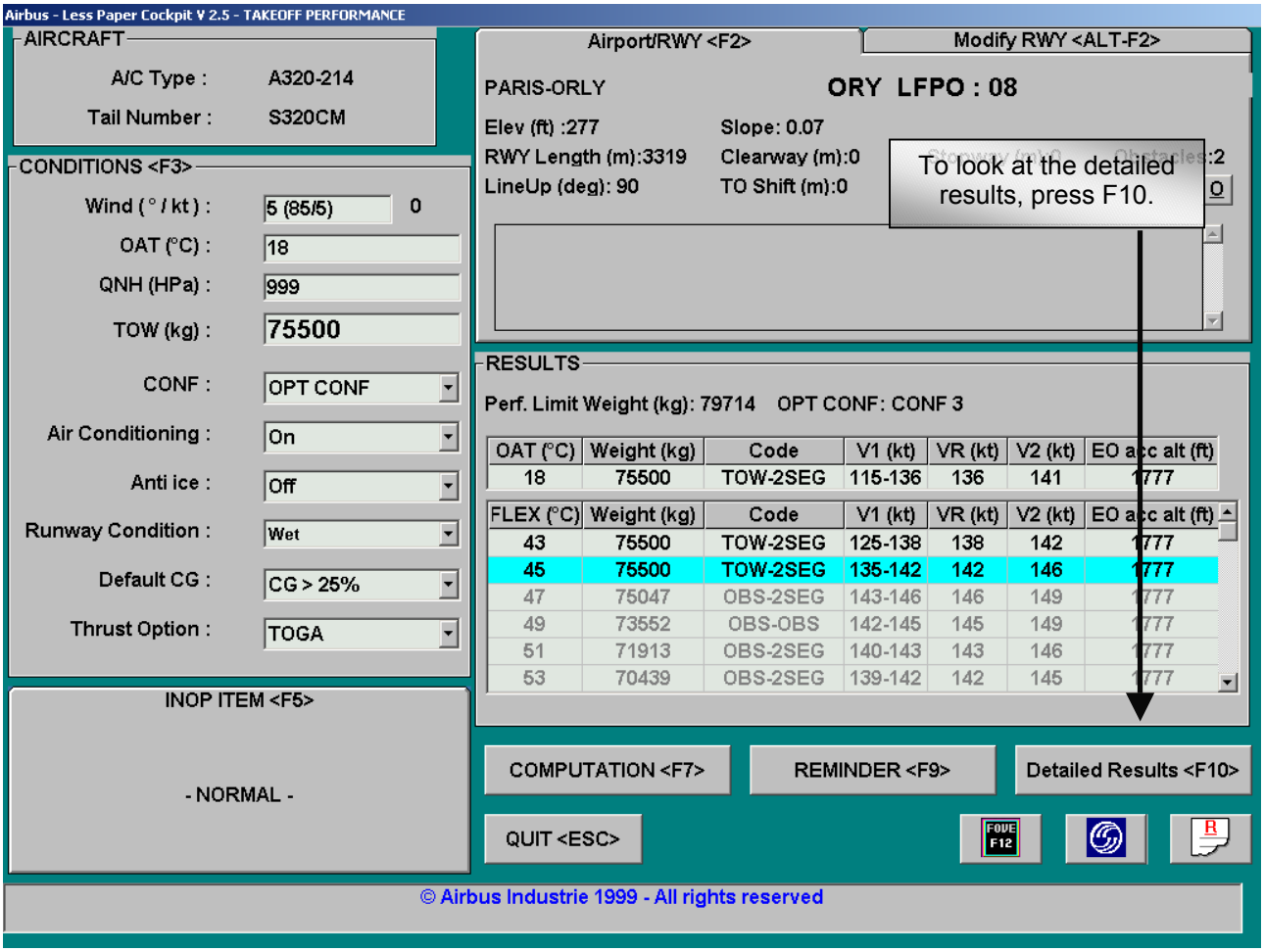
Now save it for statistical purposes, using F9.



Enter your flight number: AI1248, then press enter.

Press ESC to leave.




Airbus - Less Paper Cockpit V 2.5 - TAKEOFF PERFORMANCE
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
CONDITIONS <F3>
Wind (° / kt) : 5 (85/5) 0
OAT (°C) : 18
QNH (HPa) : 999
TOW (kg) : 75500
CONF : OPT CONF
Air Conditioning : On
Anti ice : Off
Runway Condition : Wet
Default CG : CG > 25%
Thrust Option : TOGA
INOP ITEM <F5>
- NORMAL -
Airport/RWY <F2>
Modify RWY <ALT-F2>
PARIS-ORLY
ORY LFPO : 08
Elev (ft) :277
Slope: 0.07
RWY Length (m):3319
Clearway (m):0
LineUp (deg): 90
TO Shift (m):0
To look at the detailed results, press F10.
RESULTS
Perf. Limit Weight (kg): 79714 OPT CONF: CONF 3
OAT (°C) | Weight (kg) | Code | V1 (kt) | VR (kt) | V2 (kt) | EO acc alt (ft)
18 | 75500 | TOW-2SEG | 115-136 | 136 | 141 | 1777
FLEX (°C) | Weight (kg) | Code | V1 (kt) | VR (kt) | V2 (kt) | EO acc alt (ft)
43 | 75500 | TOW-2SEG | 125-138 | 138 | 142 | 1777
45 | 75500 | TOW-2SEG | 135-142 | 142 | 146 | 1777
47 | 75047 | OBS-2SEG | 143-146 | 146 | 149 | 1777
49 | 73552 | OBS-OBS | 142-145 | 145 | 149 | 1777
51 | 71913 | OBS-2SEG | 140-143 | 143 | 146 | 1777
53 | 70439 | OBS-2SEG | 139-142 | 142 | 145 | 1777
COMPUTATION <F7>
REMINDER <F9>
Detailed Results <F10>
QUIT <ESC>
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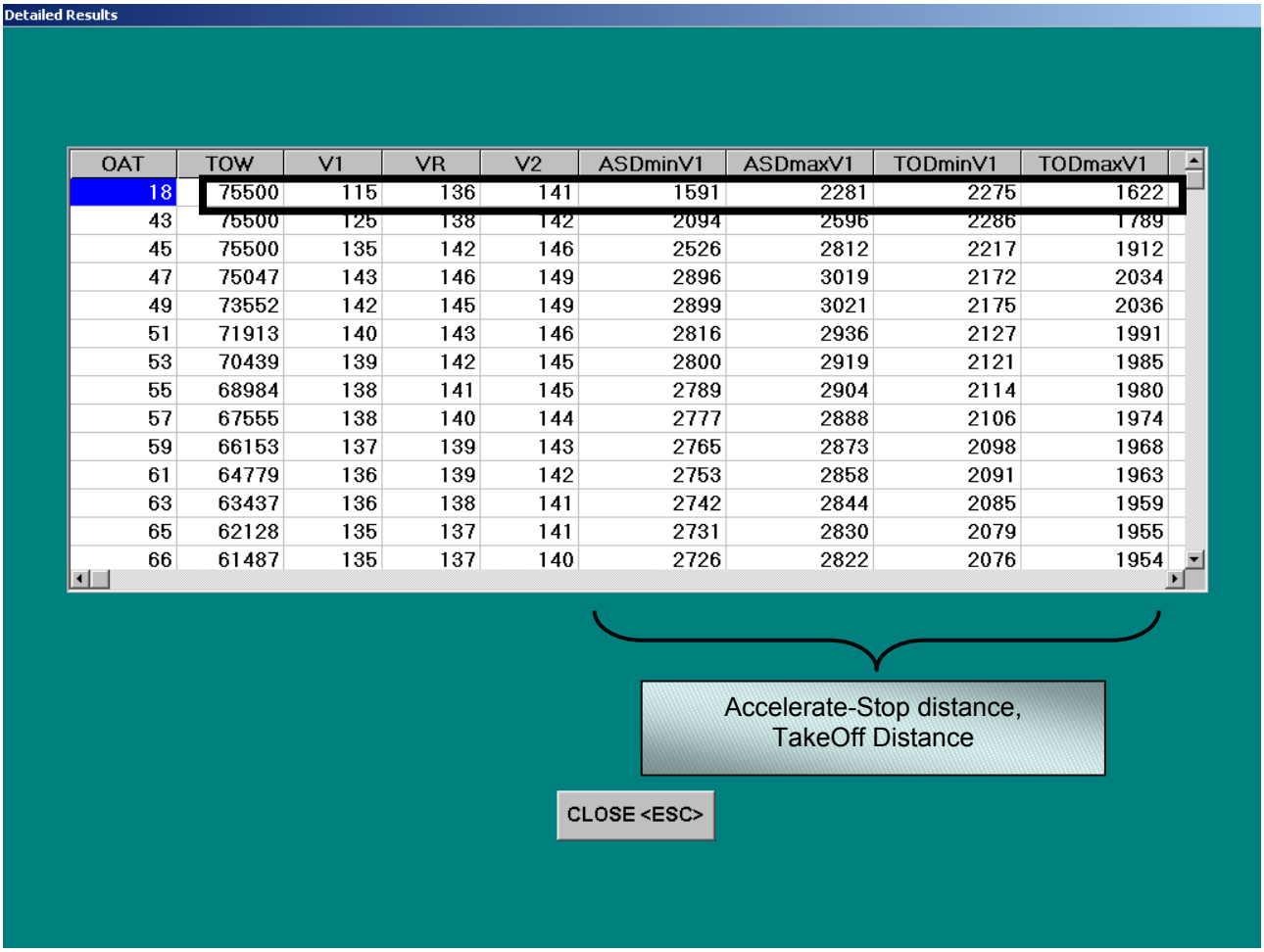
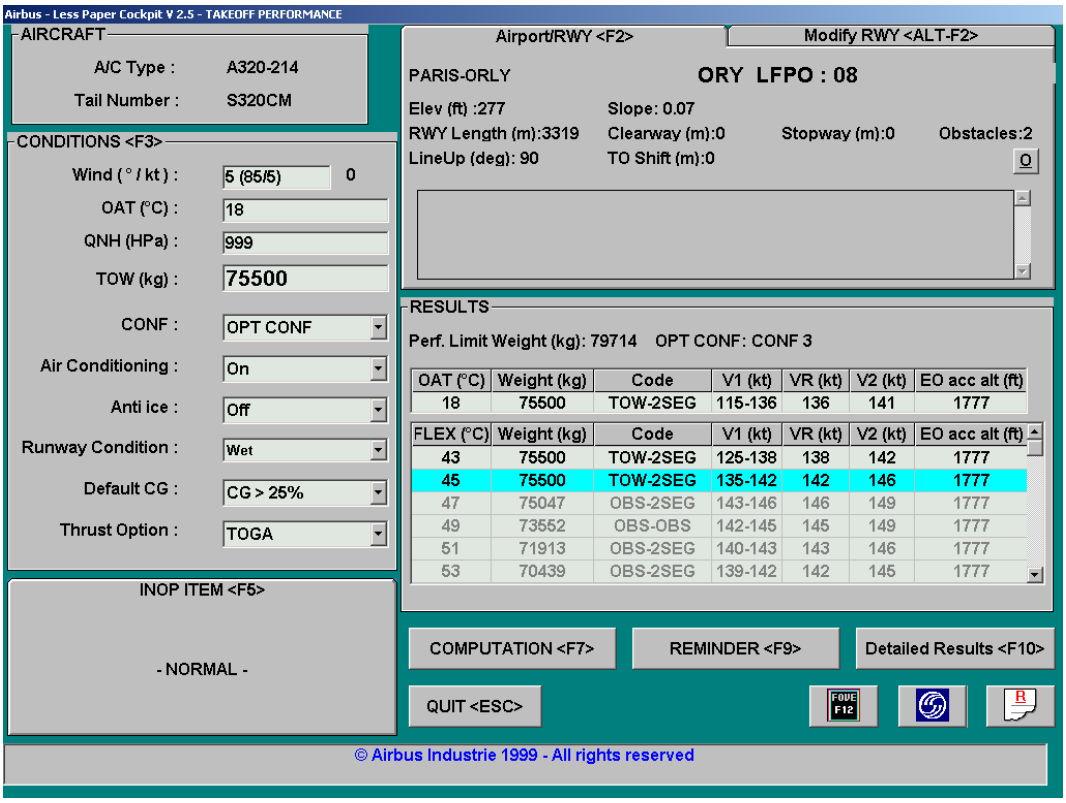
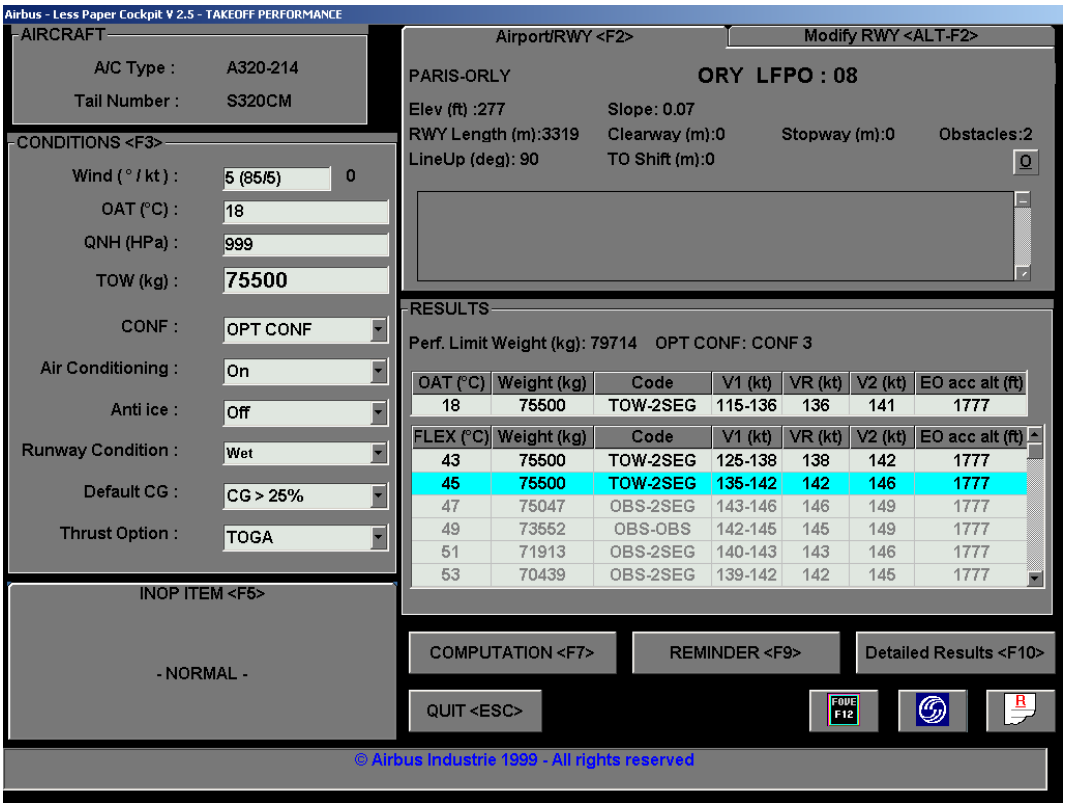
For each OAT/TFLEX, find the associated TOW, speeds, ASD, TOD and TOR, plus the minimum and maximum acceleration altitude.



OAT	TOW	V1	VR	V2	ASDminV1	ASDmaxV1	TODminV1	TODmaxV1
18	75500	115	136	141	1591	2281	2275	1622
43	75500	125	138	142	2094	2596	2286	1789
45	75500	135	142	146	2526	2812	2217	1912
47	75047	143	146	149	2896	3019	2172	2034
49	73552	142	145	149	2899	3021	2175	2036
51	71913	140	143	146	2816	2936	2127	1991
53	70439	139	142	145	2800	2919	2121	1985
55	68984	138	141	145	2789	2904	2114	1980
57	67555	138	140	144	2777	2888	2106	1974
59	66153	137	139	143	2765	2873	2098	1968
61	64779	136	139	142	2753	2858	2091	1963
63	63437	136	138	141	2742	2844	2085	1959
65	62128	135	137	141	2731	2830	2079	1955
66	61487	135	137	140	2726	2822	2076	1954

Alt + V enable to toggle the display between dim for night flying and bright during daylight.

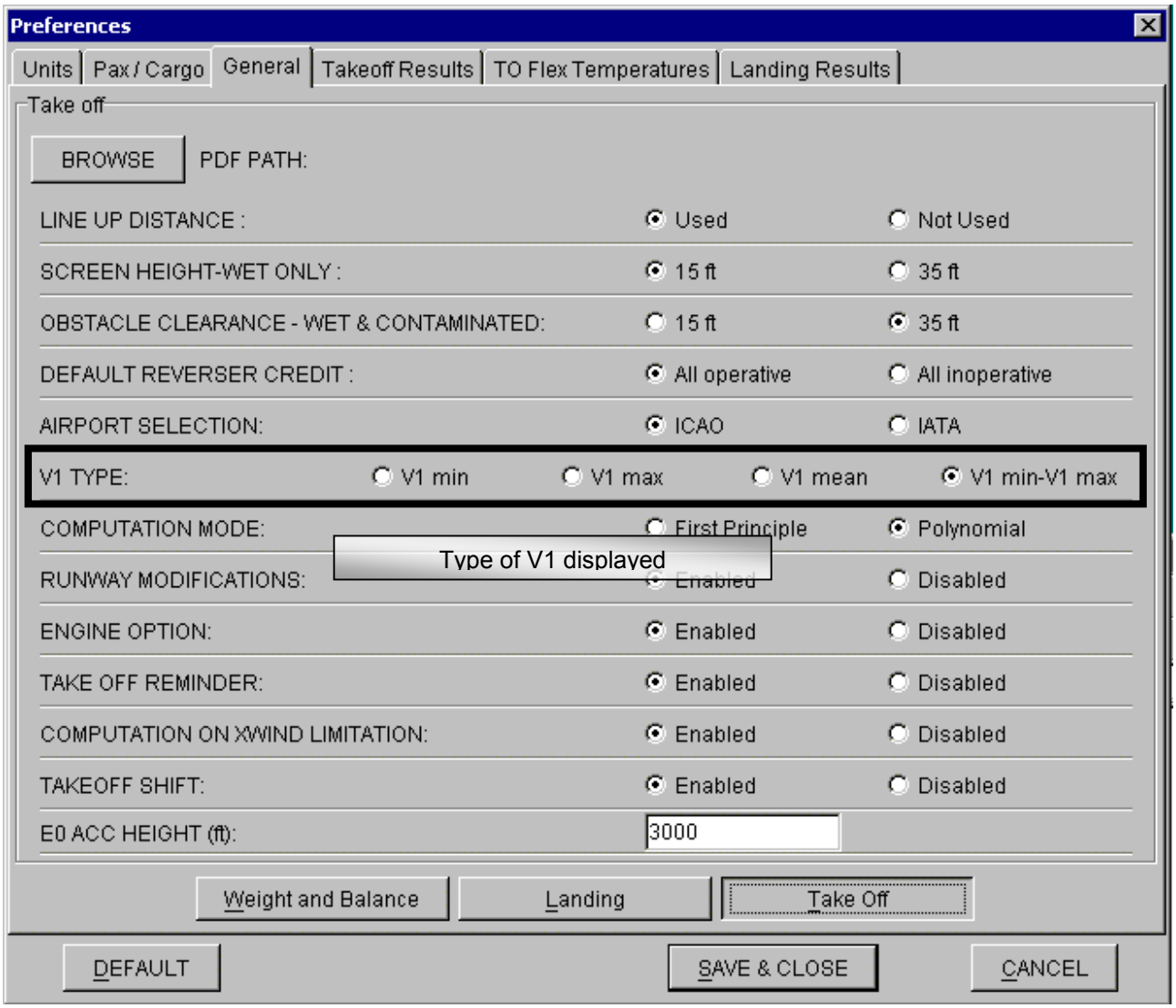




4.5. Type of V1

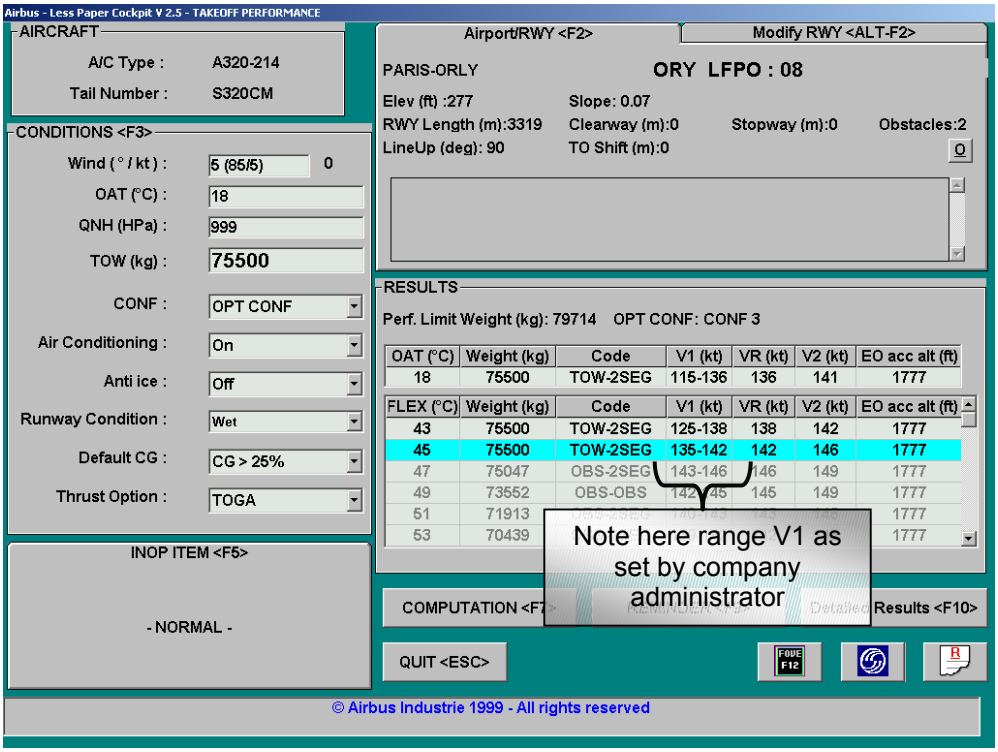
The LPC tool can be set by the company administrator to display several type of V1:

- V1 min
- V1 max
- V1 mean
- V1 min-V1 max

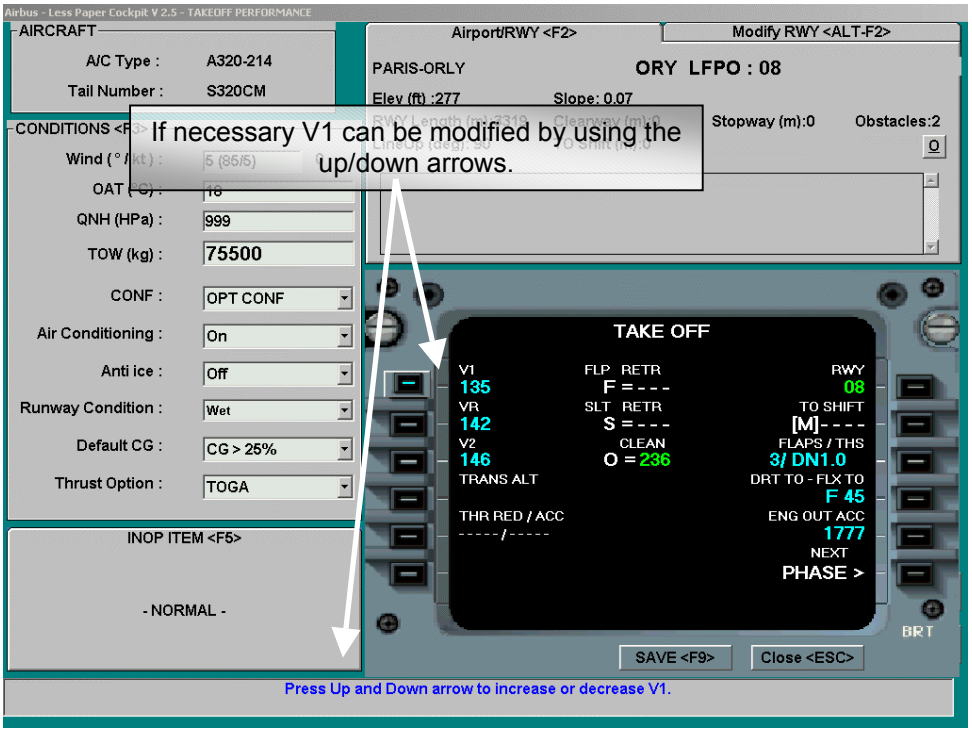


In this case, the pilot will select the lowest, highest or average value, according to the airline policy.

Observe the TakeOff speeds, including the range of V1.

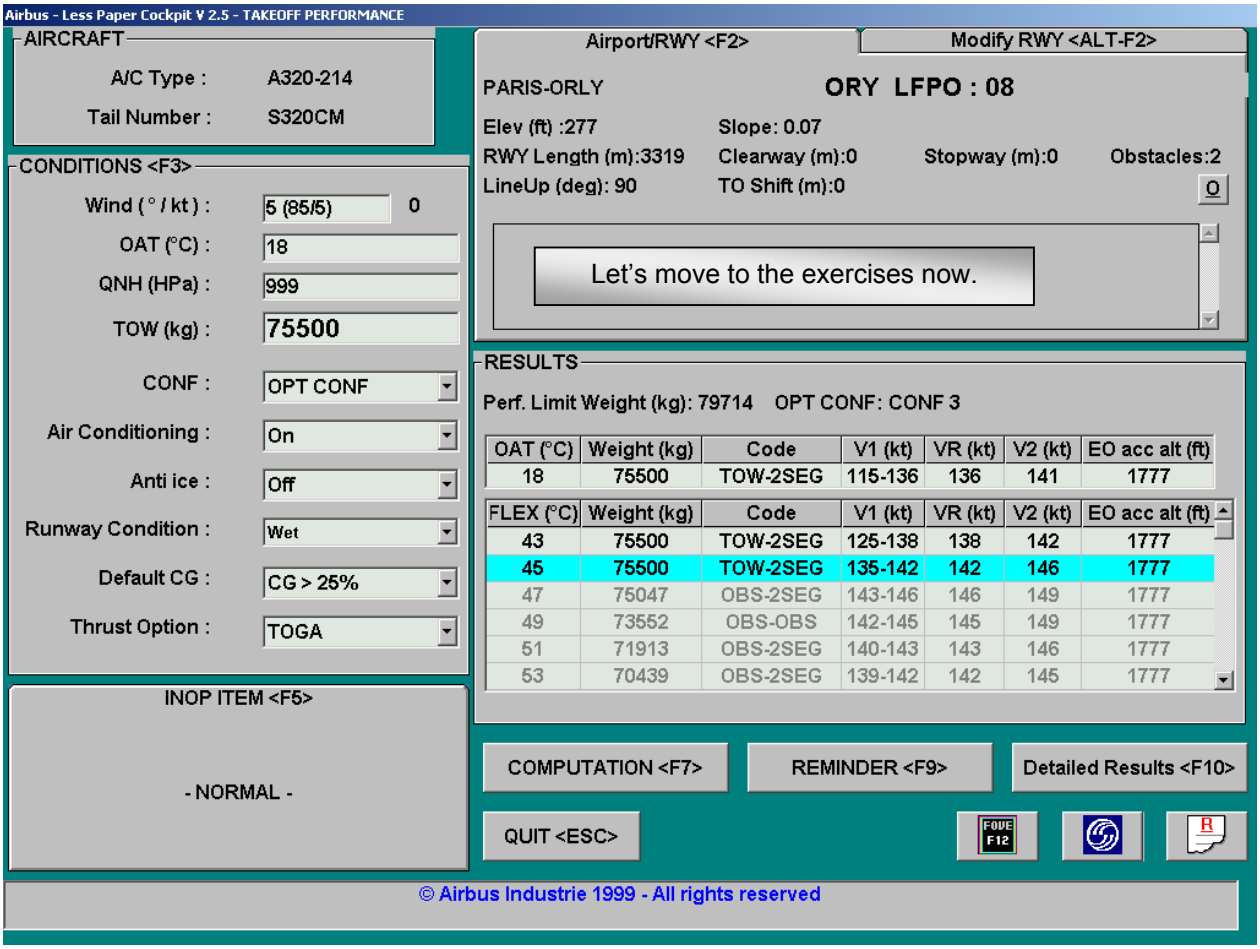


According to the company policy, V1 can be set at any value within the proposed range. This is done using the up/down arrows on the keyboard.



We will now do some practical exercises.

Please go to the TakeOff module on your laptop.



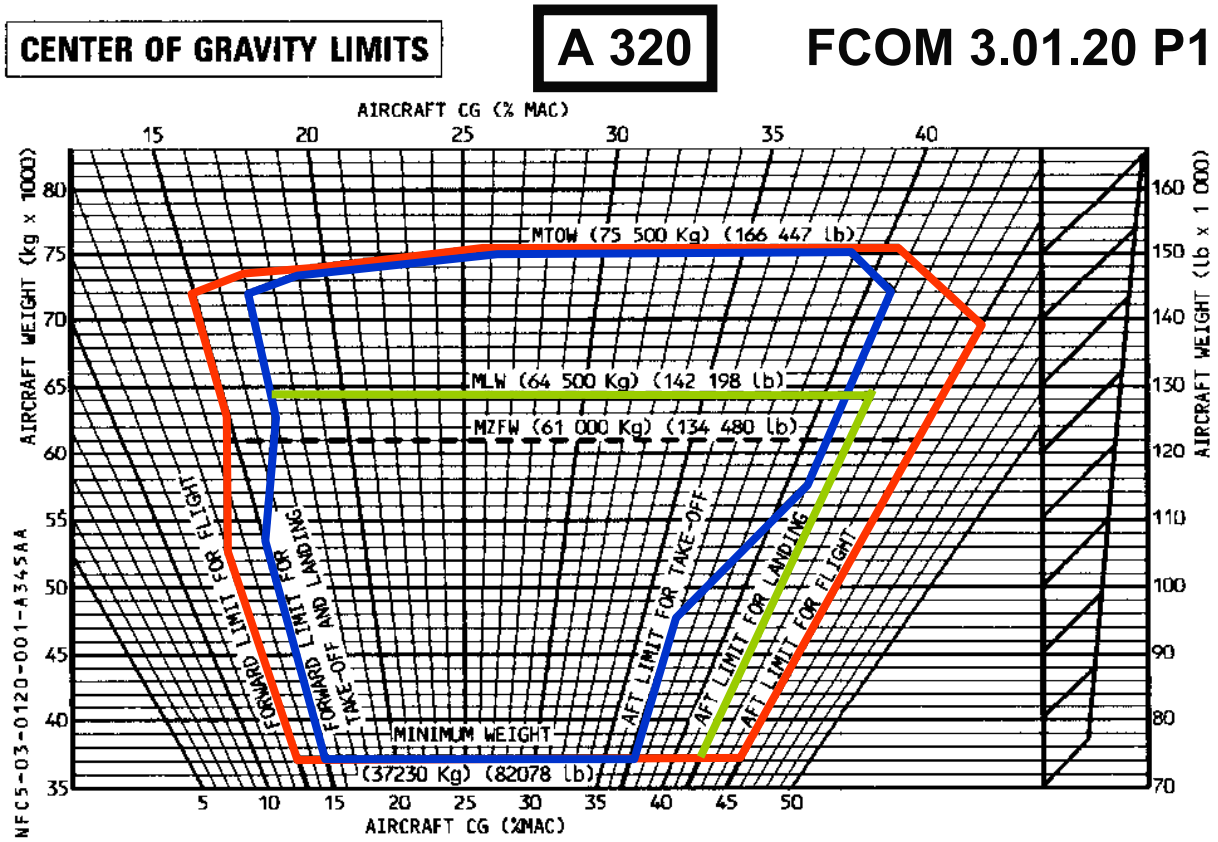
5. LPC WEIGHT & BALANCE PRESENTATION

CONTENTS:

5.1. CG Envelope

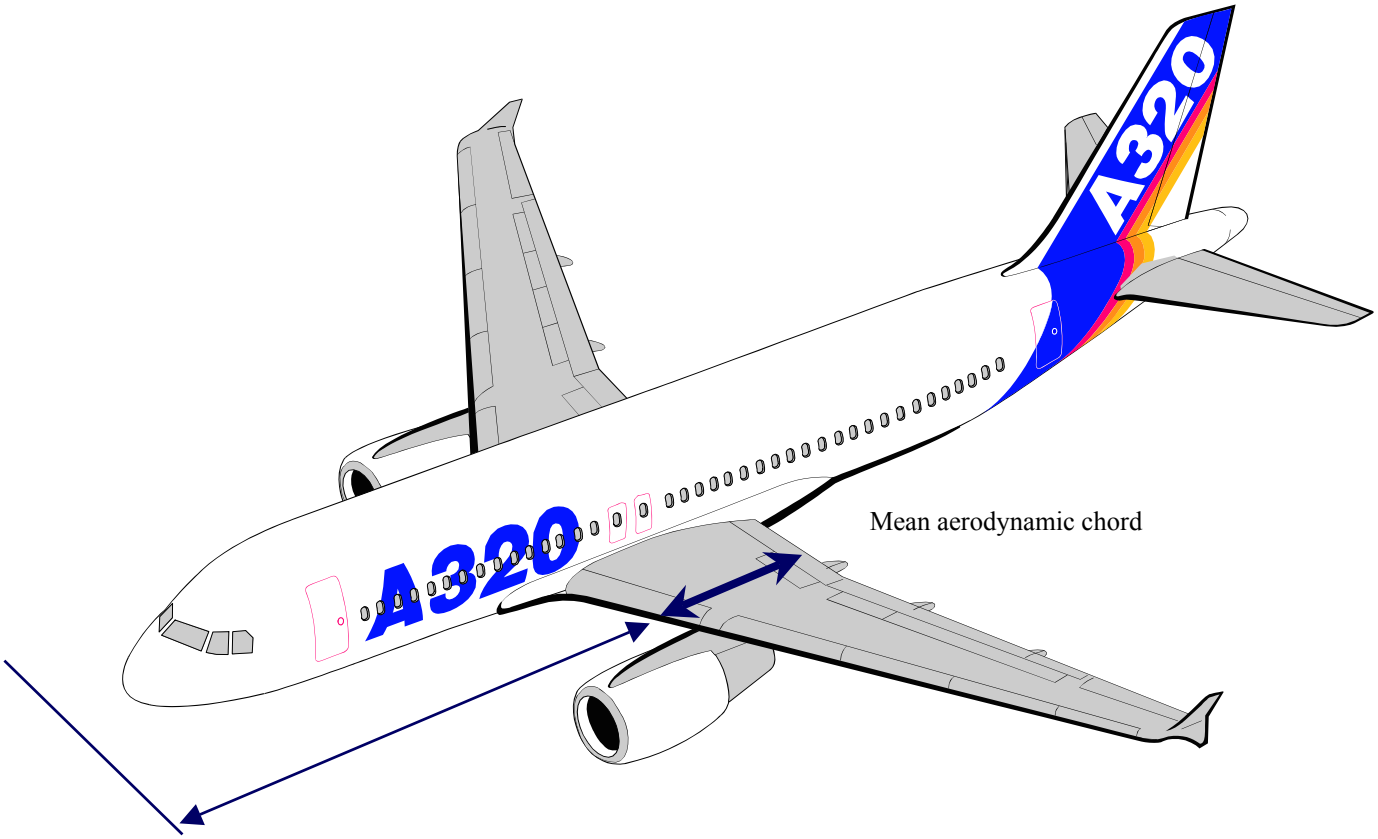
5.1.1. Objectives

- Reminder
- W&B presentation
- Exercises



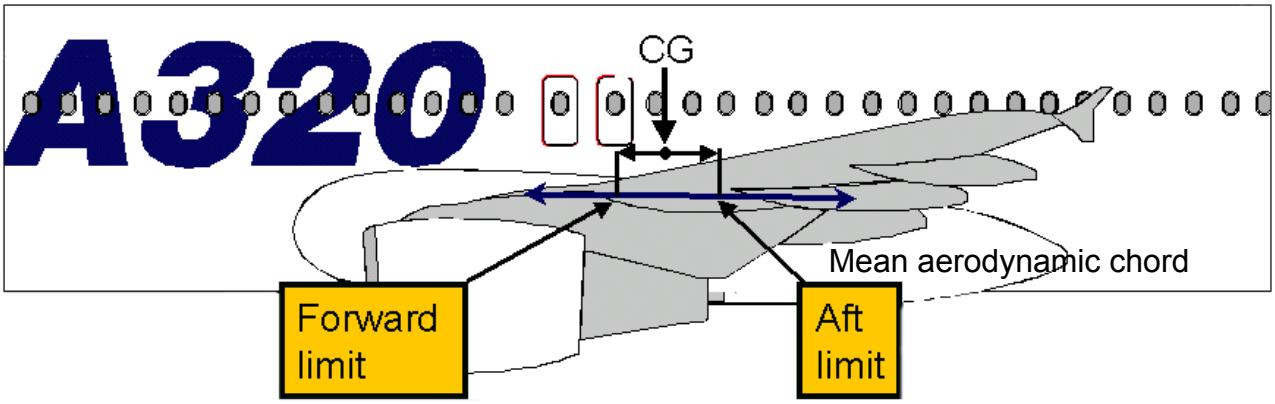
- CG limits are given in percentage of the reference chord length aft of the leading edge.
- The reference chord length is 4.193 m (13.76 ft). It is 14.71 m (48.26 ft) aft of the aircraft nose.
- The CG must always be within these limits, regardless of fuel load.

The mean aerodynamic chord (mac) is determined on the aircraft structure. It is defined according to its distance from the aircraft reference axes and the chord length.



The CG position is expressed as a percentage of the mean aerodynamic chord.

It must remain between a forward and an aft certified limit depending on the aircraft weight.

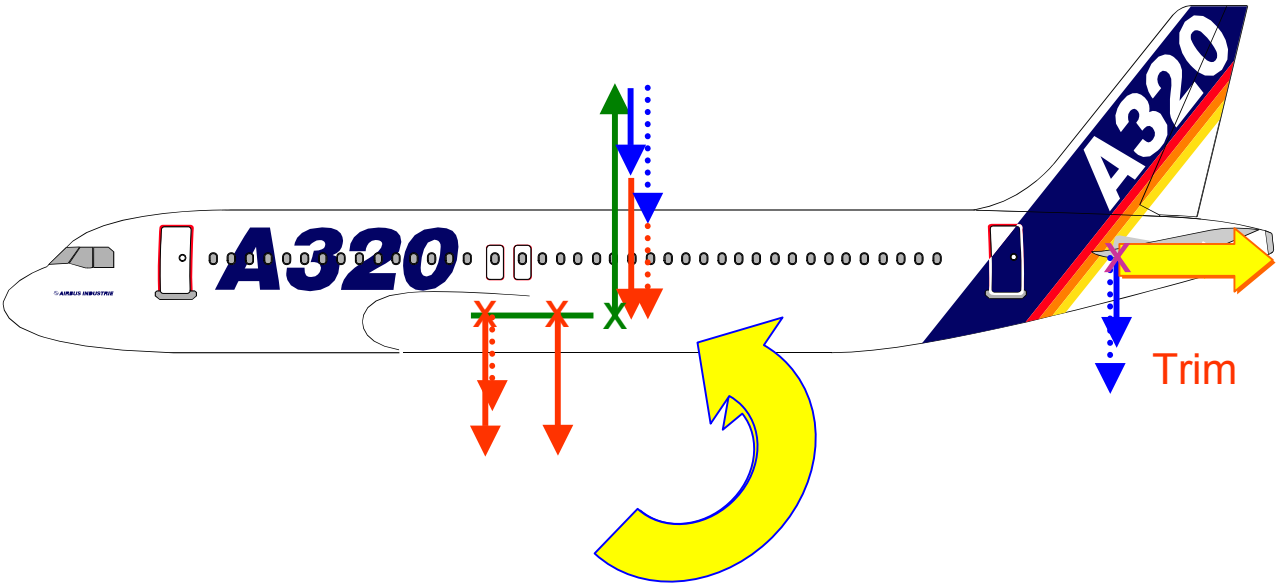


The CG position affects the takeoff performance capability of the aircraft.

The CG position affects the stability and the maneuverability of the aircraft.

The CG position affects fuel consumption.

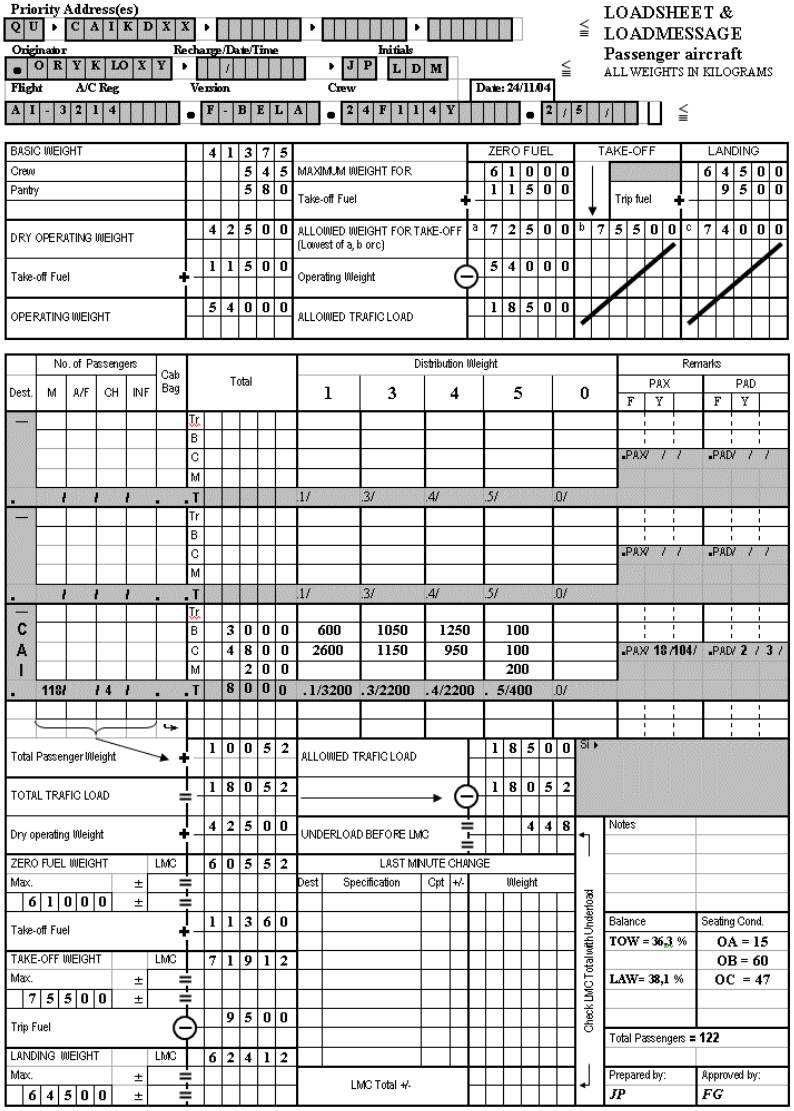
An aft CG reduces fuel consumption.



5.2. Example

- Dry operating weight: 42 500 kg
- 122 Passengers: 118 adult, 4 children
- Cabin OA: 15, Cabin OB: 60, Cabin OC: 47
- Cargo 1: 3 200 kg, Cargo 3: 2 200 kg,
  Cargo 4: 2 200 kg, Cargo 5: 400 kg
- Total fuel 11 500 kg
- Trip fuel 9 500 kg.

Here is the loadsheet for a flight from Paris to Cairo.
The details are on the right.
Let's enter these values in the LPC tool.



When you click on the LPC icon, you reach this screen.

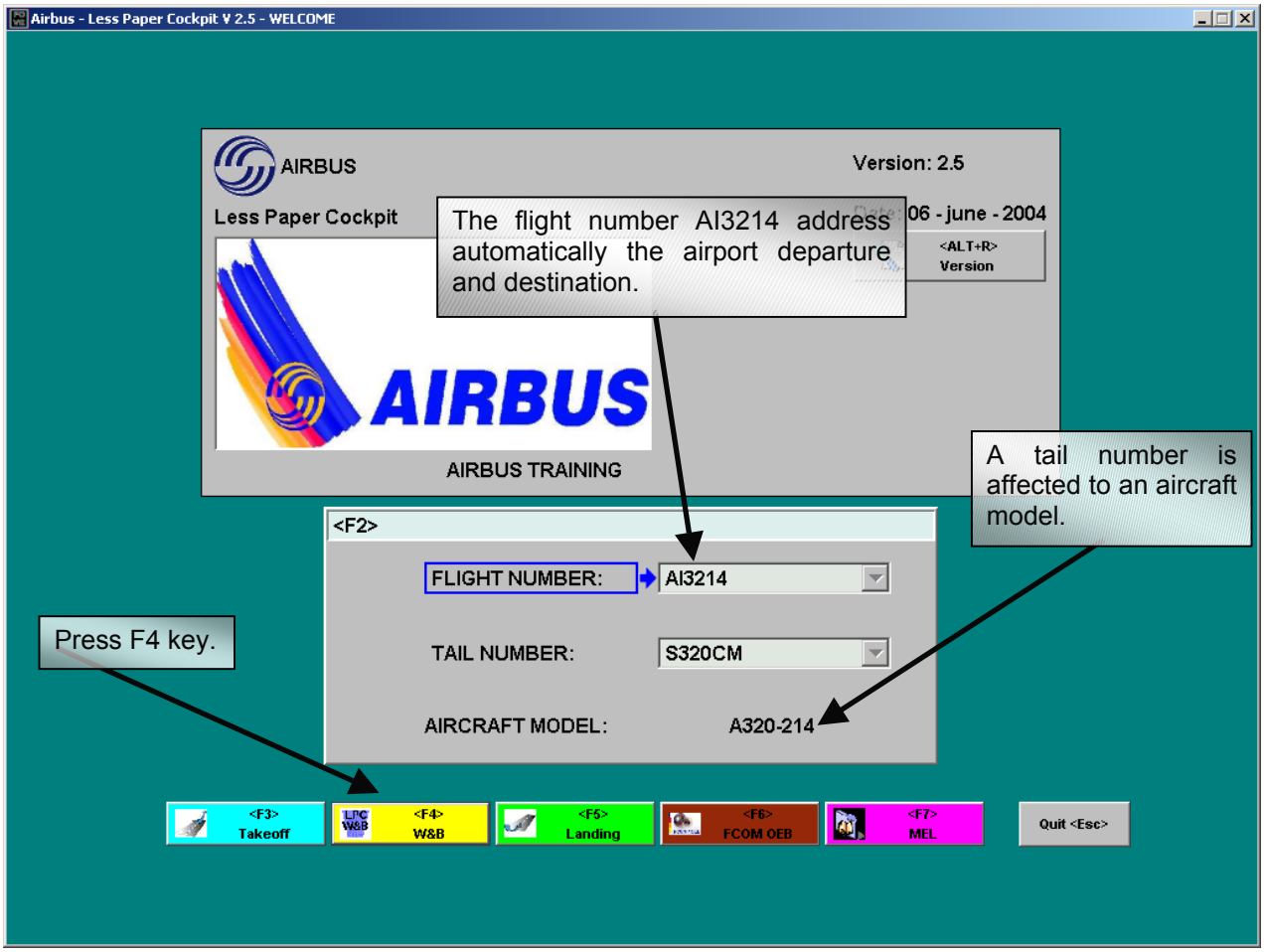
The aircraft tail number is already selected.

Depending on the setup decided by your company administrator, you enter a flight number that will automatically input the departure and destination airport in the LPCU.

If no flight number is entered, you have to select the departure and destination airport. We will see now how to do it.

As the use of a mouse is difficult in a cockpit, the LPC tool is designed for keyboard inputs.

Press the F9 key to start.

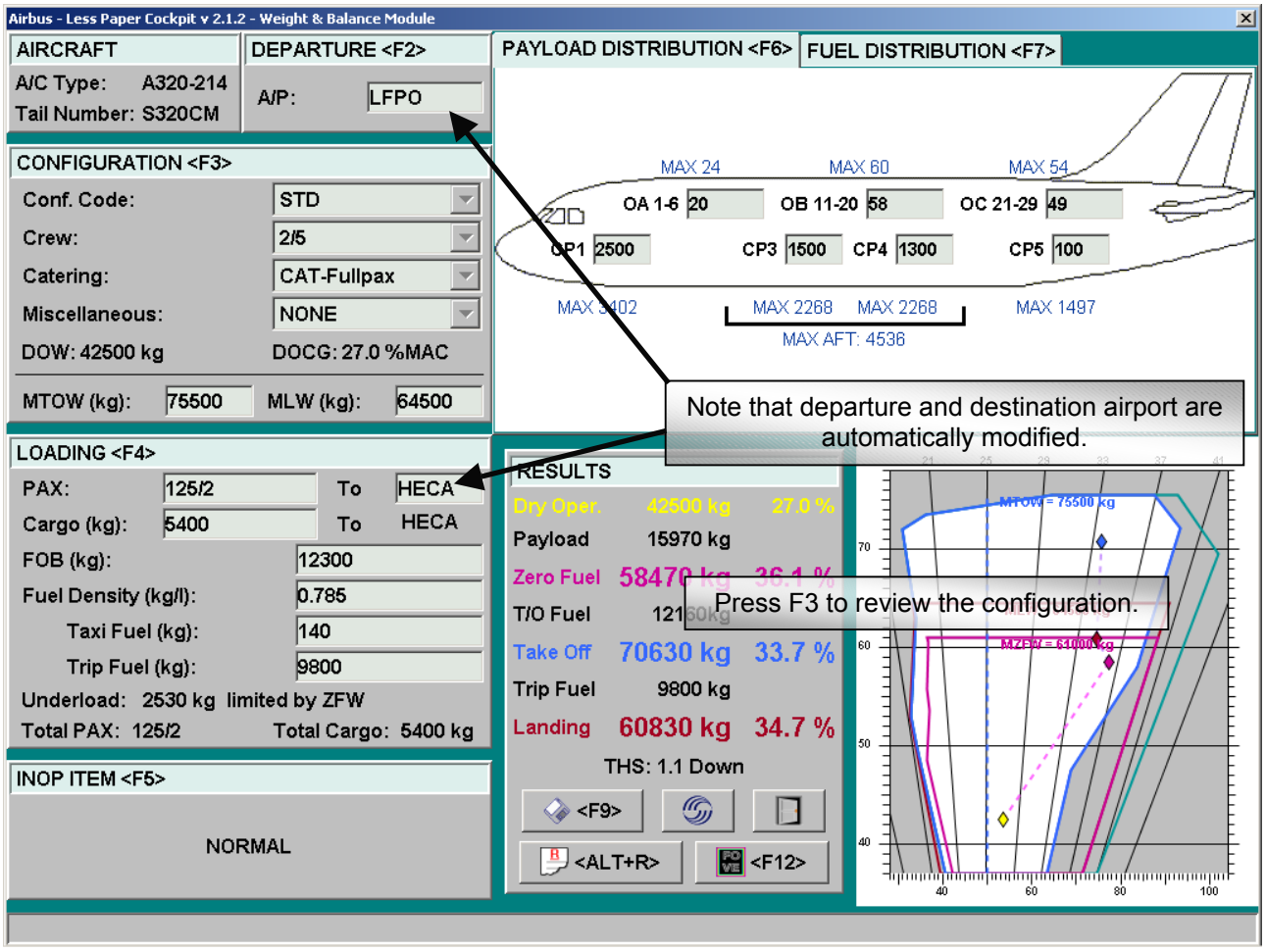


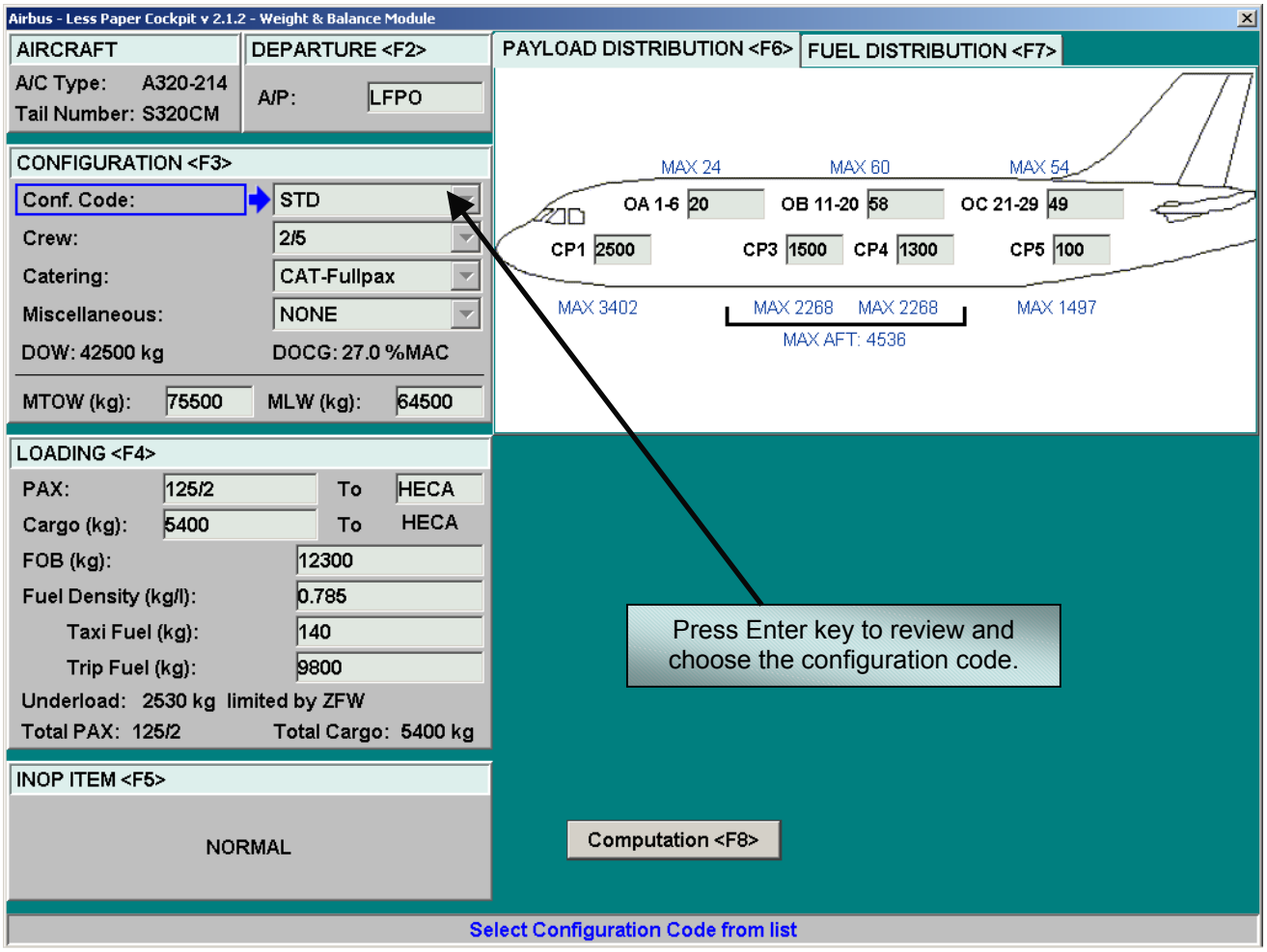
This is the load & trim sheet of the previous flight.

Note that, as you have already set your departure and destination airport, the corresponding fields are automatically updated.

Of course they can also be modified on this page.

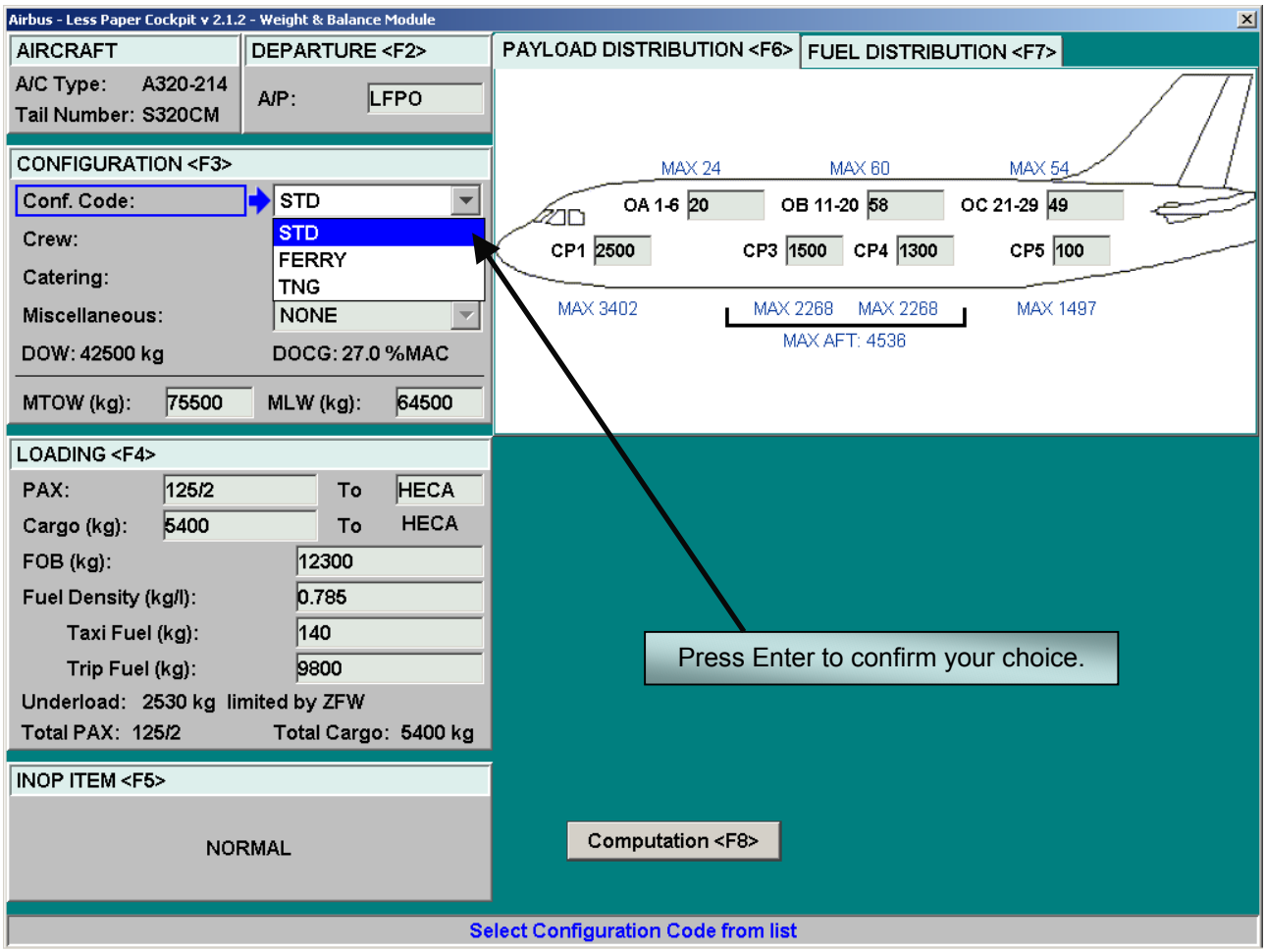
Press F3 to check the aircraft configuration: crew complement, catering and weight deviation.




Airbus - Less Paper Cockpit v 2.1.2 - Weight & Balance Module
AIRCRAFT
A/C Type: A320-214
Tail Number: S320CM
DEPARTURE <F2>
A/P: LFPO
CONFIGURATION <F3>
Conf. Code: STD
Crew: 2/5
Catering: CAT-Fullpax
Miscellaneous: NONE
DOW: 42500 kg
DOCG: 27.0 %MAC
MTOW (kg): 75500
MLW (kg): 64500
LOADING <F4>
PAX: 125/2 To HECA
Cargo (kg): 5400 To HECA
FOB (kg): 12300
Fuel Density (kg/l): 0.785
Taxi Fuel (kg): 140
Trip Fuel (kg): 9800
Underload: 2530 kg limited by ZFW
Total PAX: 125/2 Total Cargo: 5400 kg
INOP ITEM <F5>
NORMAL
PAYLOAD DISTRIBUTION <F6>
FUEL DISTRIBUTION <F7>
MAX 24
MAX 60
MAX 54
OA 1-6 20
OB 11-20 58
OC 21-29 49
CP1 2500
CP3 1500
CP4 1300
CP5 100
MAX 3402
MAX 2268
MAX 2268
MAX 1497
MAX AFT: 4536
Press Enter key to review and choose the configuration code.
Computation <F8>
Select Configuration Code from list

Configuration code enables you to choose between the most commonly used configurations, as set by the company administrator. Today we use the standard configuration i.e. for a normal operation use.

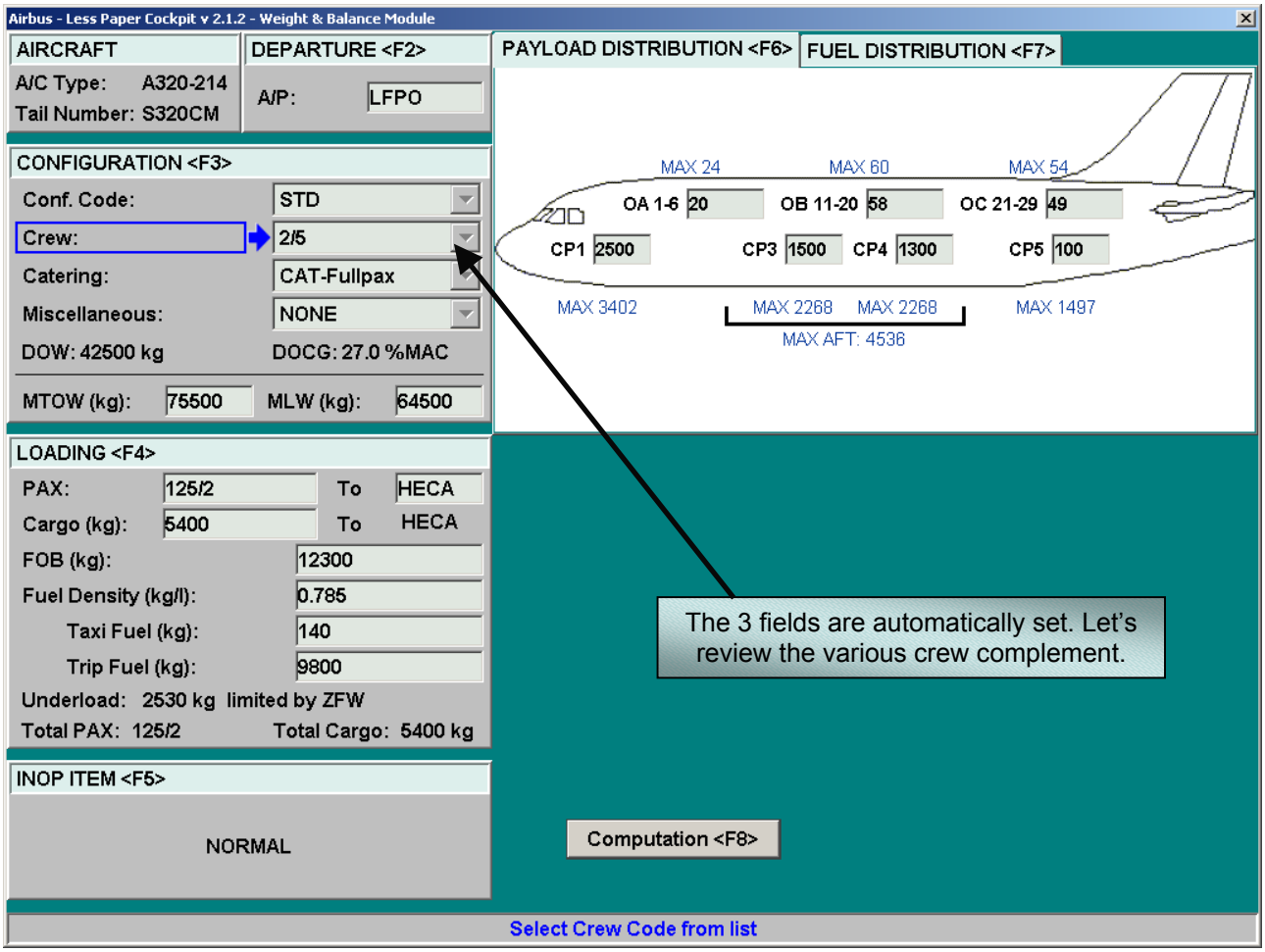
Press Enter to confirm your choice.



The blue highlight has automatically moved to the next field.

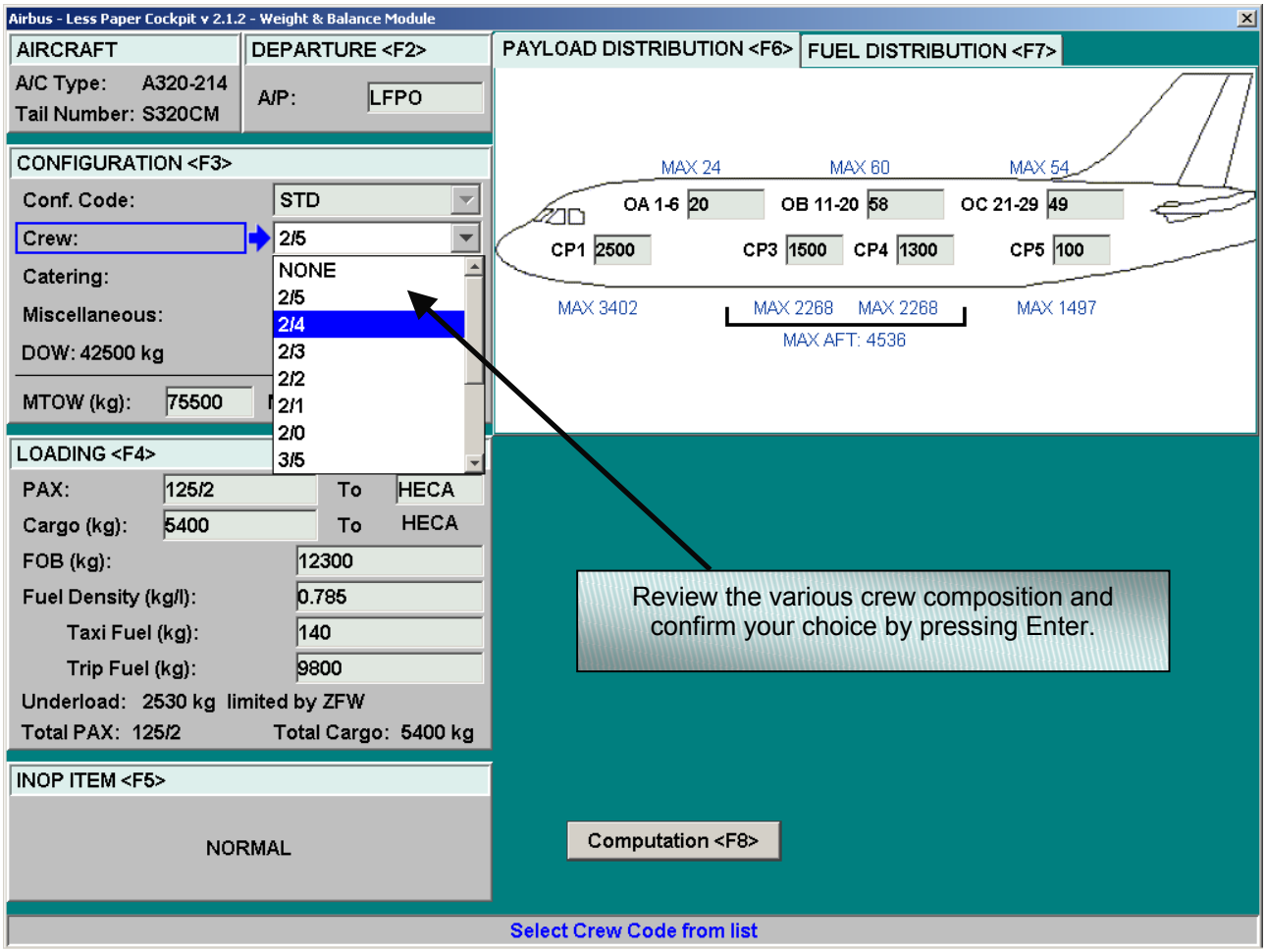
Press enter to display the scroll down menu.

Note: you can move between the various fields by using the up/down arrows on the keyboard.



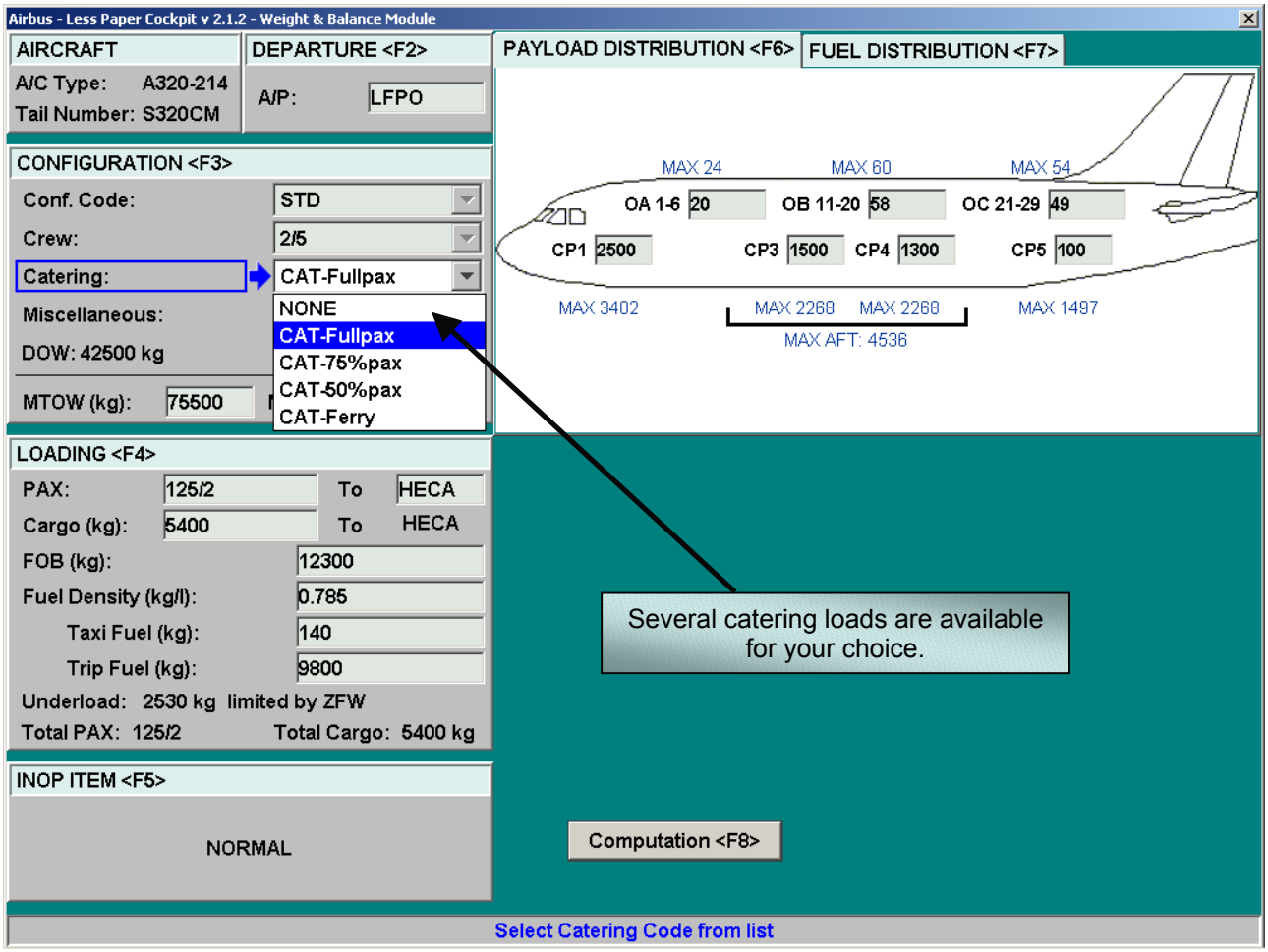
The various crew compositions have been entered by your company administrator.

Select the numbers corresponding to your flight by using the up/down arrows and press enter.



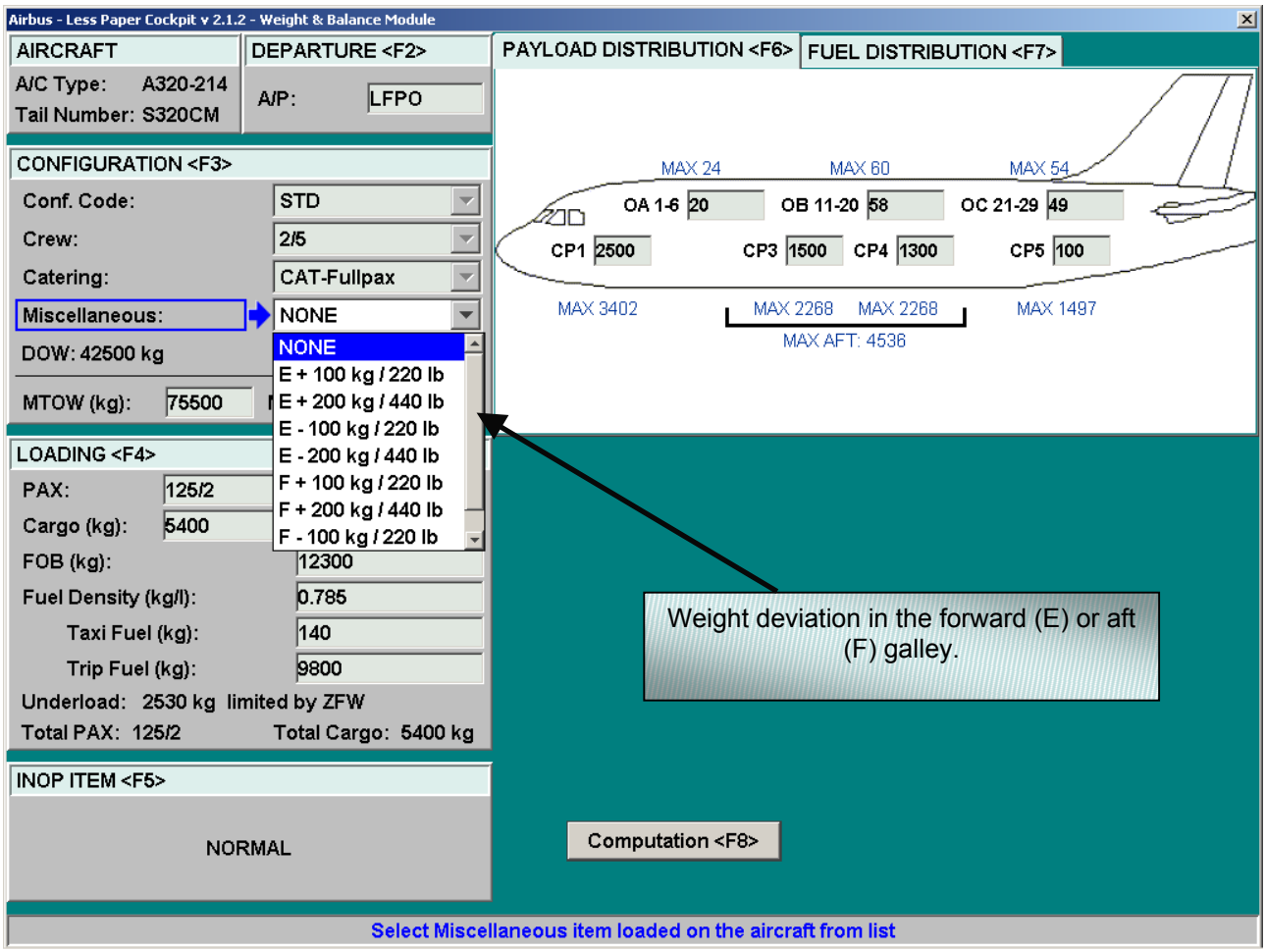
The various catering loads have also been entered by your company administrator.

Select the load corresponding to your flight.



Miscellaneous enables you to enter weight deviations in the galleys into the W&B calculations, (extra equipment, missing carts…).

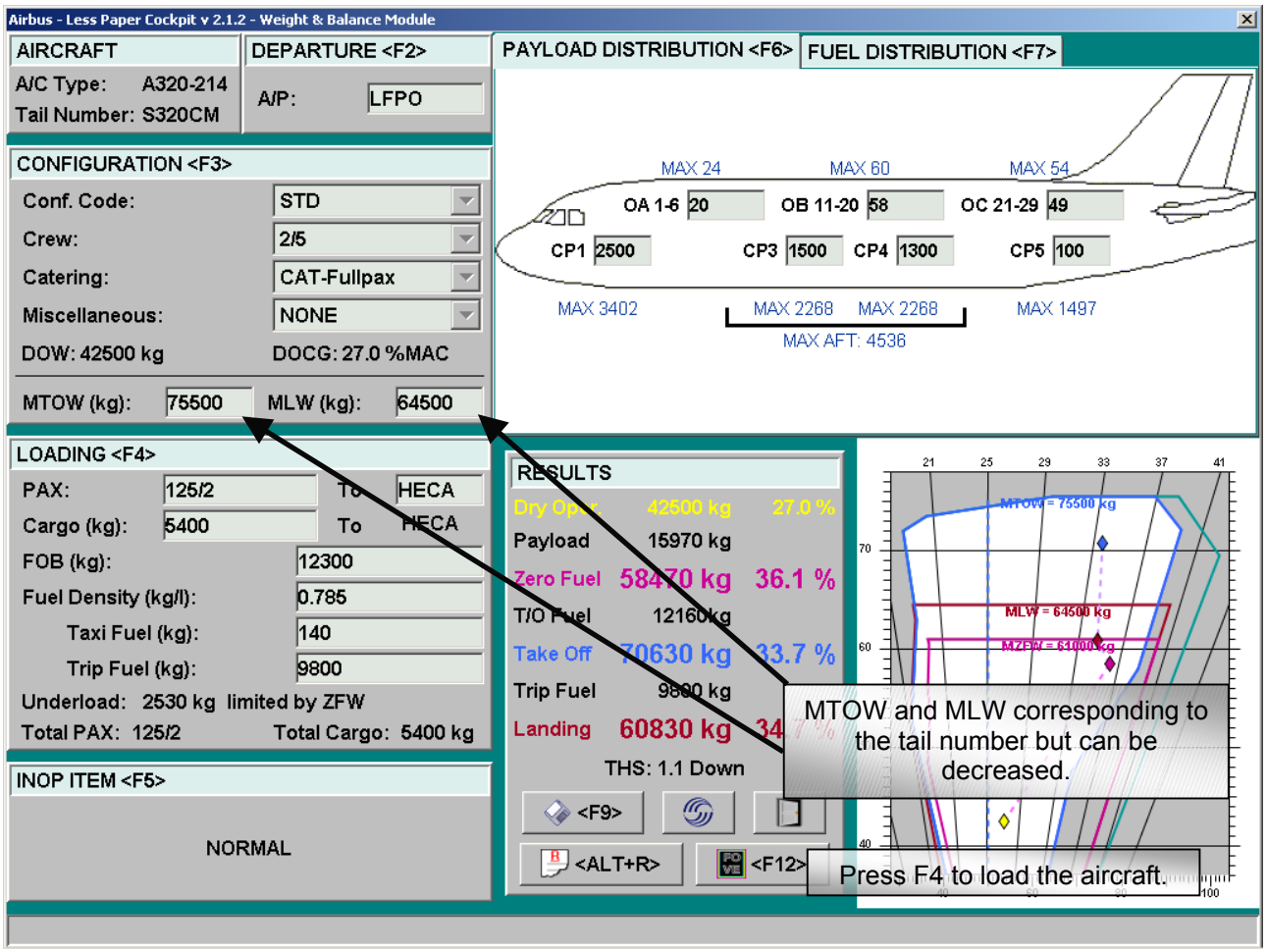
Select the extra or missing load corresponding to your flight.



The MTOW and MLW are automatically set for each tail number and take into account the maximum values computed in the TakeOff and landing modules.

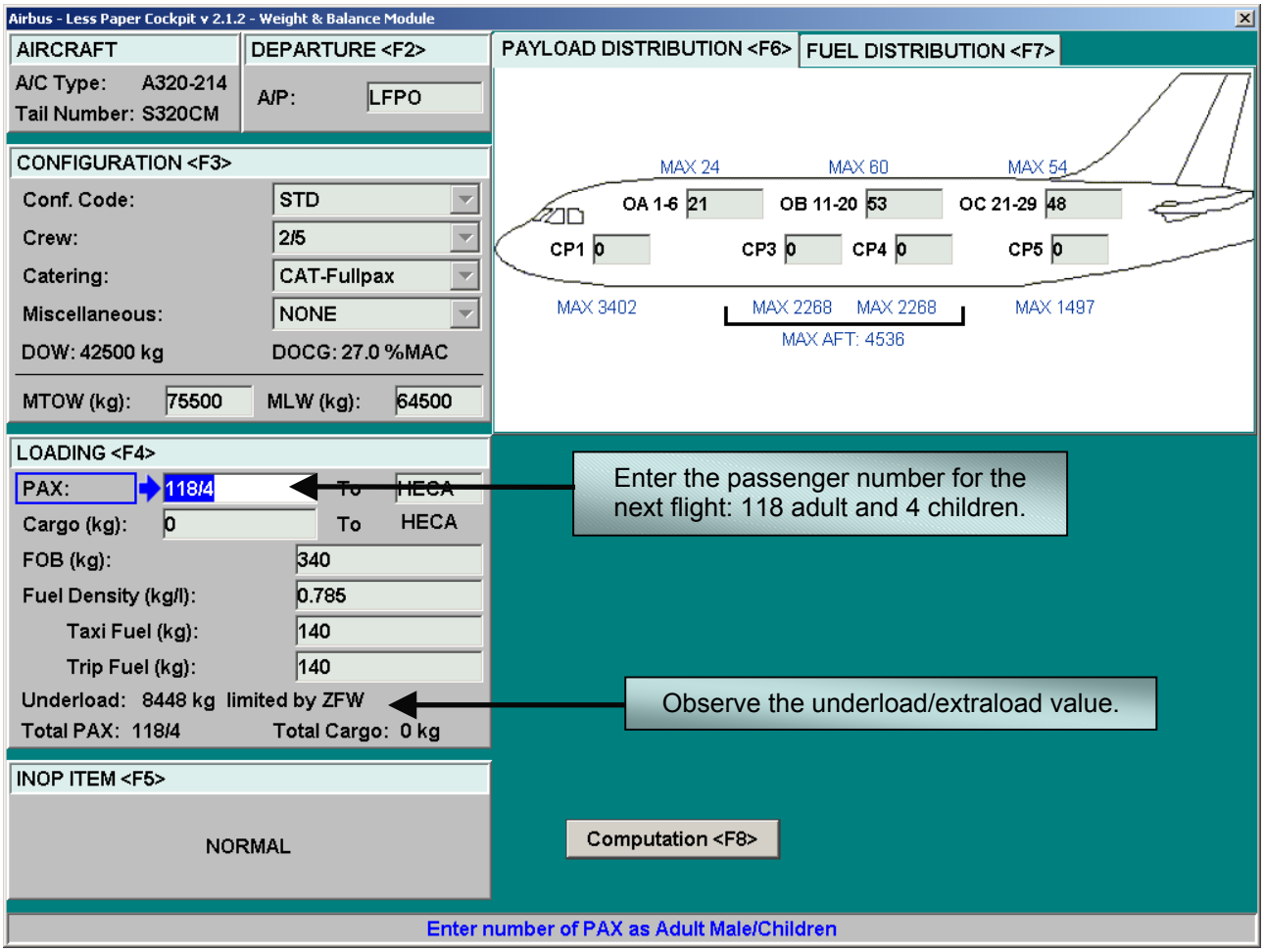
You can modify these values, BUT NOT set them above the structural limitations.

Press F4 to enter the passenger, cargo and fuel load.



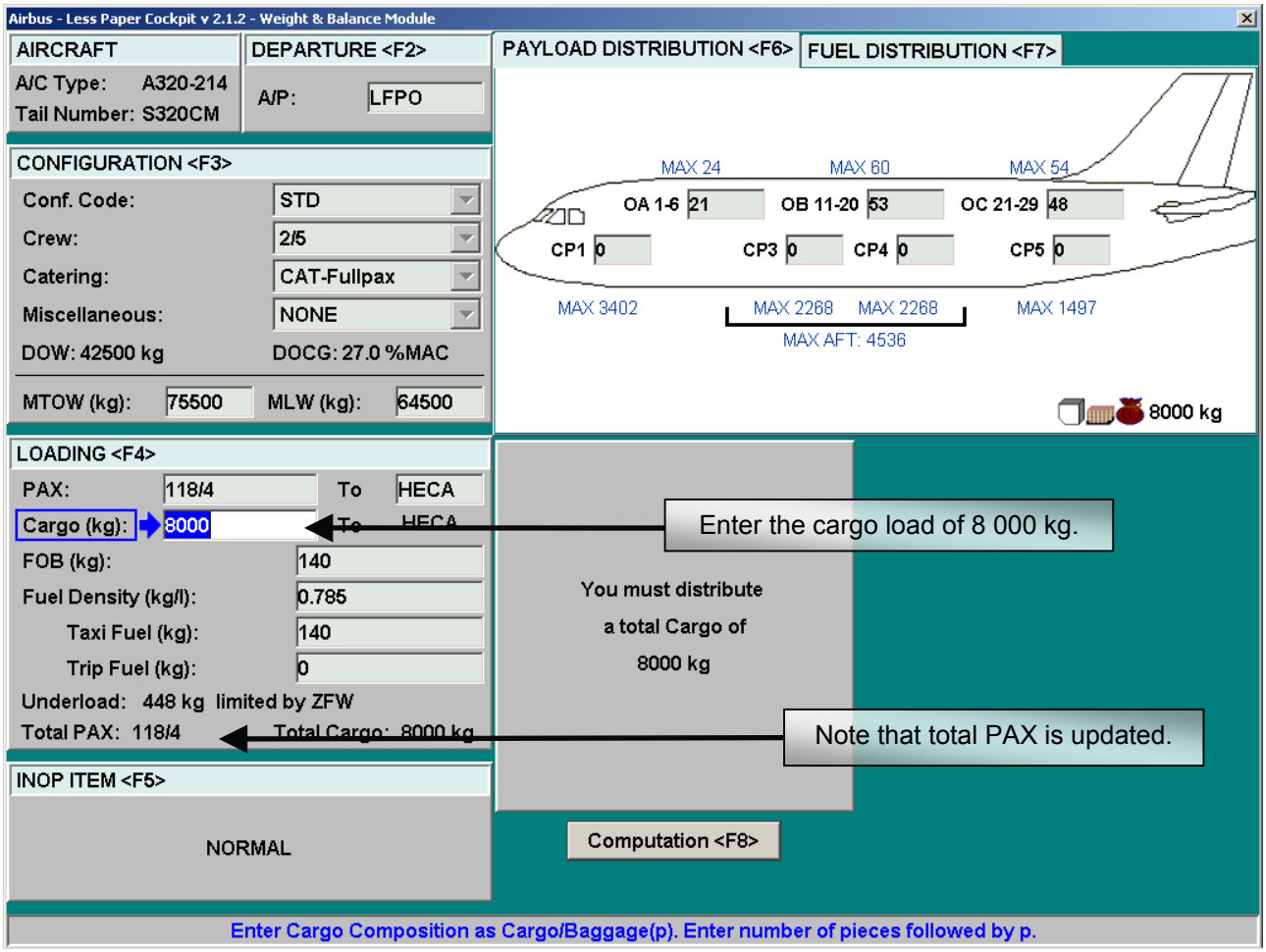
Load the aircraft by starting by the passengers. Type 118/4 en press enter.

Observe the underload/extraload line that changes as the aircraft is loaded. It's black for underload and changes to magenta for extraload (overload).



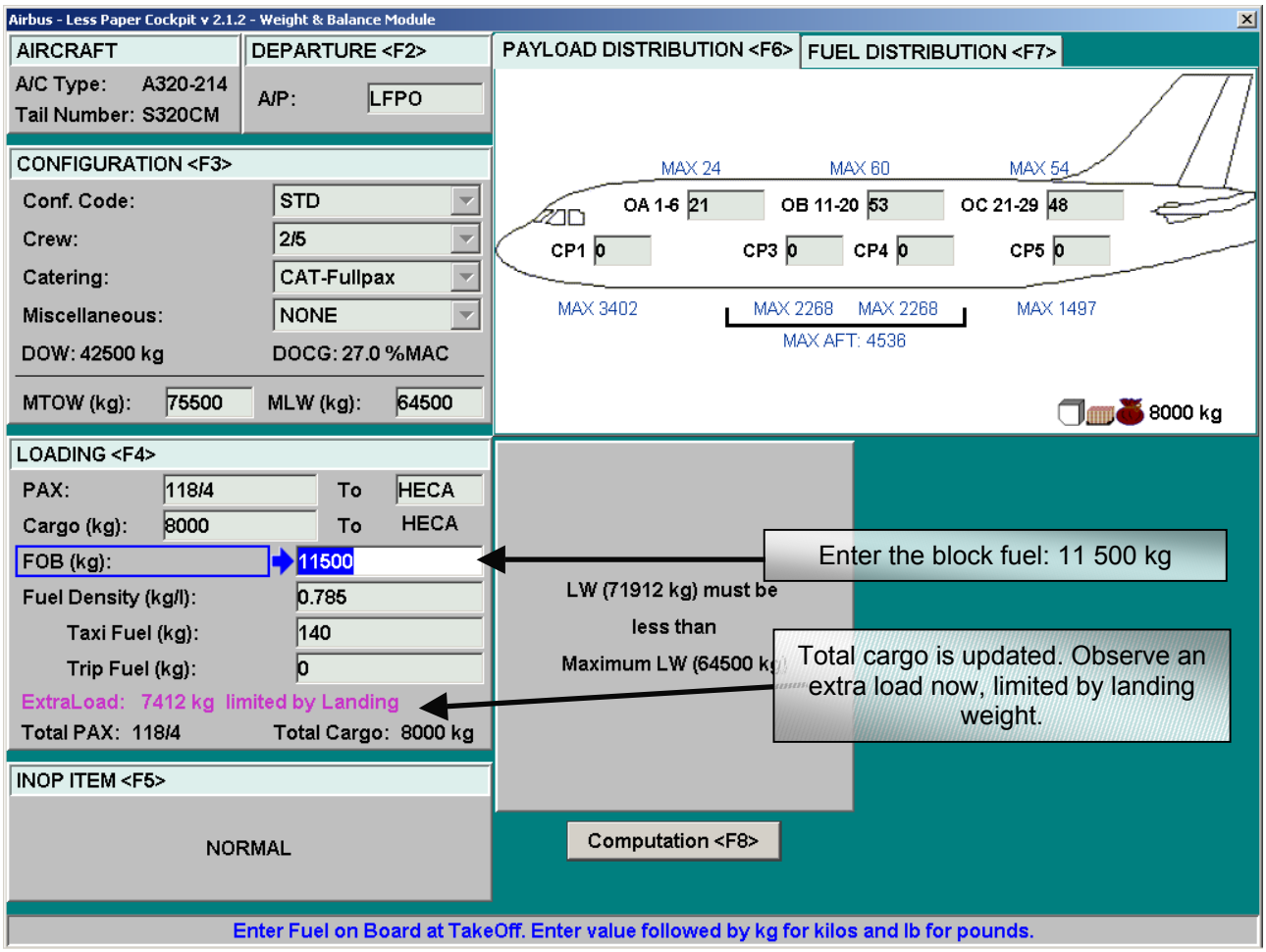
After you have entered the passenger number, note that total pax is automatically updated.

Continue with the cargo load of 8 000 kg including the luggage.

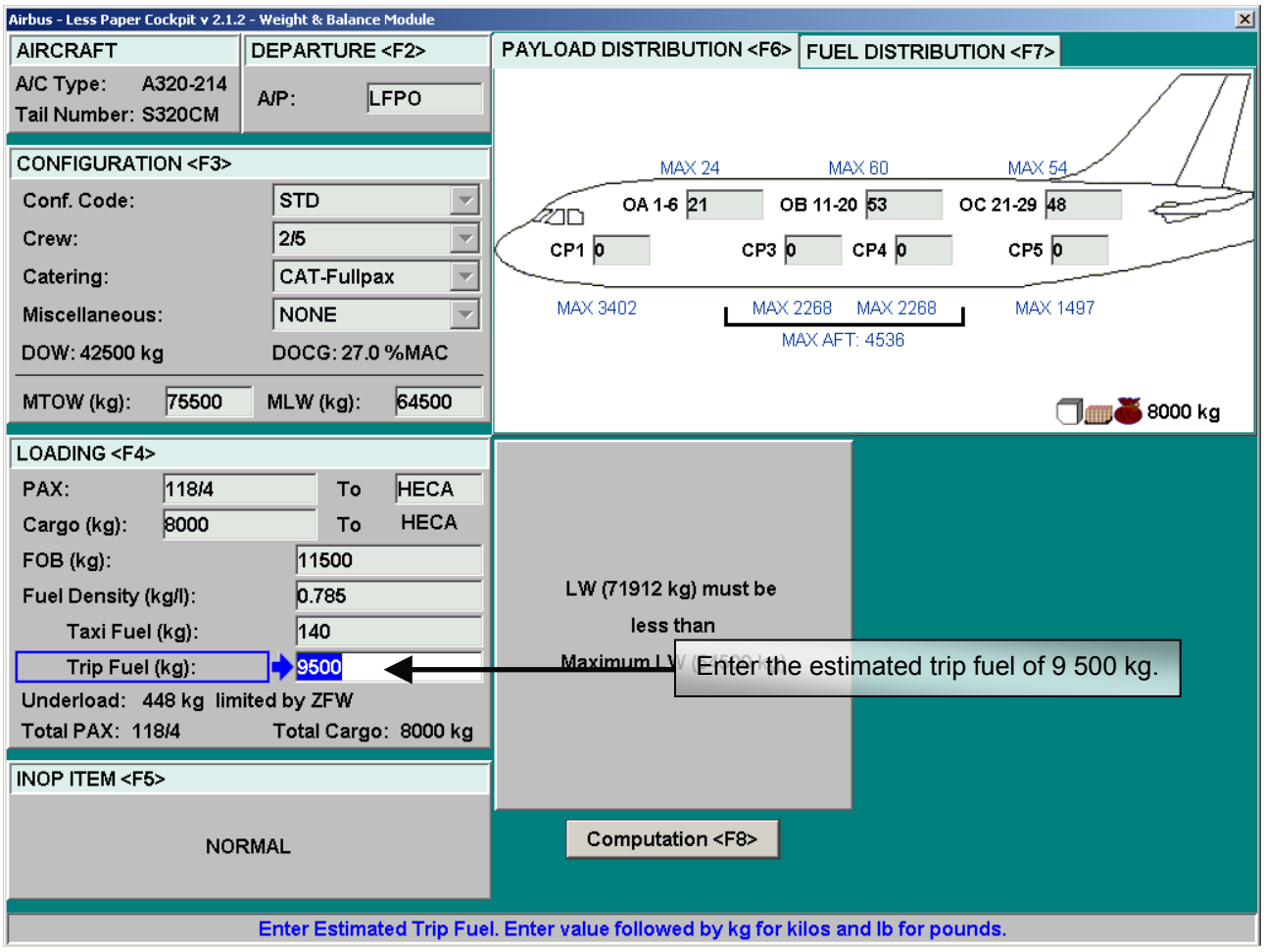


Total cargo is automatically updated. Observe that the underload/extraload line has changed to magenta for extraload (overload).

Enter the fuel on board (11 500 kg) which is the block fuel.

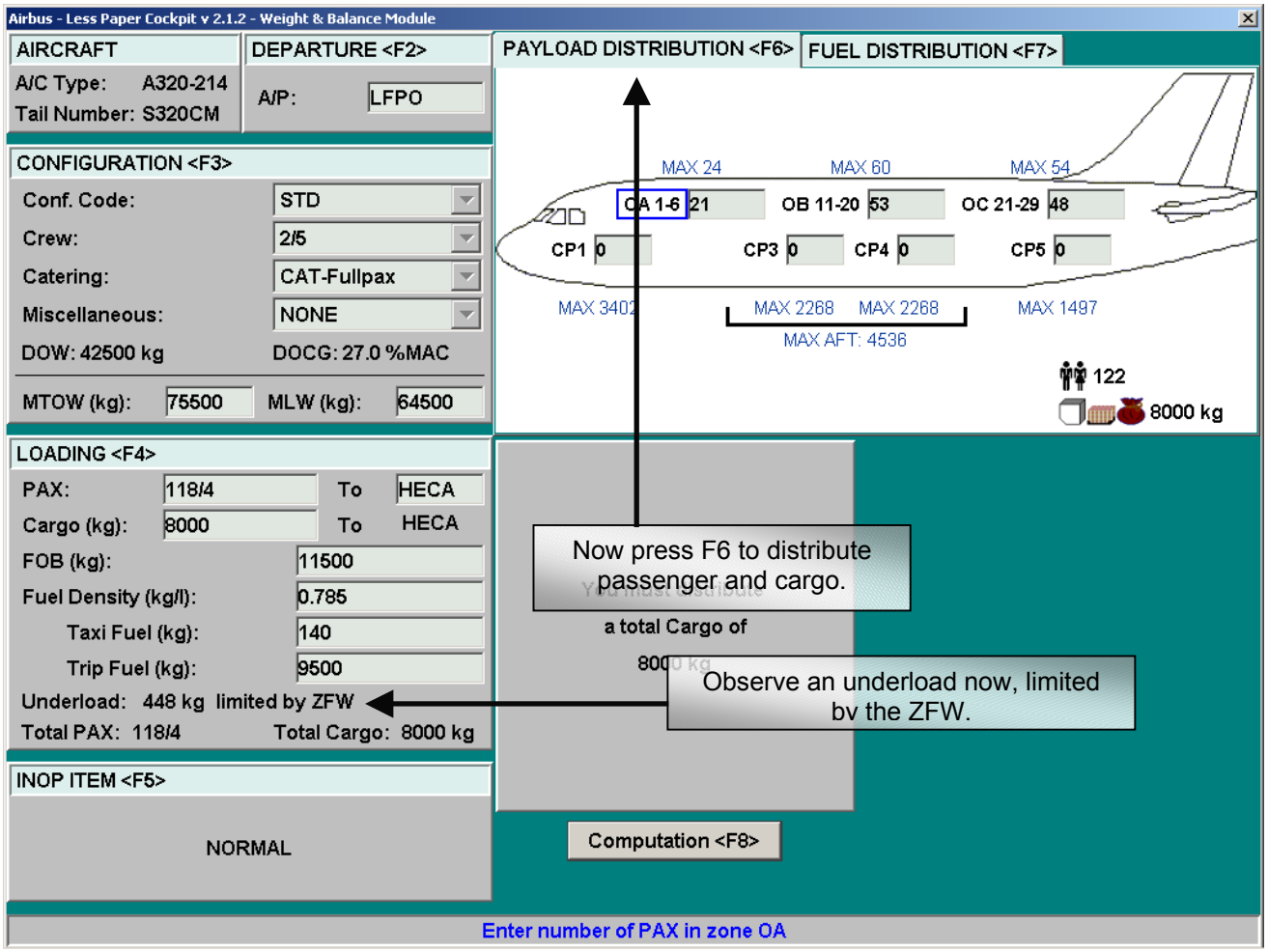


Continue with the estimated trip fuel of 9 500 kg.



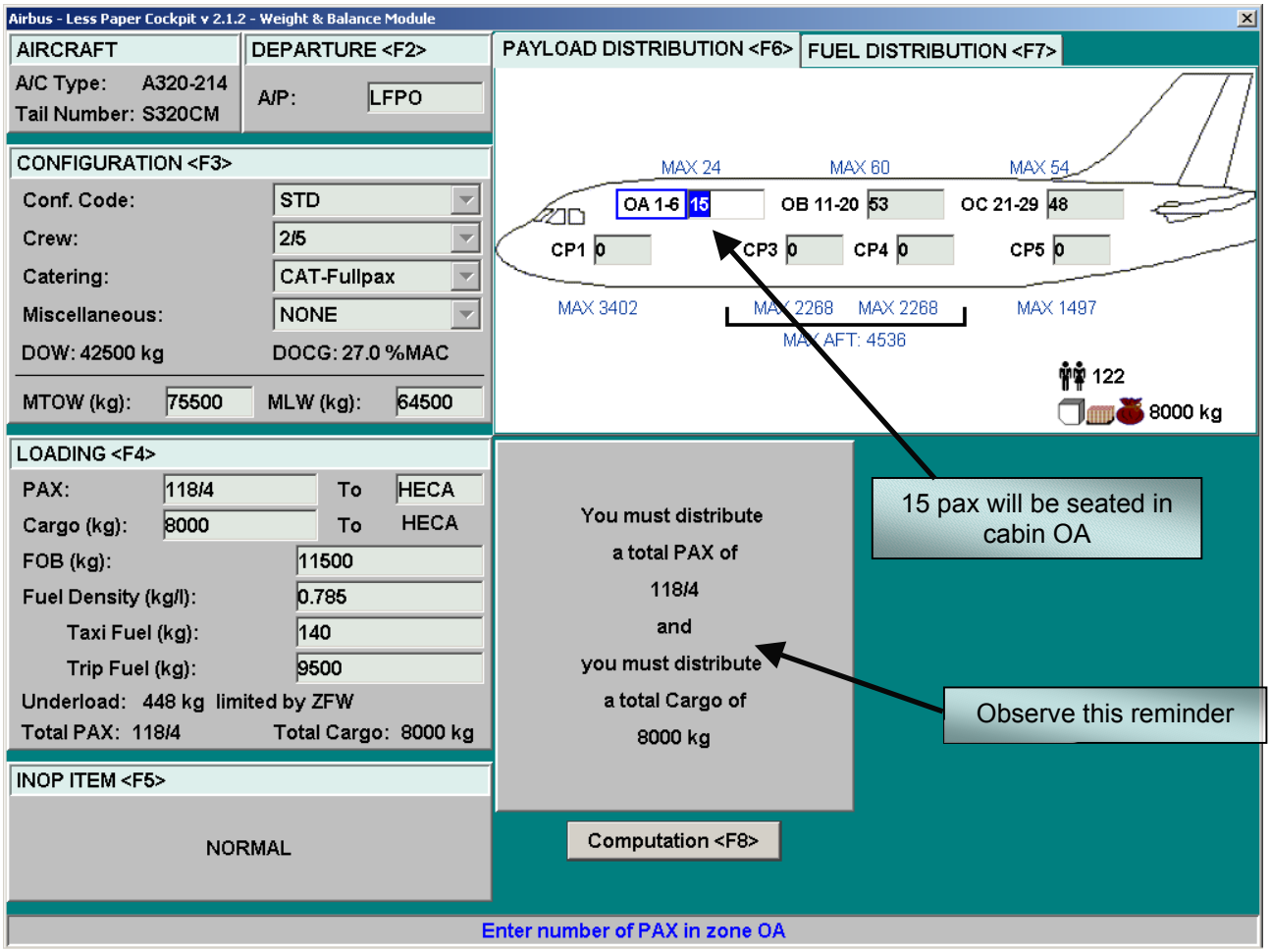
Note that our loading is good as we have a slight underload.

You have now to distribute the passengers and cargo in the various compartments. Press F6.



The passengers are automatically evenly distributed between the various cabin zones.

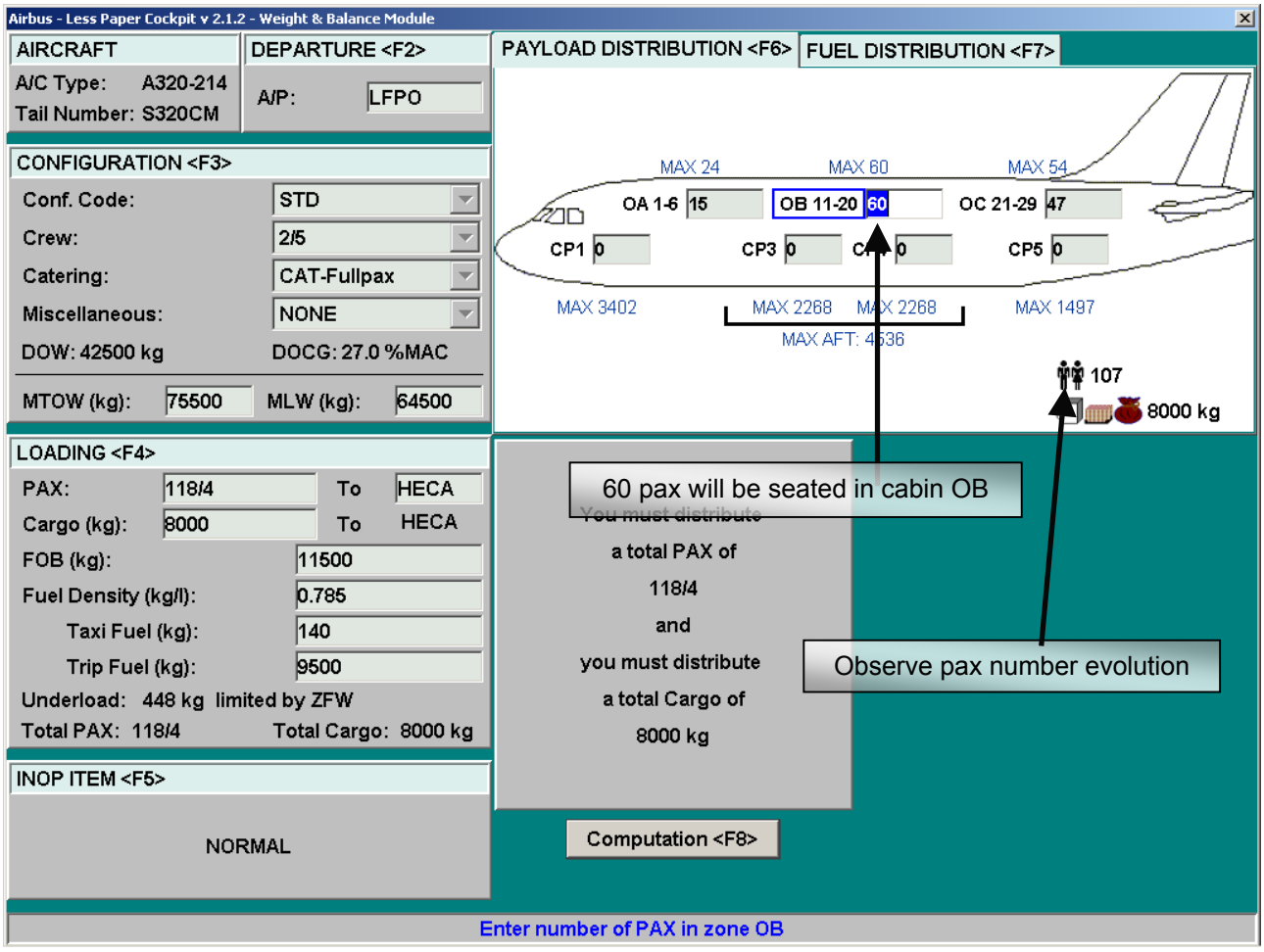
You can use the keyboard to modify any value and validate by pressing enter.



Note that passengers number to be seated is automatically modified.

The input field has automatically jumped to cabin OB.

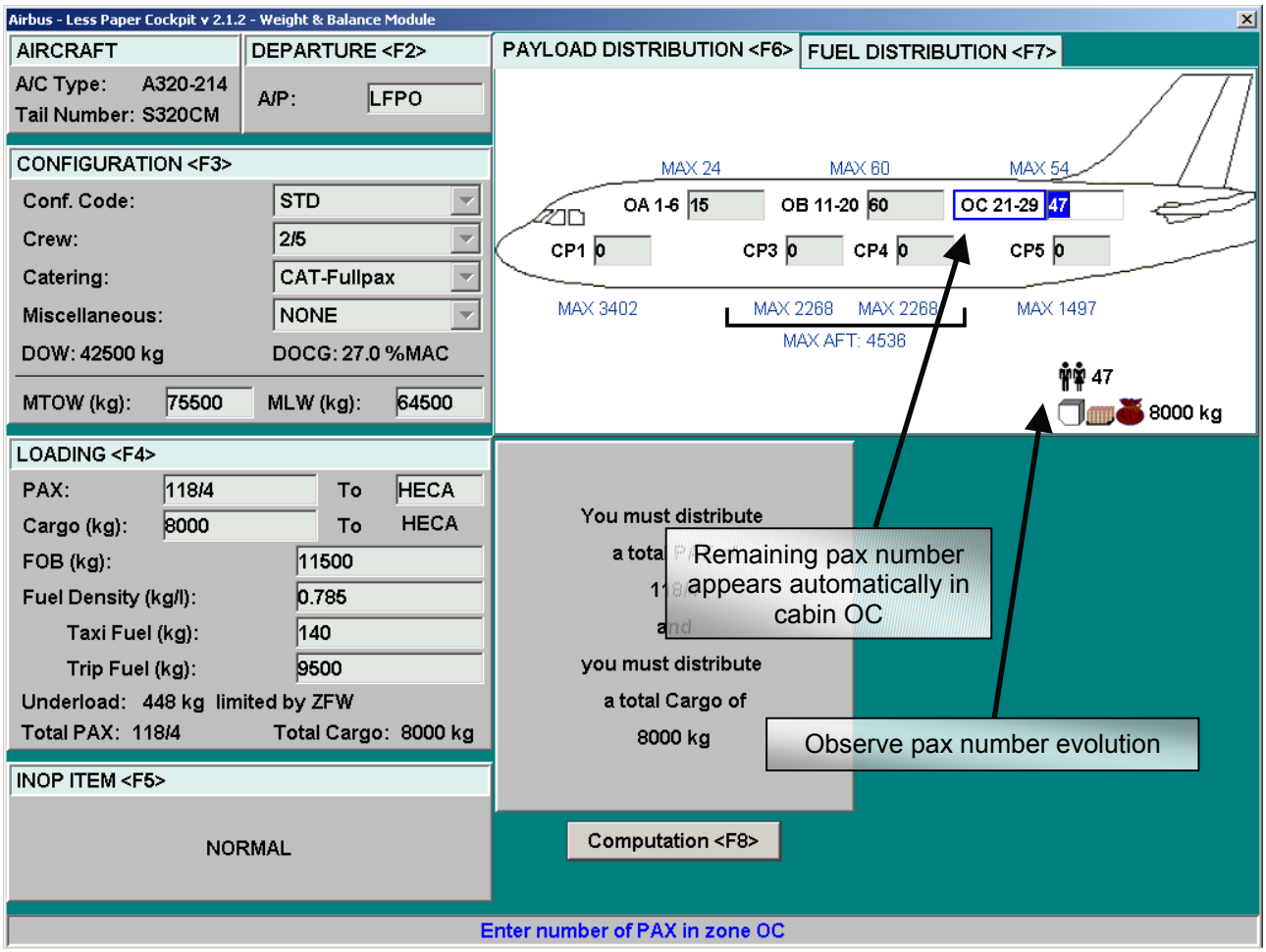
Enter 60 pax here.



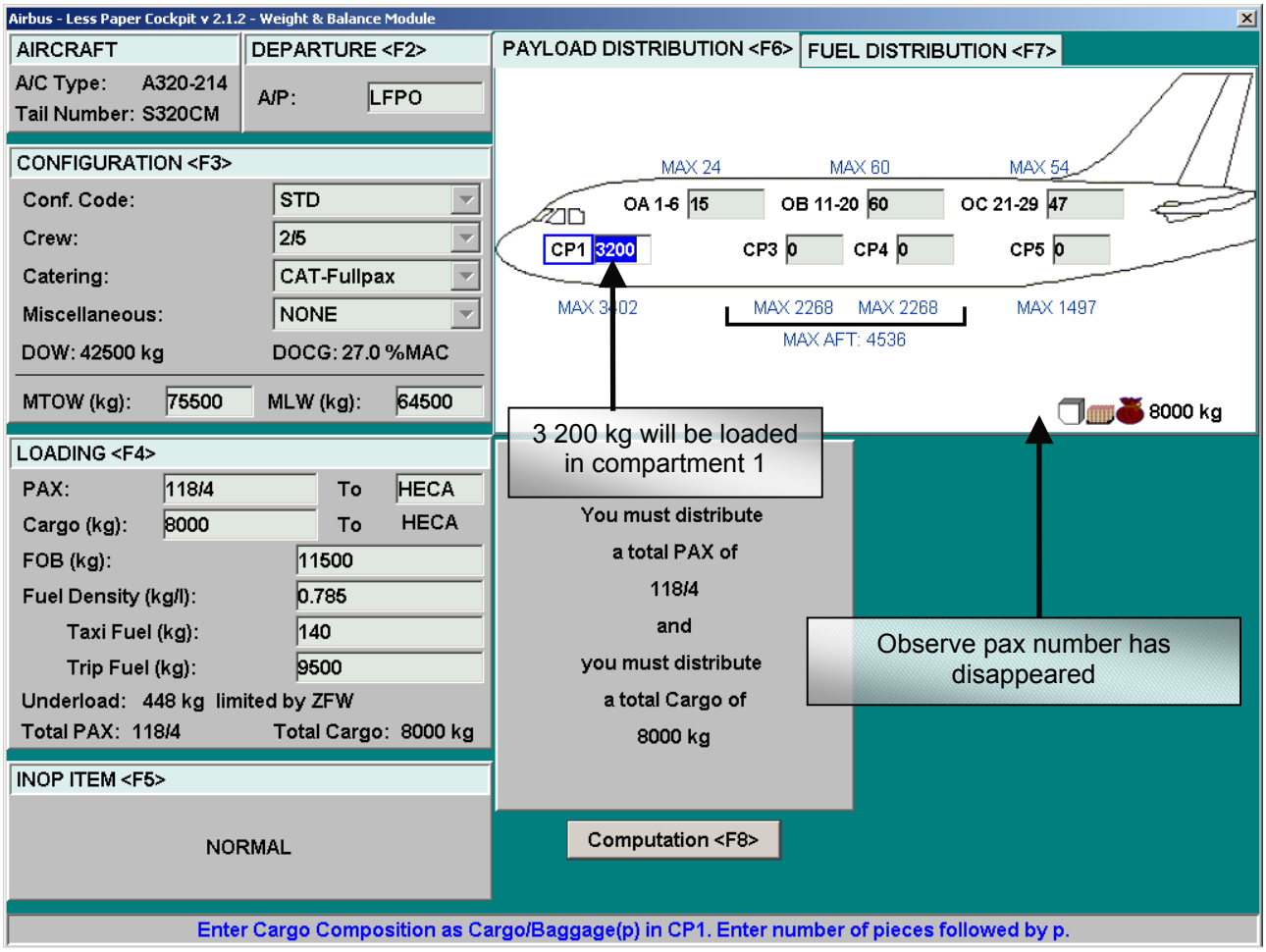
The input field has automatically jumped to cabin OC and the number of remaining passengers is automatically displayed in field OC.

Validate by pressing enter.

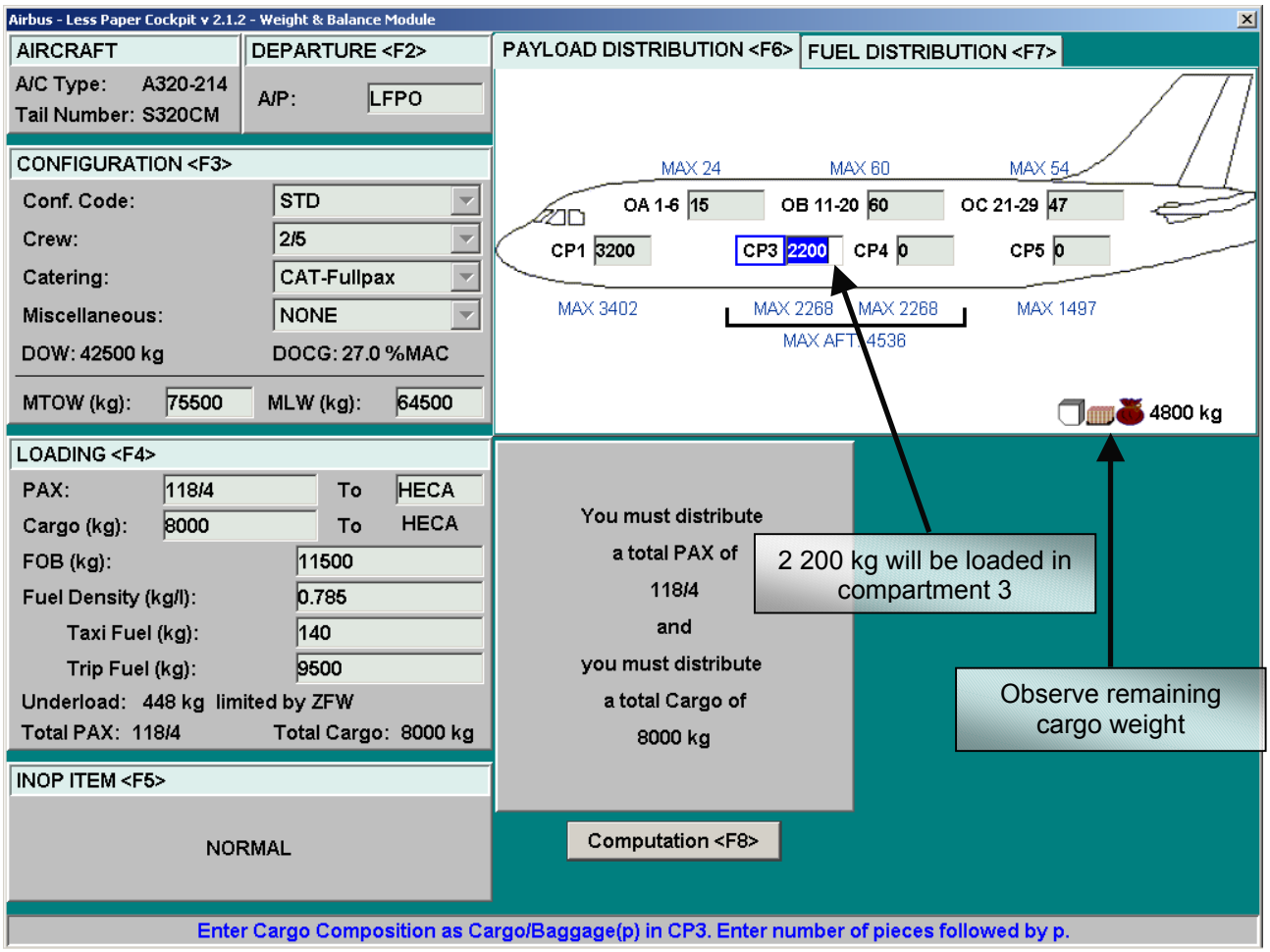
The next step is to load the cargo.



Cargo is entered in the same way with 3 200 kg to go into compartment 1.

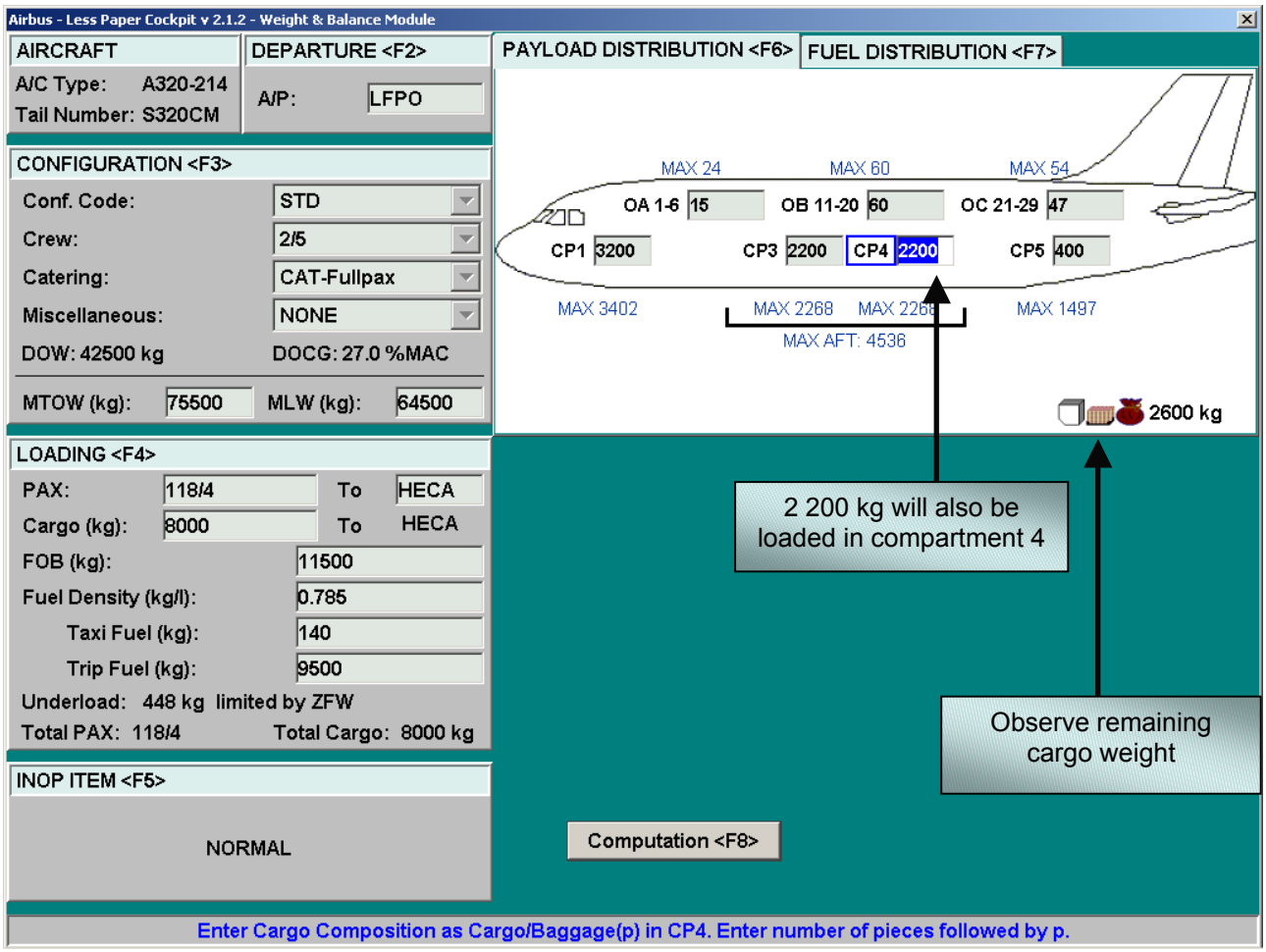


Cargo is entered in the same way with 2 200 kg to go into compartment 3. Note that there is no compartment 2.



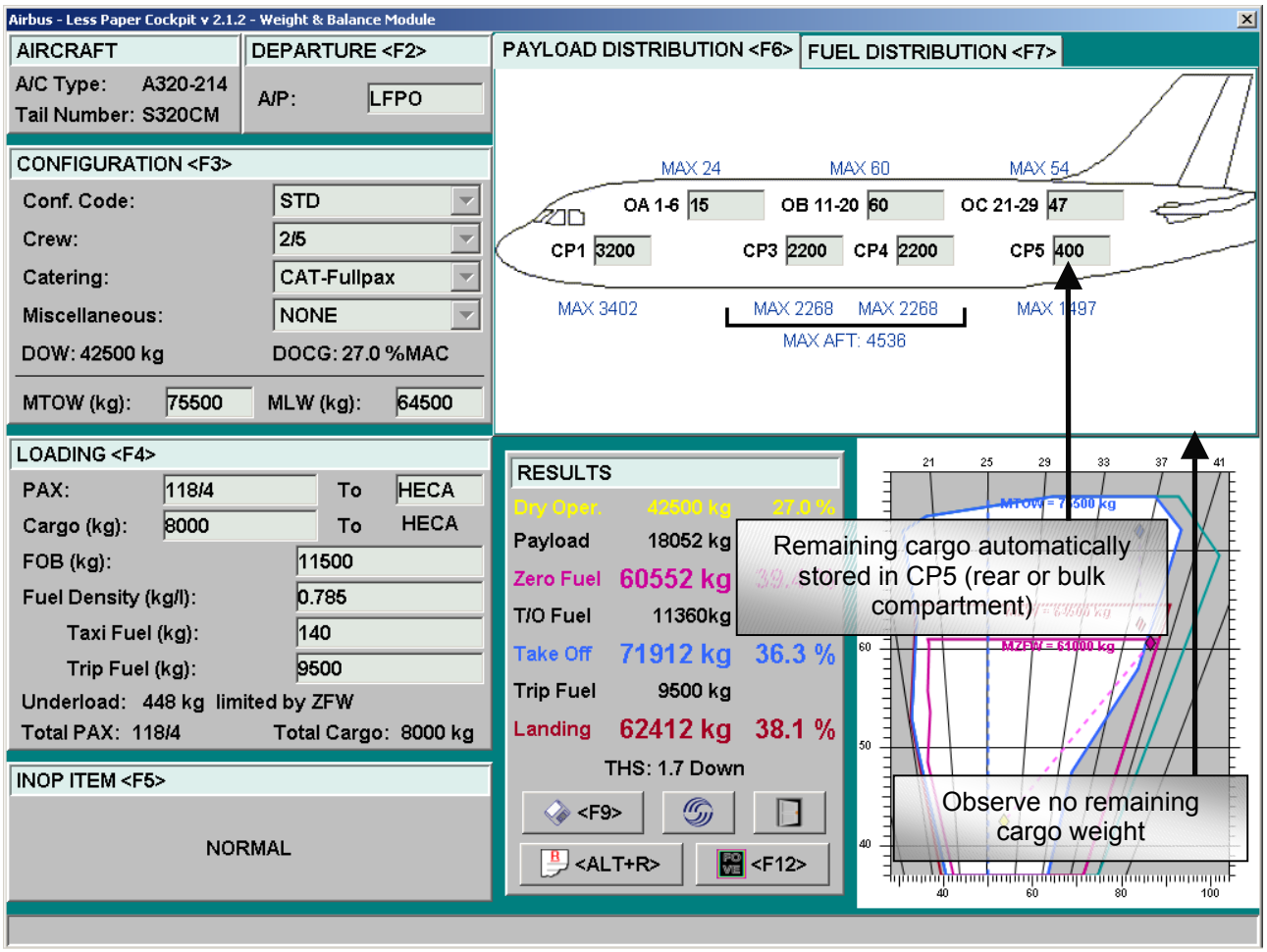
Cargo is entered in the same way with 2 200 kg to go into compartment 4.

To have a better fuel consumption, remember to keep a CG as far aft as possible by loading most of the cargo in the rear cargo compartments.



The remaining cargo is automatically entered in field CP5, up to maximum capacity. There is no remaining cargo weight.

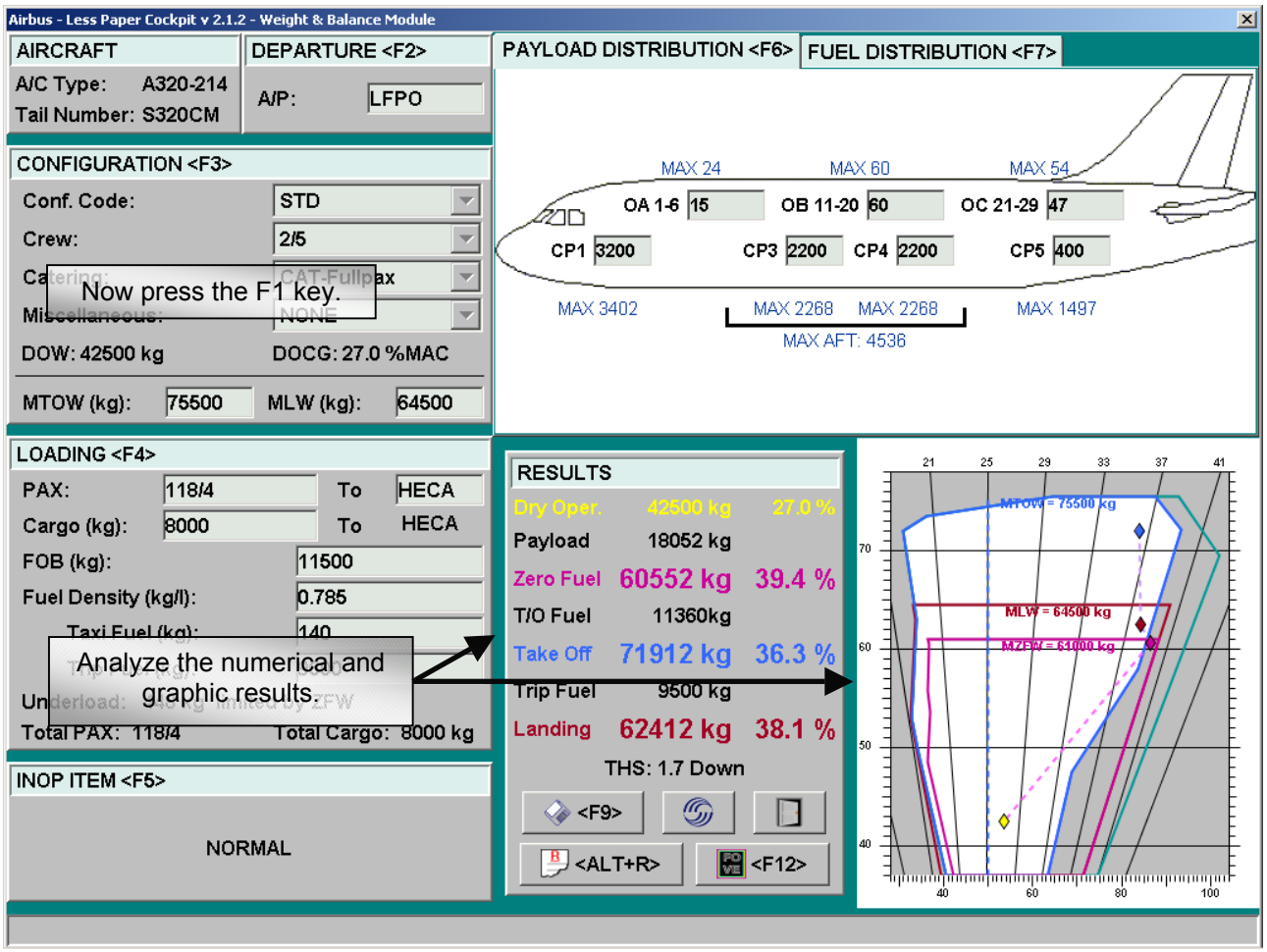
The calculation is automatically launched.



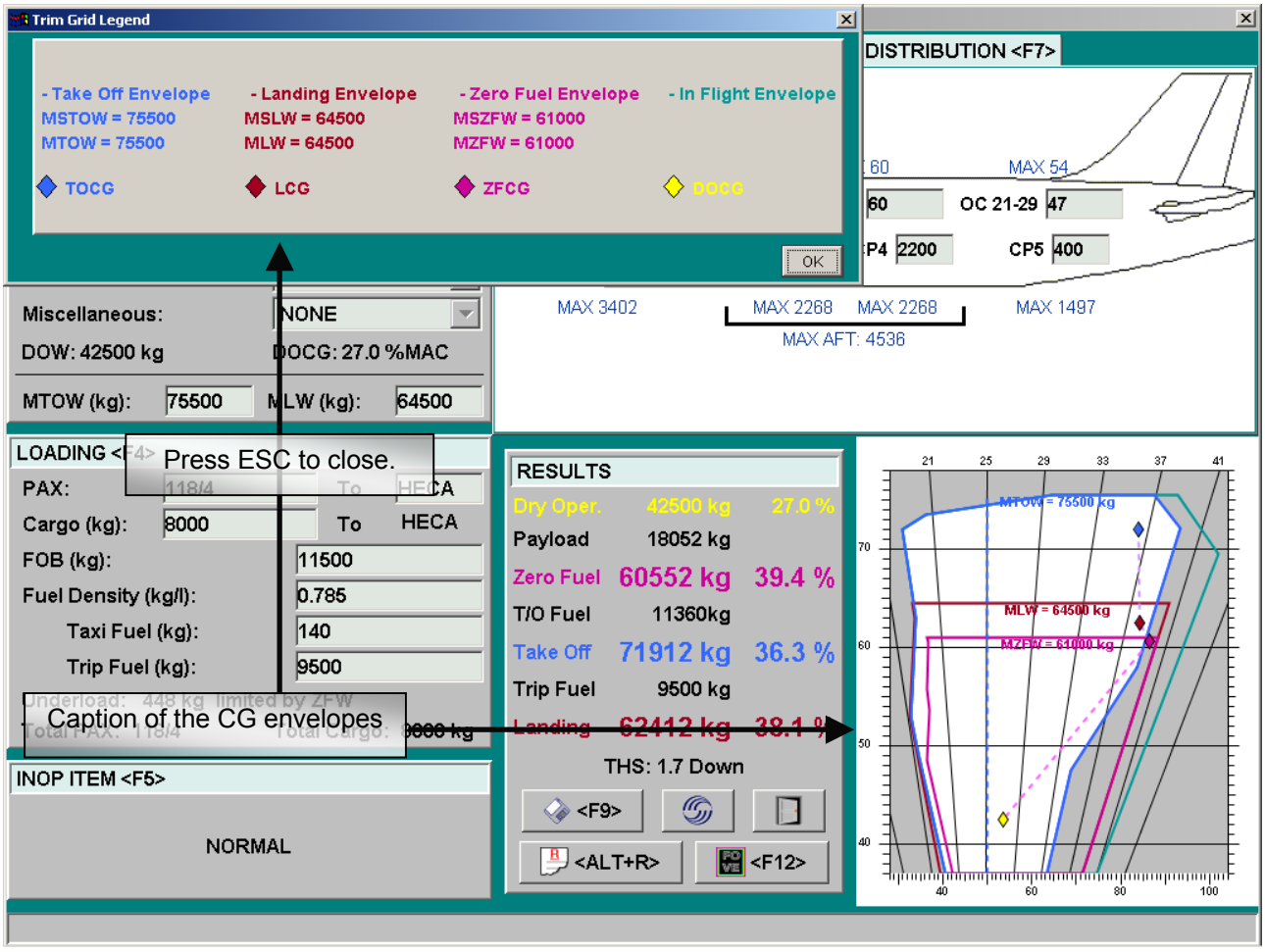
Analyze the results both in numerical and graphic format.

Observe that the CG has been kept as far aft as possible.

Press F1 key.



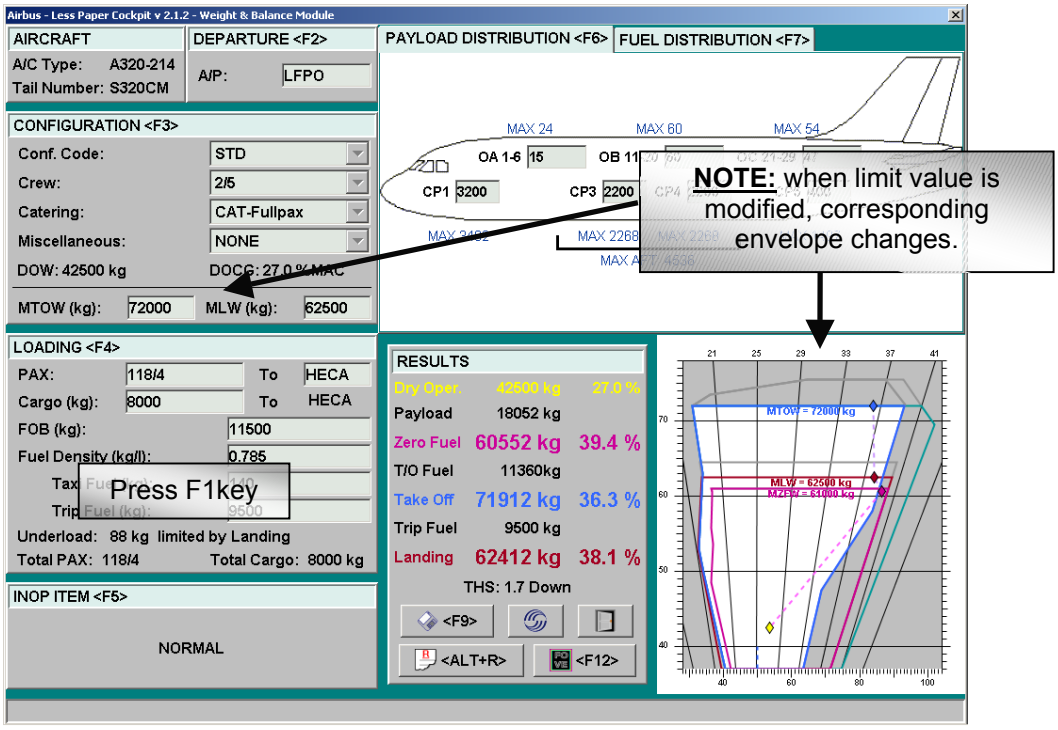
F1 gives access to the caption of CG envelopes and limit values: MTOW, MLW, MZFW.

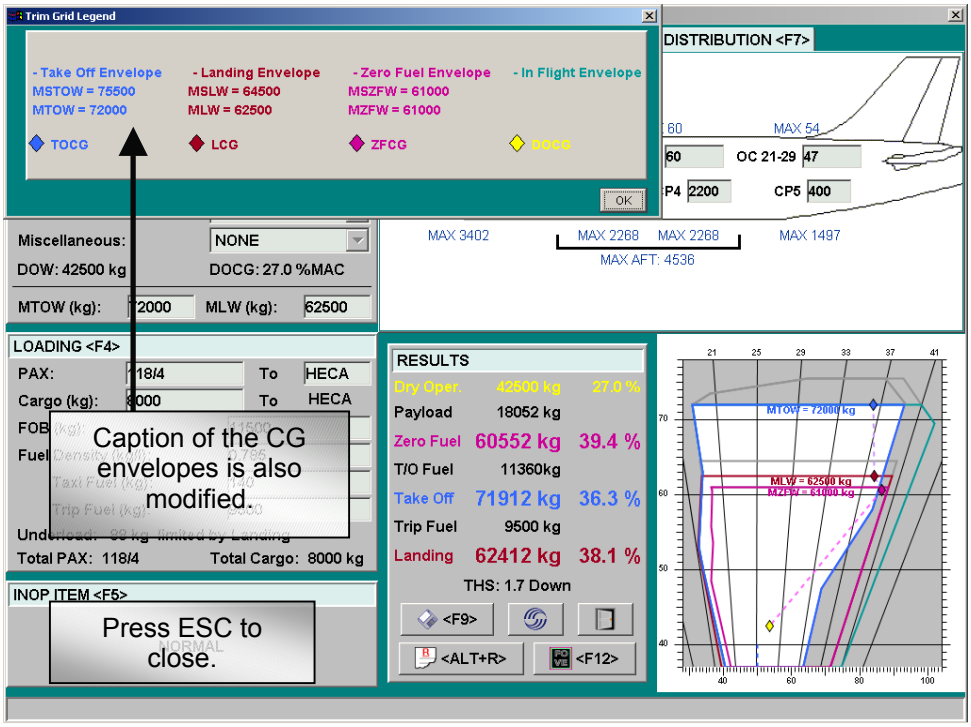


Note: as seen before, the MTOW or MLW can be modified.

The corresponding envelope changes accordingly.

Here MTOW has been decreased from 75 500 kg to 72 000 kg and MLW from 64 500 kg to 62 500 kg.

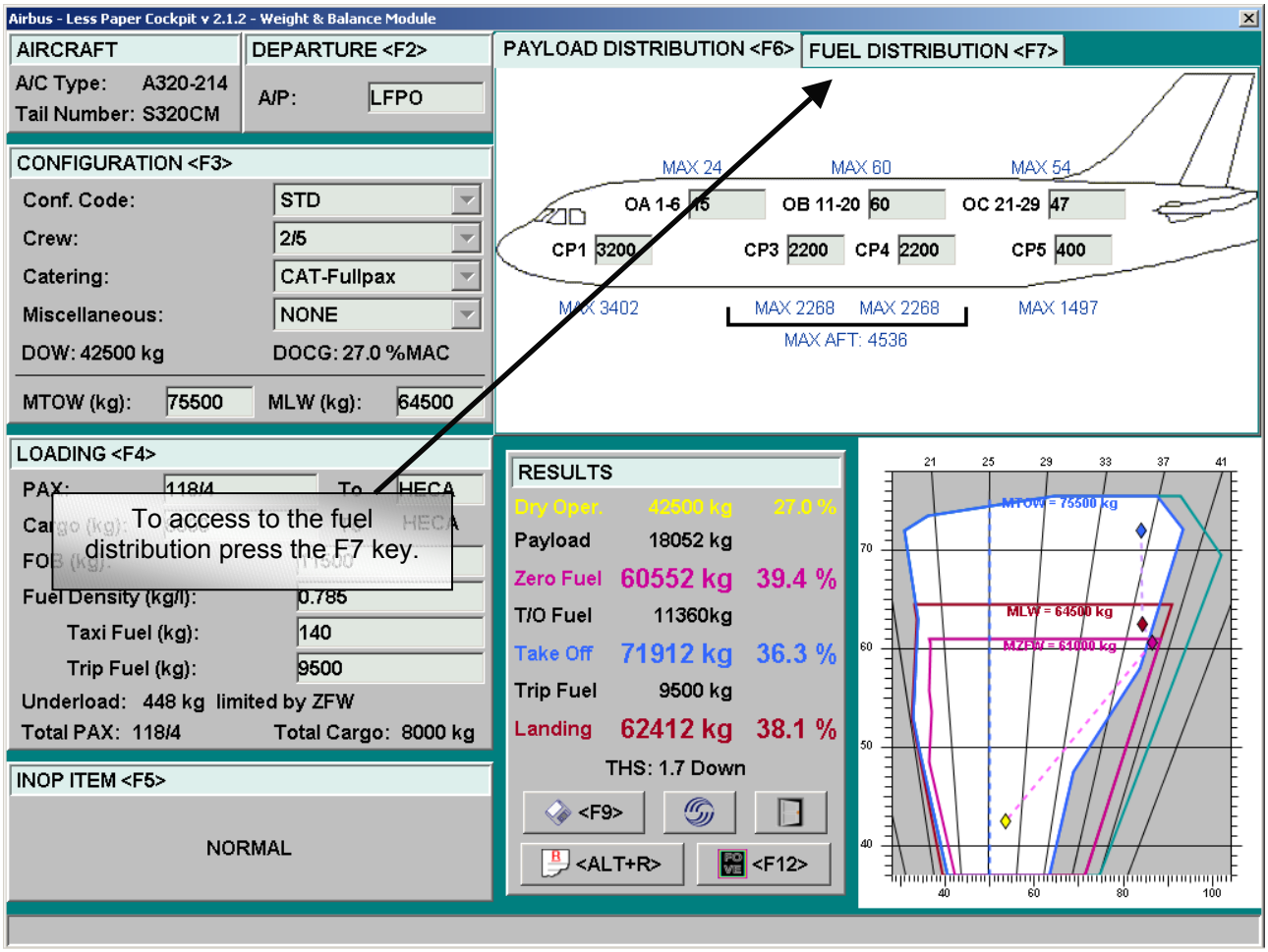




Type * into the MTOW and MLW boxes to recover the structural limitations.

Note: MTOW and MLW are back to 75 500 and 64 500 kg.

Press F7 key to look at the fuel distribution..

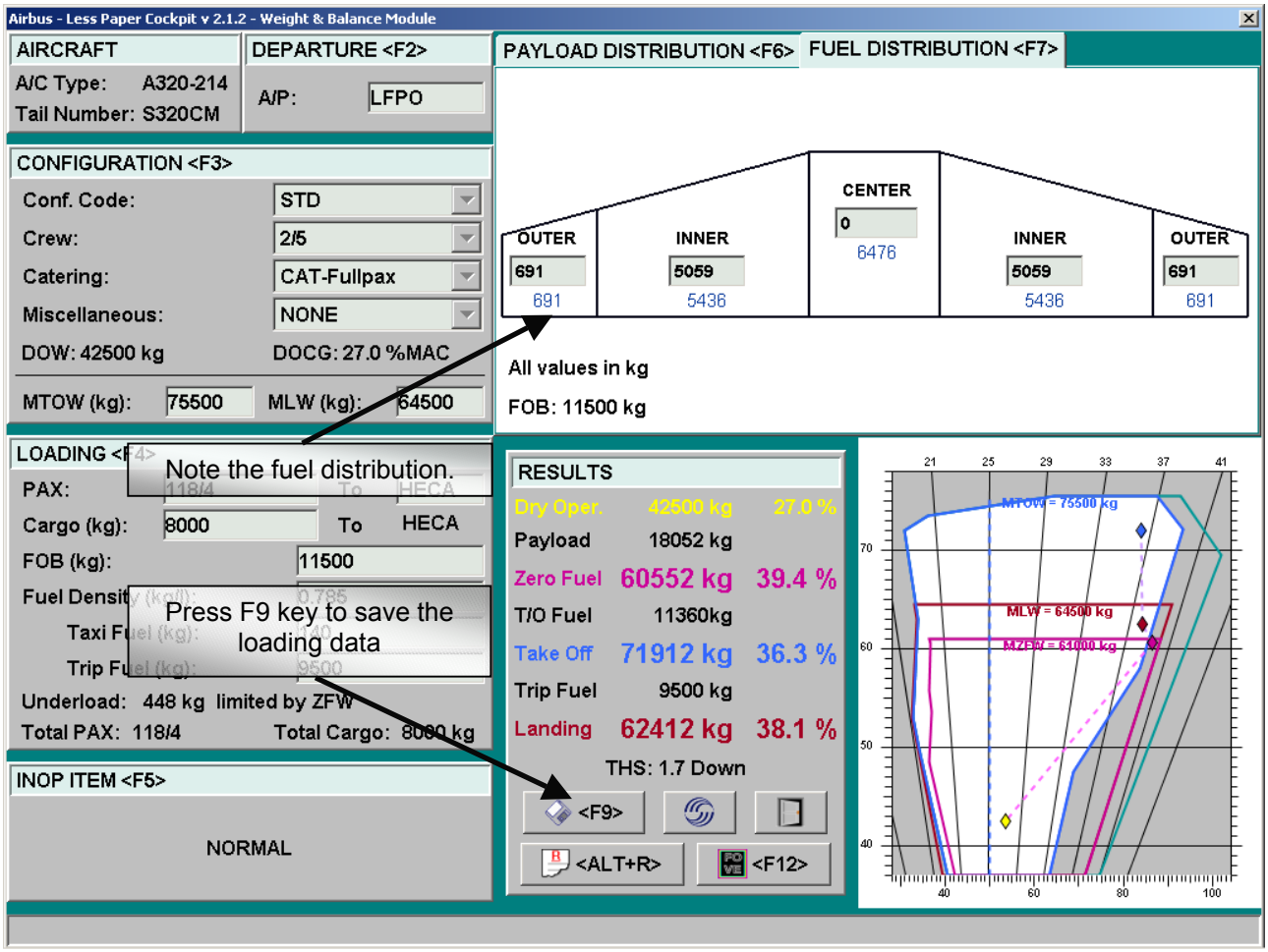


Study the fuel distribution, as determined by the LPC tool.

Note that it can be modified.

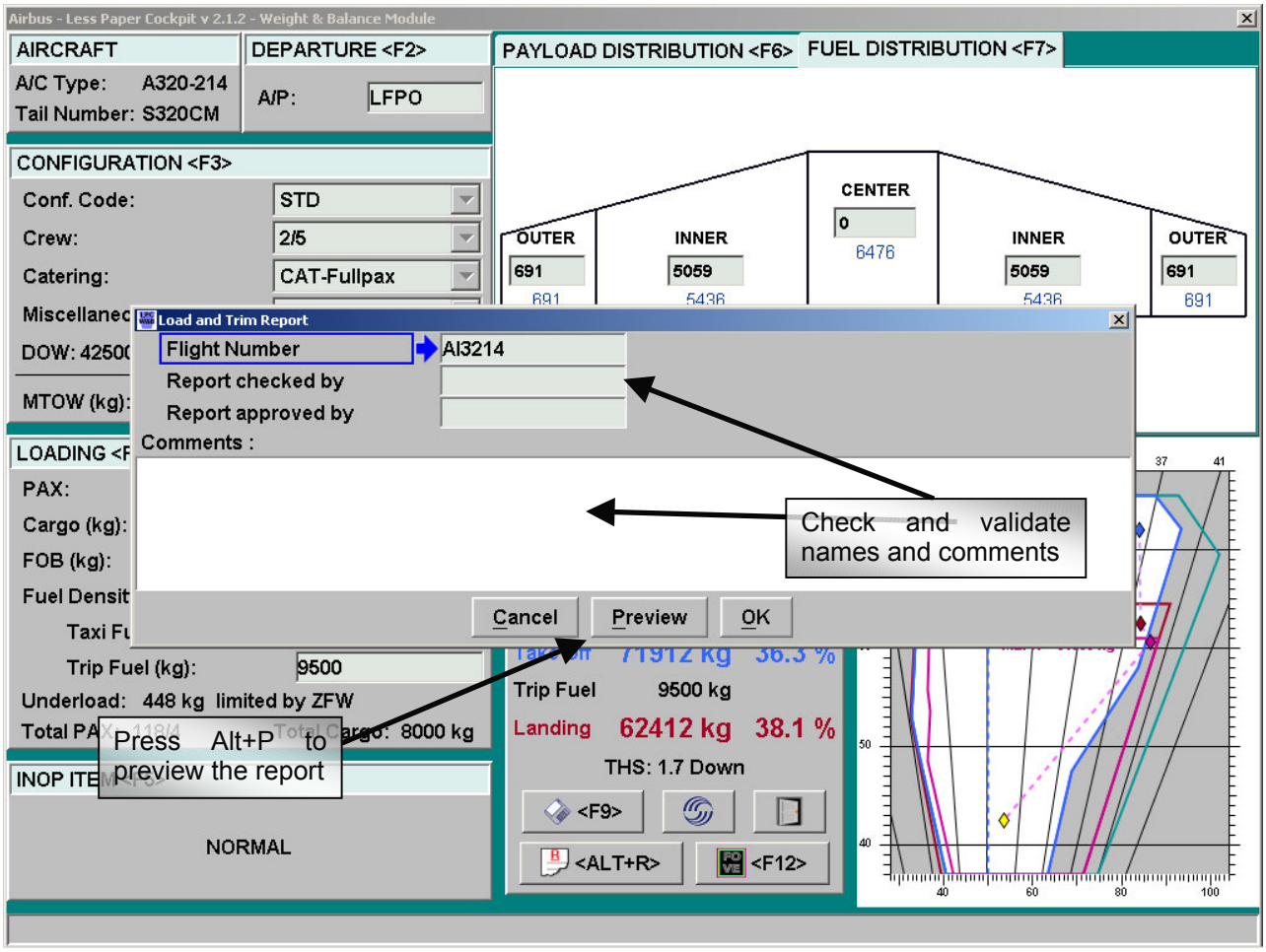
On A330/A340 an additional window is displayed for trim tank content.

F9 enables you to save the data for statistical purposes.

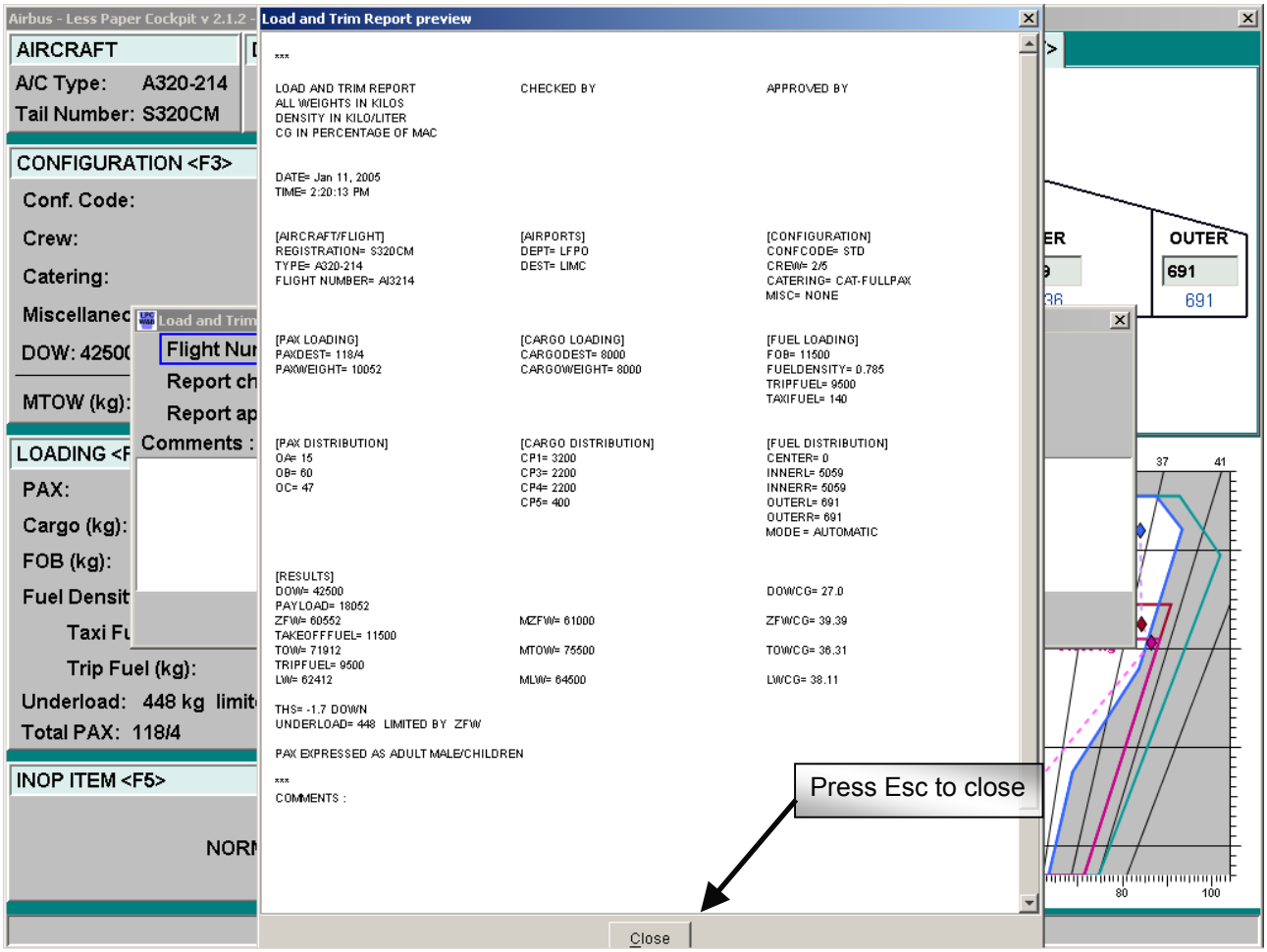


Enter name of checker and validator; comments if any.

The report can be previewed by pressing Alt + P.

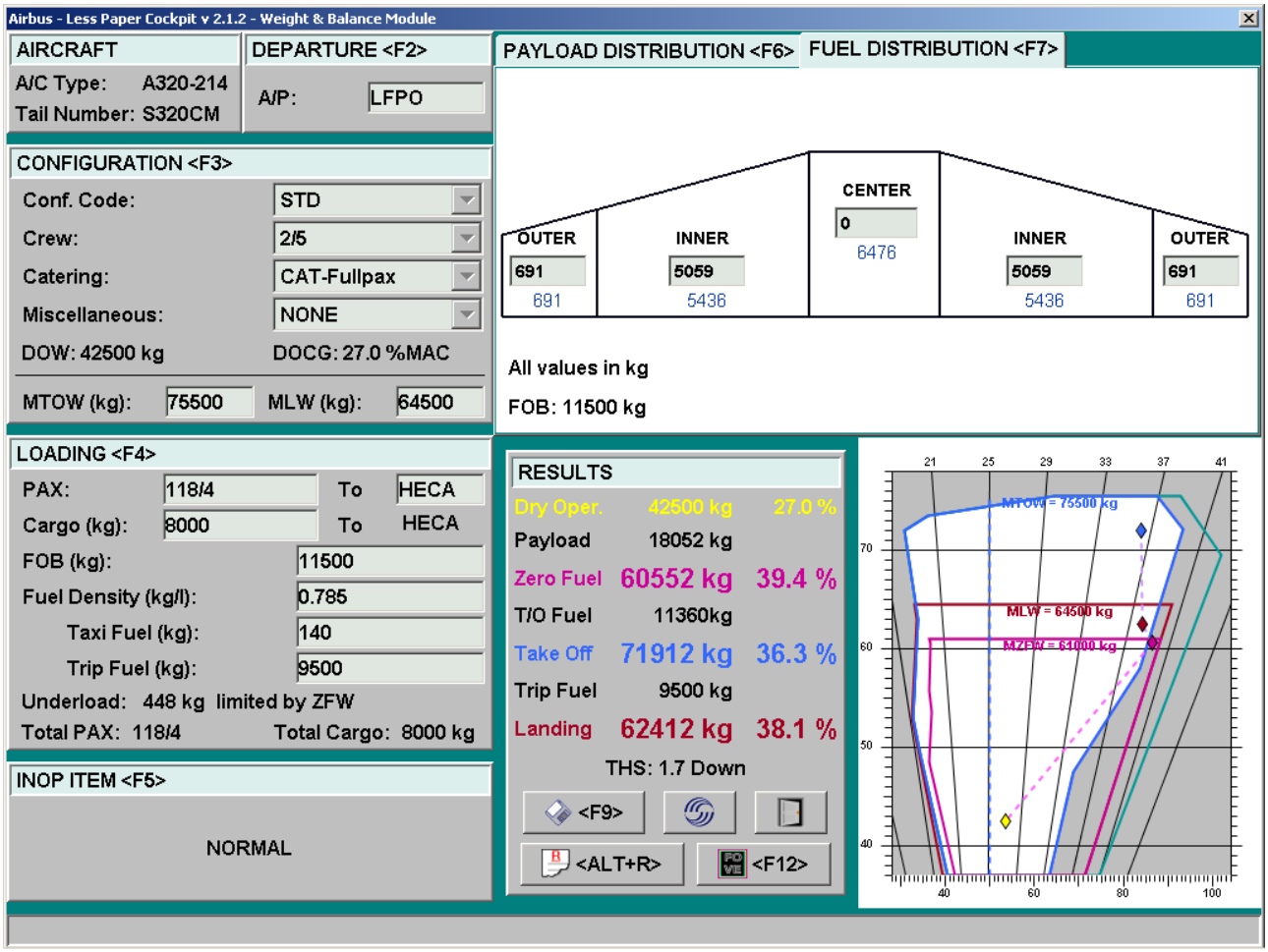


Study the report to spot any discrepancy.



We will now do some practical exercises.

Please go to the weight & balance module on your laptop.



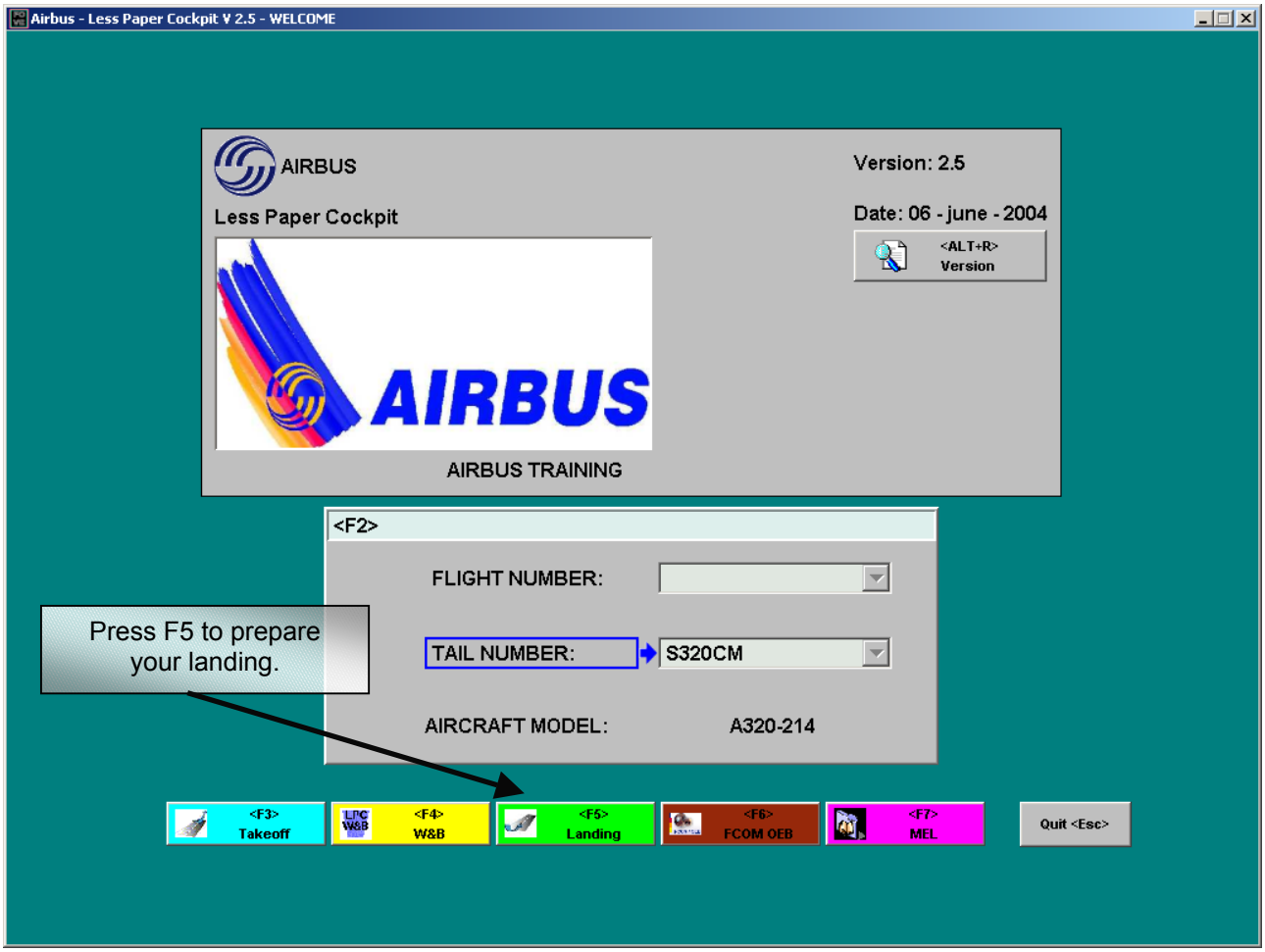
6. LPC APPROACH & LANDING PRESENTATION

CONTENTS:

6.1. Objectives

6.1.1. Dispatch Conditions

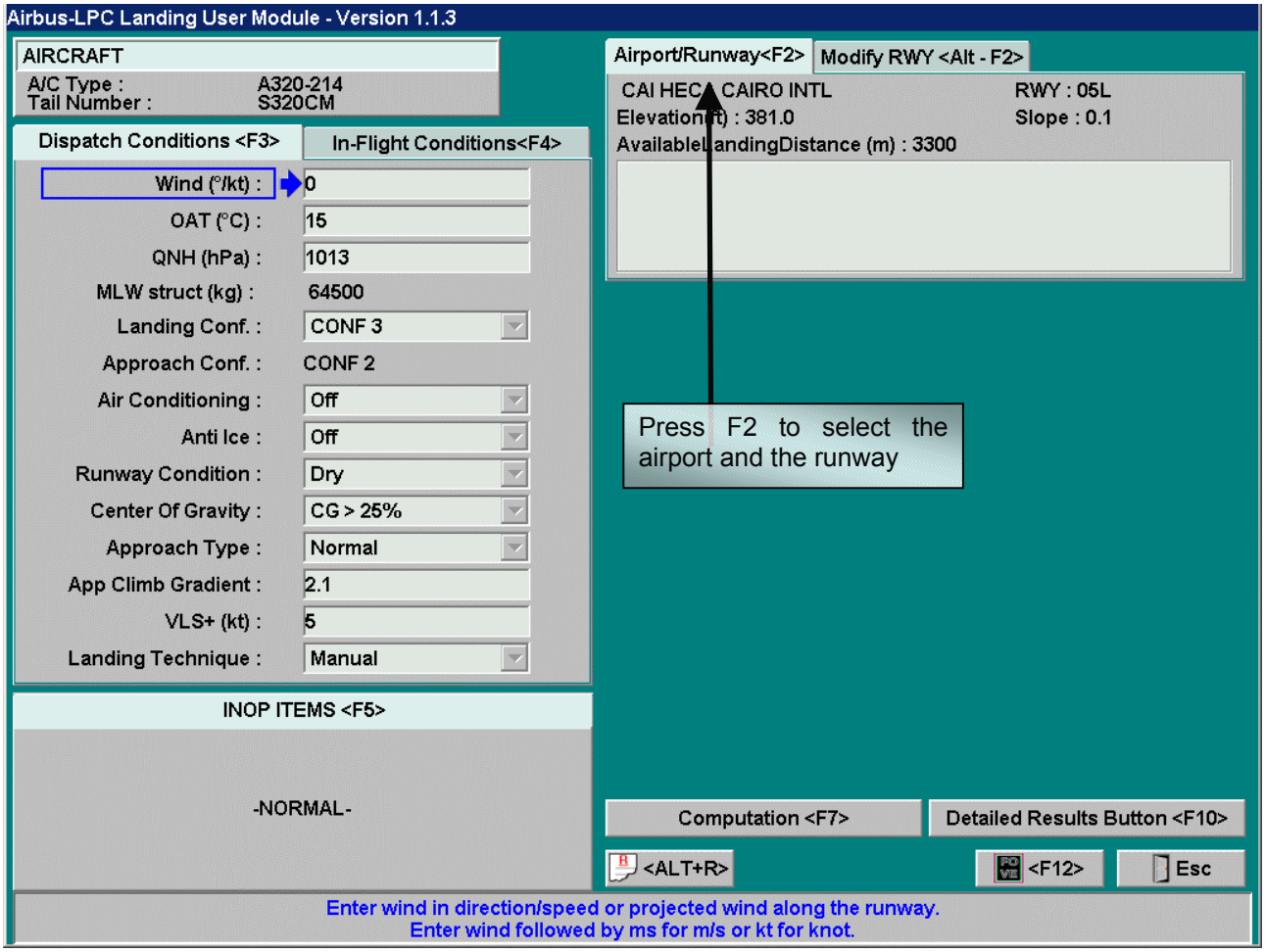
Press the F5 key to prepare your approach and landing.



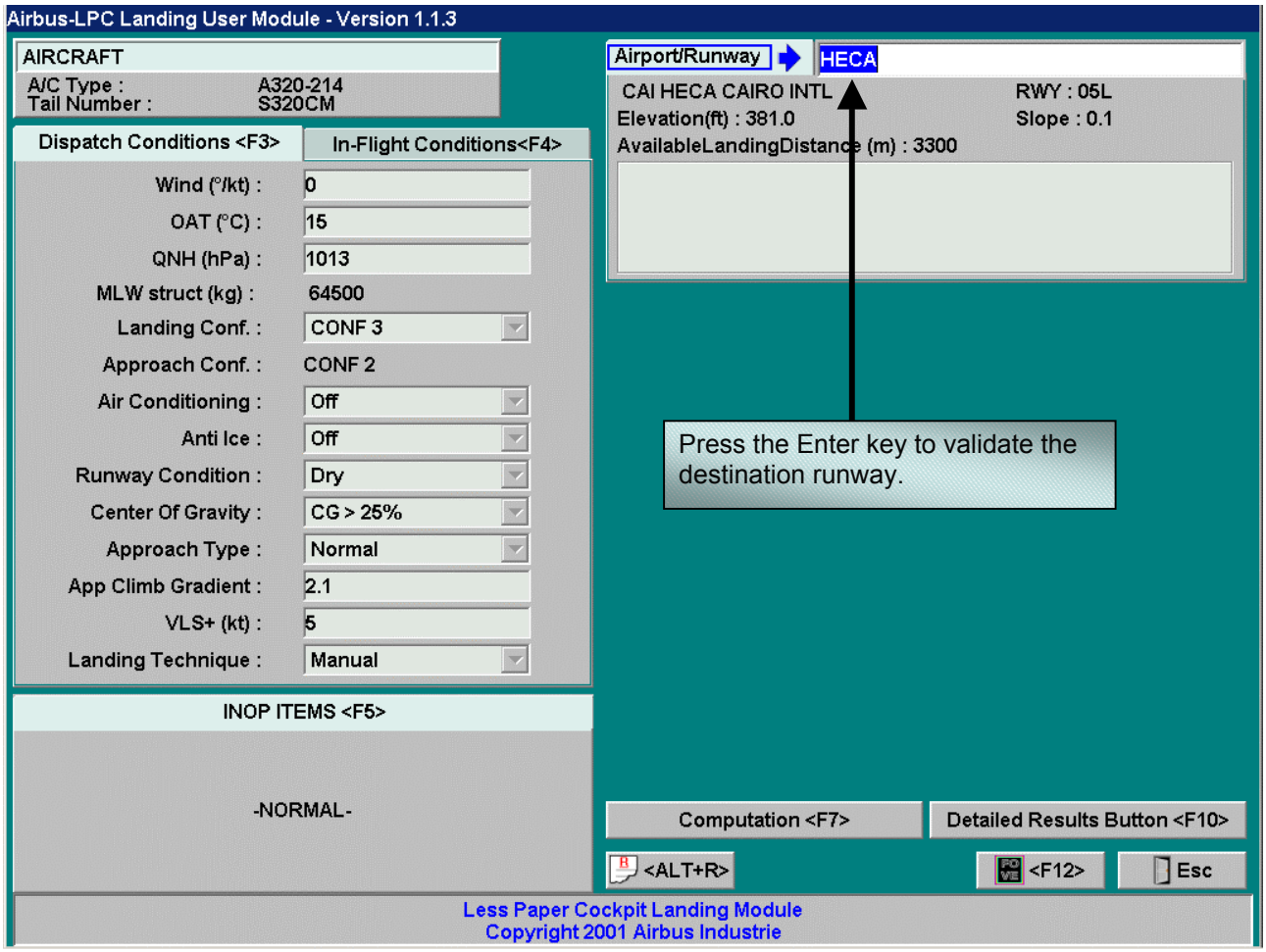
Enter your forecasting data.

Landing in Cairo RWY 23L
Forecast conditions:
Wind: 228/6kt
OAT: 25º C
QNH: 1021 hPa
Landing configuration Full
Air conditioning: On
Anti-ice: Off
Runway condition: dry
CG>25%
Approach type: Normal
Approach climb gradient: 2.1%
VLS +(kt) 5
Landing Technique: Normal
No inoperative items.

Press F2 to select the airport and the airport and the runway.



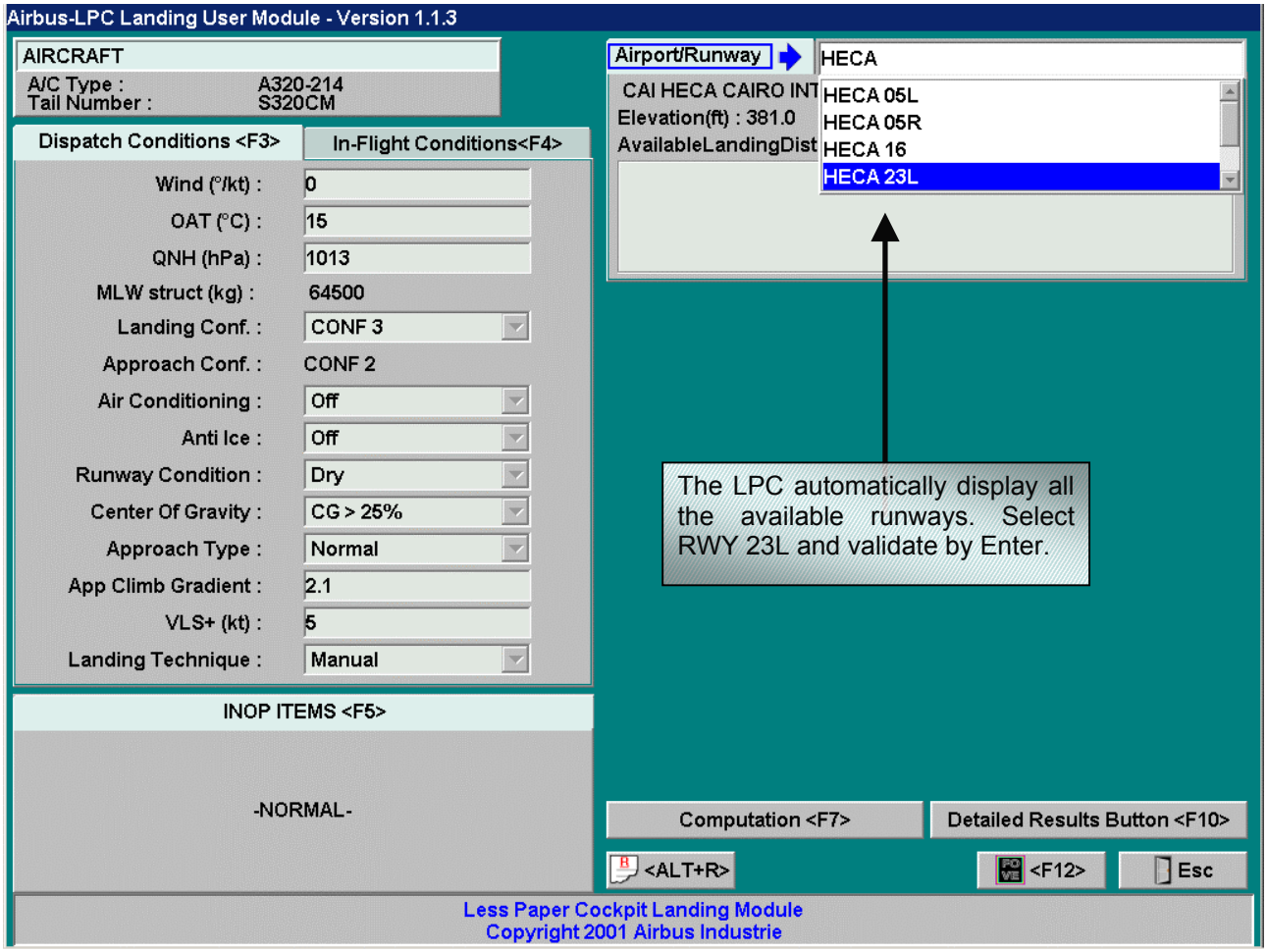
You can use either the scroll down menu or type the name of the airport.
Once this is done, press enter to validate your choice.



The next step is to choose the runway used for landing.

Let's assume it's runway 23L today.

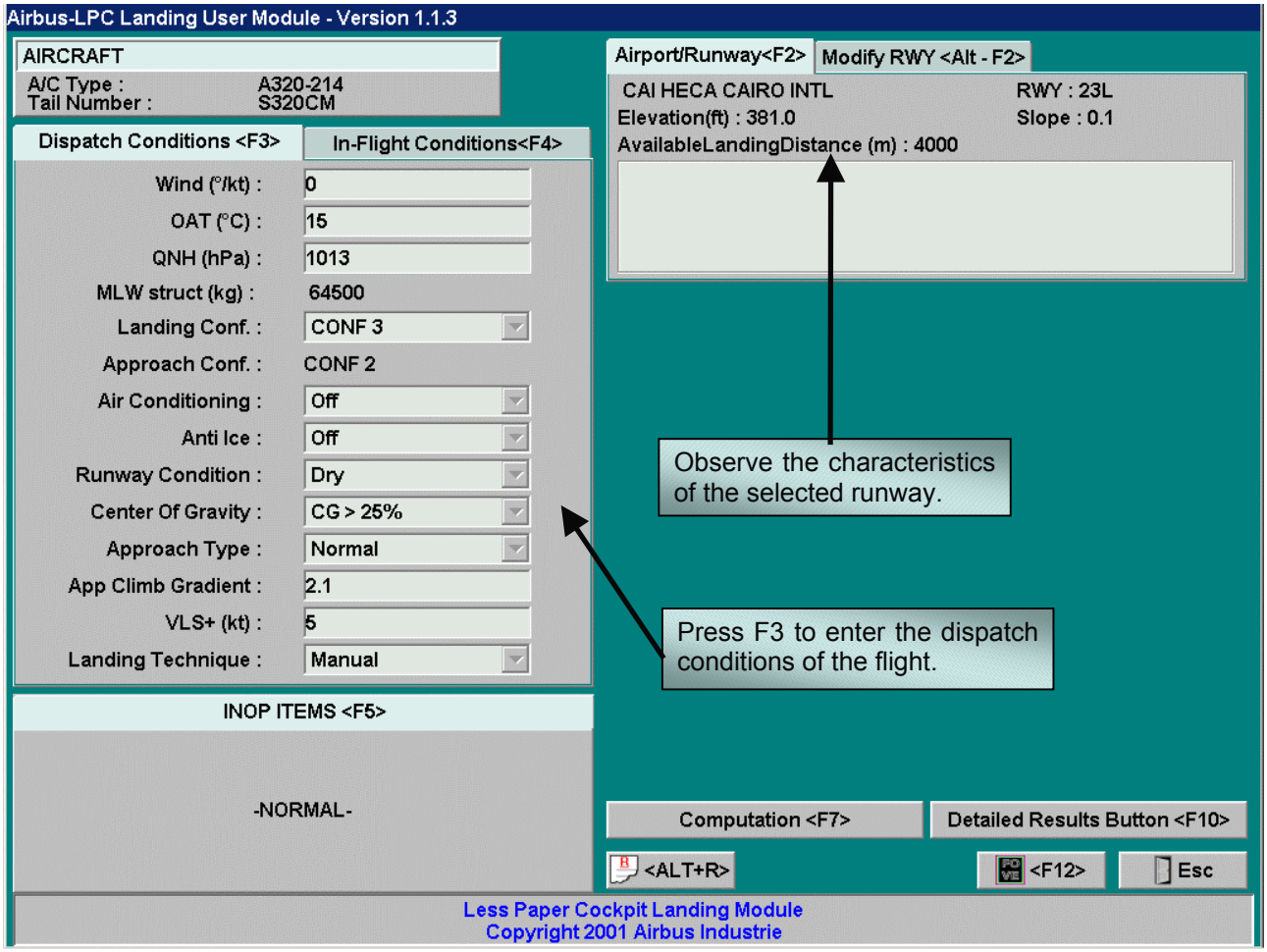
Again validate your choice by pressing Enter.



The characteristics of the selected runway are displayed: available landing distance, elevation and slope.

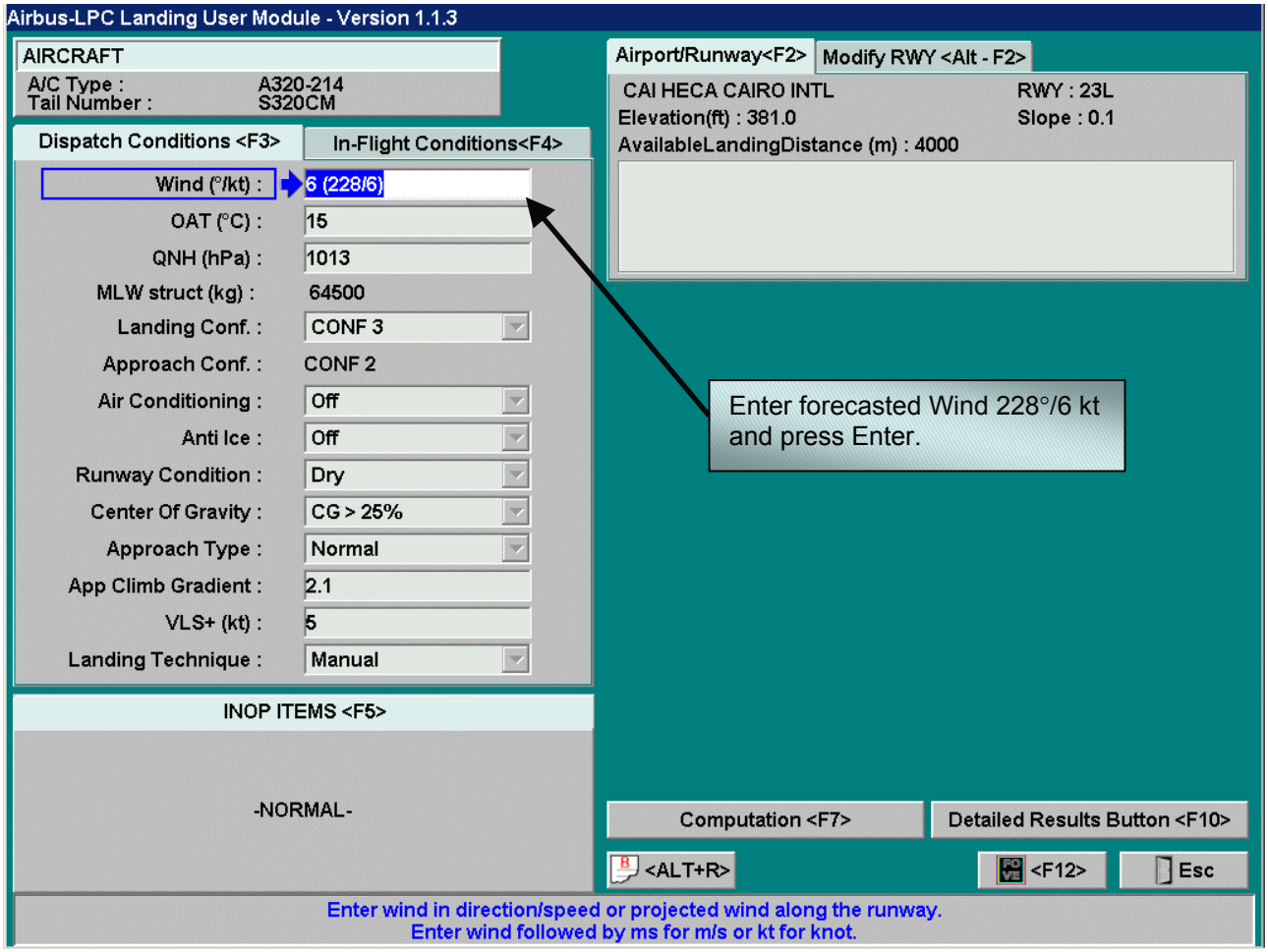
We have now to enter the dispatch conditions of the flight and check if they impose any landing limitation.

Press F3 now.

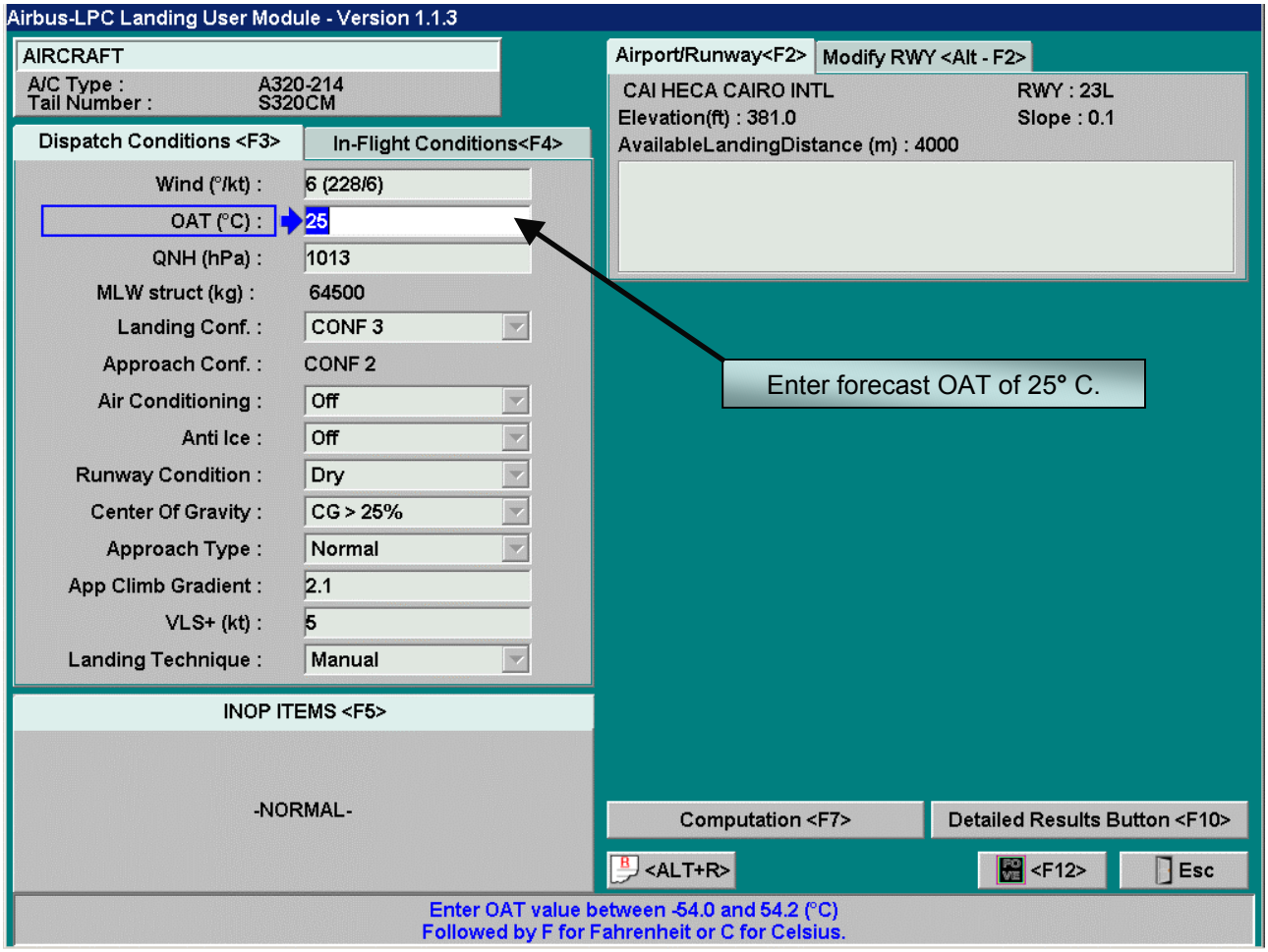


As for the TakeOff, you have to enter the weather conditions forecast in Cairo.

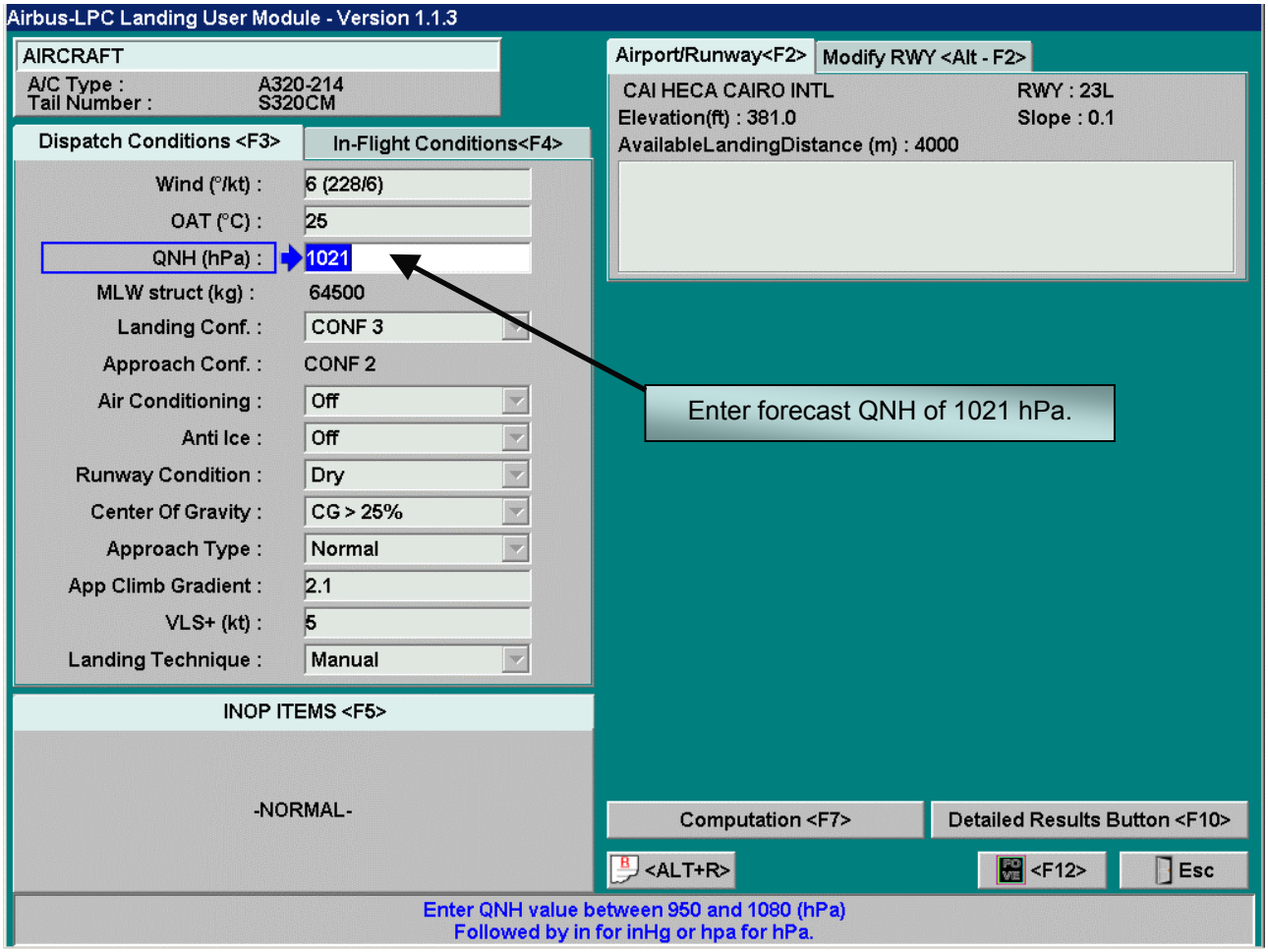
The wind is estimated at 228 deg/6 kt.



The OAT is estimated at 25 deg. C.

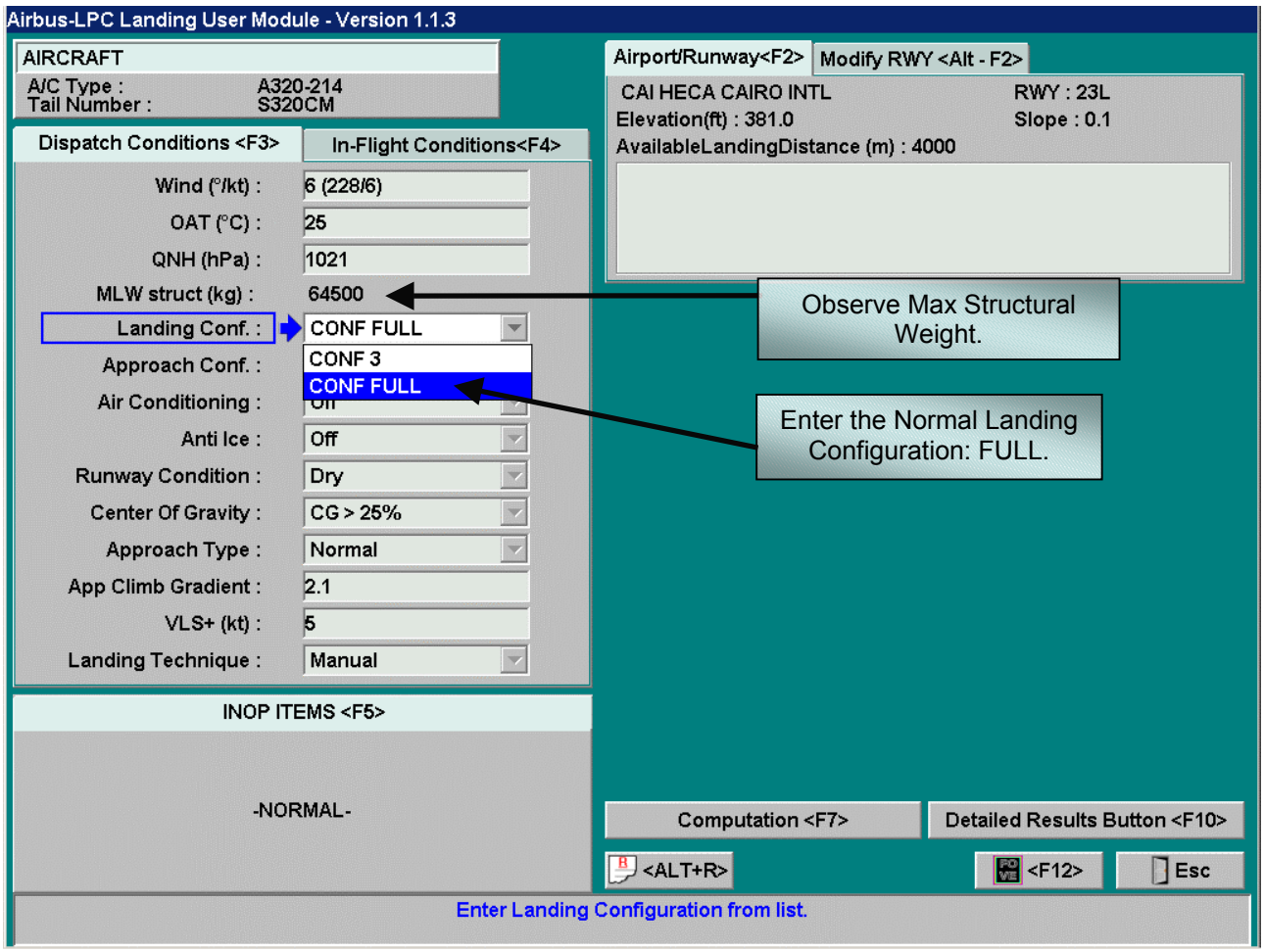


The forecast QNH is 1021 hPa.



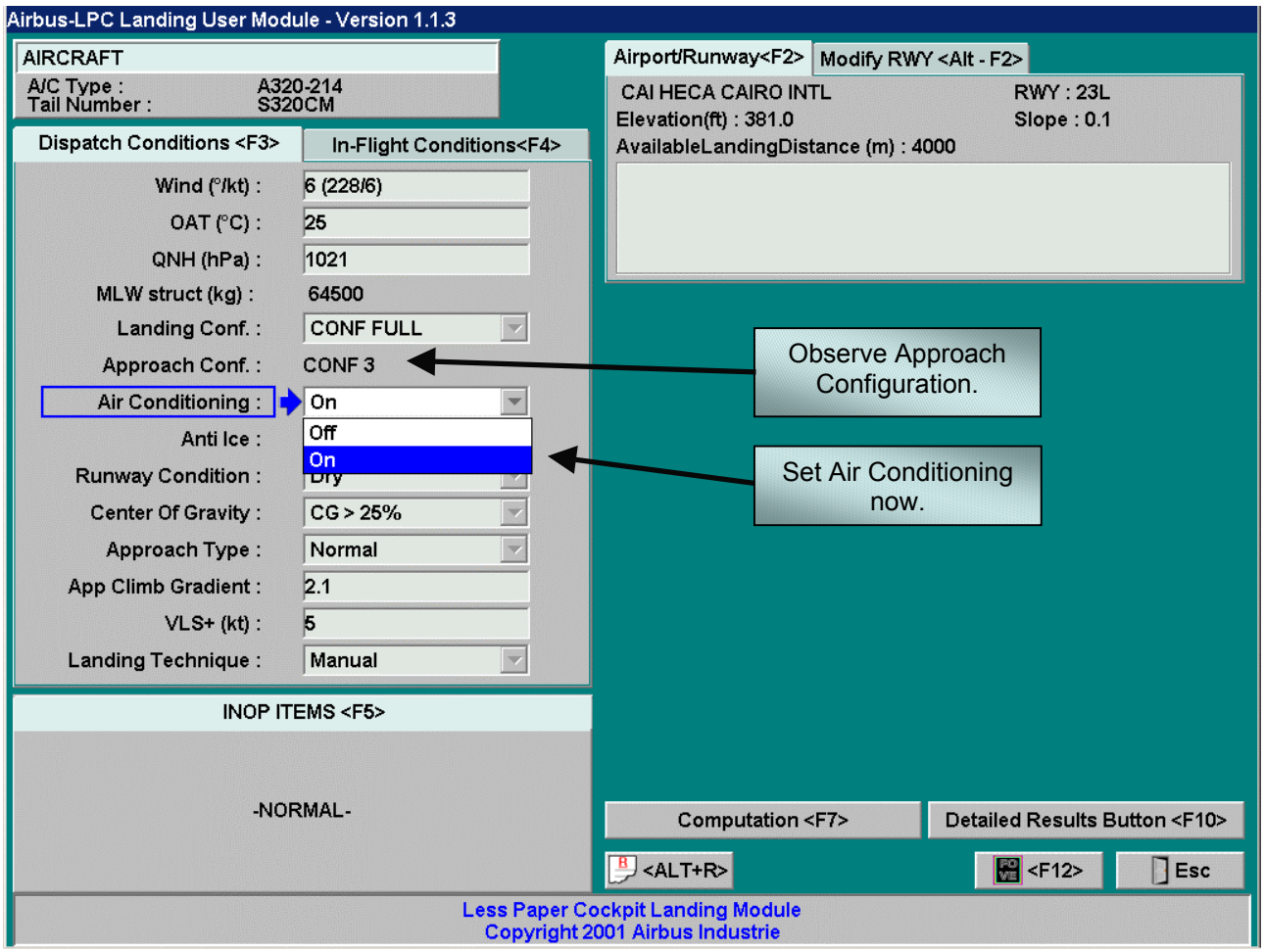
Note that the assumed landing weight is the structural maximum landing weight, whatever your actual landing weight.

Enter the expected landing configuration, full or conf 3.

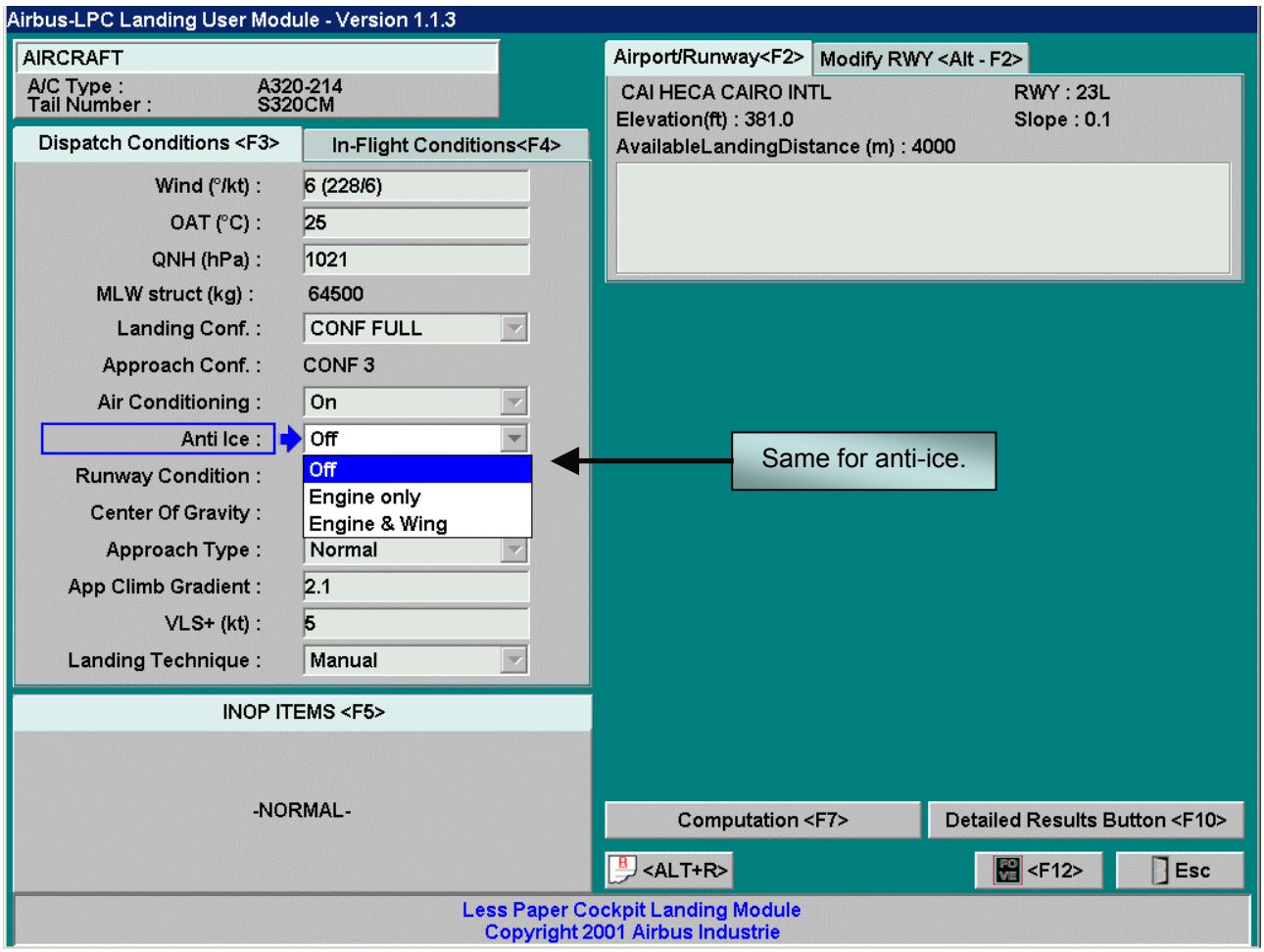


Note that the approach configuration is modified accordingly.

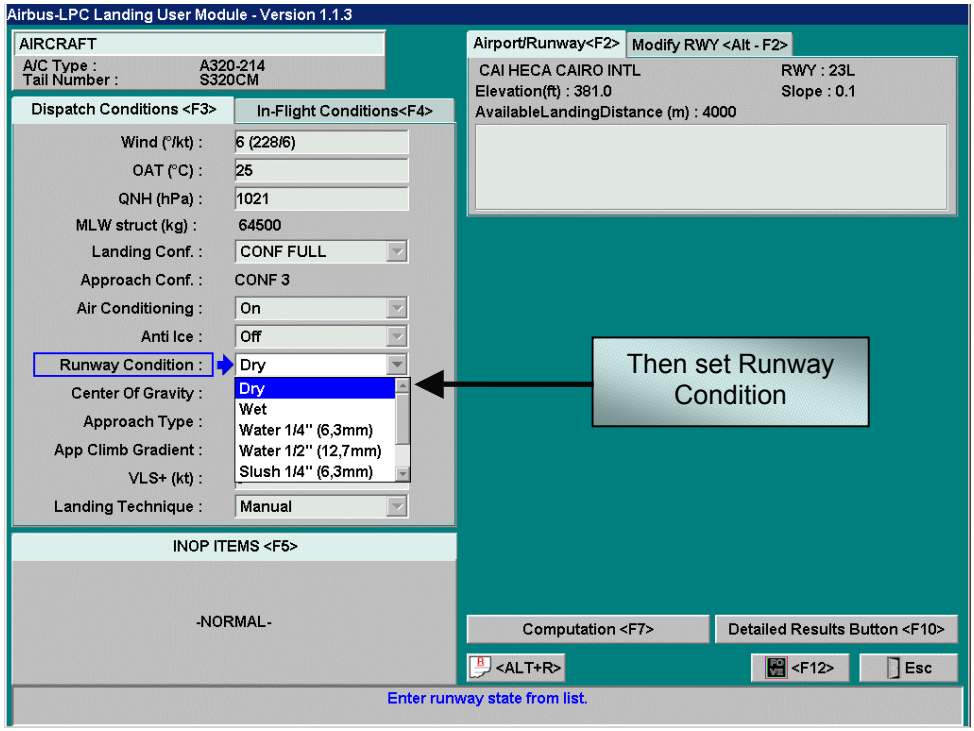
As in the TakeOff module, set the air conditioning now.

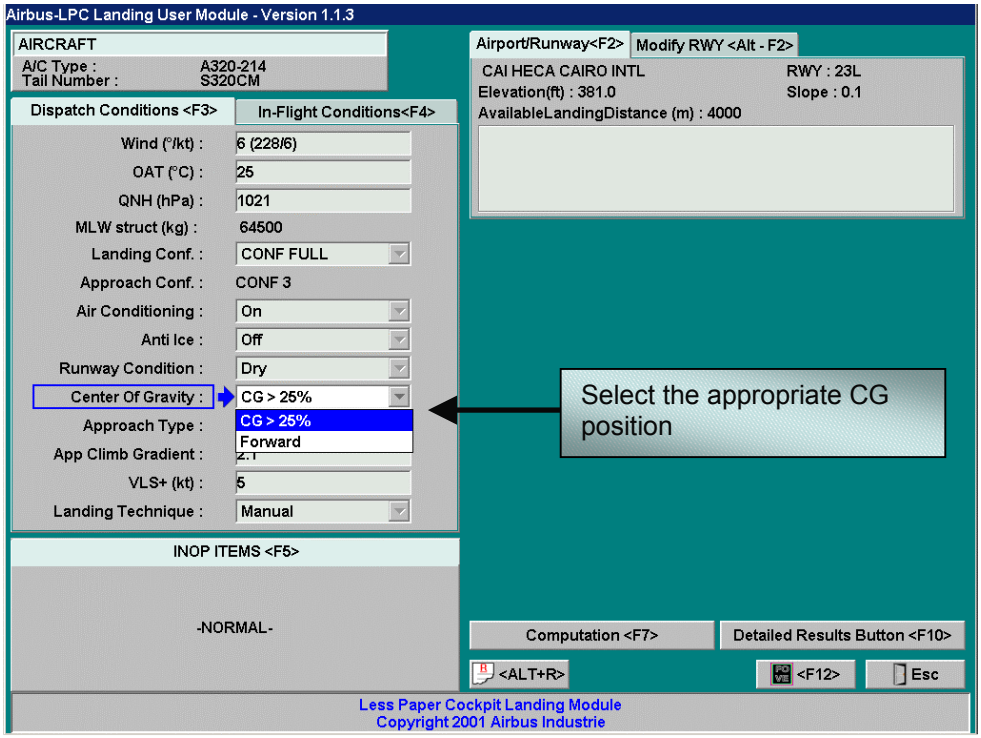


Set the anti-icing.

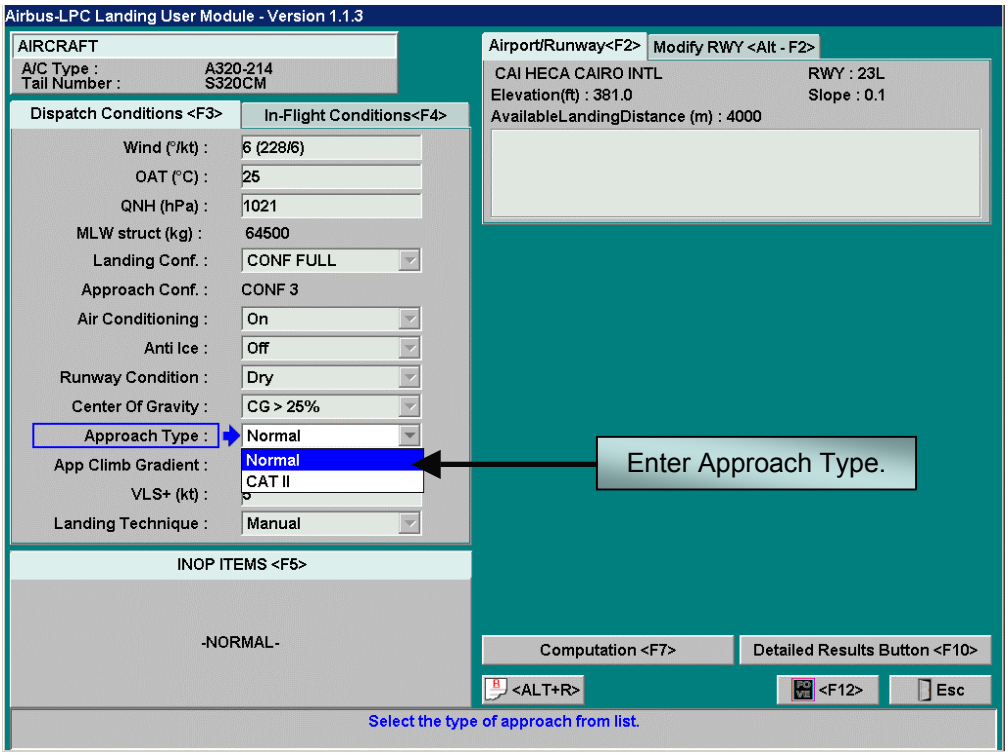


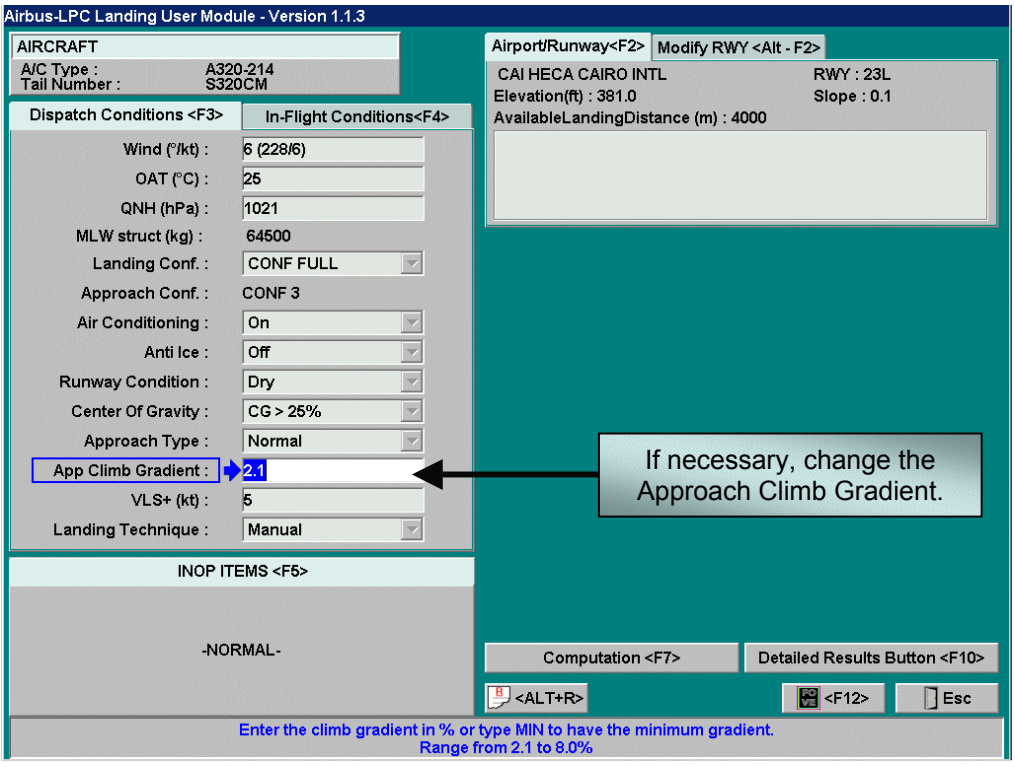
Set the runway condition and the CG position.
Standard is the normal CG (> 25% on A320) and alternate is the forward CG (< 25%).
The limit is at 26% on the A340.
And for the A330, the CG position has no effect on the landing performance. Therefore this window is not provided.
The CG position has an effect on the flare.



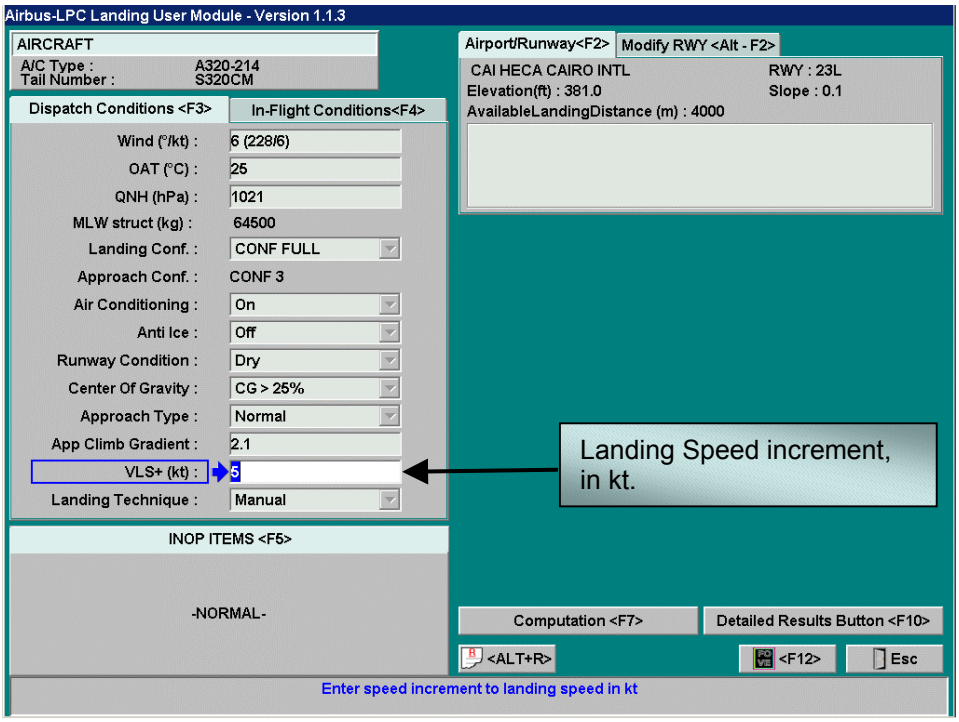


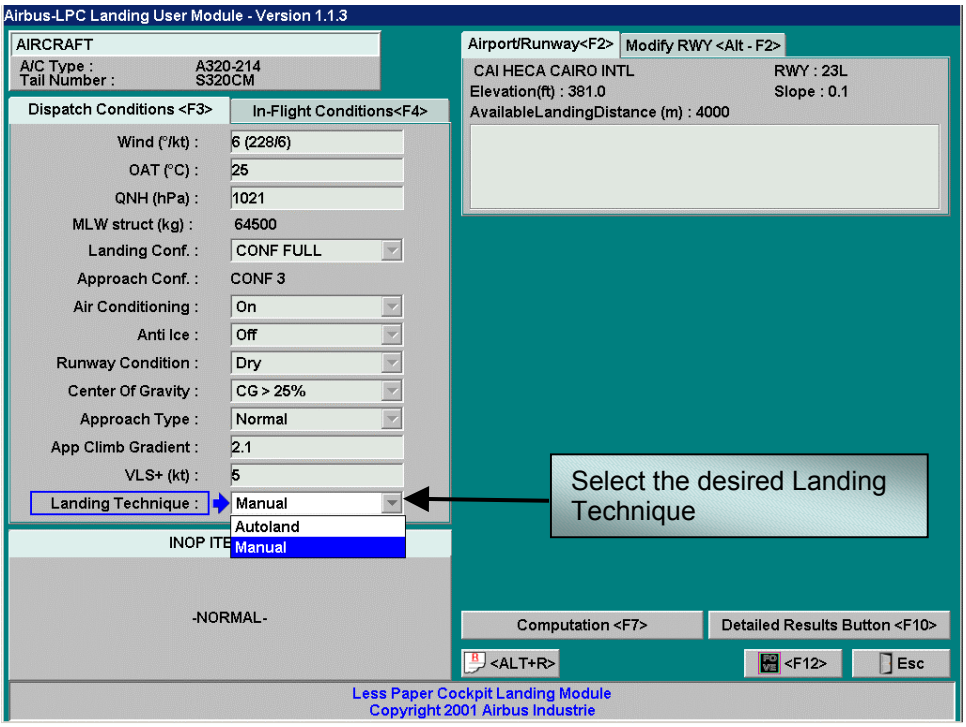
Enter the kind of approach you except to perform, as it has an effect on the approach climb gradient (2.1 for manual, 2.5 for CAT II).
When landing on an airport with limiting obstacles in the go-around trajectory, set your go-around climb gradient.
It may have an effect on your maximum landing weight.



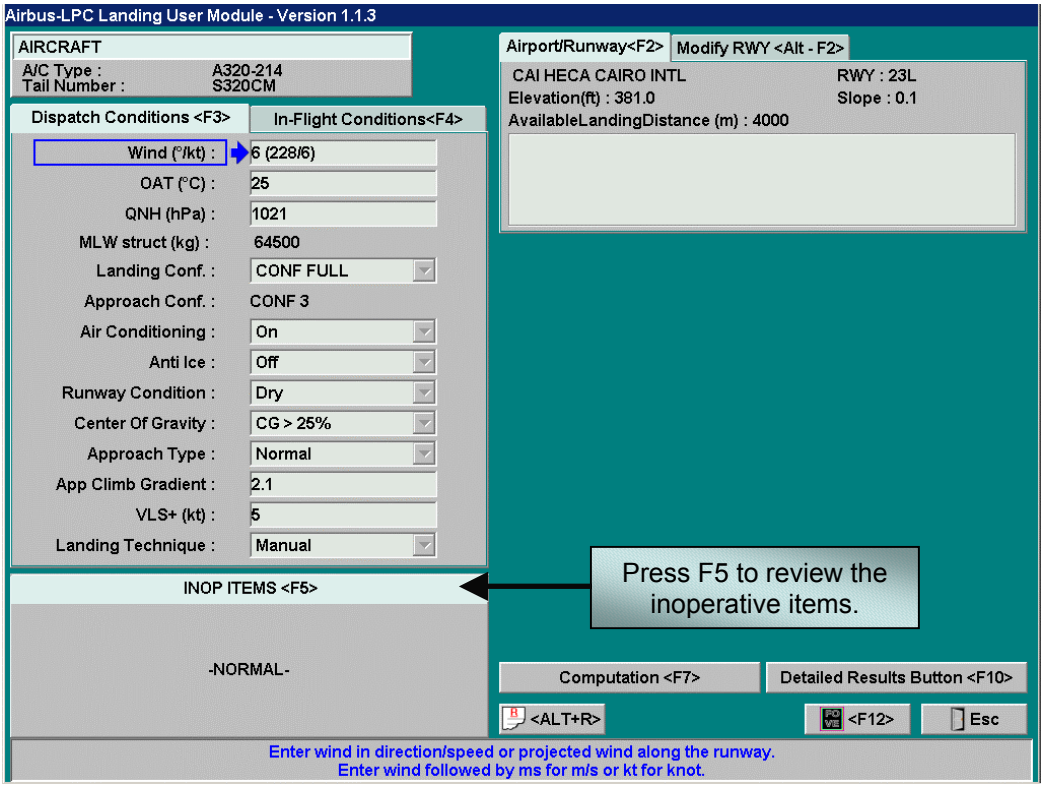


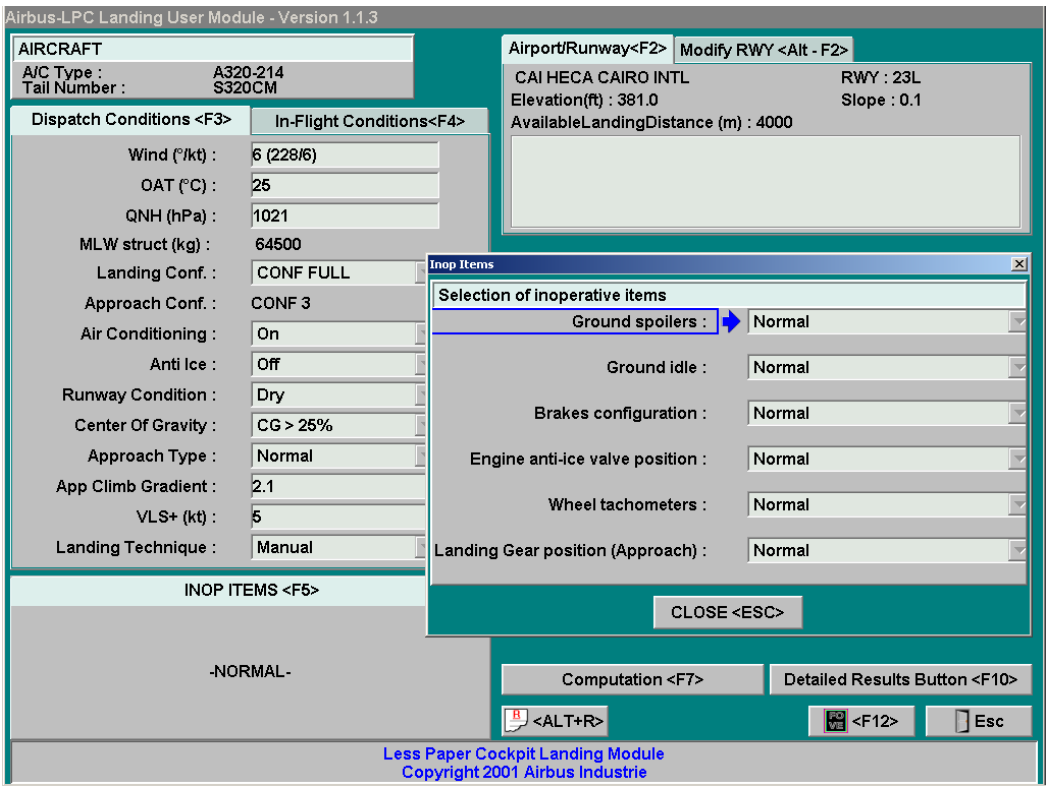
Enter the Landing Speed increment, in kt.
Then, select the kind of landing technique you intend to perform.



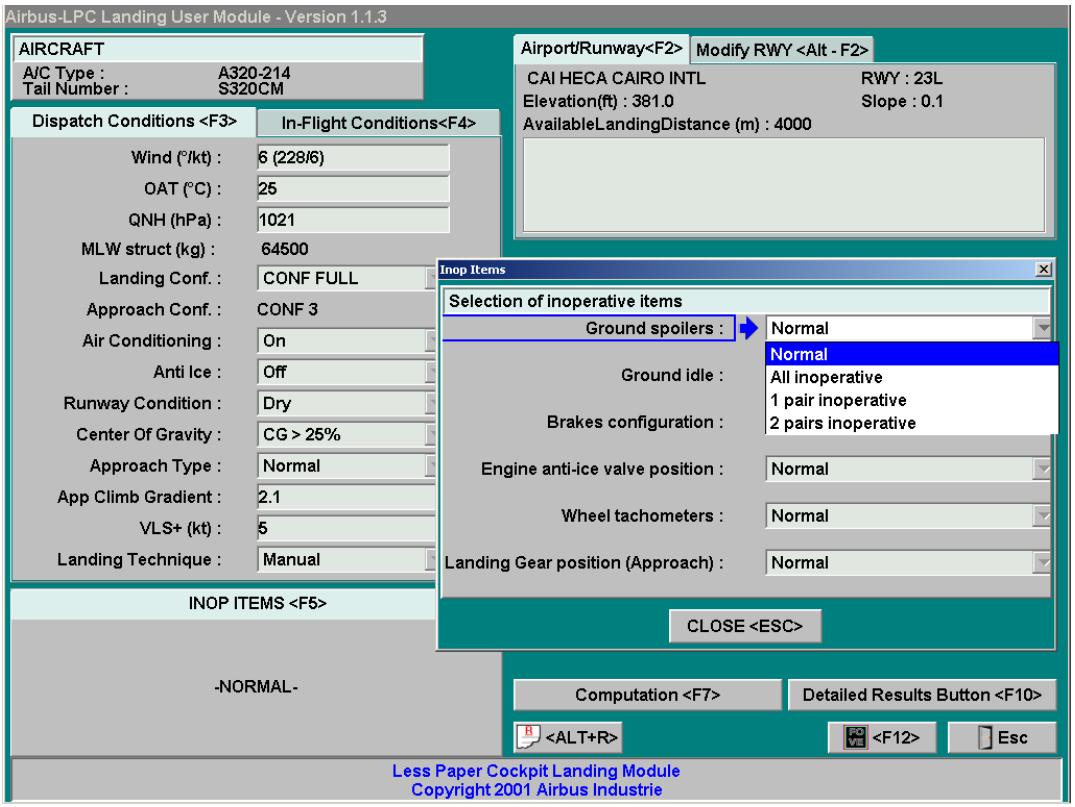


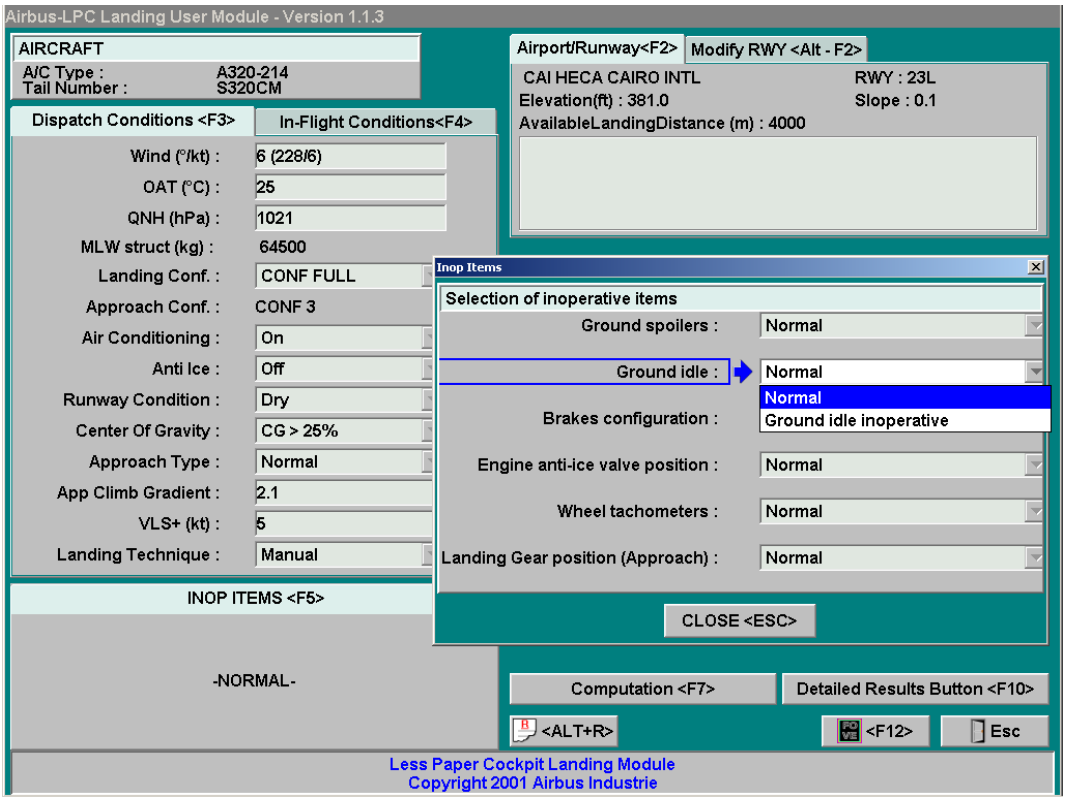
The inoperative items list is quite similar to the one provided for TakeOff. Let's review it.

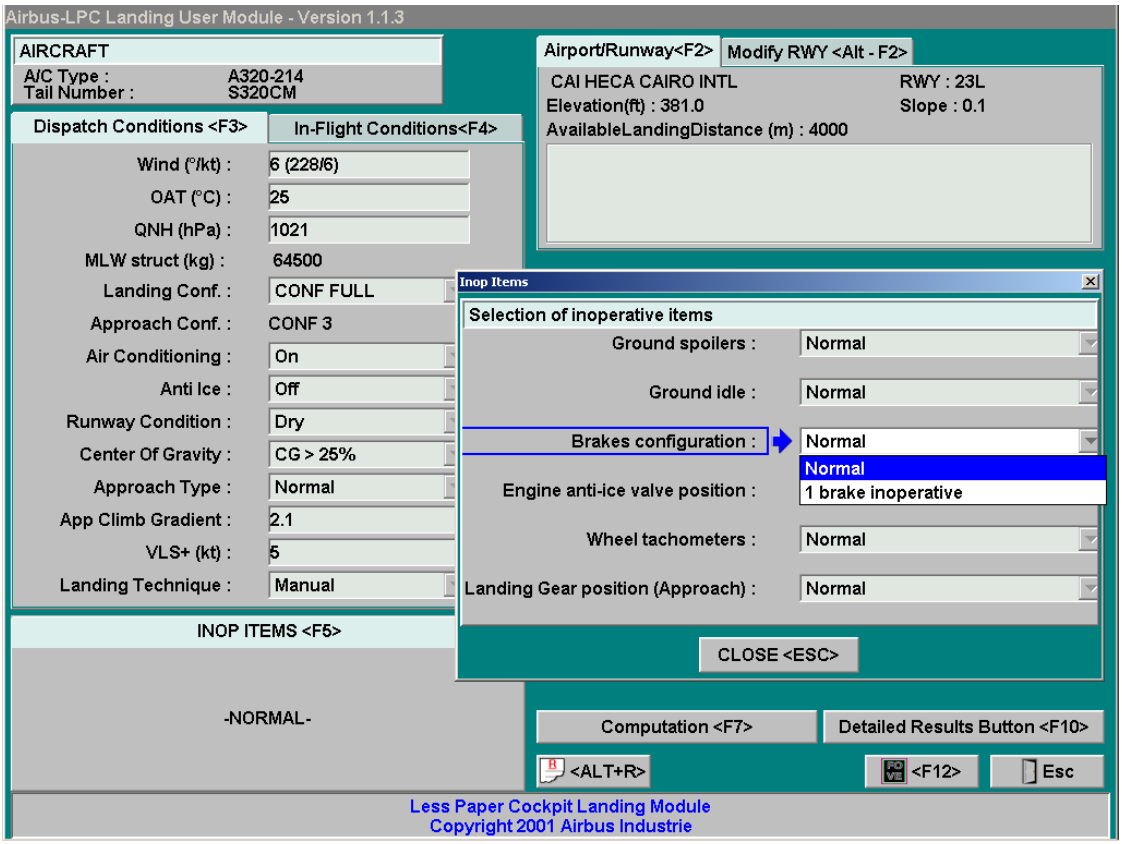


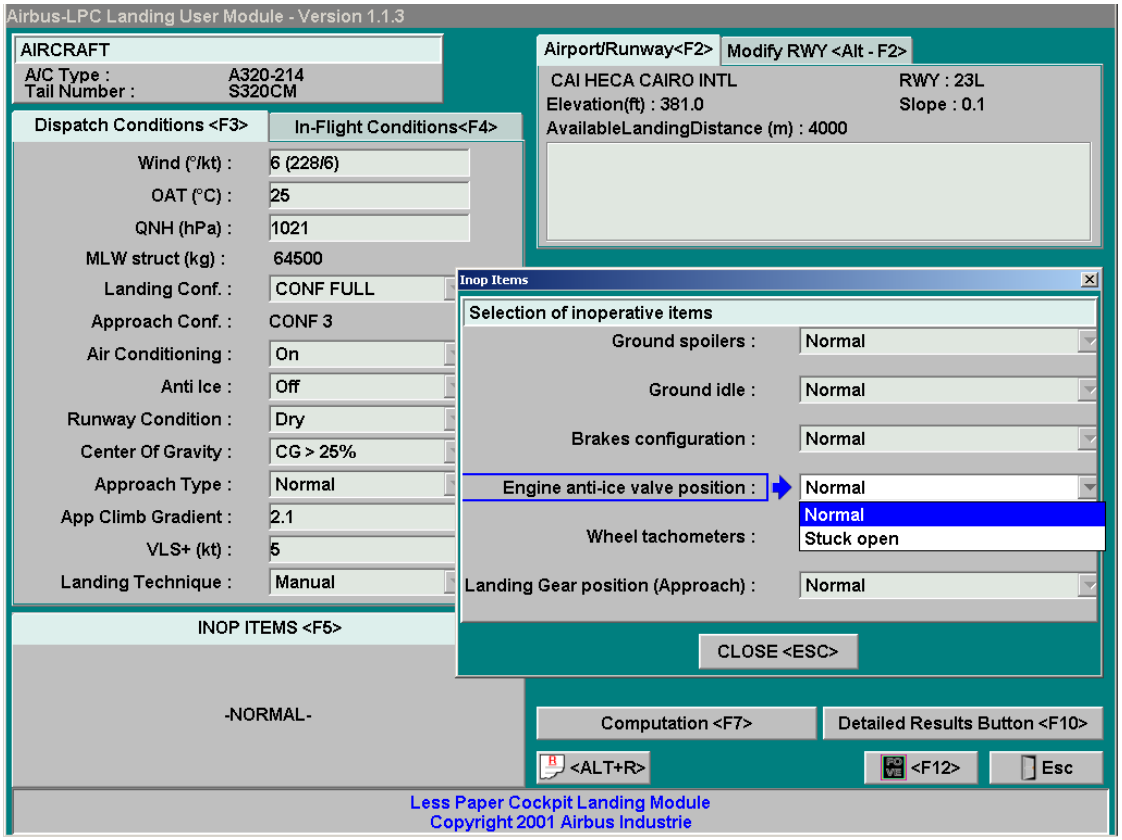


The inoperative items list is quite similar to the one provided for Takeoff. Let's review it.






Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
RWY : 23L
Elevation(ft) : 381.0
Slope : 0.1
AvailableLandingDistance (m) : 4000
Dispatch Conditions <F3>
In-Flight Conditions<F4>
Wind (°/kt) : 6 (228/6)
OAT (°C) : 25
QNH (hPa) : 1021
MLW struct (kg) : 64500
Landing Conf. : CONF FULL
Approach Conf. : CONF 3
Air Conditioning : On
Anti Ice : Off
Runway Condition : Dry
Center Of Gravity : CG > 25%
Approach Type : Normal
App Climb Gradient : 2.1
VLS+ (kt) : 5
Landing Technique : Manual
Inop Items
Selection of inoperative items
Ground spoilers : Normal
Ground idle : Normal
Brakes configuration : Normal
Normal
1 brake inoperative
Engine anti-ice valve position :
Wheel tachometers : Normal
Landing Gear position (Approach) : Normal
CLOSE <ESC>
INOP ITEMS <F5>
-NORMAL-
Computation <F7>
Detailed Results Button <F10>
<ALT+R>
<F12>
Esc
Less Paper Cockpit Landing Module
Copyright 2001 Airbus Industrie


Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
RWY : 23L
Elevation(ft) : 381.0
Slope : 0.1
AvailableLandingDistance (m) : 4000
Dispatch Conditions <F3>
In-Flight Conditions<F4>
Wind (°/kt) : 6 (228/6)
OAT (°C) : 25
QNH (hPa) : 1021
MLW struct (kg) : 64500
Landing Conf. : CONF FULL
Approach Conf. : CONF 3
Air Conditioning : On
Anti Ice : Off
Runway Condition : Dry
Center Of Gravity : CG > 25%
Approach Type : Normal
App Climb Gradient : 2.1
VLS+ (kt) : 5
Landing Technique : Manual
Inop Items
Selection of inoperative items
Ground spoilers : Normal
Ground idle : Normal
Brakes configuration : Normal
Engine anti-ice valve position : Normal
Normal
Stuck open
Wheel tachometers :
Landing Gear position (Approach) : Normal
CLOSE <ESC>
INOP ITEMS <F5>
-NORMAL-
Computation <F7>
Detailed Results Button <F10>
<ALT+R>
<F12>
Esc
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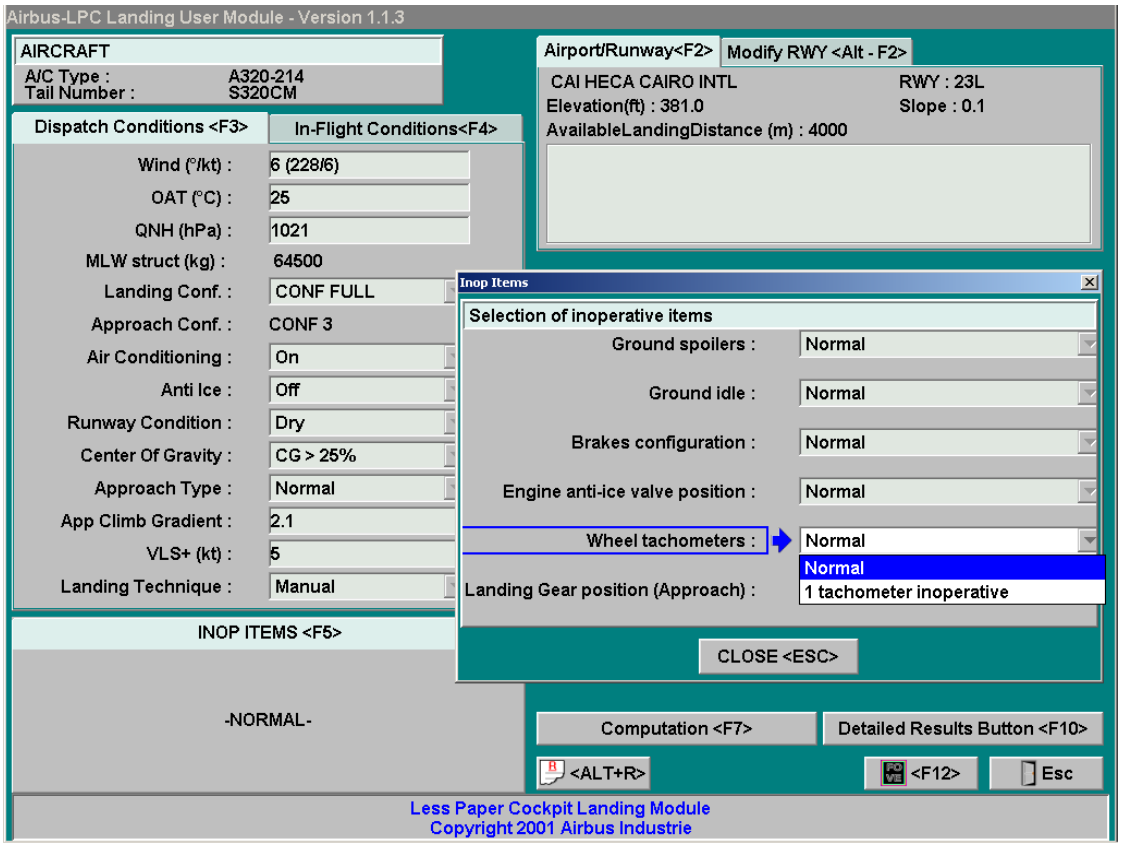
Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
RWY : 23L
Elevation(ft) : 381.0
Slope : 0.1
AvailableLandingDistance (m) : 4000
Dispatch Conditions <F3>
In-Flight Conditions<F4>
Wind (°/kt) : 6 (228/6)
OAT (°C) : 25
QNH (hPa) : 1021
MLW struct (kg) : 64500
Landing Conf. : CONF FULL
Approach Conf. : CONF 3
Air Conditioning : On
Anti Ice : Off
Runway Condition : Dry
Center Of Gravity : CG > 25%
Approach Type : Normal
App Climb Gradient : 2.1
VLS+ (kt) : 5
Landing Technique : Manual
Inop Items
Selection of inoperative items
Ground spoilers : Normal
Ground idle : Normal
Brakes configuration : Normal
Engine anti-ice valve position : Normal
Wheel tachometers : Normal
Landing Gear position (Approach) : Normal
1 tachometer inoperative
CLOSE <ESC>
INOP ITEMS <F5>
-NORMAL-
Computation <F7>
Detailed Results Button <F10>
<ALT+R>
<F12>
Esc
Less Paper Cockpit Landing Module
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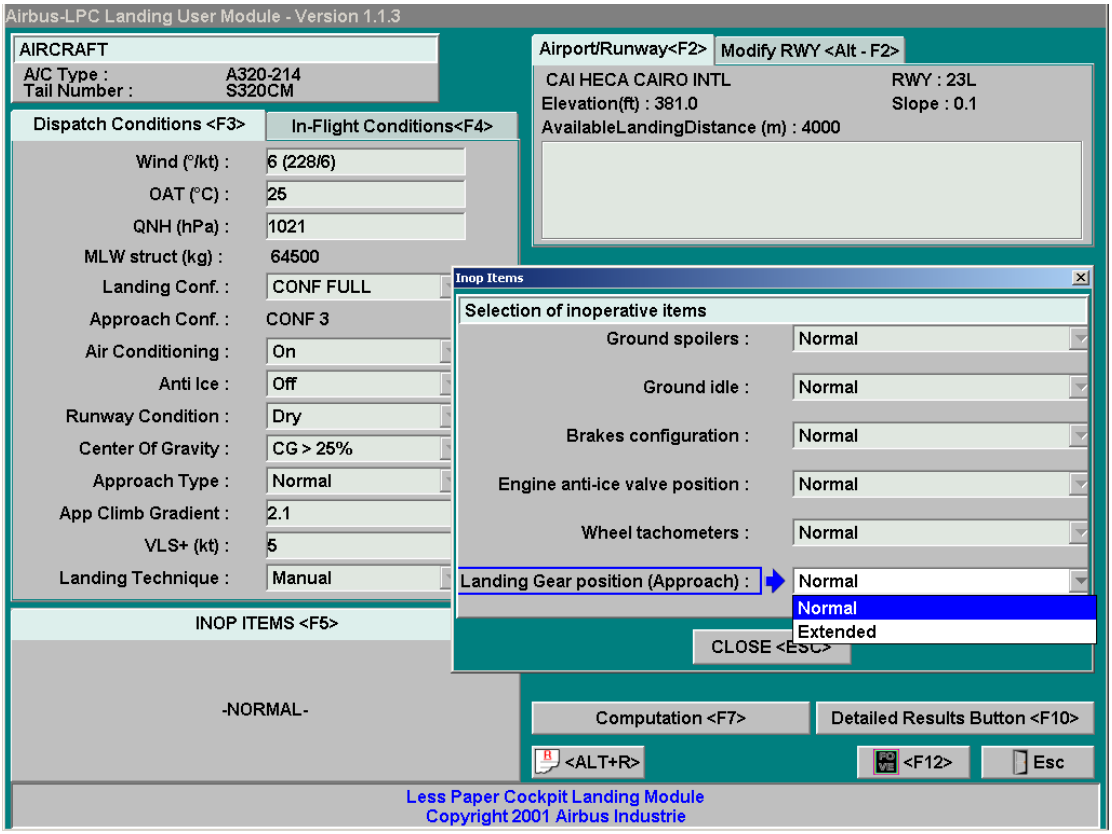
Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
RWY : 23L
Elevation(ft) : 381.0
Slope : 0.1
AvailableLandingDistance (m) : 4000
Dispatch Conditions <F3>
In-Flight Conditions<F4>
Wind (°/kt) : 6 (228/6)
OAT (°C) : 25
QNH (hPa) : 1021
MLW struct (kg) : 64500
Landing Conf. : CONF FULL
Approach Conf. : CONF 3
Air Conditioning : On
Anti Ice : Off
Runway Condition : Dry
Center Of Gravity : CG > 25%
Approach Type : Normal
App Climb Gradient : 2.1
VLS+ (kt) : 5
Landing Technique : Manual
Inop Items
Selection of inoperative items
Ground spoilers : Normal
Ground idle : Normal
Brakes configuration : Normal
Engine anti-ice valve position : Normal
Wheel tachometers : Normal
Landing Gear position (Approach) : Normal
Extended
CLOSE <ESC>
INOP ITEMS <F5>
-NORMAL-
Computation <F7>
Detailed Results Button <F10>
<ALT+R>
<F12>
Esc
Less Paper Cockpit Landing Module
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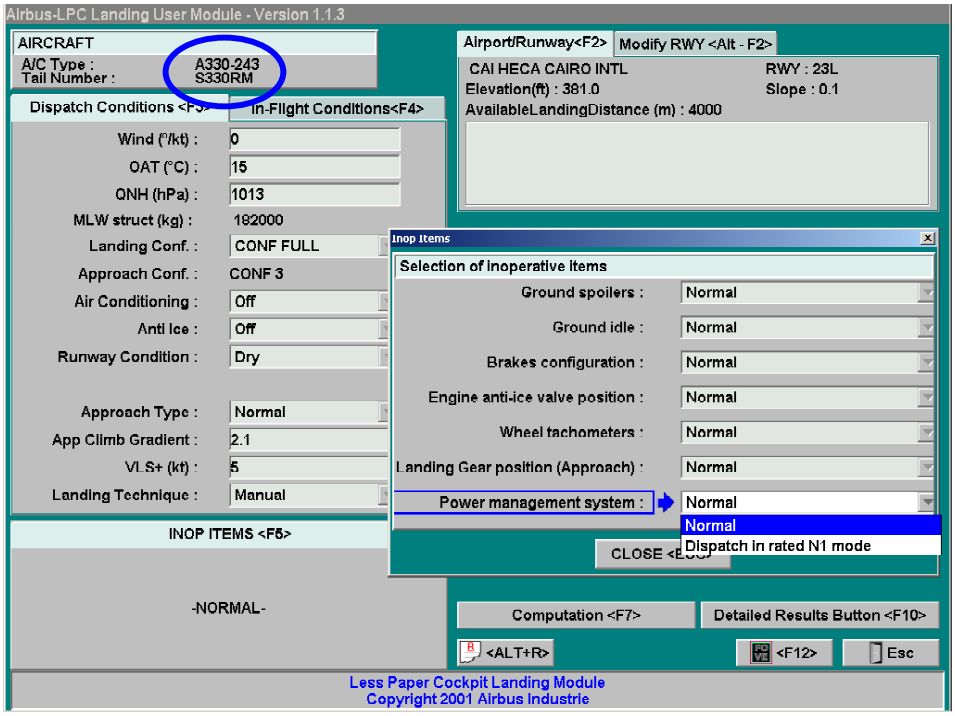
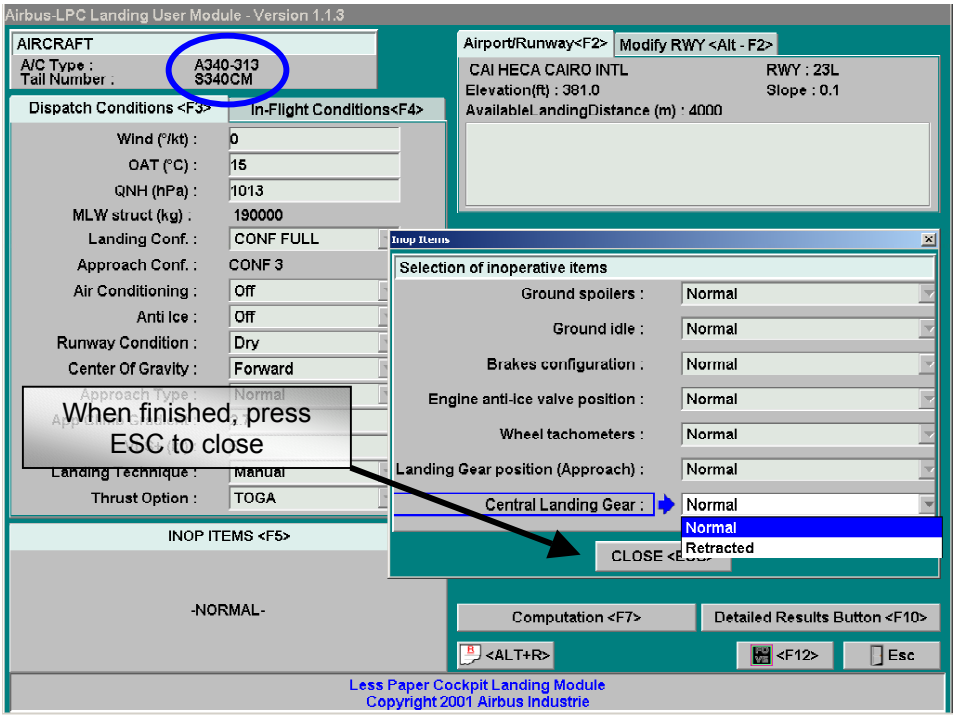
On the A330/A340, 2 additional windows are available:

- power management system: Normal or dispatch in rated N1 mode.

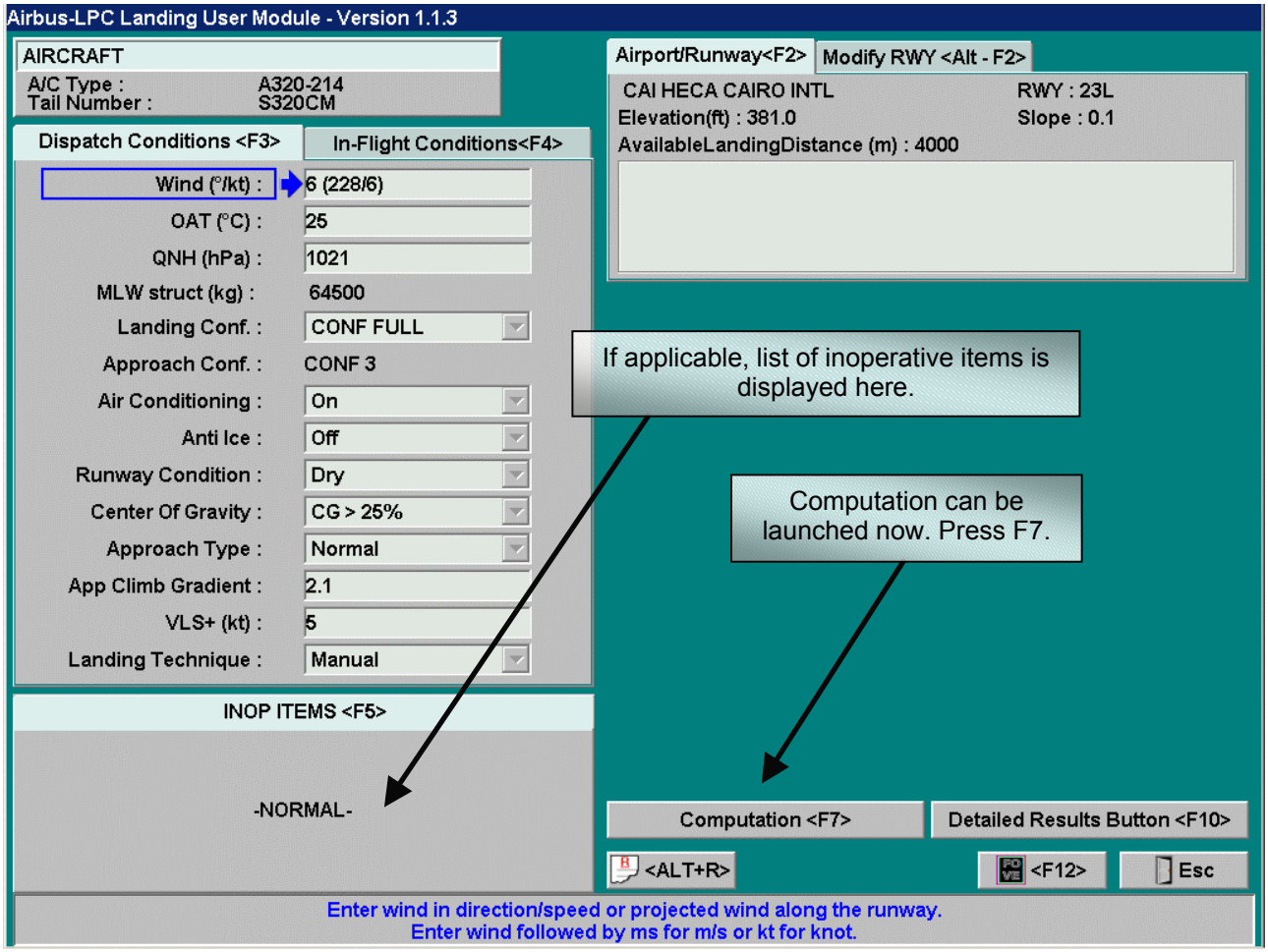
- central landing gear on A340 (normal/retracted).





Note that if failures were entered, a list would appear instead of NORMAL.

As everything is set, computation can be launched now. Press F7



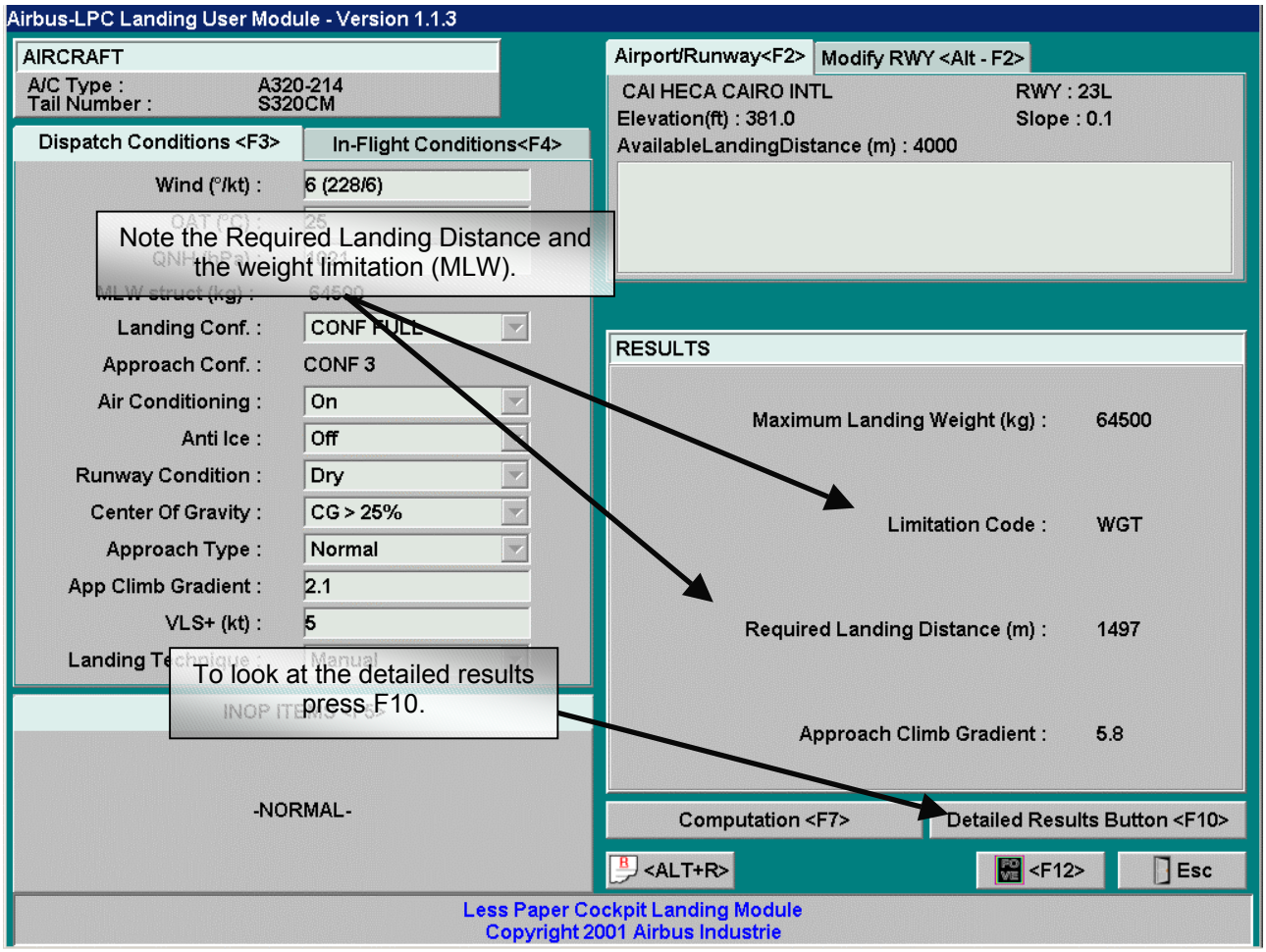
As we are in dispatch condition, we look at the Regulatory (or Required) Landing Distance (RLD) now.

Check that it is lower than the landing distance available (Runway length in Cairo).

In this case there is no landing limitations and the maximum landing weight is the structural one.

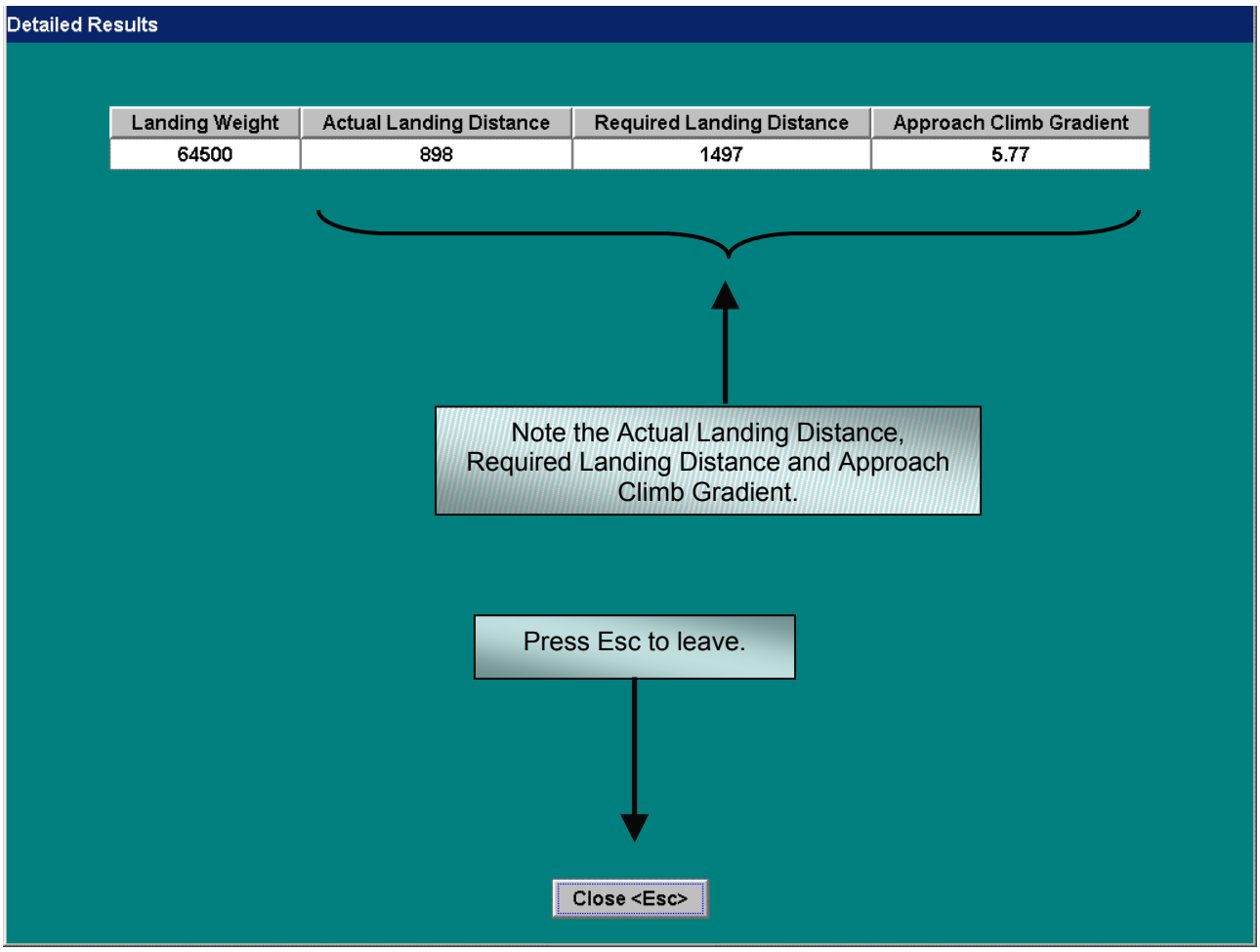
Otherwise a maximum performance weight and a limitation code would be displayed.

To look at the detailed results, press F10.



RLD dry = ALD/0.6. (ALD: actual landing distance).

Check approach climb gradient (ACG) is above the value published for this runway.



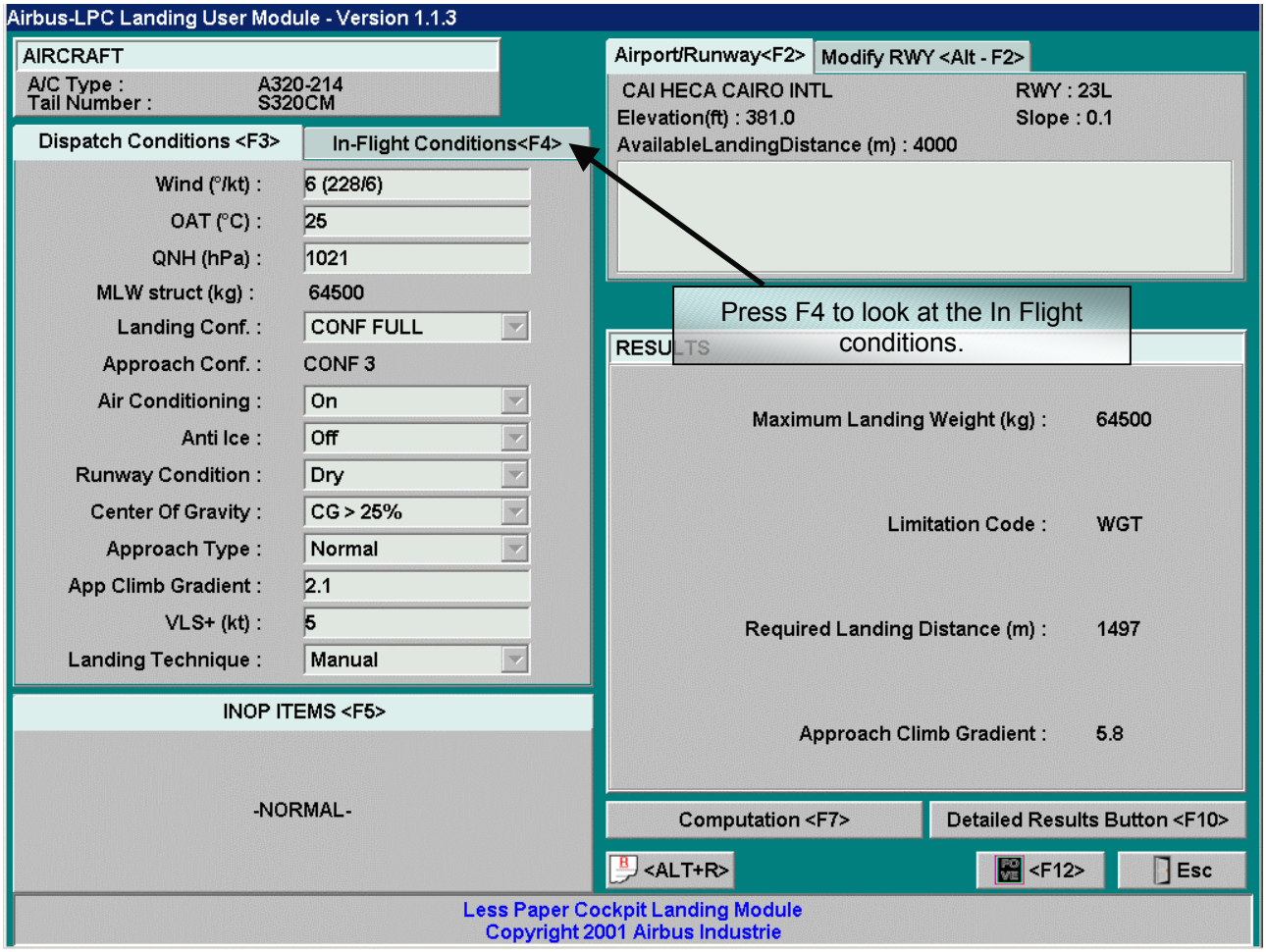
6.1.2. In Flight Conditions

If the actual landing distance is greater than the available landing distance, the landing weight is automatically reduced in the result window and a limitation code is displayed (LDA).

In that case compare the performance landing weight and the actual landing weight.

Now let's suppose we are in flight and the weather conditions have not changed.

Depress F4 to look at the in-flight conditions.



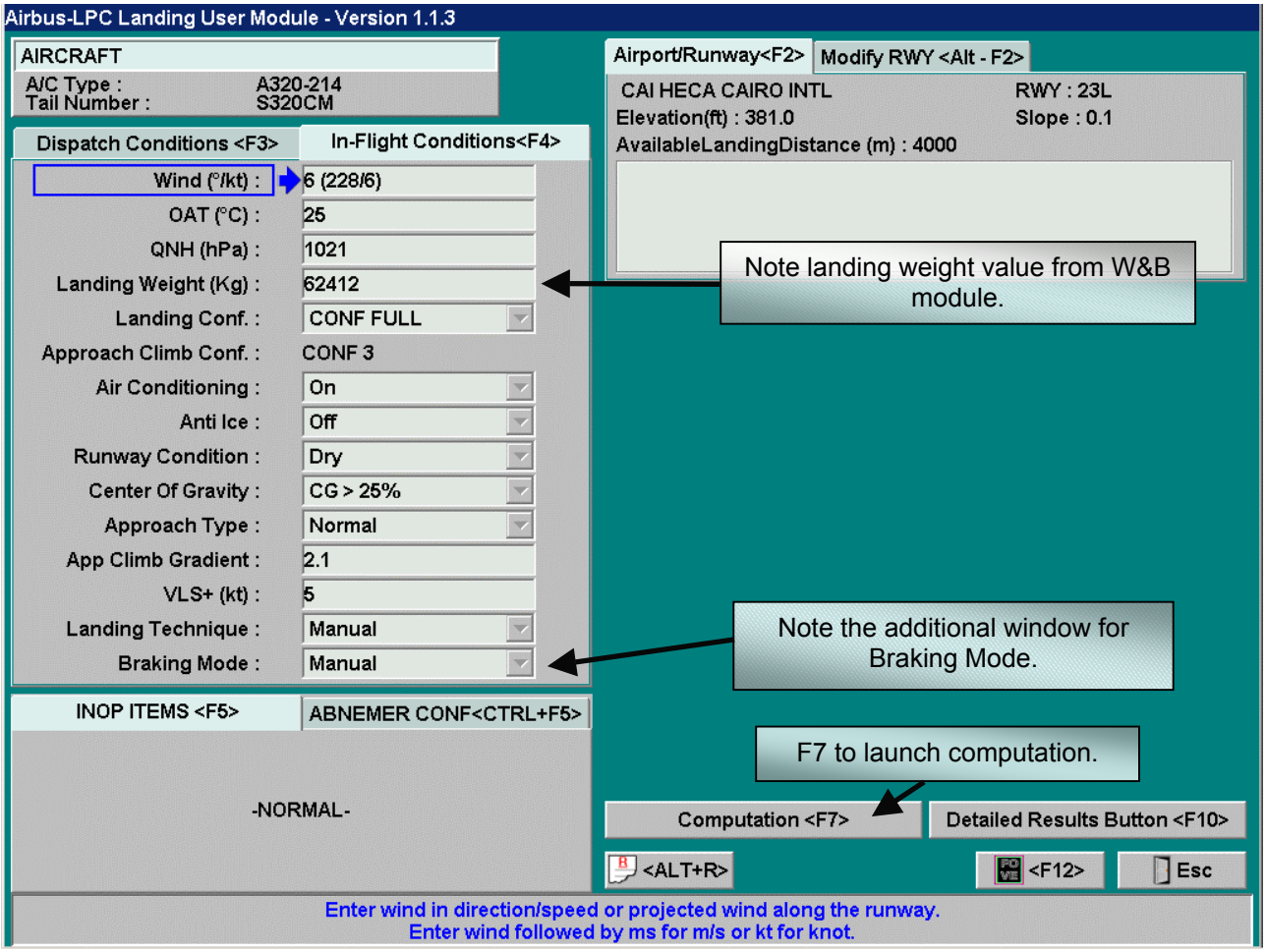
The entries are the same except two fields:

– maximum structural landing weight is replaced by the actual landing weight value coming from the weight and balance module. Note that it can be modified to enter your exact landing weight.

– an additional window is provided for Braking Mode

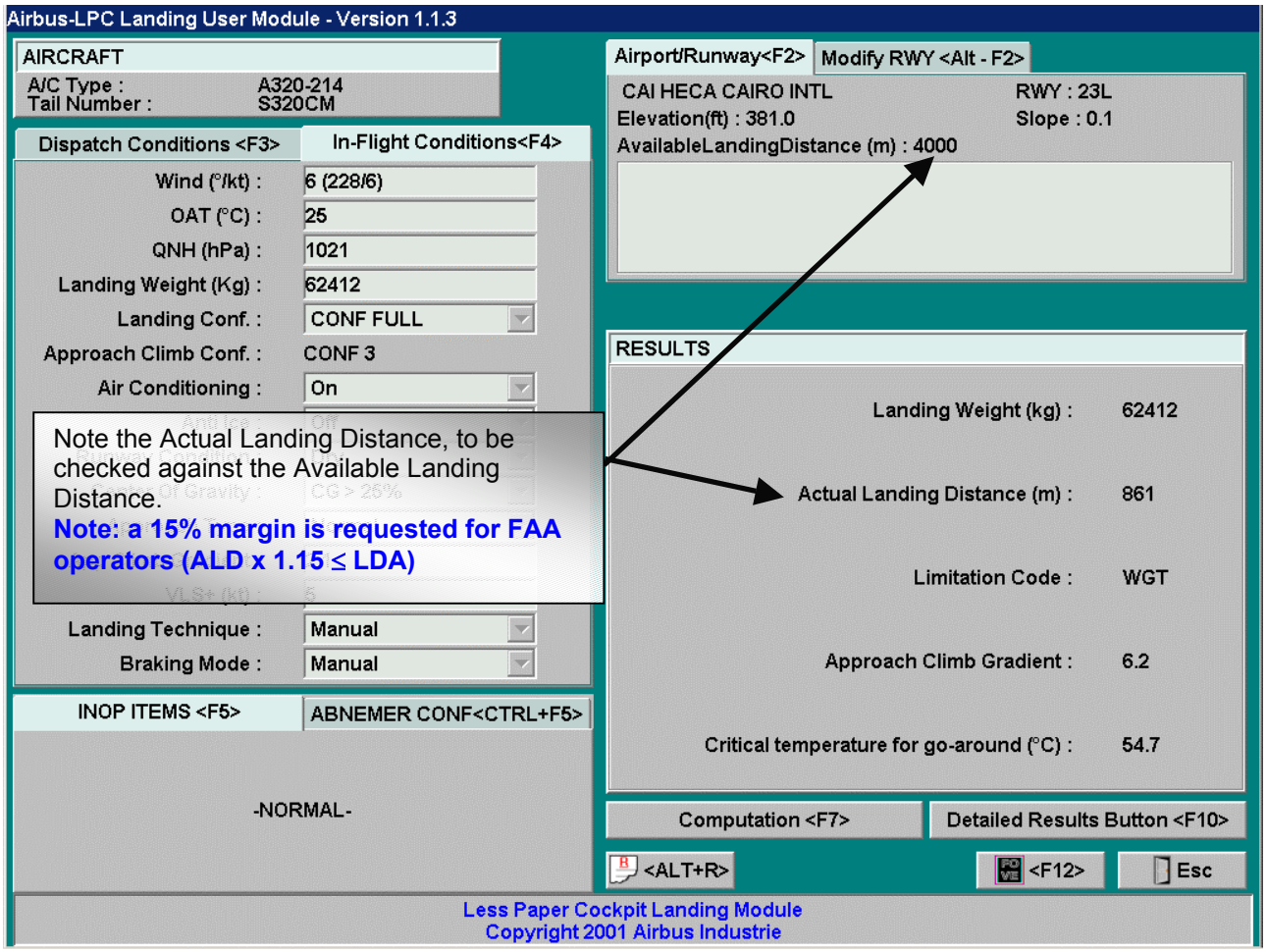
When landing on an airport with limiting obstacles in the go-around trajectory, set your go-around climb gradient.

These obstacles may limit your maximum landing weight.



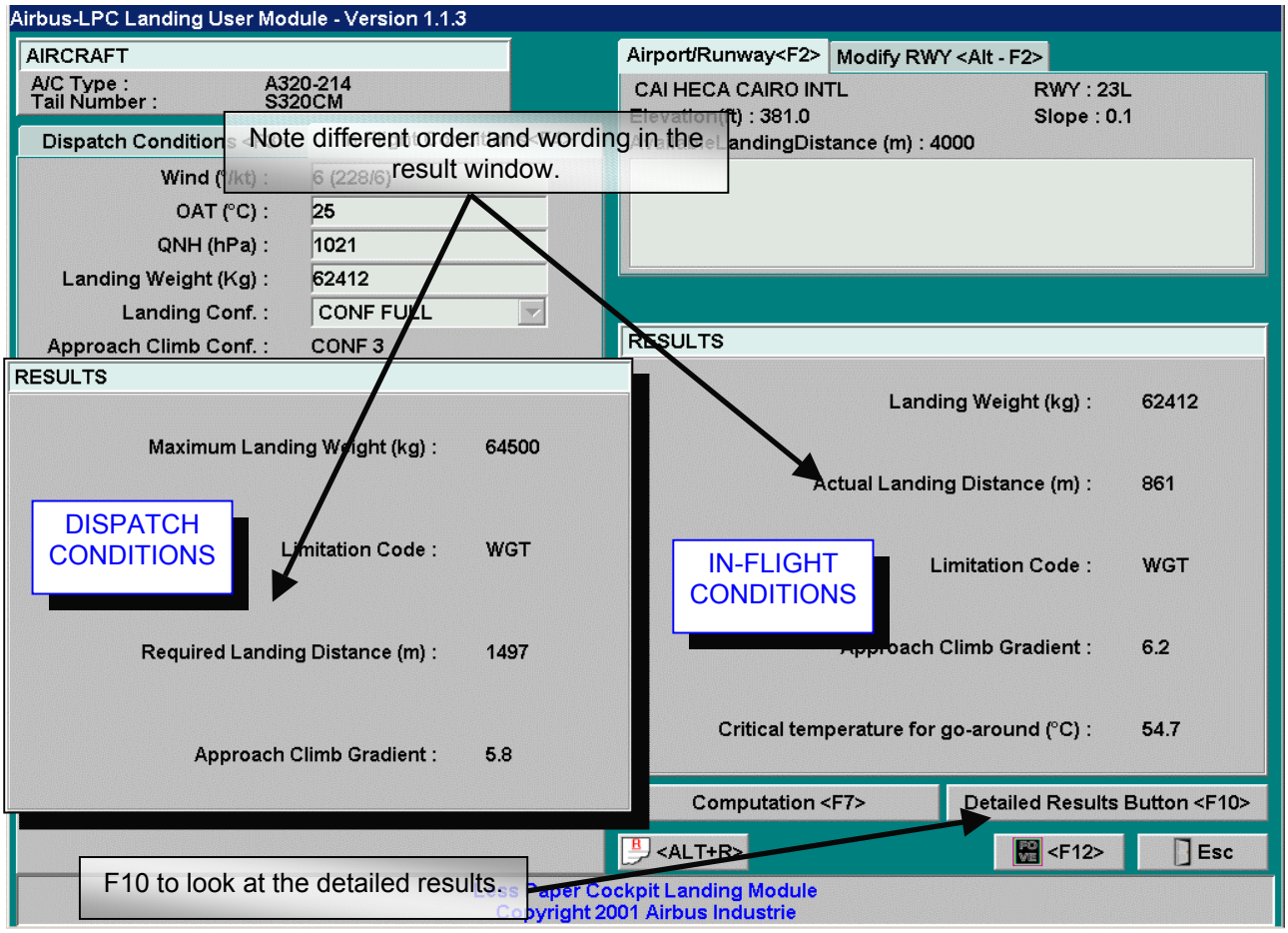
Note that the Actual Landing Distance is much smaller than the available landing distance (runway length) and that there are no limitations.

Let's compare these values with the dispatch ones.



In dispatch conditions, we look at the Required Landing Distance (RLD) and in flight at the Actual Landing Distance (ALD).

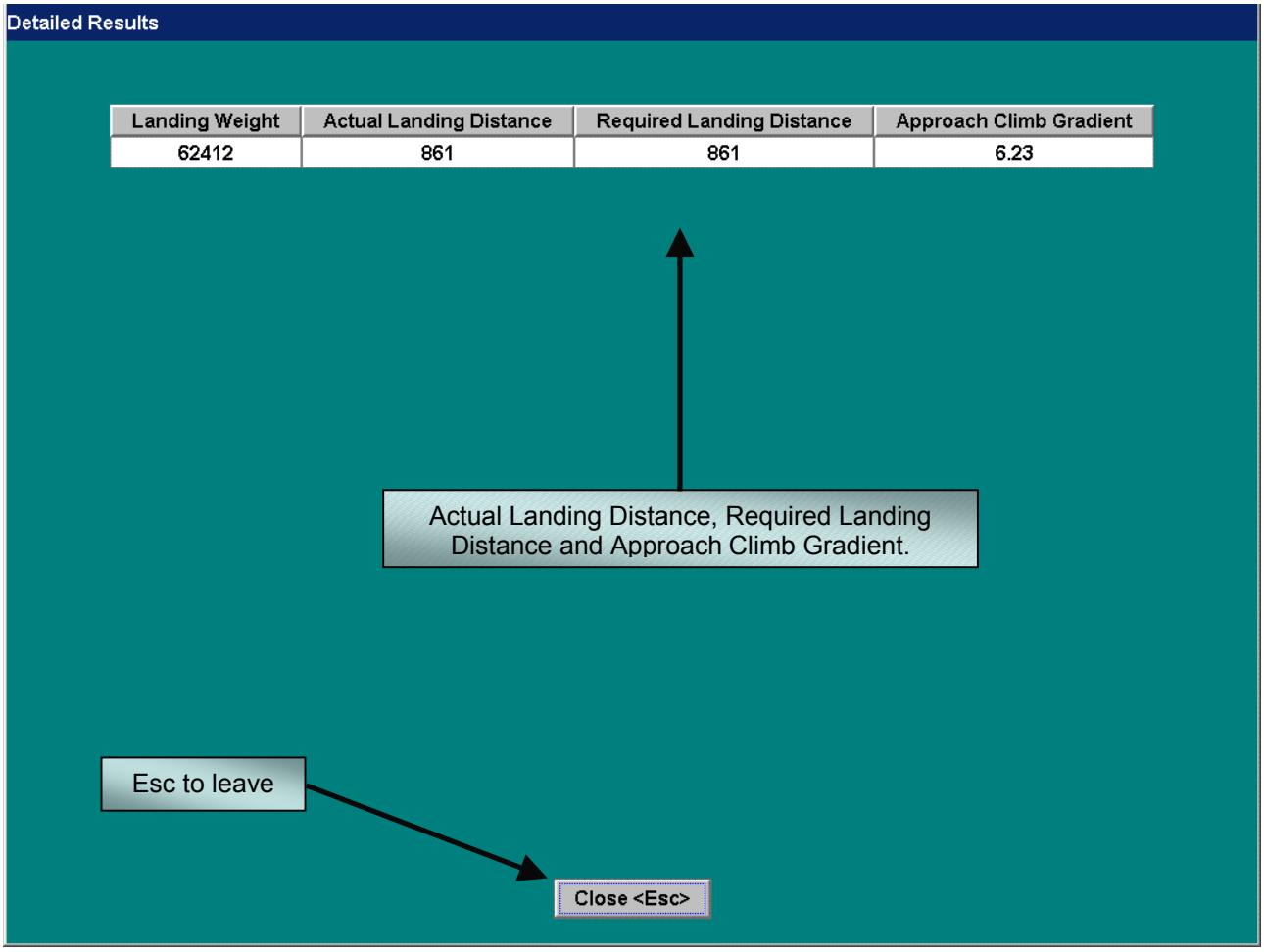
To look at the detailed results, depress F10.



For this weight you get the Actual Landing Distance and the Required Landing Distance.

The Approach Climb Gradient, is much higher than the minimum regulatory value of 2.1.

Escape to close.



The approach speed is determined using the following QRH.

Enter the landing weight and Flaps configuration FULL.

Read VLS, here 133 kt by interpolation.

Add wind correction, either 5 kt if no wind or 1/3 of headwind (limited to 15 kt) to determine Vapp

Vapp

QRH 2.31

Landing weight 62 412 kg

Wind 228/6 kt

Vapp = 133 + 5 = 138 kt

A319/A320	ABNORMAL PROCEDURES	REV 37 SEQ 210	2.31

VAPP DETERMINATION

- **NORMAL CONFIGURATION (OR NO △VREF)**

The FMGS performs the following VAPP computation for landing in normal configuration (CONF 3 or CONF FULL). These VAPP also apply for failure cases without △VREF.

Note : For CG < 25 %, add 2 knots to VLS CONF FULL and VLS CONF 3.

W(1000KG)	40	44	48	52	56	60	64	68	72	76	78
VLS CONF FULL (KT)	106	111	116	121	125	130	134	138	142	146	148
VLS CONF 3 (KT)	110	115	120	125	130	135	139	143	147	151	153

+

CORRECTION

5KT

1/3 HEADWIND (EXCLUDING GUST) MAX=15KT

WHICHEVER IS HIGHER

=

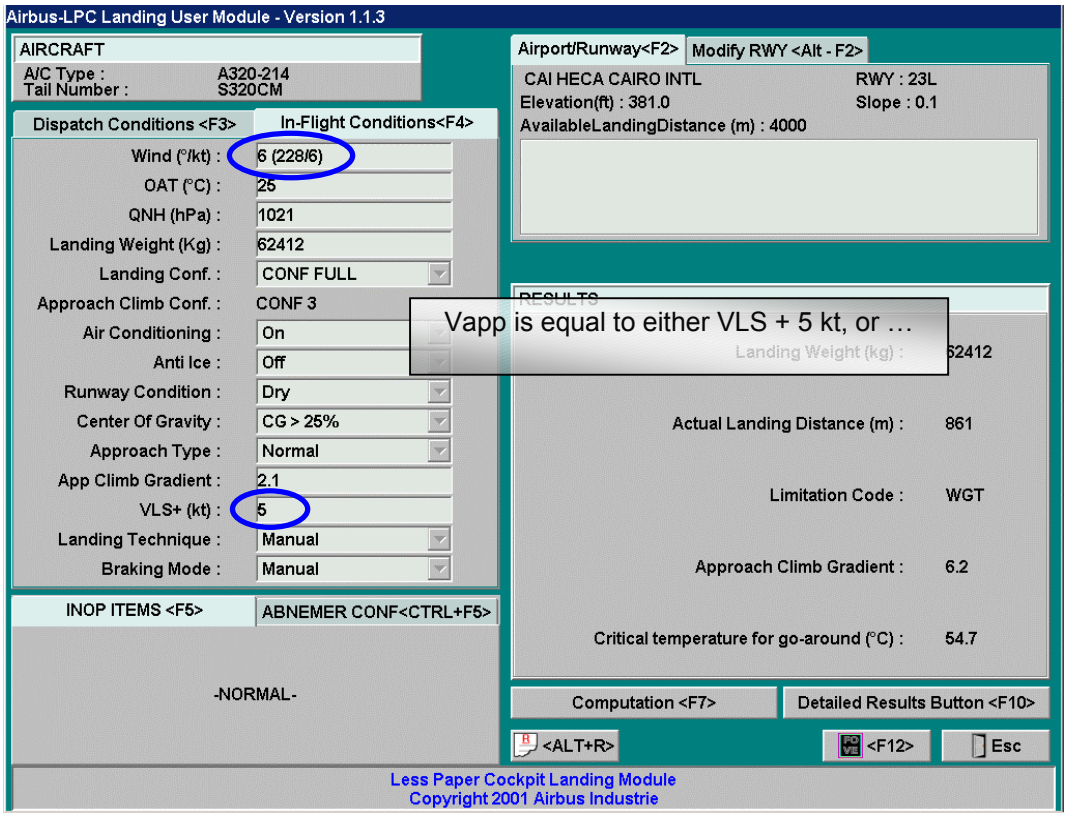
-VAPP-

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

MCLS-DD-0002-031-A210AA

The 5–knot increment is required when the A/THR is used, or when an autoland is performed.

*NOTE : * – In case of ice accretion, Vapp must not be lower than :*
- *VLS + 5 knots in CONF FULL*
- *VLS + 10 knots in CONF 3*
- *In case of gusty crosswind greater than 20 knots, Vapp should be at least VLS + 5 knots.*


Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
RWY : 23L
Elevation(ft) : 381.0
Slope : 0.1
AvailableLandingDistance (m) : 4000
Dispatch Conditions <F3>
In-Flight Conditions<F4>
Wind (°/kt) : 6 (228/6)
OAT (°C) : 25
QNH (hPa) : 1021
Landing Weight (Kg) : 62412
Landing Conf. : CONF FULL
Approach Climb Conf. : CONF 3
Air Conditioning : On
Anti Ice : Off
Runway Condition : Dry
Center Of Gravity : CG > 25%
Approach Type : Normal
App Climb Gradient : 2.1
VLS+ (kt) : 5
Landing Technique : Manual
Braking Mode : Manual
Vapp is equal to either VLS + 5 kt, or …
RESULTS
Landing Weight (kg) : 62412
Actual Landing Distance (m) : 861
Limitation Code : WGT
Approach Climb Gradient : 6.2
Critical temperature for go-around (°C) : 54.7
INOP ITEMS <F5>
ABNEMER CONF<CTRL+F5>
-NORMAL-
Computation <F7>
Detailed Results Button <F10>
<ALT+R>
<F12>
Esc
Less Paper Cockpit Landing Module
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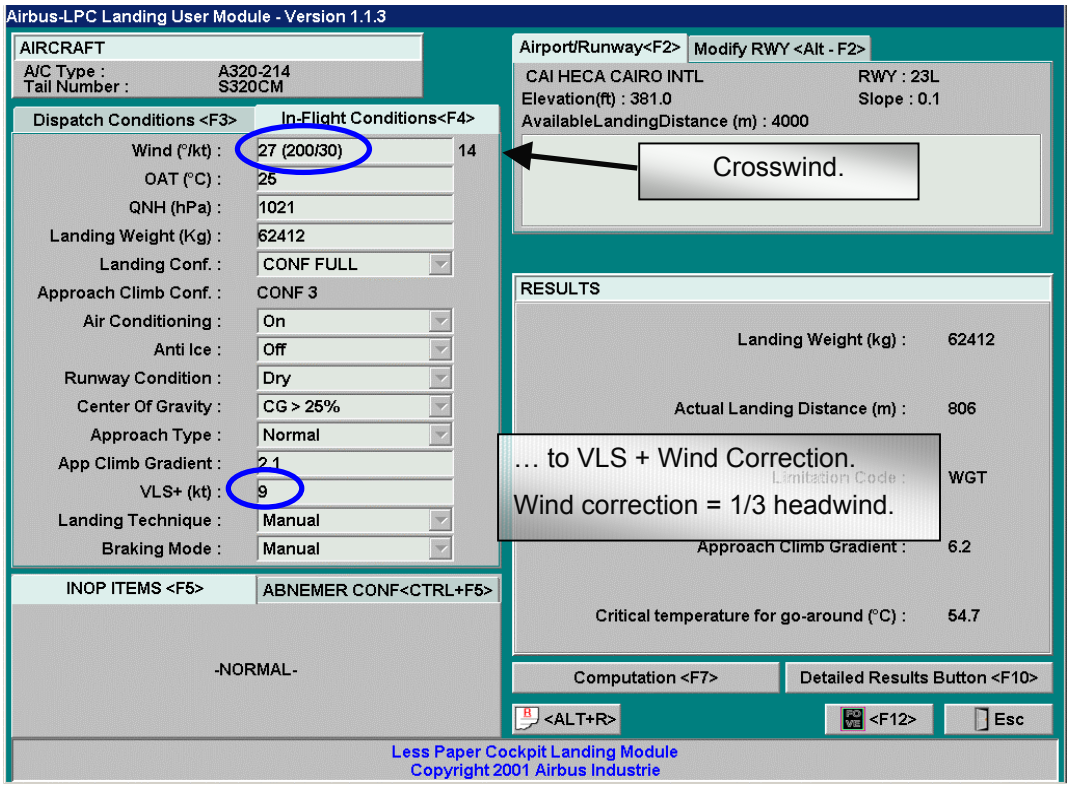
Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
RWY : 23L
Elevation(ft) : 381.0
Slope : 0.1
AvailableLandingDistance (m) : 4000
Crosswind.
Dispatch Conditions <F3>
In-Flight Conditions<F4>
Wind (°/kt) : 27 (200/30) 14
OAT (°C) : 25
QNH (hPa) : 1021
Landing Weight (Kg) : 62412
Landing Conf. : CONF FULL
Approach Climb Conf. : CONF 3
Air Conditioning : On
Anti Ice : Off
Runway Condition : Dry
Center Of Gravity : CG > 25%
Approach Type : Normal
App Climb Gradient : 2.1
VLS+ (kt) : 9
Landing Technique : Manual
Braking Mode : Manual
RESULTS
Landing Weight (kg) : 62412
Actual Landing Distance (m) : 806
… to VLS + Wind Correction.
Wind correction = 1/3 headwind.
Limitation Code : WGT
Approach Climb Gradient : 6.2
Critical temperature for go-around (°C) : 54.7
INOP ITEMS <F5>
ABNEMER CONF<CTRL+F5>
-NORMAL-
Computation <F7>
Detailed Results Button <F10>
<ALT+R>
<F12>
Esc
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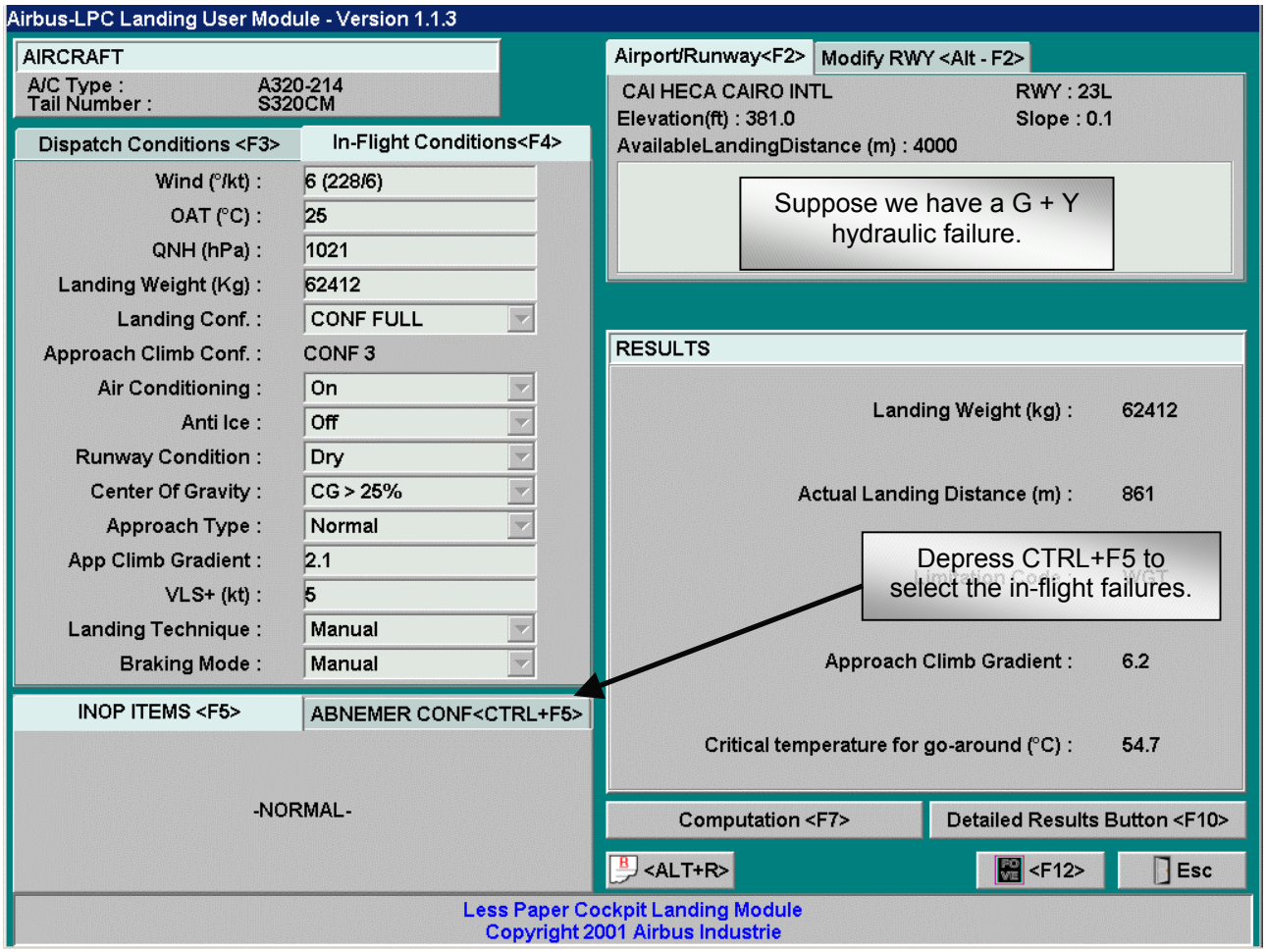
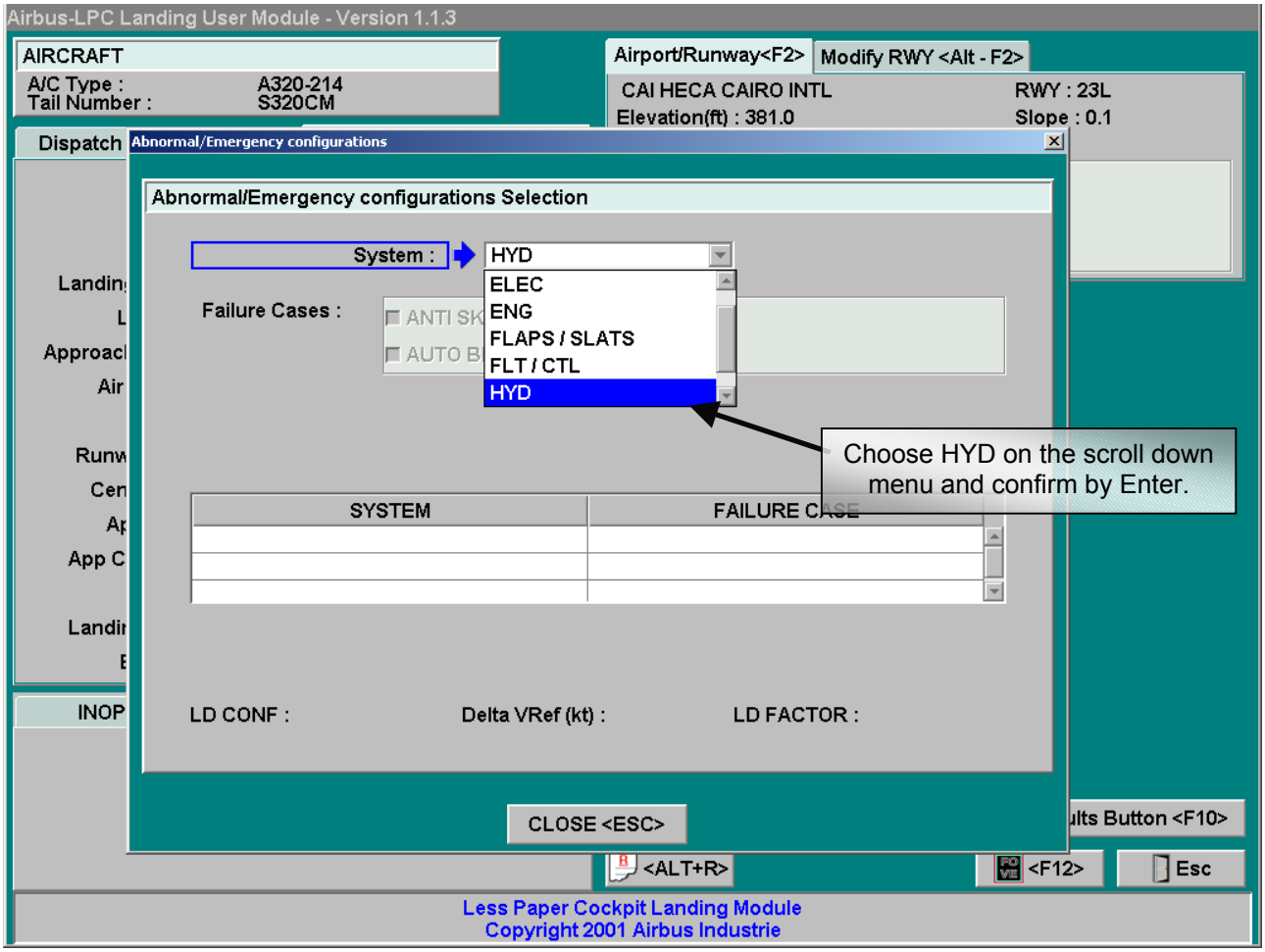
If an aircraft system failure occurs during the flight, it must be entered into the LPC tool. The system will then be able to compute its effects on the approach speed and actual landing distance.

Depress CTRL+F5 to study the way to enter the failures/inoperative items.




Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
Elevation(ft) : 381.0
RWY : 23L
Slope : 0.1
Dispatch
Abnormal/Emergency configurations
Abnormal/Emergency configurations Selection
System :
HYD
ELEC
ENG
FLAPS / SLATS
FLT / CTL
HYD
Failure Cases :
ANTI SK
AUTO B
Choose HYD on the scroll down menu and confirm by Enter.
SYSTEM
FAILURE CASE
LD CONF :
Delta VRef (kt) :
LD FACTOR :
CLOSE <ESC>
INOP
<ALT+R>
<F12>
Esc
Less Paper Cockpit Landing Module
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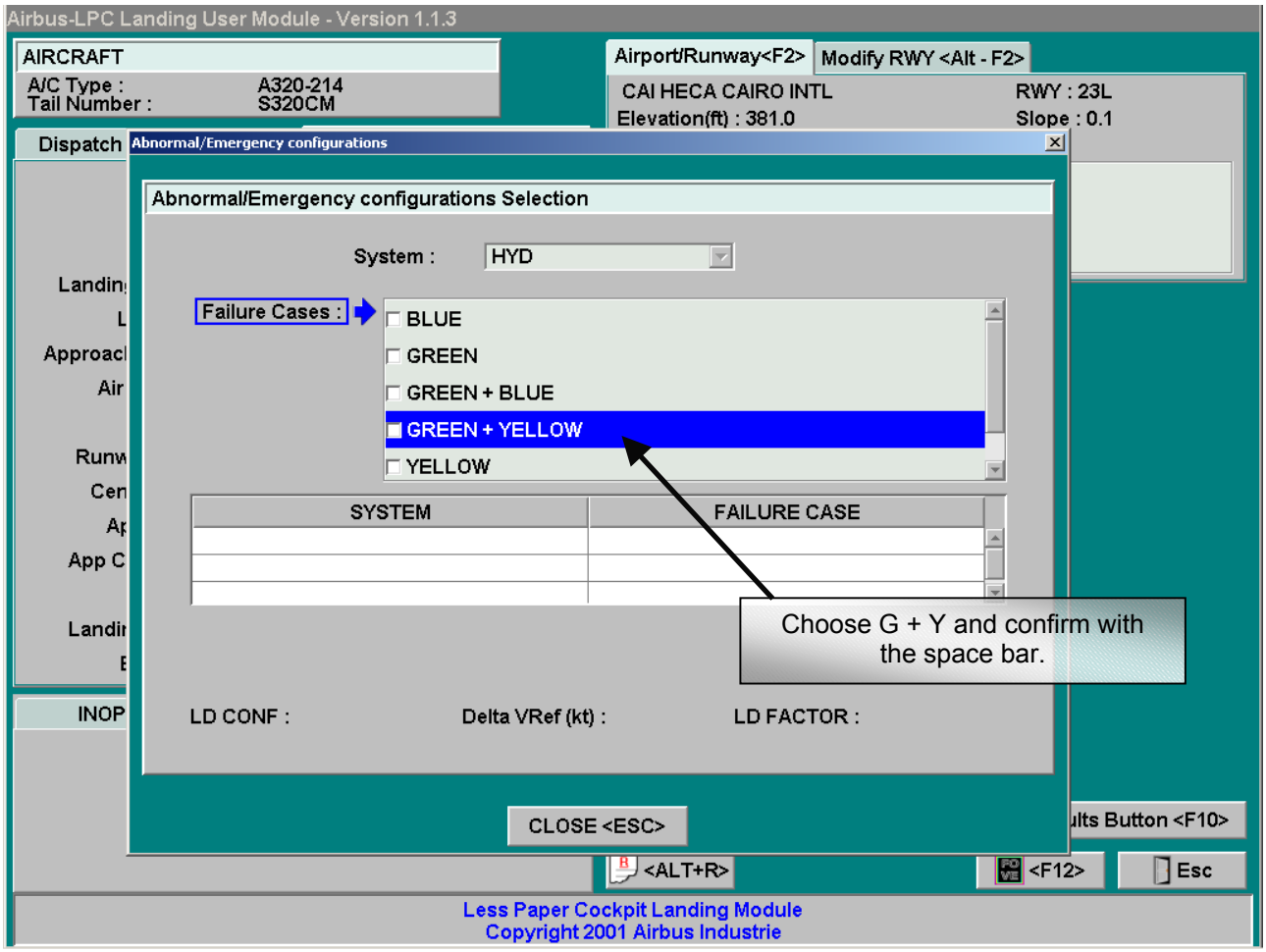
Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
Elevation(ft) : 381.0
RWY : 23L
Slope : 0.1
Dispatch
Abnormal/Emergency configurations
Abnormal/Emergency configurations Selection
System : HYD
Failure Cases :
BLUE
GREEN
GREEN + BLUE
GREEN + YELLOW
YELLOW
SYSTEM
FAILURE CASE
Choose G + Y and confirm with the space bar.
INOP
LD CONF :
Delta VRef (kt) :
LD FACTOR :
CLOSE <ESC>
<ALT+R>
<F12>
Esc
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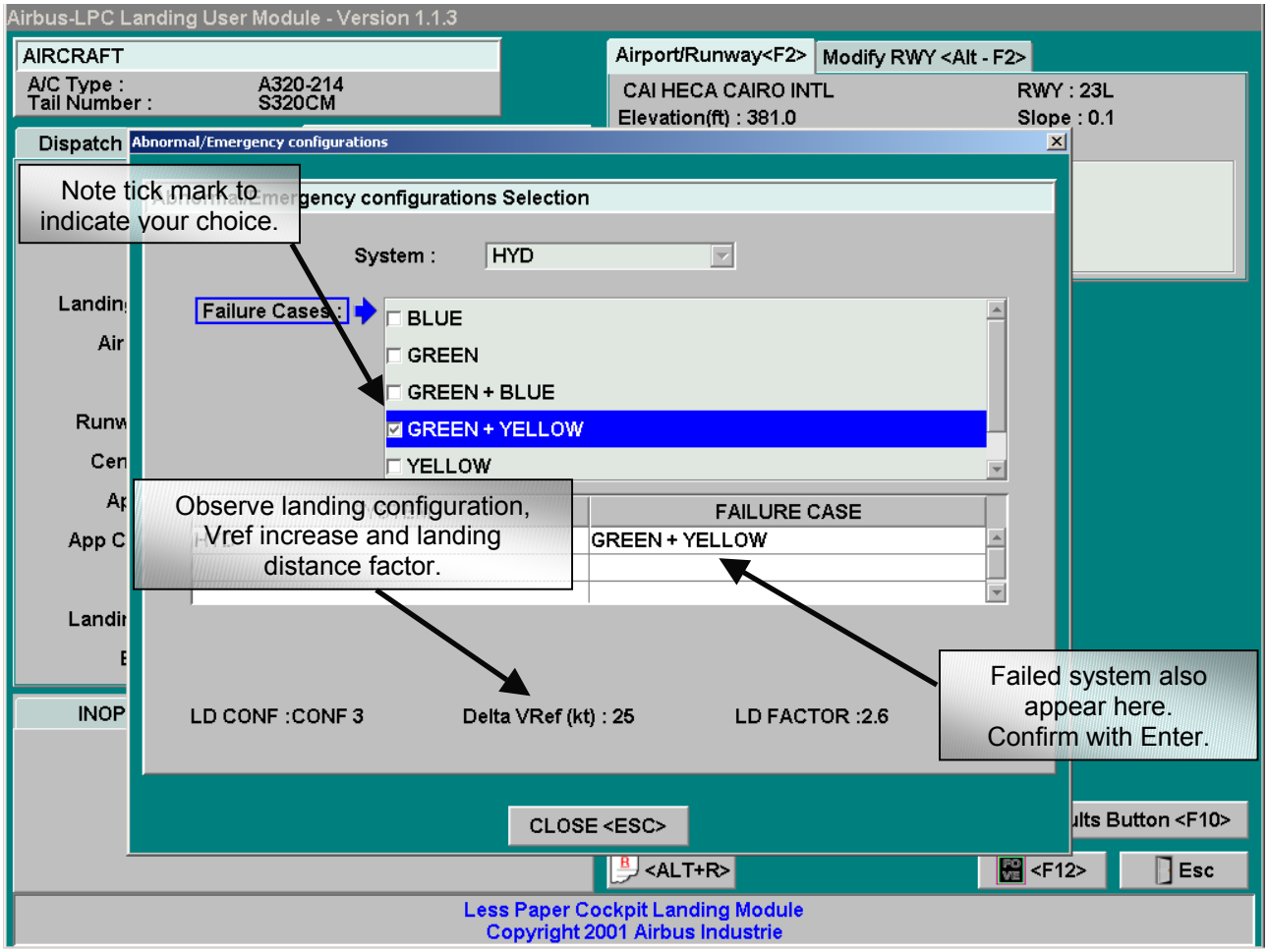
Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
RWY : 23L
Elevation(ft) : 381.0
Slope : 0.1
Dispatch
Abnormal/Emergency configurations
Note tick mark to indicate your choice.
gency configurations Selection
System : HYD
Failure Cases :
BLUE
GREEN
GREEN + BLUE
GREEN + YELLOW
YELLOW
FAILURE CASE
GREEN + YELLOW
Observe landing configuration, Vref increase and landing distance factor.
LD CONF :CONF 3
Delta VRef (kt) : 25
LD FACTOR :2.6
Failed system also appear here. Confirm with Enter.
CLOSE <ESC>
<ALT+R>
<F12>
Esc
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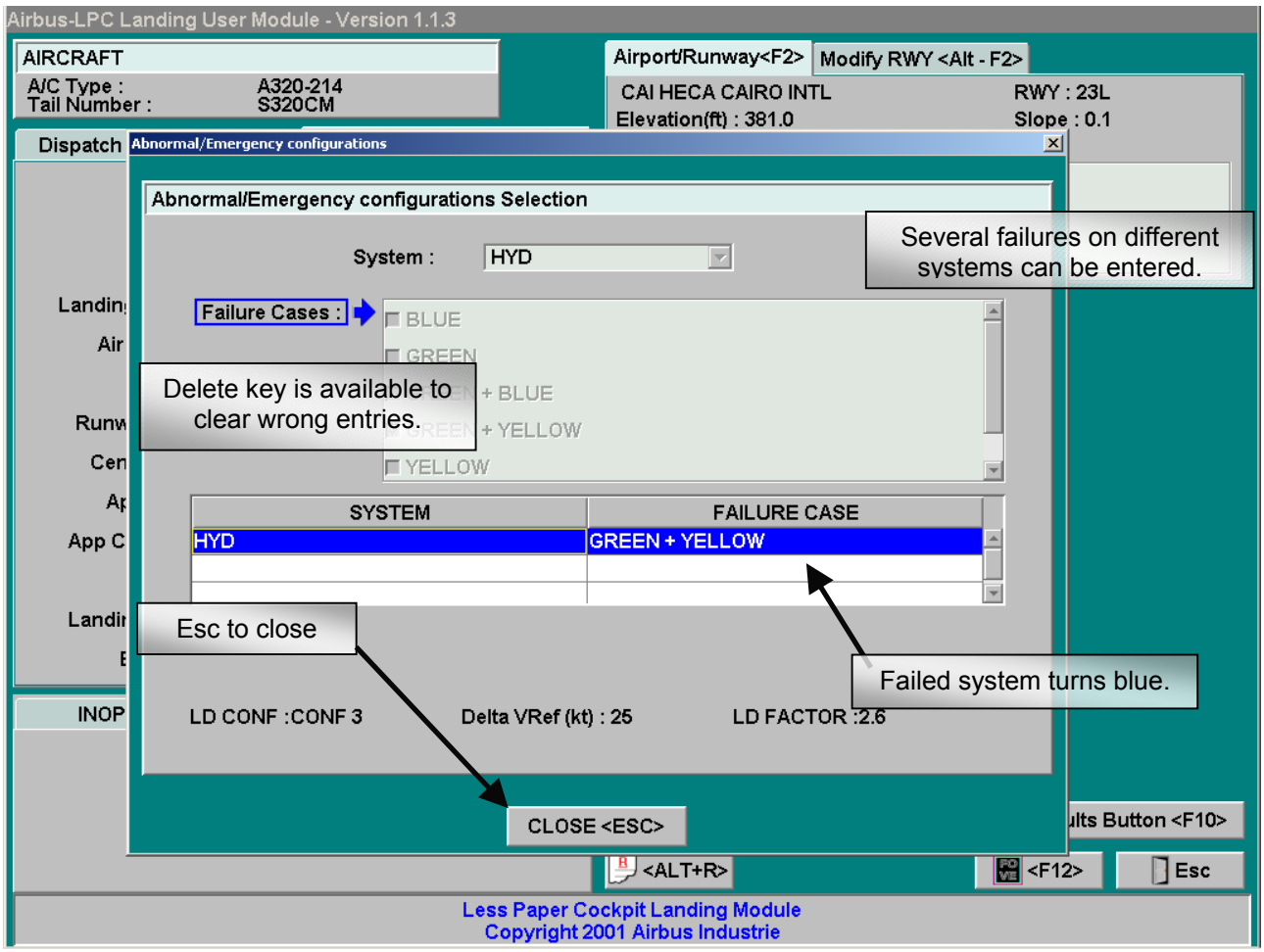
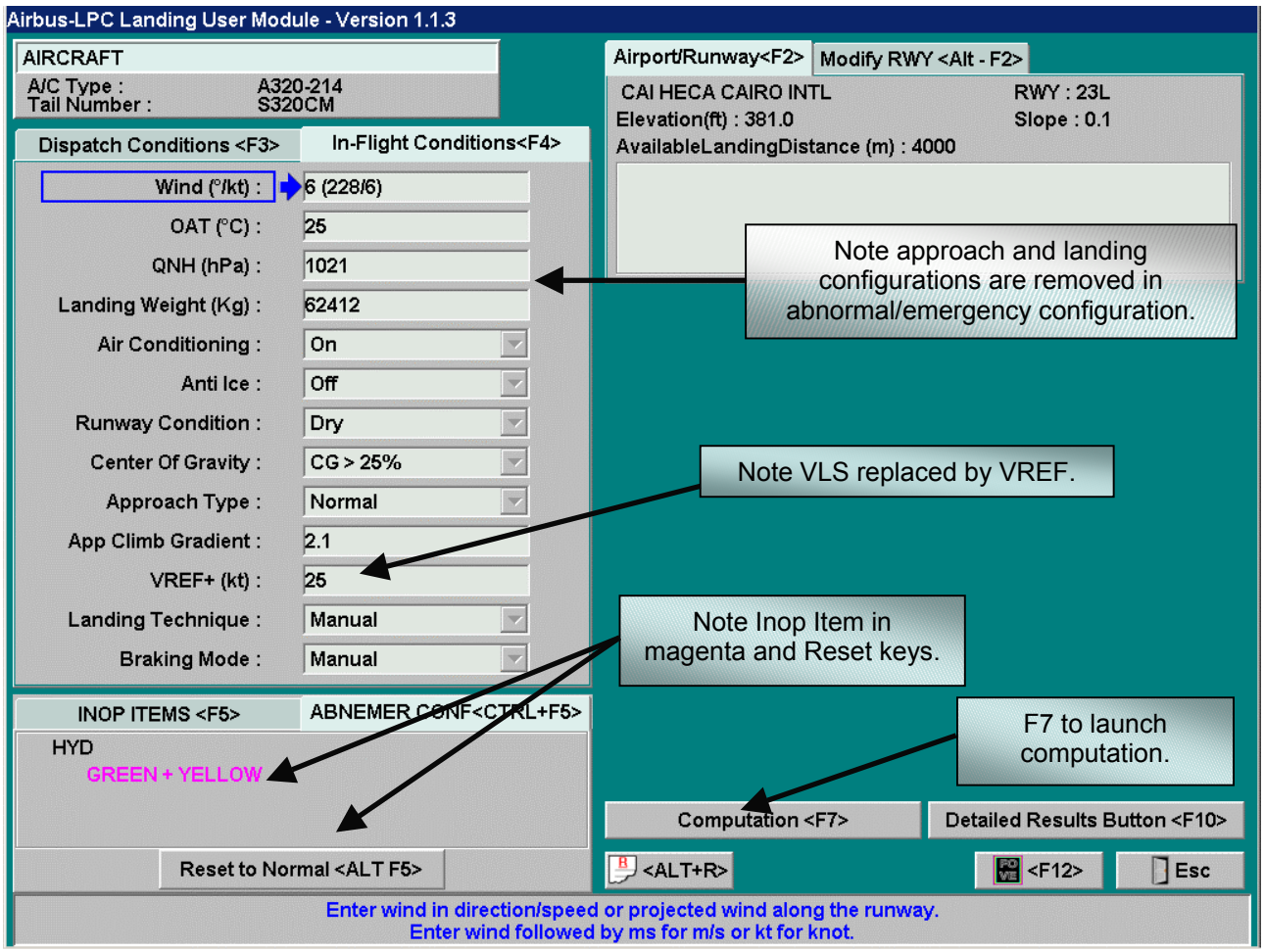
Several failures can be entered.

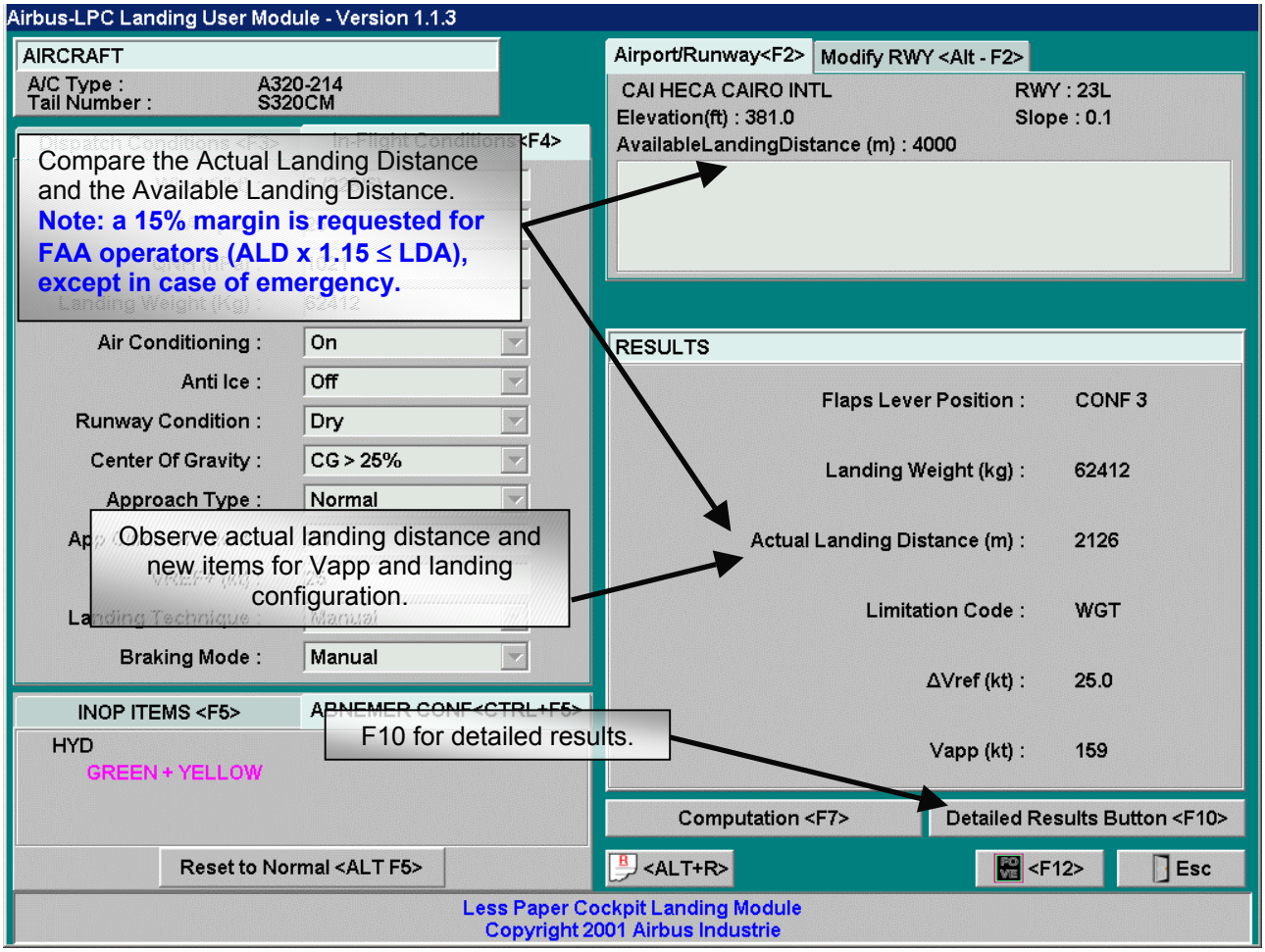
The VRef increase and landing distance factor will be automatically incremented.



As we have a failure, VLS is now replaced by VREF and the speed increase is determined by the kind of failure.

Wind effect is not taken into account.




Airbus-LPC Landing User Module - Version 1.1.3
AIRCRAFT
A/C Type : A320-214
Tail Number : S320CM
Airport/Runway<F2>
Modify RWY <Alt - F2>
CAI HECA CAIRO INTL
RWY : 23L
Elevation(ft) : 381.0
Slope : 0.1
AvailableLandingDistance (m) : 4000
Compare the Actual Landing Distance and the Available Landing Distance.
Note: a 15% margin is requested for FAA operators (ALD x 1.15 ≤ LDA), except in case of emergency.
Air Conditioning : On
Anti Ice : Off
Runway Condition : Dry
Center Of Gravity : CG > 25%
Approach Type : Normal
Braking Mode : Manual
RESULTS
Flaps Lever Position : CONF 3
Landing Weight (kg) : 62412
Actual Landing Distance (m) : 2126
Limitation Code : WGT
ΔVref (kt) : 25.0
Vapp (kt) : 159
Observe actual landing distance and new items for Vapp and landing configuration.
F10 for detailed results.
INOP ITEMS <F5>
HYD
GREEN + YELLOW
Computation <F7>
Detailed Results Button <F10>
Reset to Normal <ALT F5>
<ALT+R>
<F12>
Esc
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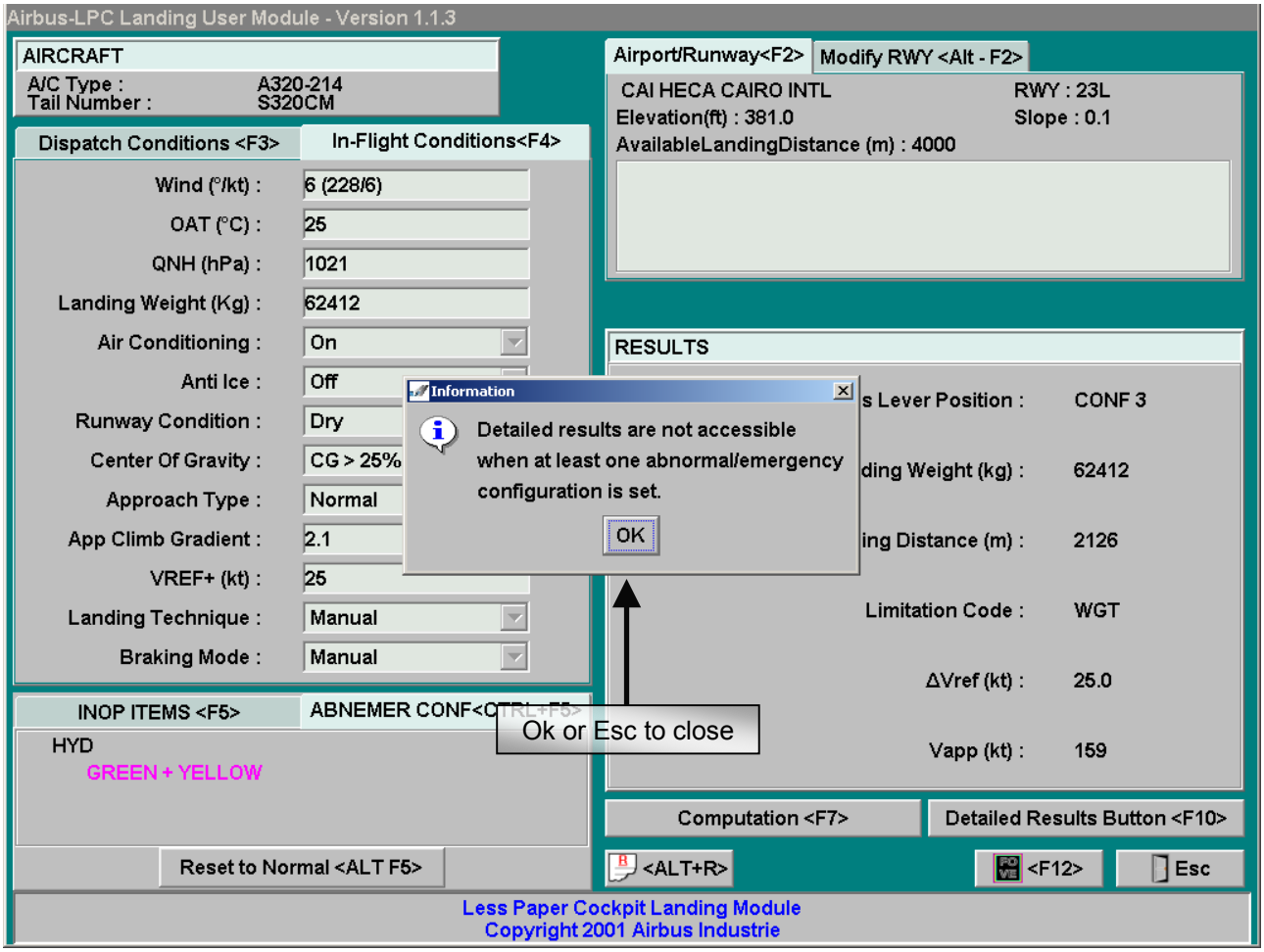
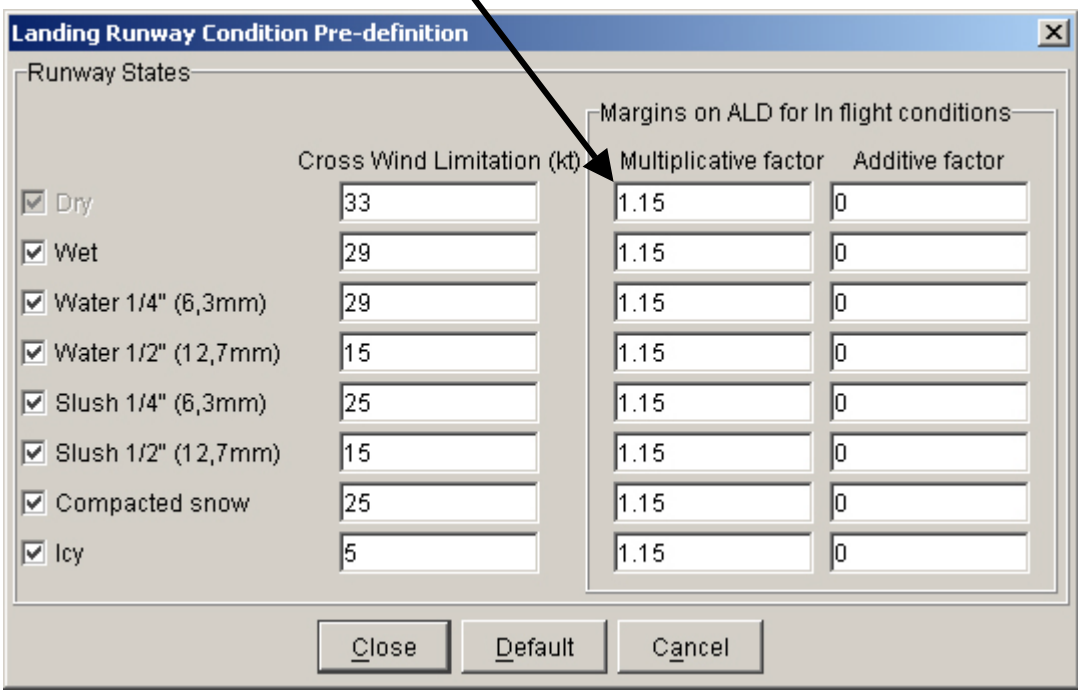
After an in flight failure, the required landing distance concept no longer applies. The runway length to be considered is the actual landing distance.



We will now do some practical exercises.
Please go to the landing module on your laptop.

Note: For FAA operators, the 15% margin requested between ALD and LDA could directly be included in the displayed ALD (LPC administration option – company policy).

Let's move to the exercises now.



7. FCOM 2 EXTRACTS

CONTENTS:

7.1. Special Operations

A319/A320/A321 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS	2.04.10	P 1
	FLUID CONTAMINATED RUNWAY	SEQ 001	REV 32

GENERAL

This section presents the recommendations of Airbus Industrie for operations from wet runways or from runways which are covered with contaminants such as standing water, slush or snow.

CAUTION
Take off from an icy runway is not recommended.

DEFINITIONS

DAMP : A runway is damp when the surface is not dry, but when the water on it does not give it a shiny appearance.

WET : A runway is considered as wet when the surface has a shiny appearance due to a thin layer of water. When this layer does not exceed 3 mm depth, there is no substantial risk of hydroplaning.

STANDING WATER : is caused by heavy rainfall and /or insufficient runway drainage with a depth of more than 3 mm.

SLUSH : is water saturated with snow which spatters when stepping firmly on it. It is encountered at temperatures around 5° C and its density is approximately 0.85 kg/liter (7.1 lb/US GAL).

WET SNOW : is a condition where, if compacted by hand, snow will stick together and tend to form a snowball. Its density is approximately 0.4 kg/liter (3.35 lb/US GAL).

DRY SNOW : is a condition where snow can be blown if loose, or if compacted by hand, will fall apart again upon release. Its density is approximately 0.2 kg/liter (1.7 lb/US GAL).

COMPACTED SNOW : is a condition where snow has been compressed (a typical friction coefficient is 0.2).

ICY : is a condition where the friction coefficient is 0.05 or below.

The performance given in this chapter has been divided into two categories which are determined by the depth of the contaminant. For each of these categories an equivalent depth of contaminant has been defined for which the performance deterioration is the same.

1. WET RUNWAY and EQUIVALENT

Equivalent of a wet runway is a runway covered with or less than :

R
- 2 mm (0.08 inch) slush
- 3 mm (0.12 inch) water
- 4 mm (0.16 inch) wet snow
- 15 mm (0.59 inch) dry snow

2. CONTAMINATED RUNWAY

R An equivalence between depth of slush and snow has been defined :
- 12.7 mm (1/2 inch) wet snow is equivalent to 6.3 mm (1/4 inch) slush

R
- 25.4 mm (1 inch) wet snow is equivalent to 12.7 mm (1/2 inch) slush
- 50.8 mm (2 inches) dry snow is equivalent to 6.3 mm (1/4 inch) slush

R
- 101.6 mm (4 inches) dry snow is equivalent to 12.7 mm (1/2 inch) slush

Note : 1. On a damp runway no performance degradation should be considered.
2. It is not recommended to take off from a runway covered with more than 4 inches of dry snow or 1 inch of wet snow.

OPERATIONAL CONDITIONS

Performance penalties for takeoff as published in this section are computed with the following assumptions :
- The contaminant is in a layer of uniform depth and density over the entire length of the runway.
- Antiskid and spoilers are operative.
- The friction coefficient is based on studies and checked by actual tests.
- The screen height at the end of takeoff segment is 15 feet, not 35 feet.

In addition, for contaminated runways only :
- There is drag due to rolling resistance of the wheels.
- There is drag due to spray on the airframe and gears.
- Reverse thrust is used for the deceleration phase.
- Maximum thrust is used for takeoff.

Note : The net flight path clears obstacles by 15 feet instead of 35 feet.

7.2. Flight Planning

A319/A320/A321	FLIGHT PLANNING	2.05.10	P 2
FLIGHT CREW OPERATING MANUAL	GENERAL	SEQ 001	REV 21

MINIMUM RECOMMENDED FUEL REQUIREMENTS

The total fuel quantity required to fly a given sector is the sum of the following quantities:

TAXI FUEL

Quantity required for startup and taxi. Fuel calculation is based on a consumption of
11.5 kg/min or **25 lb/min**
Average quantity (12 minutes) → **140 kg** or **300 lb**

TRIP FUEL

Fuel required from departure to destination includes the following quantities:
- Takeoff and climb at selected speed.
- Cruise at selected speed.
- Descent from cruising level to 1500 feet above destination airport.
- Approach and landing. Fuel calculation is based on a consumption of **20 kg/min** or **45 lb/min**.
  Average quantity (6 minute IFR) → **120 kg** or **270 lb**

RESERVE FUEL

This quantity includes :

"En Route" reserve fuel (contingency fuel)
- According to national regulations and company policy (generally based on a percentage of trip fuel).

Alternate fuel
- Fuel required to fly from destination to alternate airport.
  It includes go-around **100 kg** or **220 lb**, climb to cruising level, cruise at long range speed, descent and approach procedure.
  80 kg or 180 lb for 4 minute VFR

Holding Fuel
Calculation of holding fuel should take into account the altitude of the alternate and the landing weight at the alternate, using holding charts of chapter 3.05.25.
A conservative quantity corresponding to a 30 minute holding at 1500 feet above alternate airport elevation at "green dot" speed in the clean configuration is
1200 kg or **2700 lb** .

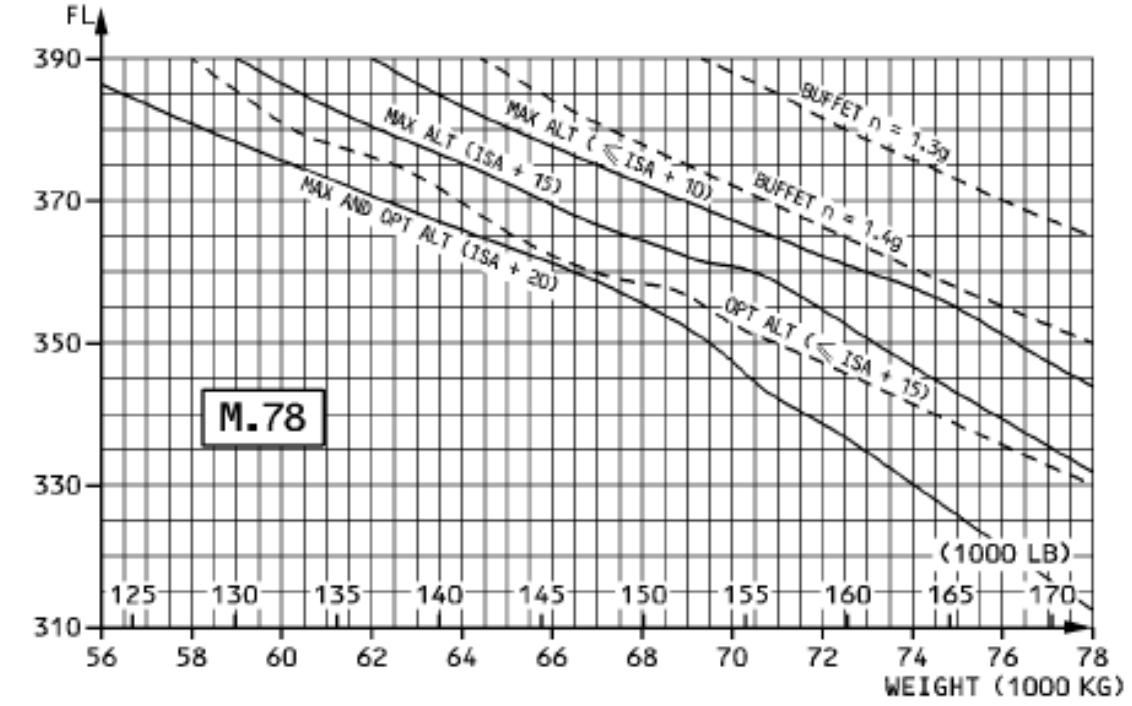
APU FUEL

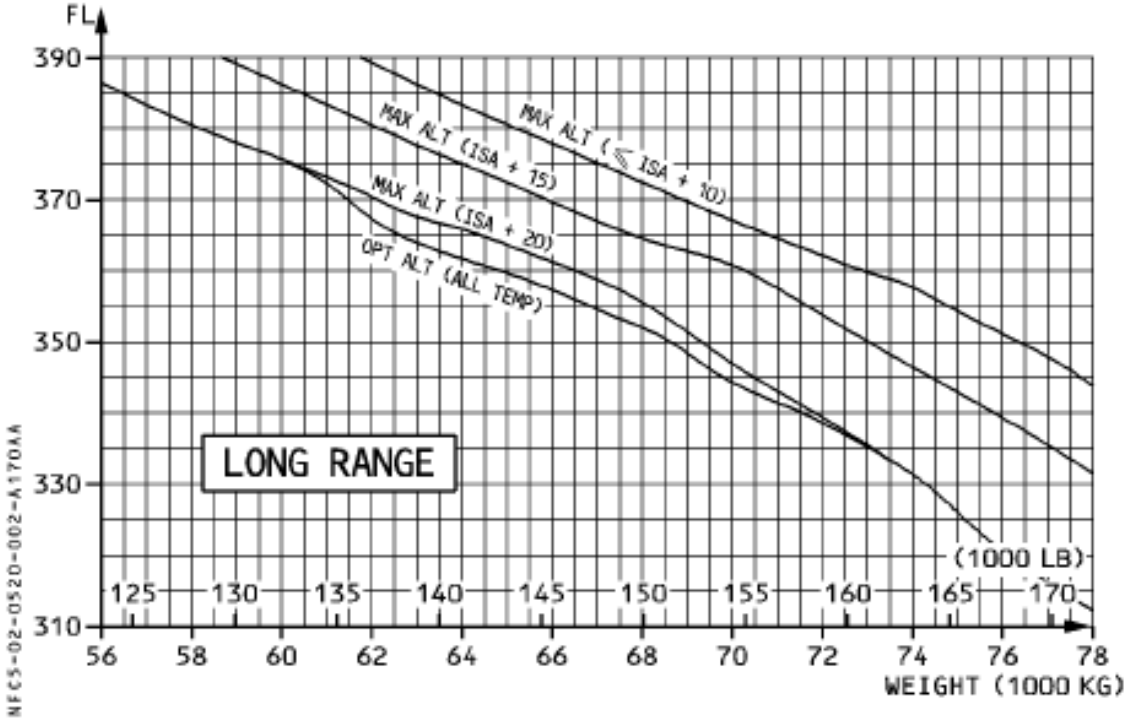
During ground operations, APU fuel consumption is about **130 kg/h** or **290 lb/h** (Packs ON, 90 kVA load on APU GEN).

EEZ ALL

A319/A320/A321	FLIGHT PLANNING	2.05.20	P 2
FLIGHT CREW OPERATING MANUAL	CRUISE LEVEL	SEQ 170	REV 34

R





A319/A320/A321	FLIGHT PLANNING	2.05.40	P 10
FLIGHT CREW OPERATING MANUAL	QUICK DETERMINATION OF F-PLN	SEQ 180	REV 23

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1450	8460 3.44	8247 3.39	8063 3.33	7896 3.29	7764 3.26	7735 3.25	84	89	109
1475	8602 3.47	8384 3.42	8197 3.37	8026 3.32	7892 3.30	7863 3.29	85	90	111
1500	8744 3.51	8522 3.46	8332 3.40	8157 3.36	8021 3.33	7990 3.32*	87	92	113
1525	8887 3.55	8660 3.49	8466 3.43	8288 3.39	8149 3.36	8121 3.35*	88	93	115
1550	9029 3.58	8798 3.53	8600 3.47	8419 3.42	8278 3.40	8251 3.39*	90	95	117
1575	9172 4.02	8936 3.56	8735 3.50	8550 3.46	8407 3.43	8400 3.42*	91	96	119
1600	9315 4.05	9075 4.00	8870 3.54	8682 3.49	8536 3.46	8513 3.45*	93	98	121
1625	9458 4.09	9213 4.03	9005 3.57	8813 3.52	8665 3.50	8644 3.49*	94	100	123
1650	9601 4.12	9352 4.07	9141 4.00	8945 3.56	8795 3.53	8775 3.52*	96	101	125
1675	9745 4.16	9491 4.10	9276 4.04	9078 3.59	8924 3.56	8907 3.55*	97	103	127
1700	9888 4.20	9630 4.14	9411 4.07	9210 4.02	9054 3.59	9039 3.59*	99	104	129
1725	10032 4.23	9770 4.17	9546 4.11	9342 4.06	9185 4.03	9170 4.02*	100	106	131
1750	10176 4.27	9910 4.21	9682 4.14	9474 4.09	9315 4.06	9303 4.05*	102	108	133
1775	10321 4.30	10050 4.24	9818 4.17	9607 4.12	9446 4.09	9435 4.09*	103	109	135
1800	10465 4.34	10190 4.27	9954 4.21	9740 4.16	9577 4.13	9567 4.12*	105	111	138
1825	10610 4.37	10330 4.31	10090 4.24	9873 4.19	9708 4.16	9700 4.15*	106	113	140
1850	10755 4.41	10470 4.34	10226 4.28	10006 4.22	9840 4.19	9833 4.19*	108	114	142
1875	10900 4.45	10611 4.38	10363 4.31	10140 4.26	9972 4.23	9966 4.22*	109	116	144
1900	11045 4.48	10752 4.41	10500 4.34	10273 4.29	10105 4.26	10100 4.26*	111	118	146
1925	11191 4.52	10893 4.45	10637 4.38	10407 4.32	10237 4.29	10233 4.29*	112	119	148
1950	11337 4.55	11034 4.48	10774 4.41	10541 4.36	10370 4.33	10367 4.32*	114	121	151
1975	11483 4.59	11176 4.52	10911 4.45	10675 4.39	10503 4.36	10501 4.36*	115	123	153
2000	11629 5.02	11318 4.55	11049 4.48	10810 4.42	10636 4.39	10635 4.39*	117	124	155
2025	11775 5.06	11460 4.58	11187 4.51	10944 4.46	10769 4.43	10769 4.42*	118	126	157
2050	11922 5.09	11602 5.02	11325 4.55	11079 4.49	10903 4.46	10904 4.46*	120	128	159
2075	12068 5.13	11744 5.05	11463 4.58	11214 4.52	11037 4.49	11039 4.49*	121	129	162

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = –0.5 %	ΔFUEL = + 2.5 %	ΔFUEL = + 5 %

FLIP23D A320-214 CFM56-5B4/P SA3420 03301.000011 0250300 .7801 .00200 120 0300350 55 0 100100 40100 18590 FCOM-02-05-40-010-180

A319/A320/A321	FLIGHT PLANNING	2.05.60	P 2
FLIGHT CREW OPERATING MANUAL	GROUND DISTANCE/AIR DISTANCE	SEQ 001	REV 23

M.78

R

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND			WIND COMPONENTS (KT)			HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	7	8	9	10	11	13	15
20	15	16	18	20	23	26	30
30	22	25	27	30	34	39	45
40	30	33	36	40	45	51	60
50	37	41	45	50	56	64	75
100	75	82	90	100	113	129	150
200	150	164	180	200	225	257	300
300	225	245	270	300	338	386	450
400	300	327	360	400	450	514	600
500	375	409	450	500	563	643	750
1000	750	818	900	1000	1125	1286	1501
1500	1125	1227	1350	1500	1688	1929	2251
2000	1500	1636	1800	2000	2248	2572	3001
2500	1875	2045	2250	2500	2813	3215	3752
3000	2250	2454	2700	3000	3375	3858	4502
3500	2624	2863	3150	3500	3938	4501	5252
4000	2999	3272	3600	4000	4500	5144	6003
4500	3374	3681	4050	4500	5063	5787	6753
5000	3749	4090	4500	5000	5626	6430	7503

FLIP23 A320211 M565A1PIP 3410 03301.000011 0250300 .7800 .00000 0 0300350 0 0 77 64 43 61 18590 FCOM-N0-03-50-002-001

A319/A320/A321	FLIGHT PLANNING	2.05.50	P 3
FLIGHT CREW OPERATING MANUAL	ALTERNATE	SEQ 180	REV 23

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND : 100 KG - CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE
DESCENT : M.78/300KT/250KT - VMC PROCEDURE : 80 KG (4MIN)

REF. LANDING WEIGHT = 55000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 230	270	310	350	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL230 FL270	FL310 FL350	FL390
100								0
120	1065 0.25					7		0
140	1183 0.29	1193 0.28				9		0
160	1301 0.32	1303 0.31	1319 0.30			10	10	0
180	1419 0.35	1413 0.34	1422 0.33			11	12	0
200	1538 0.38	1523 0.37	1524 0.36	1531 0.35		12	13	0
220	1656 0.42	1633 0.40	1627 0.39	1628 0.38		13	14	0
240	1775 0.45	1744 0.43	1730 0.42	1724 0.41		14	15	0
260	1893 0.48	1854 0.46	1832 0.45	1822 0.44	1822 0.43	15	16	17
280	2012 0.52	1965 0.49	1935 0.48	1919 0.46	1915 0.46	16	17	18
300	2131 0.55	2076 0.52	2038 0.51	2016 0.49	2009 0.49	17	18	20
320	2250 0.58	2186 0.55	2142 0.54	2113 0.52	2103 0.51	18	19	21
340	2369 1.02	2297 0.58	2245 0.56	2211 0.55	2196 0.54	19	21	23
360	2489 1.05	2408 1.01	2348 0.59	2308 0.58	2290 0.57	20	22	24
380	2608 1.08	2519 1.04	2452 1.02	2406 1.00	2385 0.59	21	23	26
400	2728 1.12	2630 1.07	2555 1.05	2504 1.03	2479 1.02	22	24	27
420	2847 1.15	2742 1.10	2659 1.08	2602 1.06	2573 1.05	23	25	27
440	2967 1.18	2853 1.13	2763 1.11	2700 1.09	2668 1.07	24	26	28
460	3087 1.21	2965 1.16	2867 1.14	2798 1.11	2762 1.10	25	27	30
480	3207 1.25	3076 1.19	2971 1.17	2896 1.14	2857 1.13	26	28	31
500	3327 1.28	3188 1.22	3075 1.20	2994 1.17	2952 1.16	27	29	32

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 5 %

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A319/A320/A321	FLIGHT PLANNING	2.05.60	P 4
FLIGHT CREW OPERATING MANUAL	GROUND DISTANCE/AIR DISTANCE	SEQ 001	REV 21

LONG RANGE SPEED ABOVE FL270

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND			WIND COMPONENTS (KT)			HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	8	8	9	10	11	13	15
20	15	16	18	20	22	26	30
30	23	25	27	30	34	38	45
40	30	33	36	40	45	51	60
50	38	41	45	50	56	64	75
100	75	82	90	100	112	128	149
200	150	164	180	200	225	256	299
300	226	246	270	300	337	385	448
400	301	328	360	400	449	513	597
500	376	410	450	500	562	641	746
1000	752	820	901	1000	1124	1282	1493
1500	1128	1230	1351	1500	1685	1923	2239
2000	1504	1639	1802	2000	2247	2564	2985
2500	1880	2049	2252	2500	2809	3205	3731
3000	2256	2459	2703	3000	3371	3846	4478
3500	2632	2869	3153	3500	3933	4487	5224
4000	3008	3279	3604	4000	4494	5128	5970
4500	3383	3689	4054	4500	5056	5769	6716
5000	3759	4098	4505	5000	5618	6410	7463

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8. FCOM 3 EXTRACTS

CONTENTS:

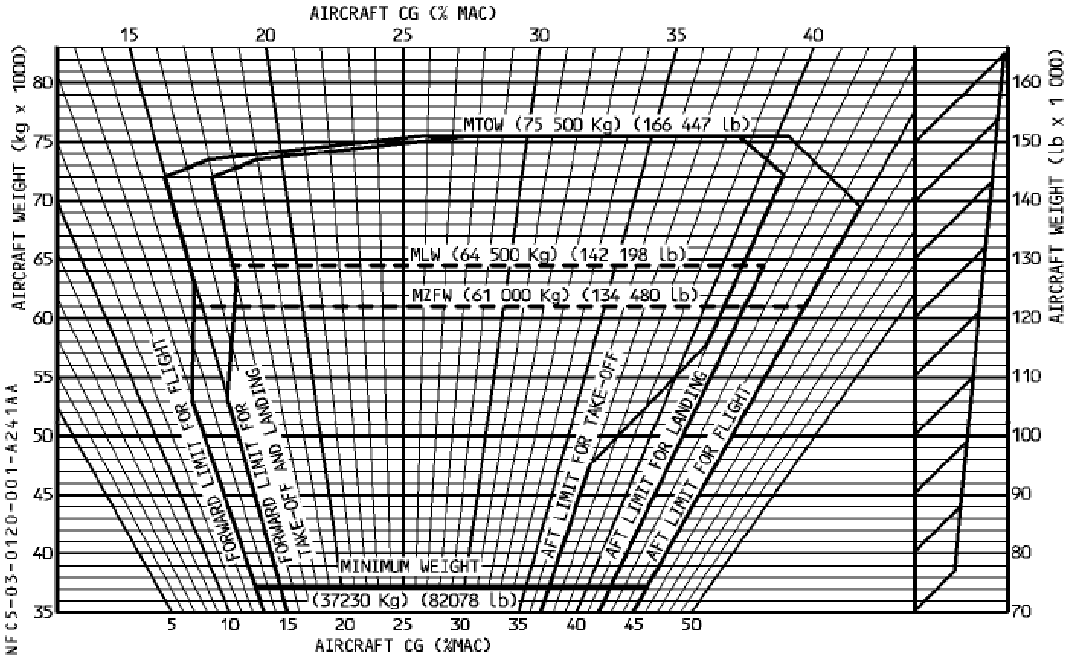
8.1. Operating Limitations

A319/A320/A321	OPERATING LIMITATIONS	3.01.20	P 1
FLIGHT CREW OPERATING MANUAL	GENERAL LIMITATIONS	SEQ 241	REV 32

MINIMUM FLIGHT CREW

The minimum flight crew consists of 2 pilots.

CENTER OF GRAVITY LIMITS



- CG limits are given in percentage of the reference chord length aft of the leading edge.
- The reference chord length is 4.193 m (13.76 ft). It is 16.31 m (53.51 ft) aft of the aircraft nose.
- The CG must always be within these limits, regardless of fuel load.

WEIGHT LIMITATIONS

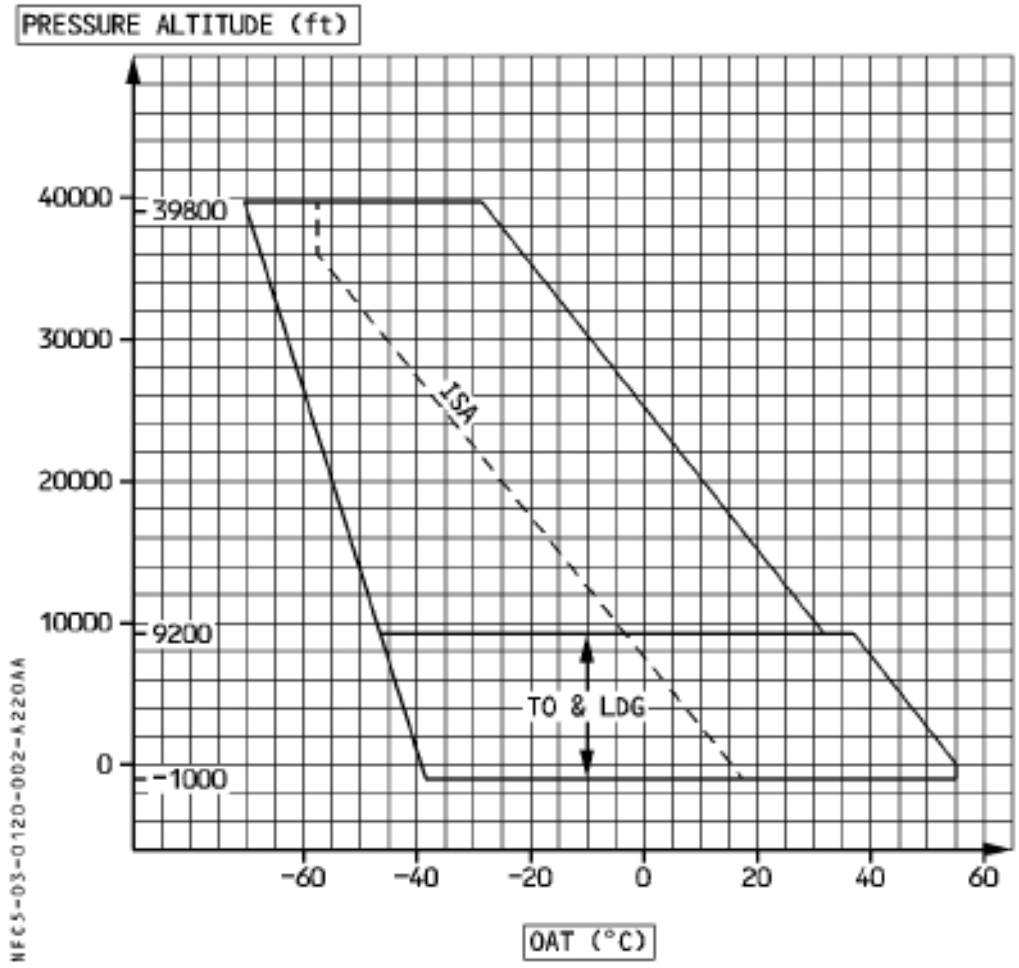
Maximum taxi weight . . . . . 75 900 kg (167 329 lb)
Maximum takeoff weight (brake release) . . . . . 75 500 kg (166 447 lb)
Maximum landing weight . . . . . 64 500 kg (142 198 lb)
Maximum zero fuel weight . . . . . 61 000 kg (134 480 lb)
Minimum weight . . . . . 37 230 kg (82 078 lb)
In exceptional cases (in flight turn back or diversion), an immediate landing at weight above maximum landing weight is permitted, provided the pilot follows the overweight landing procedure.

A319/A320/A321 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS	3.01.20	P 2
	GENERAL LIMITATIONS	SEQ 220	REV 33

FLIGHT MANEUVERING LOAD ACCELERATION LIMITS

Clean configuration . . . . . – 1 g to + 2.5 g
Slats and flaps extended . . . . . 0 g to + 2 g
Slats extended and flaps retracted . . . . . 0 g to + 2 g

ENVIRONMENTAL ENVELOPE



A319/A320/A321	OPERATING LIMITATIONS	3.01.20	P 3
FLIGHT CREW OPERATING MANUAL	GENERAL LIMITATIONS	SEQ 050	REV 37

AIRPORT OPERATIONS

- Runway slope (mean) . . . . . ± 2 %
- Runway altitude . . . . . 9200 feet
- Nominal runway width . . . . . 45 meters
- Wind for takeoff and landing :
  - · Maximum crosswind demonstrated for takeoff . . 29 knots gusting up to 38 knots*
  - · Maximum crosswind demonstrated for landing . . 33 knots gusting up to 38 knots*
  - · Maximum tailwind . . . . . 10 knots

    * : Maximum crosswind values have been demonstrated with flight controls in normal law, as well as in direct law with and without yaw damper.

R - Wind for passenger / cargo door operation :

R · Maximum wind for passenger door operation : . . . . . 65 knots

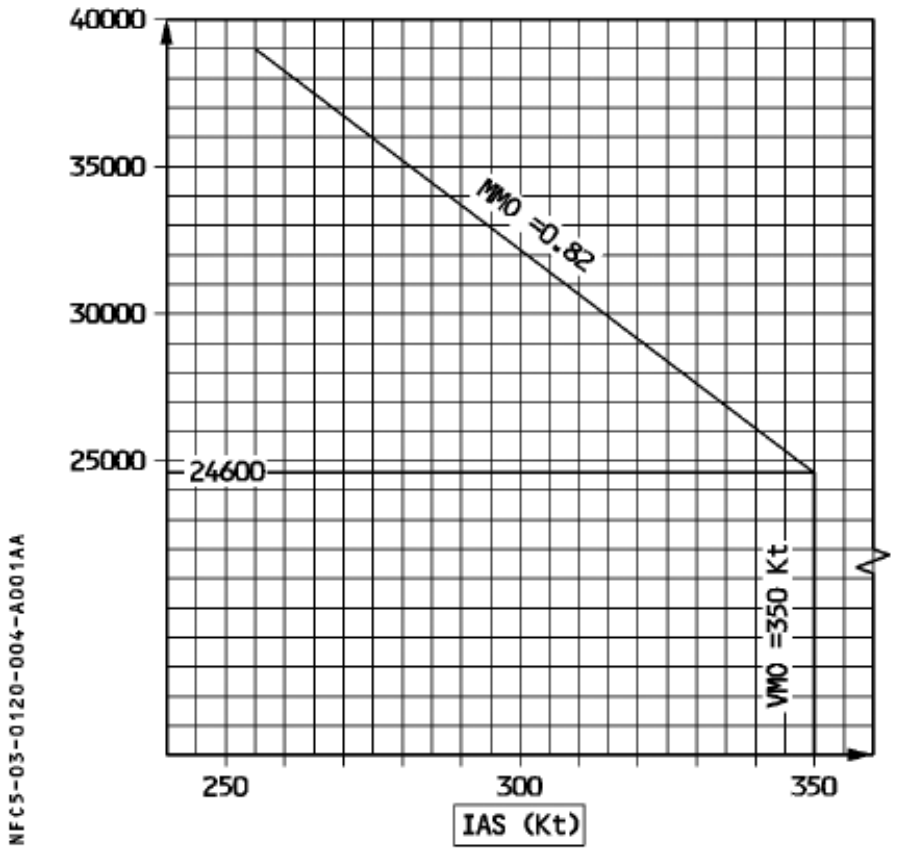
R · Maximum wind for cargo door opening : . . . . . 40 knots

R · The cargo door must be closed, before the wind speed exceeds 65 knots.

A319/A320/A321	OPERATING LIMITATIONS	3.01.20	P 4
FLIGHT CREW OPERATING MANUAL	GENERAL LIMITATIONS	SEQ 001	REV 26

SPEED LIMITATIONS

R **MAXIMUM OPERATING SPEED VMO/MMO**

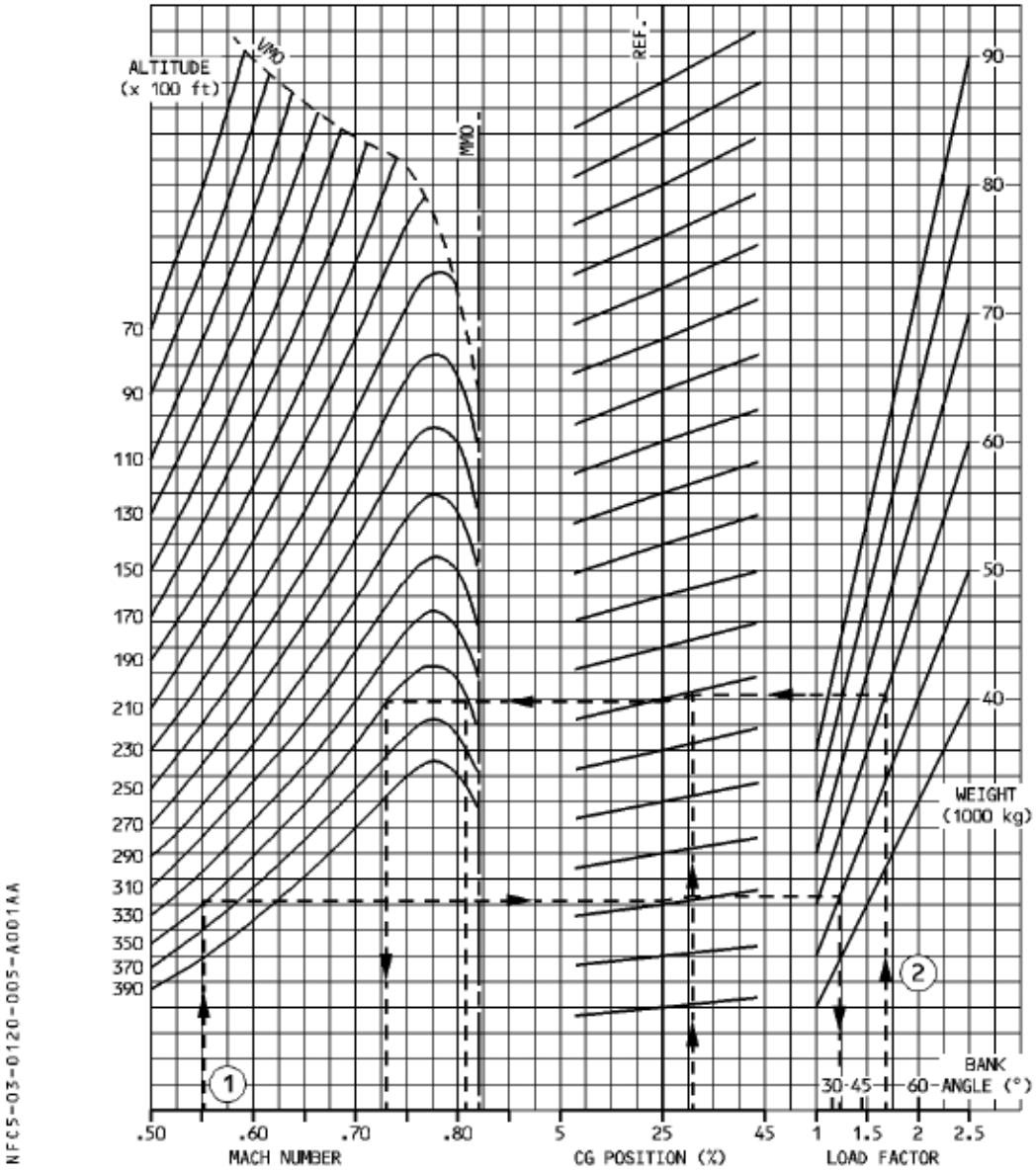


The maximum operating limit speed VMO/MMO may not be exceeded deliberately in any regime of flight.

A319/A320/A321	OPERATING LIMITATIONS	3.01.20	P 5
FLIGHT CREW OPERATING MANUAL	GENERAL LIMITATIONS	SEQ 001	REV 27

BUFFET ONSET

R



R Examples :

R 1. Determine Maximum Bank Angle limited by buffet :

R DATA : M = 0.55, FL = 350, CG = 31 %, WEIGHT = 50000 kg

R RESULT : load factor = 1.25 g or 35° bank

R 2. Determine low and high speed limited by buffet :

R DATA : 52° bank or 1.7 g, WEIGHT = 60000 kg, CG = 31%, FL = 350

R RESULT : M = 0.73 (low speed buffet) and M = 0.81 (high speed buffet).

A319/A320/A321	OPERATING LIMITATIONS	3.01.20	P 6
FLIGHT CREW OPERATING MANUAL	GENERAL LIMITATIONS	SEQ 050	REV 34

MINIMUM CONTROL SPEEDS

R

Altitude (ft)	VMCA (KT CAS)	VMCG (KT IAS)		
		CONF 1 + F	CONF 2	CONF 3
0	110	109.5	107.5	107
2000	108	107.5	105.5	105
4000	107.5	107	105	104.5
6000	105.5	105	103	102.5
8000	103	102.5	100.5	100
9200	101.2	100.5	98.5	98

MAXIMUM FLAPS/SLATS SPEEDS

LEVER POSITION	SLATS	FLAPS	Ind. on ECAM	MAX SPD	FLIGHT PHASE
1	18	0	1	230	HOLDING
1	18	10	1 + F	215	TAKEOFF
2	22	15	2	200	TAKEOFF/APPROACH
3	22	20	3	185	TAKEOFF/APPROACH/LANDING
FULL	27	35	FULL	177	LANDING

GEAR DOWN SPEEDS

- Maximum speed with landing gear extended (VLE) 280 kt/M.67
- Maximum speed at which the landing gear may be extended (VLO extension) . 250 kt
- Maximum speed at which the landing gear may be retracted (VLO retraction) . 220 kt
- Maximum altitude at which the landing gear may be extended . . . . . 25 000 ft

MAXIMUM TIRE SPEED

- Ground speed . . . . . 195 knots

IN USE

- Maximum speed . . . . . 230 knots

COCKPIT WINDOW OPEN

- Maximum speed . . . . . 200 knots

A319/A320/A321	OPERATING LIMITATIONS	3.01.20	P 8
FLIGHT CREW OPERATING MANUAL	GENERAL LIMITATIONS	SEQ 001	REV 24

STALLING SPEEDS

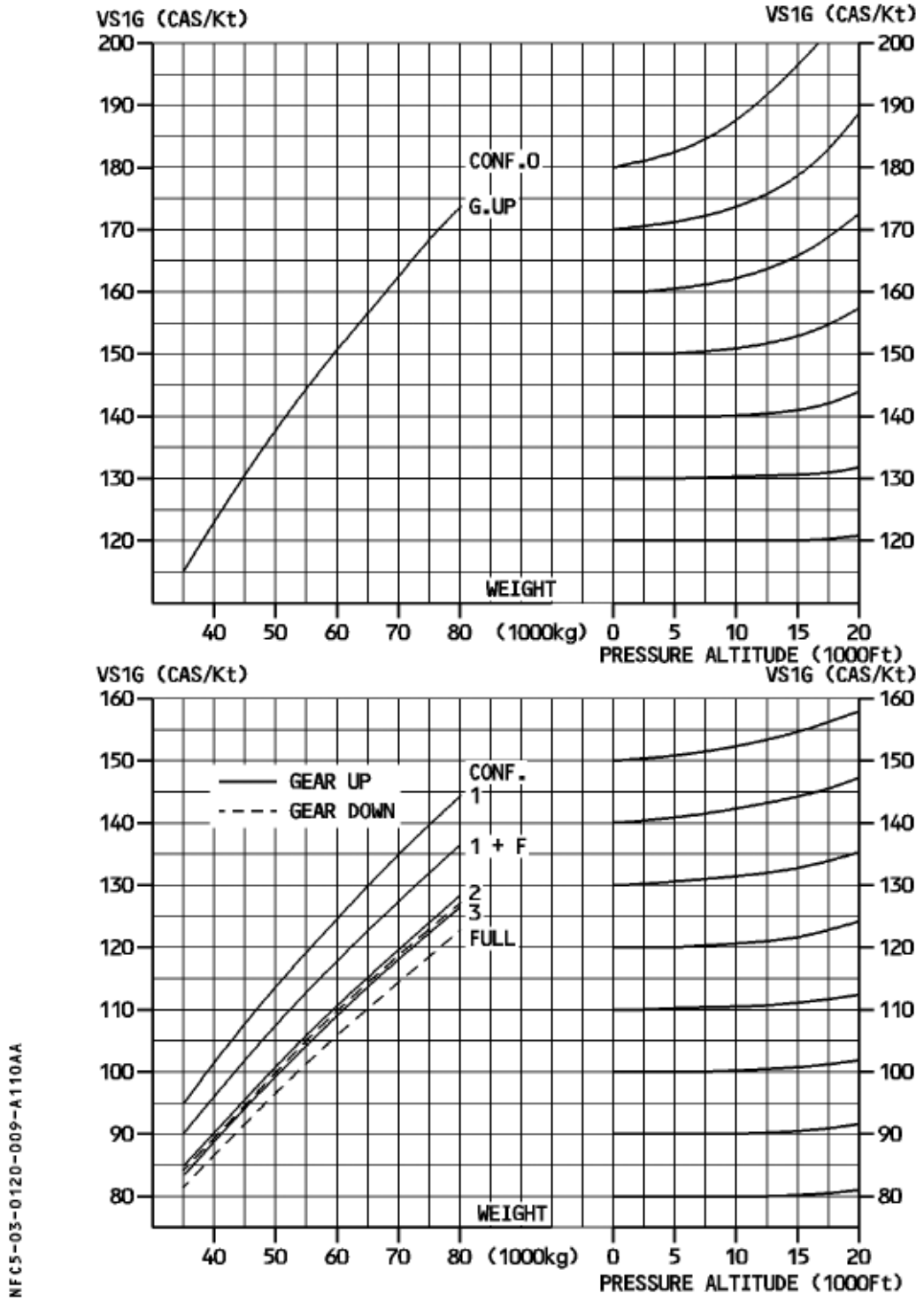
The following graphs serve to determine the VS according to the configuration.
These graphs have been established for

- Basic forward CG
  - 23 % CG location in clean configuration
  - 25 % CG location in takeoff, approach and landing configuration
- Alternate forward CG
  - forward CG limit. See 3.01.20 p 1.

In most cases the CG location remains within the CG envelope below. Consequently the basic forward CG must be retained for any performance determination.
In some rare cases, if more forward CG is anticipated during any part of the flight, the alternate forward CG must be retained for any performance determination.

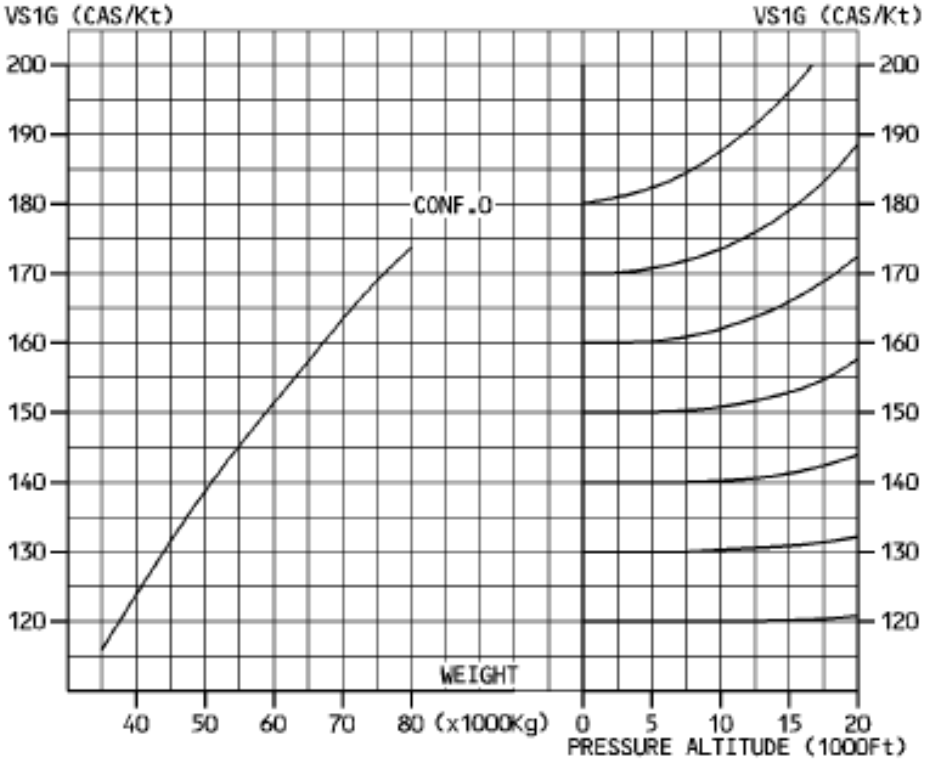
A319/A320/A321	OPERATING LIMITATIONS	3.01.20	P 9
FLIGHT CREW OPERATING MANUAL	GENERAL LIMITATIONS	SEQ 110	REV 24

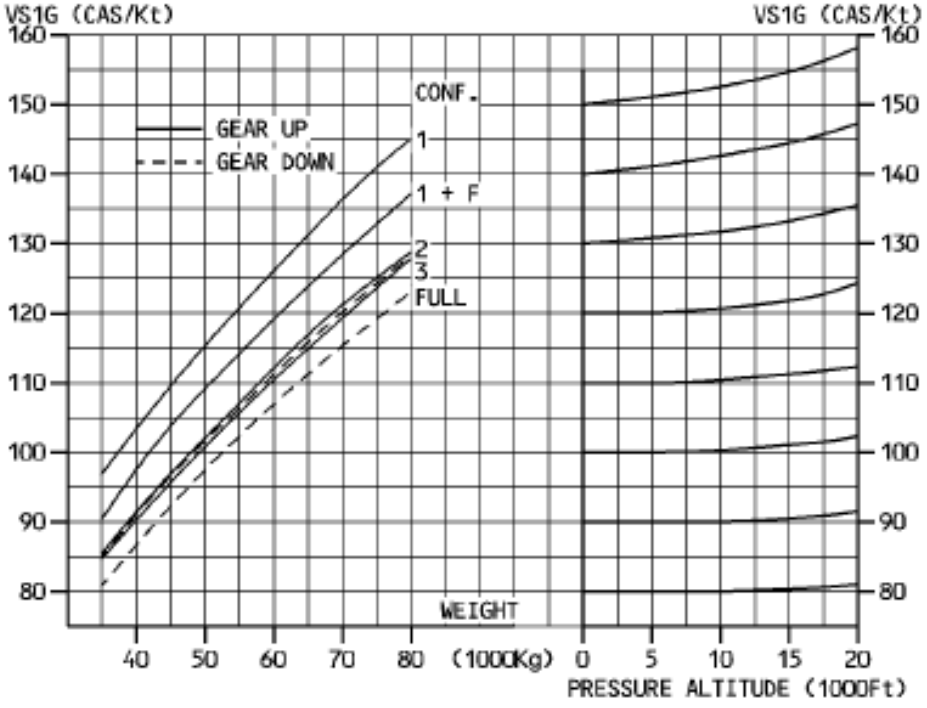
STALLING SPEEDS (BASIC FORWARD C.G.)



A319/A320/A321 eurofly FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS	3.01.20	P 10
	GENERAL LIMITATIONS	SEQ 120	REV 26

STALLING SPEEDS (ALTERNATE FORWARD C.G.)





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8.2. Supplementary Techniques

A319/A320/A321 FLIGHT CREW OPERATING MANUAL	SUPPLEMENTARY TECHNIQUES	3.04.10	P 1
	OPERATING SPEEDS DEFINITION	SEQ 001	REV 24

GENERAL

This chapter shows the symbology and definition of speeds.
Source of computation is also given when applicable.

CHARACTERISTIC SPEEDS

The characteristic speeds displayed on the PFD are computed by the FAC (Flight Augmentation Computer) according to aerodynamic data.
VLS (of normal landing configuration : CONF 3 or FULL), F, S and Green Dot speeds are also displayed on the MCDU TAKEOFF and/or APPR pages.
These values are computed by the FMGC, based on the aircraft gross weight (which is computed according to the entered ZFW and the FOB) or predicted grossweight (for approach or go around).

VS : Stalling speed.
Not displayed.
For a conventional aircraft, the reference stall speed, VSmin, is based on a load factor that is less than 1g. This gives a stall speed that is lower than the stall speed at 1g. All operating speeds are expressed as functions of this speed (for example, VREF = 1.3 VSmin).
Because aircraft of the A320 family have a low-speed protection feature (alpha limit) that the flight crew cannot override, the airworthiness authorities have reconsidered the definition of stall speed for these aircraft.
All the operating speeds must be referenced to a speed that can be demonstrated by flight test. This speed is designated VS1g.
Airworthiness authorities have agreed that a factor of 0.94 represents the relationship between VS1g for aircraft of the A320 family and VSmin for conventional aircraft types. As a result the authorities allow aircraft of the A320 family to use the following factors :
V2 = 1.2×0.94 VS1g = 1.13 VS1g
VREF = 1.3×0.94 VS1g = 1.23 VS1g
These speeds are identical to those that the conventional 94 % rule would have defined for these aircraft. The A319, A320 and A321 have exactly the same maneuver margin that a conventional aircraft would have at its reference speeds.
The FCOM uses VS for VS1g.

A319/A320/A321	SUPPLEMENTARY TECHNIQUES	3.04.10	P 2
FLIGHT CREW OPERATING MANUAL	OPERATING SPEEDS DEFINITION	SEQ 005	REV 28

VLS : Lowest Selectable speed.
Represented by the top of an amber strip along the airspeed scale on the PFD.
Computed by the FAC based on aerodynamic data, corresponds to 1.13 VS during takeoff or following a touch and go.
Becomes 1.23 VS after retraction of one step of flaps.
R Becomes 1.28 VS when in clean configuration.

Note : If in CONF 0 VLS were 1.23 VS (instead of 1.28 VS), the alpha protection strip would hit the VLS strip on the PFD.

Above 20000 feet, VLS is corrected for Mach effect to maintain a 0.2g buffet margin.

F : Minimum speed at which the flaps may be retracted at takeoff.
In approach, used as a target speed when the aircraft is in CONF 2 or CONF 3.
Represented by "F" on the PFD speed scale. Equal to about 1.18 VS to 1.22 VS of CONF 1 + F.

S : Minimum speed at which the slats may be retracted at takeoff.
In approach, used as a target speed when the aircraft is in CONF 1.
Represented by "S" on the PFD airspeed scale.
Equal to about 1.22 VS to 1.25 VS of clean configuration.

0 : Green dot speed.
Engine out operating speed in clean configuration.
(Best lift to drag ratio speed).
Corresponds also to the final takeoff speed.
Represented by a green dot on the PFD scale.
Below 20000 feet equal to 2 × weight (tonnes) + 85
Above 20000 feet add 1 knot per 1000 feet

A319/A320/A321	SUPPLEMENTARY TECHNIQUES	3.04.10	P 3
FLIGHT CREW OPERATING MANUAL	OPERATING SPEEDS DEFINITION	SEQ 001	REV 37

PROTECTION SPEEDS

Vα PROT, Vα MAX and VSW are computed by the FAC, based on aerodynamic data. They are only used for display on the PFD, and not for flight control protection (the activation of the protections is computed by the ELAC).

Vα PROT : Angle of attack protection speed.
Corresponds to the angle of attack at which the angle of attack protection becomes active.
Represented by the top of a black and amber strip along the PFD speed scale, in normal law.

Vα MAX : Maximum angle of attack speed.
Corresponds to the maximum angle of attack that may be reached in pitch normal law.
Represented by the top of a red strip along the PFD speed scale, in normal law.

VSW : Stall warning speed.
Represented by a red and black strip along the speed scale when the flight control normal law is inoperative.

VMAX : Represented by the bottom of a red and black strip along the speed scale.
Determined by the FAC according to the aircraft configuration.
Is equal to VMO (or speed corresponding to MMO), VLE or VFE.

LIMIT SPEEDS

VMCG : Minimum speed, on the ground during takeoff, at which the aircraft can be controlled by only using the primary flight controls, after a sudden failure of the critical engine, the other engine remaining at takeoff power.

VMCA : Minimum control speed in flight at which the aircraft can be controlled with a maximum bank of 5°, if one engine fails, the other engine remaining at takeoff power (takeoff flap setting, gear retracted).

R VMCL : Minimum control speed in flight, at which the aircraft can be
R controlled with a maximum bank of 5°, if one engine fails, the other
R engine remaining at takeoff power (approach flap setting).

VFE : Maximum speed for each flap configuration.

VLE : Maximum speed with landing gear extended.

VLO : Maximum speed for landing gear operation.

VMO : Maximum speed.

VFE NEXT : Maximum speed for the next (further extended) flap lever position.

OTHER SPEEDS

V1 : The highest speed, during takeoff, at which the flight crew has a choice between continuing the takeoff or stopping the aircraft.
Represented by "1" on the airspeed scale (or the V1 value when it is off the airspeed scale).
Inserted manually through the MCDU by the crew at the latest.
Displayed on the MCDU TAKEOFF page.

VR : The speed at which the pilot rotates in order to reach V2 at an altitude of 35 feet at the latest after an engine failure.
Inserted manually through the MCDU by the crew.
Displayed on the MCDU TAKEOFF page.

V2 : Takeoff safety speed that the aircraft attains at the latest at an altitude of 35 feet with one engine failed and maintains during the second segment of the takeoff.
Represented by the SPEED SELECT symbol on the speed scale.
Minimum value equal to 1.13 VS for the corresponding configuration.
Inserted manually through the MCDU by the crew.
Displayed on the MCDU TAKEOFF page.

VREF : Reference speed used for normal final approach.
Equal to 1.23 × VS of configuration FULL.
Displayed on the MCDU APPR page if landing is planned in CONF FULL (VLS CONF FULL).

VAPP : Final approach speed.
Displayed on MCDU APPR page.
Calculated by the FMGCs.
Represents : VAPP = VLS + wind correction.
The wind correction is limited to a minimum of 5 knots and a maximum of 15 knots.
The flight crew may modify VAPP through the MCDU.
– During autoland or when A/THR is on or in case of ice accretion or gusty crosswind greater than 20 knots, VAPP must not be lower than VLS + 5 knots.

VAPP TARGET : Represented by a magenta triangle.
Calculated by the FMGCs
Gives efficient speed guidance in approach during various windy conditions.
Represents :
VAPP TARGET = GS mini + actual headwind (measured by ADIRS)
GS mini = VAPP – TOWER WIND (headwind component along runway axis calculated by FMGC from tower wind entered on MCDU).

8.3. In Flight Performance

A319/A320/A321	IN FLIGHT PERFORMANCE	3.05.05	P 2
FLIGHT CREW OPERATING MANUAL	OPERATING DATA	SEQ 001	REV 25

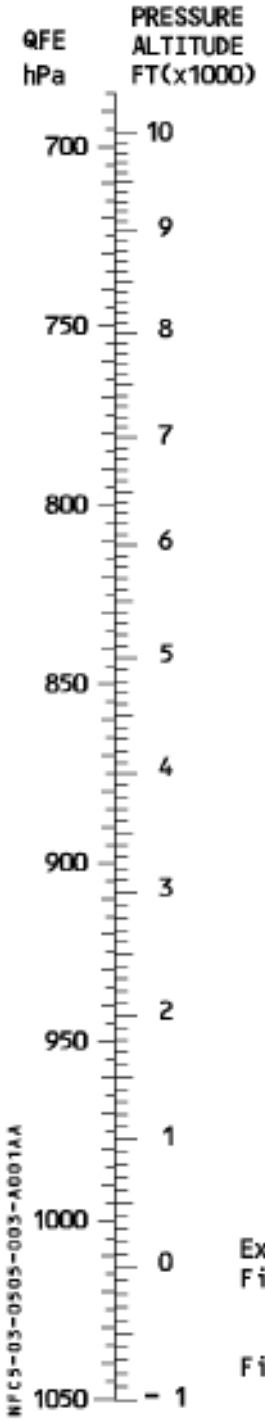
INTERNATIONAL STANDARD ATMOSPHERE (ISA)

R

ALTITUDE (Feet)	TEMP. (°C)	PRESSURE			PRESSURE RATIO $\delta = P / Po$	DENSITY $\sigma = \rho / \rho o$	SPEED OF SOUND (a) (kt)	ALTITUDE (meters)
		hPa	P.S.I.	in. Hg.				
40,000	– 56.5	188	2.72	5.54	0.1851	0.2462	573	12.192
39,000	– 56.5	197	2.85	5.81	0.1942	0.2583	573	11.887
38,000	– 56.5	206	2.99	6.10	0.2038	0.2710	573	11.582
37,000	– 56.5	217	3.14	6.40	0.2138	0.2844	573	11.278
36,000	– 56.3	227	3.30	6.71	0.2243	0.2981	573	10.973
35,000	– 54.3	238	3.46	7.04	0.2353	0.3099	576	10.668
34,000	– 52.4	250	3.63	7.38	0.2467	0.3220	579	10.363
33,000	– 50.4	262	3.80	7.74	0.2586	0.3345	581	10.058
32,000	– 48.4	274	3.98	8.11	0.2709	0.3473	584	9.754
31,000	– 46.4	287	4.17	8.49	0.2837	0.3605	586	9.449
30,000	– 44.4	301	4.36	8.89	0.2970	0.3741	589	9.144
29,000	– 42.5	315	4.57	9.30	0.3107	0.3881	591	8.839
28,000	– 40.5	329	4.78	9.73	0.3250	0.4025	594	8.534
27,000	– 38.5	344	4.99	10.17	0.3398	0.4173	597	8.230
26,000	– 36.5	360	5.22	10.63	0.3552	0.4325	599	7.925
25,000	– 34.5	376	5.45	11.10	0.3711	0.4481	602	7.620
24,000	– 32.5	393	5.70	11.60	0.3876	0.4642	604	7.315
23,000	– 30.6	410	5.95	12.11	0.4046	0.4806	607	7.010
22,000	– 28.6	428	6.21	12.64	0.4223	0.4976	609	6.706
21,000	– 26.6	446	6.47	13.18	0.4406	0.5150	611	6.401
20,000	– 24.6	466	6.75	13.75	0.4595	0.5328	614	6.096
19,000	– 22.6	485	7.04	14.34	0.4791	0.5511	616	5.791
18,000	– 20.7	506	7.34	14.94	0.4994	0.5699	619	5.406
17,000	– 18.7	527	7.65	15.57	0.5203	0.5892	621	5.182
16,000	– 16.7	549	7.97	16.22	0.5420	0.6090	624	4.877
15,000	– 14.7	572	8.29	16.89	0.5643	0.6292	626	4.572
14,000	– 12.7	595	8.63	17.58	0.5875	0.6500	628	4.267
13,000	– 10.8	619	8.99	18.29	0.6113	0.6713	631	3.962
12,000	– 8.8	644	9.35	19.03	0.6360	0.6932	633	3.658
11,000	– 6.8	670	9.72	19.79	0.6614	0.7156	636	3.353
10,000	– 4.8	697	10.10	20.58	0.6877	0.7385	638	3.048
9,000	– 2.8	724	10.51	21.39	0.7148	0.7620	640	2.743
8,000	– 0.8	753	10.92	22.22	0.7428	0.7860	643	2.438
7,000	+ 1.1	782	11.34	23.09	0.7716	0.8106	645	2.134
6,000	+ 3.1	812	11.78	23.98	0.8014	0.8359	647	1.829
5,000	+ 5.1	843	12.23	24.90	0.8320	0.8617	650	1.524
4,000	+ 7.1	875	12.69	25.84	0.8637	0.8881	652	1.219
3,000	+ 9.1	908	13.17	26.82	0.8962	0.9151	654	914
2,000	+ 11.0	942	13.67	27.82	0.9298	0.9428	656	610
1,000	+ 13.0	977	14.17	28.86	0.9644	0.9711	659	305
0	+ 15.0	1013	14.70	29.92	1.0000	1.0000	661	0
– 1.000	+ 17.0	1050	15.23	31.02	1.0366	1.0295	664	– 305

A319/A320/A321	IN FLIGHT PERFORMANCE	3.05.05	P 3
FLIGHT CREW OPERATING MANUAL	OPERATING DATA	SEQ 001	REV 24

CONVERSIONS - QNH - QFE - PRESSURE ALTITUDE



QNH (hPa)	CORRECTION (ft)	QNH (in Hg)
949 – 951	+ 1900	28.01 – 28.10
952 – 955	+ 1800	28.11 – 28.20
956 – 958	+ 1700	28.21 – 28.30
959 – 961	+ 1600	28.31 – 28.40
962 – 964	+ 1500	28.41 – 28.45
965 – 968	+ 1400	28.46 – 28.56
969 – 971	+ 1300	28.57 – 28.66
972 – 974	+ 1200	28.68 – 28.77
975 – 978	+ 1100	28.78 – 28.86
979 – 981	+ 1000	28.87 – 28.95
982 – 984	+ 900	28.96 – 29.05
985 – 988	+ 800	29.06 – 29.15
989 – 991	+ 700	29.16 – 29.25
992 – 994	+ 600	29.26 – 29.35
995 – 997	+ 500	29.36 – 29.45
998 – 1001	+ 400	29.46 – 29.54
1002 – 1004	+ 300	29.55 – 29.64
1005 – 1007	+ 200	29.65 – 29.74
1008 – 1011	+ 100	29.75 – 29.84
1012 – 1014	0	29.85 – 29.94
1015 – 1018	– 100	29.95 – 30.04
1019 – 1021	– 200	30.05 – 30.14
1022 – 1025	– 300	30.15 – 30.24
1026 – 1028	– 400	30.25 – 30.34
1029 – 1031	– 500	30.35 – 30.44
1032 – 1035	– 600	30.45 – 30.54
1036 – 1038	– 700	30.55 – 30.65
1039 – 1042	– 800	30.66 – 30.75
1043 – 1045	– 900	30.76 – 30.85
1046 – 1050	–1000	30.86 – 30.95

Examples : 1) Elevation: 2500 ft QNH = 1020 hPa
Find : correction: -200 ft
Pressure altitude = 2300 ft QFE = 933 hPa
2) Elevation: 1500 ft QFE = 980 hPa
Find : Pressure altitude: 920 ft
Correction = - 580 ft QNH = 1032 hPa

A319/A320/A321	IN FLIGHT PERFORMANCE	3.05.20	P 15
FLIGHT CREW OPERATING MANUAL	IN-CRUISE QUICK CHECK	SEQ 170	REV 27

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1350	6998 3.30	6781 3.24	6579 3.19	6396 3.14	6245 3.10	6165 3.09	60	63	81
1375	7126 3.34	6905 3.28	6700 3.22	6513 3.17	6359 3.13	6278 3.12	61	65	82
1400	7254 3.37	7029 3.32	6821 3.26	6631 3.21	6474 3.17	6390 3.16	62	66	84
1425	7382 3.41	7153 3.36	6941 3.30	6748 3.24	6588 3.20	6502 3.19	63	67	85
1450	7510 3.45	7277 3.39	7061 3.33	6865 3.28	6702 3.24	6614 3.22	64	68	86
1475	7638 3.49	7401 3.43	7181 3.37	6982 3.31	6817 3.27	6726 3.26	66	70	88
1500	7765 3.53	7524 3.47	7301 3.40	7099 3.35	6930 3.30	6837 3.29	67	71	89
1525	7893 3.56	7648 3.51	7421 3.44	7215 3.38	7044 3.34	6949 3.32	68	72	91
1550	8020 4.00	7771 3.54	7540 3.48	7332 3.42	7158 3.37	7060 3.36	69	73	92
1575	8147 4.04	7894 3.58	7659 3.51	7448 3.45	7271 3.41	7171 3.39	70	75	93
1600	8274 4.08	8017 4.02	7779 3.55	7564 3.49	7384 3.44	7282 3.42	71	76	95
1625	8400 4.12	8140 4.05	7898 3.59	7680 3.53	7497 3.47	7393 3.46	72	77	96
1650	8527 4.16	8262 4.09	8016 4.02	7796 3.56	7610 3.51	7503 3.49	74	78	97
1675	8653 4.20	8385 4.13	8135 4.06	7912 4.00	7723 3.54	7614 3.52	75	80	99
1700	8780 4.23	8507 4.17	8254 4.10	8028 4.03	7836 3.58	7724 3.56	76	81	100
1725	8906 4.27	8629 4.21	8372 4.13	8143 4.07	7948 4.01	7834 3.59	77	82	101
1750	9032 4.31	8751 4.24	8490 4.17	8258 4.10	8061 4.04	7944 4.02	78	83	103
1775	9158 4.35	8873 4.28	8608 4.20	8374 4.14	8173 4.08	8054 4.06	79	85	104
1800	9283 4.39	8995 4.32	8726 4.24	8489 4.17	8285 4.11	8163 4.09	80	86	105
1825	9409 4.43	9116 4.36	8844 4.28	8604 4.21	8397 4.15	8273 4.12	81	87	106
1850	9534 4.46	9237 4.39	8962 4.31	8718 4.24	8509 4.18	8382 4.16	82	88	108
1875	9660 4.50	9359 4.43	9079 4.35	8833 4.28	8620 4.22	8491 4.19	83	90	109
1900	9785 4.54	9480 4.47	9197 4.39	8947 4.31	8732 4.25	8600 4.23	85	91	110
1925	9910 4.58	9601 4.51	9314 4.42	9062 4.35	8843 4.29	8708 4.26	86	92	112
1950	10035 5.02	9722 4.54	9431 4.46	9176 4.38	8954 4.32	8817 4.29	87	93	113
1975	10159 5.06	9842 4.58	9548 4.50	9290 4.42	9065 4.35	8925 4.33	88	95	114

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.000011 0250300 .7801 .00200 120 0300350 60 0 100 20 20 20 18590 FCOM-N0-03-05-20-015-170

A319/A320/A321	IN FLIGHT PERFORMANCE	3.05.25	P 2
FLIGHT CREW OPERATING MANUAL	HOLDING	SEQ 170	REV 31

R

RACE TRACK HOLDING PATTERN - GREEN DOT SPEED

MAX. CRUISE THRUST LIMITS
CLEAN CONFIGURATION
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%)
FF (KG/H/ENG)

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL140	FL180	FL200	FL220	FL250
46	45.6 890	47.9 873	51.1 839	54.0 813	57.5 794	58.9 789	60.6 787	63.5 784
48	46.5 926	48.9 908	52.1 871	55.1 844	58.4 828	59.9 823	61.7 821	64.7 818
50	47.4 962	49.8 940	53.0 901	56.2 876	59.4 861	61.0 859	62.8 855	65.8 851
52	48.3 997	50.6 971	53.9 931	57.3 908	60.3 896	62.0 892	63.9 889	66.7 884
54	49.2 1033	51.4 1002	54.9 963	58.3 942	61.3 931	63.0 926	65.0 924	67.7 916
56	50.1 1065	52.2 1033	55.8 994	59.1 975	62.2 964	64.0 960	66.1 955	68.6 949
58	50.8 1097	52.9 1063	56.8 1026	59.9 1008	63.2 997	65.1 994	66.9 988	69.5 982
60	51.5 1128	53.7 1094	57.7 1059	60.7 1043	64.1 1031	66.1 1026	67.7 1021	70.4 1016
62	52.2 1158	54.5 1125	58.7 1092	61.6 1078	65.1 1065	66.9 1058	68.6 1054	71.2 1049
64	52.9 1189	55.3 1156	59.4 1126	62.4 1110	66.0 1097	67.7 1091	69.4 1087	72.1 1084
66	53.6 1219	56.1 1188	60.1 1159	63.2 1143	67.0 1129	68.5 1124	70.3 1120	72.9 1119
68	54.3 1250	56.9 1221	60.9 1193	64.1 1176	67.7 1162	69.3 1157	71.1 1154	73.7 1155
70	55.0 1282	57.8 1254	61.6 1228	64.9 1210	68.4 1195	70.1 1191	71.8 1188	74.6 1192
72	55.8 1314	58.6 1287	62.3 1261	65.7 1243	69.2 1228	70.8 1224	72.5 1223	75.4 1230
74	56.5 1347	59.4 1321	63.1 1294	66.6 1275	69.9 1262	71.6 1258	73.3 1258	76.1 1269
76	57.2 1380	60.2 1355	63.8 1327	67.4 1307	70.6 1296	72.3 1292	74.0 1295	76.9 1309
78	58.0 1413	60.8 1389	64.5 1360	68.2 1339	71.3 1330	73.0 1328	74.8 1332	77.6 1350

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON	PER 1° ABOVE ISA	STRAIGHT LINE
ΔFF = – 0.3 %	ΔFF = + 5 %	ΔFF = + 9 %	ΔFF = + 0.3 %	ΔFF = – 5 %

A319/A320/A321 FLIGHT CREW OPERATING MANUAL	IN FLIGHT PERFORMANCE	3.05.35	P 2
	GO AROUND	SEQ 326	REV 38

APPROACH CLIMB LIMITING WEIGHT (1000 KG) ONE ENGINE OUT ONE ENGINE AT GO AROUND THRUST	Gradient : 2.1% High Air Conditioning Anti ice OFF V = 1.23 Vs	CONF 2

R

PRESSURE ALTITUDE (FT)												
OAT (°C)	–2000	0	200	400	600	800	1000	1500	2000	5000	10000	14100
≤ 10	84.6	83.7	83.4	83.2	83.0	82.7	82.5	81.9	81.4	81.7	71.2	61.0
20	84.2	83.3	83.1	82.9	82.6	82.4	82.2	81.7	81.1	81.4	67.5	55.0
22	84.2	83.3	83.1	82.8	82.6	82.4	82.1	81.6	81.1	81.4	66.3	54.2
24	84.1	83.2	83.0	82.8	82.5	82.3	82.1	81.5	81.0	80.9	65.0	
26	84.1	83.2	82.9	82.7	82.5	82.3	82.0	81.5	81.0	80.0	64.0	
28	84.0	83.1	82.9	82.7	82.4	82.2	82.0	81.5	80.9	79.0	63.0	
30	83.9	83.1	82.8	82.6	82.4	82.1	81.9	81.4	80.9	78.1	62.0	
32	83.9	83.0	82.8	82.6	82.3	82.1	81.9	81.4	80.8	77.1	61.0	
34	83.8	83.0	82.8	82.5	82.3	82.1	81.9	81.3	80.8	76.2	60.0	
36	83.8	83.0	82.7	82.5	82.3	82.1	81.8	81.3	80.8	74.9		
38	83.7	82.9	82.7	82.5	82.3	82.0	81.8	81.3	80.8	73.4		
40	83.7	82.9	82.7	82.5	82.3	82.0	81.8	81.3	80.7	71.7		
42	83.7	82.9	82.7	82.5	82.2	82.0	81.7	80.3	78.8	70.0		
44	83.6	82.8	82.2	81.6	81.1	80.5	79.9	78.5	77.0	68.3		
46	83.6	81.0	80.4	79.8	79.3	78.7	78.1	76.7	75.6			
48	83.5	79.1	78.6	78.0	77.4	76.9	76.4	75.3	74.1			
50	81.5	77.3	76.8	76.3	75.9	75.4	75.0	73.8	72.5			
52	79.6	75.8	75.3	74.8	74.4	73.9	73.5	72.2				
54	77.7	74.2	73.8	73.3								
55	76.8	73.5										

AIR CONDITIONING OFF ADD 1400 kg	ENGINE ANTI ICE ON SUBTRACT 900 kg up to 10000 ft 3600 kg above 10000 ft	TOTAL ANTI ICE ON SUBTRACT 1100 kg up to 5000 ft 7000 kg above 5000 ft	SPEED INCREASE PER 0.01 Vs ADD 200 kg

A319/A320/A321 FLIGHT CREW OPERATING MANUAL	IN FLIGHT PERFORMANCE	3.05.35	P 3
	GO AROUND	SEQ 326	REV 37

APPROACH CLIMB LIMITING WEIGHT (1000 KG) ONE ENGINE OUT ONE ENGINE AT GO AROUND THRUST	Gradient : 2.1% High Air Conditioning Anti ice OFF V = 1.23 Vs	CONF 3

	PRESSURE ALTLTITUDE (FT)											
OAT (°C)	–1000	0	200	400	600	800	1000	1500	2000	5000	8000	9200
≤10	84.0	83.5	83.2	83.0	82.7	82.5	82.3	81.7	81.2	81.4	76.7	72.8
20	83.7	83.1	82.9	82.7	82.4	82.2	82.0	81.5	80.9	81.2	75.4	70.3
22	83.6	83.1	82.9	82.6	82.4	82.2	81.9	81.4	80.8	81.1	74.5	69.1
24	83.6	83.0	82.8	82.6	82.3	82.1	81.9	81.3	80.8	80.7	73.4	67.8
26	83.5	83.0	82.7	82.5	82.3	82.0	81.8	81.3	80.7	79.7	72.2	66.6
28	83.4	82.9	82.7	82.5	82.2	82.0	81.8	81.2	80.7	78.8	70.9	65.5
30	83.4	82.9	82.6	82.4	82.2	81.9	81.7	81.2	80.7	77.8	69.7	64.4
32	83.4	82.8	82.6	82.4	82.1	81.9	81.7	81.2	80.6	76.9	68.4	63.3
34	83.3	82.8	82.6	82.3	82.1	81.9	81.7	81.1	80.6	76.0	67.1	62.1
36	83.3	82.8	82.5	82.3	82.1	81.8	81.6	81.1	80.6	74.4	65.7	61.0
38	83.2	82.7	82.5	82.3	82.1	81.8	81.6	81.1	80.6	72.6	64.3	
40	83.2	82.7	82.5	82.3	82.0	81.8	81.6	81.1	80.5	70.9		
42	83.2	82.7	82.5	82.2	82.0	81.8	81.5	80.1	78.6	69.2		
44	83.1	82.6	82.0	81.5	80.9	80.3	79.7	78.3	76.9	67.6		
46	83.0	80.8	80.2	79.6	79.1	78.5	77.9	76.6	75.2			
48	81.1	79.0	78.4	77.8	77.3	76.7	76.2	74.9	73.5			
50	79.3	77.1	76.6	76.1	75.6	75.1	74.5	73.1	71.7			
52	77.4	75.5	74.9	74.4	73.8	73.3	72.7	71.4				
54	75.7	73.7	73.1	72.6								
55	74.8	72.8										

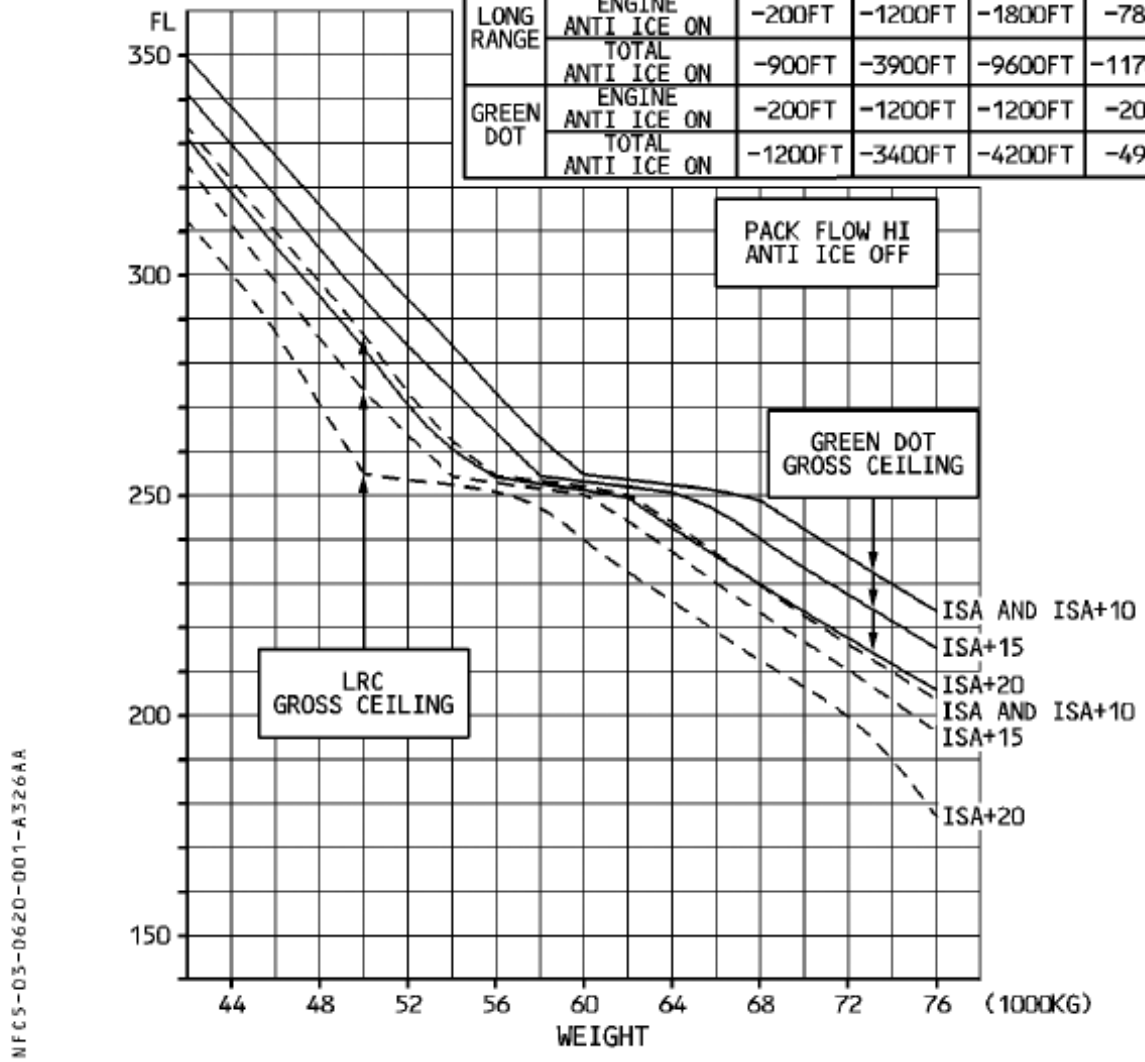
AIR CONDITIONING OFF ADD 1400 kg	ENGINE ANTI ICE ON SUBTRACT 300 kg	TOTAL ANTI ICE ON SUBTRACT 3400 kg	SPEED INCREASE PER 0.01 Vs ADD 209 kg

8.4. Single Engine Operation

A319/A320/A321	SINGLE ENGINE OPERATIONS	3.06.20	P 1
FLIGHT CREW OPERATING MANUAL	CEILINGS	SEQ 326	REV 37

GROSS CEILINGS AT LONG RANGE AND GREEN DOT SPEEDS

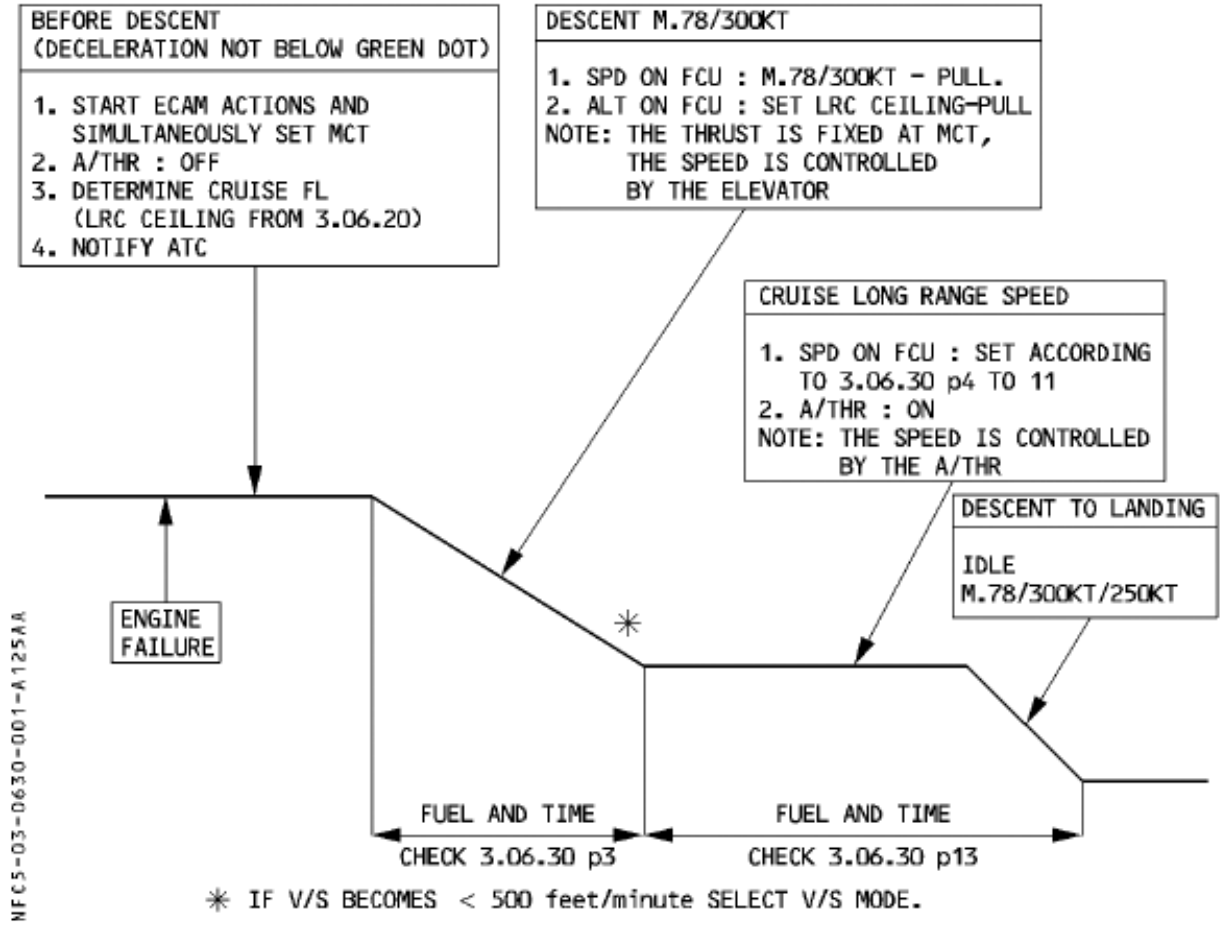
		ISA	ISA+10	ISA+15	ISA+20
LONG RANGE	ENGINE ANTI ICE ON	-200FT	-1200FT	-1800FT	-7800FT
	TOTAL ANTI ICE ON	-900FT	-3900FT	-9600FT	-11700FT
GREEN DOT	ENGINE ANTI ICE ON	-200FT	-1200FT	-1200FT	-2000FT
	TOTAL ANTI ICE ON	-1200FT	-3400FT	-4200FT	-4900FT



A319/A320/A321 FLIGHT CREW OPERATING MANUAL	SINGLE ENGINE OPERATIONS	3.06.30	P 1
	STANDARD STRATEGY	SEQ 125	REV 27

PROCEDURE

Unless a specific procedure has been established before dispatch (ETOPS, mountainous areas) the recommended procedure is as follows :



A319/A320/A321 FLIGHT CREW OPERATING MANUAL	SINGLE ENGINE OPERATIONS	3.06.30	P 3
	STANDARD STRATEGY	SEQ 170	REV 27

R

DESCENT - M.78/300KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF	ISA CG=33.0%	MINIMUM RATE OF DESCENT 500FT/MIN

WEIGHT (1000KG)	50				70				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
390	41.6	1408	280	MCT					241
370	39.8	1372	267	MCT	39.4	1386	264	MCT	252
350	38.1	1330	255	MCT	38.0	1353	253	MCT	264
330	36.5	1288	243	MCT	36.5	1315	243	MCT	277
310	35.1	1246	231	MCT	35.0	1274	231	MCT	289
290	33.6	1201	220	MCT	33.5	1226	219	MCT	300
270	31.5	1134	205	MCT	31.3	1156	203	MCT	300
250	29.1	1052	187	MCT	28.8	1072	185	MCT	300
230	26.0	942	165	MCT	25.9	967	164	MCT	300
220	24.0	867	151	V/S	24.0	896	151	V/S	300
210	22.0	793	137	V/S	22.0	818	137	V/S	300
200	20.0	719	124	V/S	20.0	741	124	V/S	300
190	18.0	645	111	V/S	18.0	665	111	V/S	300
180	16.0	572	98	V/S	16.0	589	98	V/S	300
170	14.0	499	85	V/S	14.0	514	85	V/S	300
160	12.0	427	72	V/S	12.0	439	72	V/S	300
150	10.0	355	60	V/S	10.0	365	60	V/S	300
140	8.0	283	47	V/S	8.0	291	47	V/S	300
100	.0	0	0	V/S	.0	0	0	V/S	300

CORRECTIONS	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON	PER 1° ABOVE ISA
TIME	– 0.3 %	– 1.5 %	–
FUEL	+ 2 %	+ 4 %	+ 0.3 %
DISTANCE	– 0.5 %	– 1.5 %	+ 0.2 %

11.0-08FDA320-214 CFM56-5B4/P SA2320001OC6K0330 0 018590 0 0 3 .0 .0 500.00 0 02 .780300.000 .000 0 FCOM-N0-03-06-30-003-200

A319/A320/A321	SINGLE ENGINE OPERATIONS	3.06.30	P 9
FLIGHT CREW OPERATING MANUAL	STANDARD STRATEGY	SEQ 170	REV 32

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA+15
CG=33.0%

N1 (%)
KG/H
NM/1000KG

MACH
IAS (KT)
TAS (KT)

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
50	85.8	.531	86.6	.540	87.3	.548	87.8	.553	88.4	.559	89.1	.565
	1840	238	1840	237	1836	235	1824	233	1817	230	1814	228
	182.0	335	184.3	339	186.6	343	188.8	344	190.9	347	192.5	349
52	86.8	.539	87.5	.547	88.0	.553	88.6	.558	89.3	.565	89.8	.566
	1914	241	1910	240	1901	238	1891	235	1892	233	1875	229
	177.5	340	179.7	343	181.9	346	183.9	348	185.4	351	186.8	350
54	87.7	.546	88.2	.552	88.8	.557	89.5	.566	90.0	.566	89.9	.552
	1986	245	1976	242	1965	240	1970	238	1950	234	1874	223
	173.3	344	175.4	347	177.3	349	178.8	352	180.2	351	182.0	341
56	88.4	.552	88.9	.556	89.6	.564	90.2	.567	91.1	.577	89.9	.518
	2053	247	2040	244	2043	243	2029	239	2056	238	1853	208
	169.3	348	171.2	349	172.7	353	174.0	353	174.1	358	172.7	320
58	89.1	.556	89.7	.562	90.3	.567	91.1	.574	92.2	.585		
	2118	249	2115	247	2108	244	2120	242	2158	242		
	165.4	350	166.9	353	168.2	354	168.6	357	168.3	363		
60	89.8	.561	90.4	.567	91.1	.570	92.2	.583	93.3	.594		
	2189	251	2187	249	2181	246	2226	246	2266	246		
	161.4	353	162.7	356	163.5	357	163.2	363	162.8	369		
62	90.6	.567	91.0	.568	92.2	.581	93.3	.591	93.5	.581		
	2268	254	2245	249	2292	250	2332	250	2265	240		
	157.5	357	158.7	356	158.4	363	158.0	368	159.2	360		
64	91.1	.568	92.1	.578	93.1	.588	93.8	.589	93.5	.556		
	2326	255	2359	254	2394	254	2380	249	2249	230		
	153.8	358	153.8	363	153.6	368	154.1	367	153.5	345		
66	92.0	.574	93.1	.586	94.1	.595	93.9	.570				
	2418	258	2463	258	2497	257	2369	241				
	149.6	362	149.3	368	149.1	372	150.0	355				
68	93.0	.583	94.1	.594	94.2	.581	94.0	.535				
	2530	262	2571	261	2488	250	2349	225				
	145.3	368	144.9	373	146.0	363	141.9	333				
70	93.9	.590	94.5	.590	94.3	.559						
	2633	265	2611	260	2476	241						
	141.3	372	141.7	370	141.3	350						
72	94.8	.597	94.6	.573								
	2737	268	2602	252								
	137.4	376	138.4	360								
74	94.9	.585	94.7	.548								
	2730	263	2589	241								
	134.9	368	133.0	344								
76	95.0	.566										
	2721	254										
	131.2	357										
78	95.2	.529										
	2705	237										
	123.3	334										

ENGINE ANTI ICE ON
ΔFUEL = + 3.5 %

TOTAL ANTI ICE ON
ΔFUEL = + 7 %

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FLIGHT CREW OPERATING MANUAL	STANDARD STRATEGY	SEQ 265	REV 30

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING - ONE ENGINE FAILURE
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 55000 KG
PACK FLOW HI
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 100	150	200	220	240	250	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL200 FL220	FL240 FL250
200	1375 0.46	1180 0.44	1048 0.42	1002 0.42	962 0.41	945 0.41	6	7	8
300	2053 1.06	1804 1.03	1627 1.00	1566 0.59	1515 0.59	1494 0.58	14	13	16
400	2728 1.26	2425 1.22	2202 1.18	2127 1.17	2064 1.16	2039 1.16	20	20	23
500	3398 1.47	3043 1.40	2774 1.36	2684 1.35	2609 1.34	2579 1.33	26	26	31
600	4065 2.07	3657 2.00	3342 1.55	3238 1.53	3150 1.51	3116 1.51	32	32	38
700	4727 2.28	4267 2.19	3907 2.13	3788 2.11	3686 2.09	3648 2.08	38	39	45
800	5385 2.49	4874 2.38	4468 2.31	4335 2.28	4220 2.27	4177 2.26	44	45	52
900	6039 3.10	5477 2.57	5025 2.50	4879 2.46	4749 2.45	4701 2.43	50	51	59
1000	6689 3.32	6076 3.17	5578 3.08	5418 3.04	5275 3.02	5222 3.01	56	57	65
1100	7336 3.53	6673 3.36	6128 3.27	5954 3.23	5797 3.20	5739 3.19	62	63	72
1200	7978 4.15	7265 3.56	6675 3.46	6487 3.41	6316 3.38	6252 3.36	67	69	78
1300	8617 4.37	7855 4.16	7219 4.04	7017 3.59	6832 3.56	6762 3.54	73	74	84
1400	9253 4.59	8441 4.35	7759 4.23	7543 4.17	7344 4.14	7269 4.12	79	80	90
1500	9882 5.21	9024 4.55	8296 4.42	8067 4.35	7853 4.32	7771 4.30	85	86	96
1600	10508 5.43	9605 5.15	8829 5.01	8587 4.54	8359 4.50	8271 4.48	91	91	102
1700	11129 6.05	10182 5.35	9360 5.20	9104 5.12	8862 5.08	8767 5.06	97	97	107
1800	11748 6.27	10757 5.55	9889 5.39	9618 5.31	9361 5.27	9260 5.24	103	102	113
1900	12362 6.50	11328 6.15	10415 5.58	10127 5.49	9858 5.45	9750 5.42	108	108	118
2000	12973 7.13	11897 6.35	10938 6.17	10634 6.08	10353 6.03	10237 6.00	114	113	124
2100	13581 7.35	12463 6.56	11458 6.36	11137 6.27	10844 6.21	10720 6.18	120	118	130
2200	14183 7.58	13026 7.16	11975 6.55	11638 6.46	11333 6.39	11201 6.37	126	123	135
2300	14780 8.22	13587 7.36	12490 7.14	12136 7.05	11818 6.58	11679 6.55	131	129	140
2400	15373 8.45	14143 7.57	13002 7.33	12631 7.24	12302 7.16	12153 7.13	136	134	146
2500	15962 9.09	14692 8.18	13511 7.52	13123 7.43	12782 7.34	12626 7.32	142	139	151
2600	16548 9.32	15239 8.39	14018 8.12	13613 8.03	13260 7.52	13095 7.50	147	144	156
2700	17131 9.56	15783 9.00	14522 8.31	14099 8.22	13735 8.11	13561 8.08	153	149	161

ENGINE ANTI ICE ON
ΔFUEL = + 3.5 %

TOTAL ANTI ICE ON
ΔFUEL = + 5.5 %

A319/A320/A321 FLIGHT CREW OPERATING MANUAL	SINGLE ENGINE OPERATIONS	3.06.40	P 1
	OBSTACLE STRATEGY	SEQ 125	REV 32

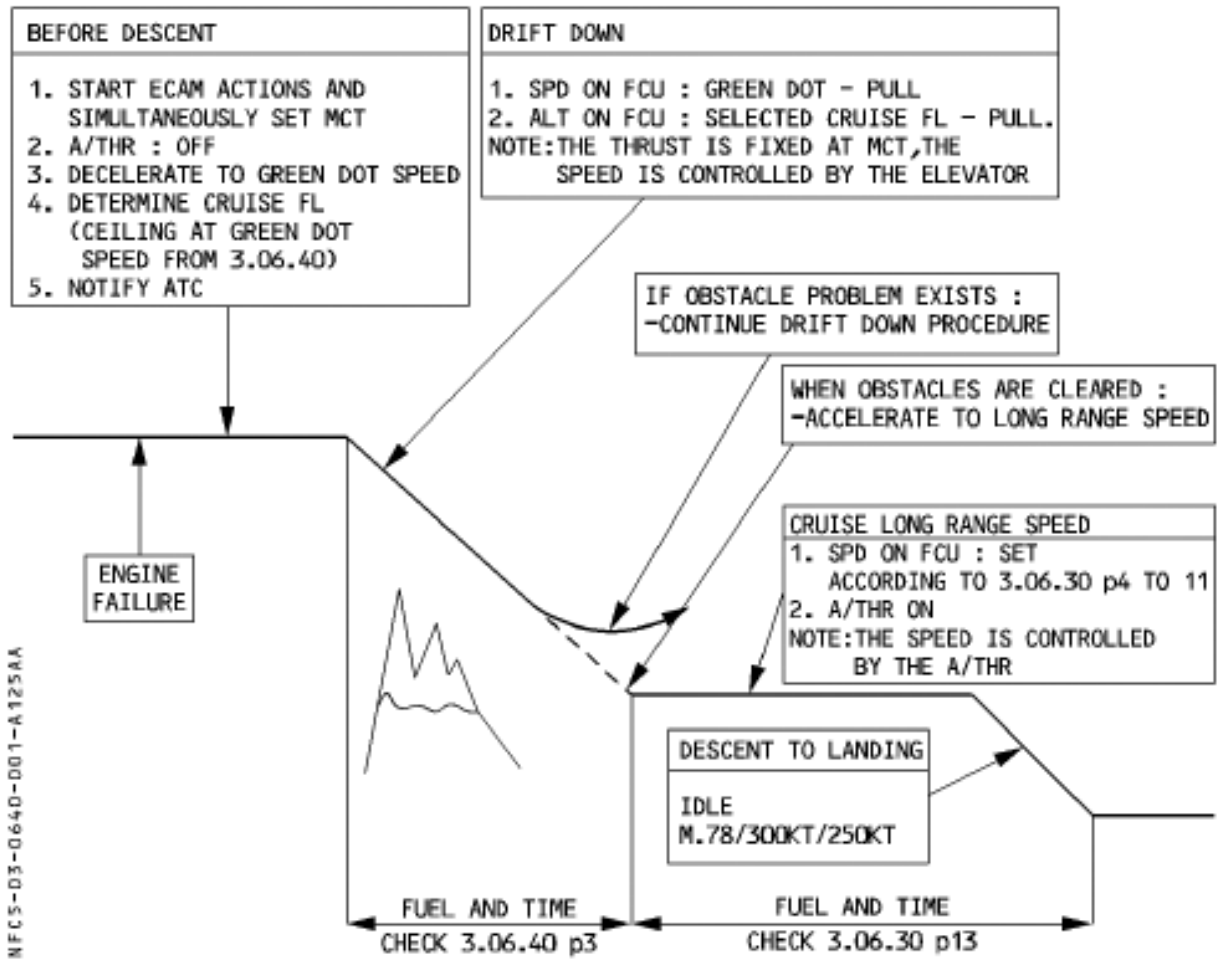
PROCEDURE

In order to maintain the highest possible level, the drift down procedure must be adopted. This requires maximum continuous thrust on the remaining engine at green dot speed.

- If, having reached drift down ceiling altitude, an obstacle problem remains, the drift down procedure must be maintained so as to fly an ascending cruise profile.
- If, after drift down, no obstacle problem remains, the speed should be allowed to increase to long range speed and maintained. The subsequent cruise should be made using either the long range speed by adjusting it as a function of aircraft weight or by maintaining the initial cruise speed.

Note : Due to the fact that the long range speed is higher than the green dot speed, the cruise will be made at an altitude lower than the drift down ceiling.

R



A319/A320/A321	SINGLE ENGINE OPERATIONS	3.06.40	P 5
FLIGHT CREW OPERATING MANUAL	OBSTACLE STRATEGY	SEQ 170	REV 32

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+15
CG=33.0%

DISTANCE (NM) TIME (MIN)
INITIAL SPEED(KT) FUEL(1000KG)
LEVEL OFF (FT)

INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
50					179 33 196 .9 29900	249 46 198 1.2 30100	288 53 200 1.4 30200	317 57 202 1.5 30200	339 61 204 1.6 30300
52				115 22 198 .6 28600	220 41 200 1.1 28900	270 50 202 1.4 29000	304 55 204 1.5 29100	329 59 206 1.6 29200	350 63 208 1.6 29200
54				188 35 202 1.0 27700	252 47 204 1.3 27900	293 54 206 1.5 28000	321 59 208 1.6 28100	345 62 210 1.7 28100	364 65 212 1.8 28100
56			132 25 204 .8 26500	230 43 206 1.3 26800	279 52 208 1.5 26900	312 57 210 1.7 27000	338 62 212 1.8 27000	358 65 214 1.8 27100	379 68 216 1.9 27100
58			196 37 208 1.1 25600	259 49 210 1.5 25800	299 55 212 1.7 25900	327 60 214 1.8 26000	352 64 216 1.9 26000	372 67 218 1.9 26000	390 70 220 2.0 26100
60			97 18 212 .6 25300	175 32 214 1.0 25300	198 36 216 1.1 25300	231 41 218 1.2 25300	275 49 220 1.4 25400	296 52 222 1.5 25400	317 56 224 1.6 25400
62			73 13 216 .4 25200	118 21 218 .7 25200	174 31 220 1.0 25200	202 36 222 1.1 25200	222 39 224 1.2 25200	220 38 226 1.1 25200	238 40 228 1.1 25200
64			62 11 220 .4 25000	99 18 222 .5 25100	128 22 224 .7 25100	152 26 226 .8 25100	173 29 228 .9 25100	191 32 230 .9 25100	208 34 232 1.0 25100
66		72 13 222 .5 24800	126 23 224 .8 24900	149 26 226 .9 24900	167 29 228 1.0 24900	182 31 230 1.0 24900	194 33 232 1.0 24900	209 35 234 1.1 25000	225 37 236 1.1 25000
68		140 25 226 1.0 24300	179 32 228 1.2 24300	205 36 230 1.3 24400	227 40 232 1.4 24400	246 42 234 1.5 24400	263 45 236 1.5 24400	278 47 238 1.6 24500	
70		170 30 230 1.2 23700	204 36 232 1.4 23700	229 40 234 1.5 23800	249 43 236 1.6 23800	269 46 238 1.6 23800	286 49 240 1.7 23900	302 51 242 1.8 23900	
72	63 11 232 .5 22800	192 34 234 1.3 23100	221 39 236 1.5 23200	246 43 238 1.6 23200	266 46 240 1.7 23200	284 48 242 1.8 23200	300 51 244 1.8 23300	316 53 246 1.9 23300	
74	132 23 236 1.0 22400	208 36 238 1.5 22500	234 41 240 1.6 22600	256 44 242 1.7 22600	277 47 244 1.8 22600	295 50 246 1.9 22700	311 52 248 1.9 22700	326 54 250 2.0 22700	
76	162 28 240 1.2 21800	221 39 242 1.6 22000	246 43 244 1.7 22000	268 46 246 1.8 22000	284 48 248 1.9 22000	303 51 250 2.0 22100	319 53 252 2.0 22100		
78	186 32 244 1.4 21300	233 40 246 1.7 21400	256 44 248 1.8 21400	276 47 250 1.9 21500	293 50 252 2.0 21500	309 52 254 2.0 21500	326 54 256 2.1 21500		

CORRECTIONS	DISTANCE	TIME	FUEL	LEVEL OFF
ENGINE ANTI ICE ON	+ 3 %	+ 3 %	+ 7 %	– 100 FT
TOTAL ANTI ICE ON	+ 8 %	+ 8 %	+ 10 %	– 700 FT

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9. QRH EXTRACTS

CONTENTS:

9.1. Abnormal Procedures

A319/A320 /A321	ABNORMAL PROCEDURES	REV 37 SEQ 210	2.31

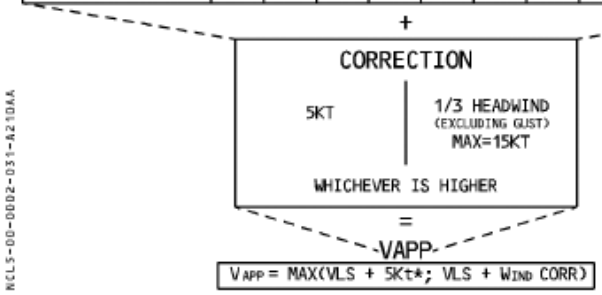
VAPP DETERMINATION

● **NORMAL CONFIGURATION (OR NO △VREF)**

The FMGS performs the following VAPP computation for landing in normal configuration (CONF 3 or CONF FULL). These VAPP also apply for failure cases without △VREF.

Note : For CG < 25 %, add 2 knots to VLS CONF FULL and VLS CONF 3.

W(1000KG)	40	44	48	52	56	60	64	68	72	76	78
VLS CONF FULL (KT)	106	111	116	121	125	130	134	138	142	146	148
VLS CONF 3 (KT)	110	115	120	125	130	135	139	143	147	151	153



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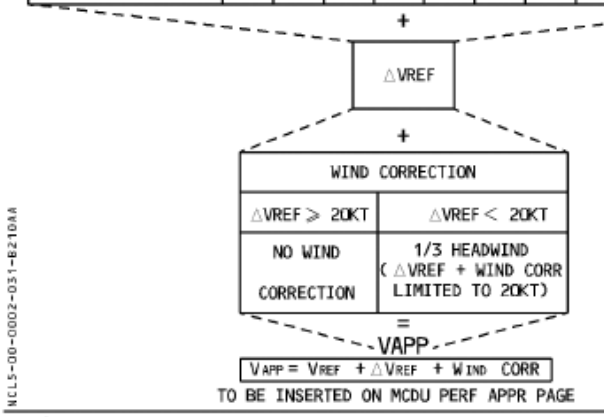
The 5–knot increment is required when the A/THR is used, or when an autoland is performed.

*NOTE : * – In case of ice accretion, Vapp must not be lower than :*
– VLS + 5 knots in CONF FULL
– VLS + 10 knots in CONF 3
– In case of gusty crosswind greater than 20 knots, Vapp should be at least VLS + 5 knots.

● **ABNORMAL/EMERGENCY CONFIGURATION (WITH △VREF)**

Note : For CG < 25 %, add 2 knots to VREF.

W(1000Kg)	40	44	48	52	56	60	64	68	72	76	78
VREF=VLS CONF FULL	106	111	116	121	125	130	134	138	142	146	148



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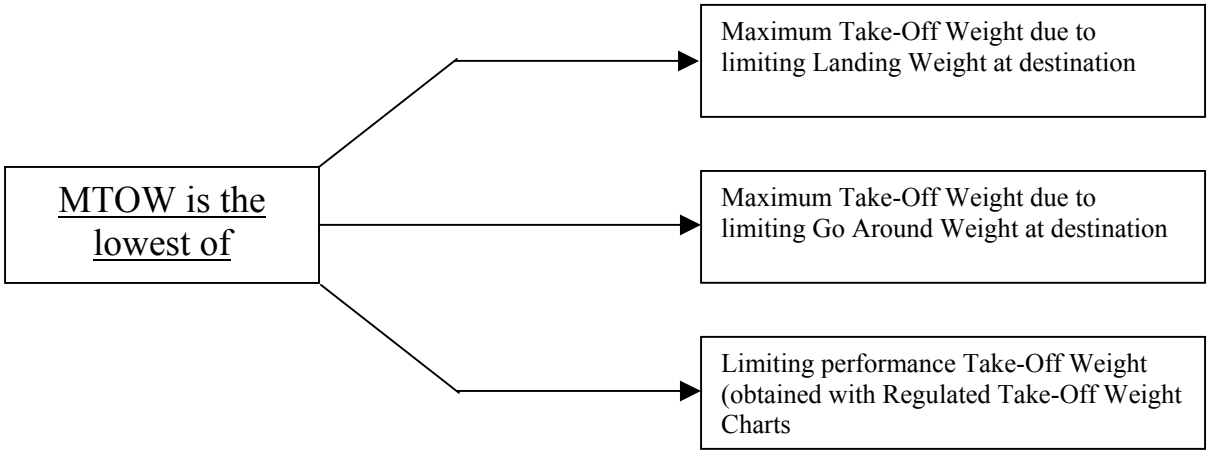
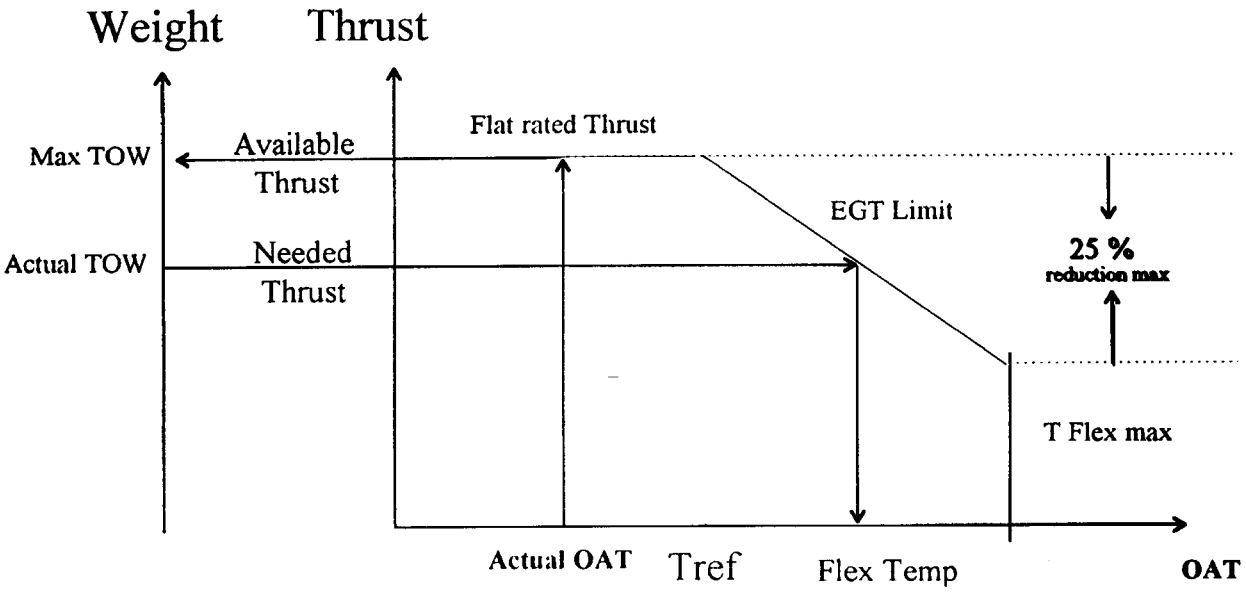
EEZ ALL

10. GUIDED EXAMPLES

CONTENTS:



Use of RTLOW Charts



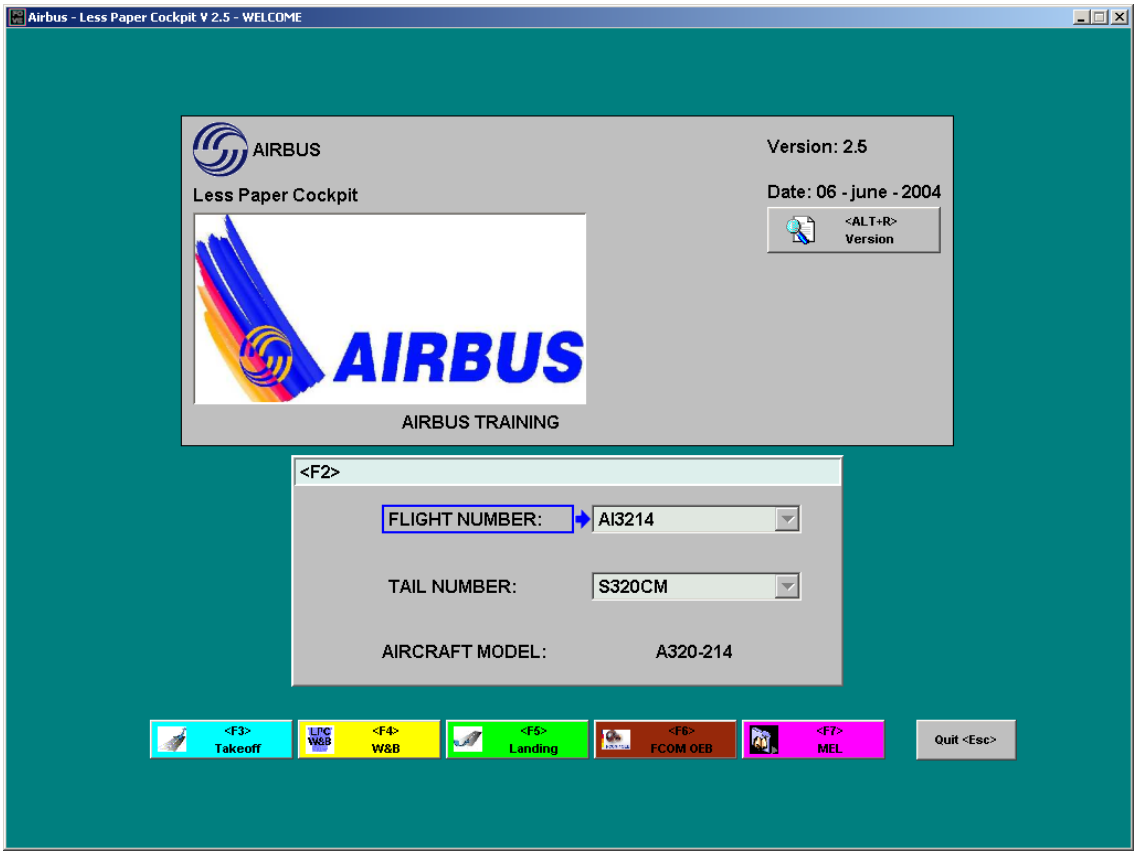
10.1. TakeOff

10.1.1. Exercise 1: Flight Number and MTOW

FOVE EXERCISES

Please be aware that the screen numerical results given as only examples.

On the entry screen of the FOVE tool, choose a flight number already defined by the company administrator: AI3214 and an A320 model.



Determine the MTOW, corresponding speeds and optimum configuration.

Airport ORLY 08.

Weather

Wind 060/12-20 kt
Temperature 13°C
QNH 995 hPa

Aircraft status

Max certified weight: 75.5 t
Air cond ON
Anti-icing OFF
RWY dry
CG > 25%
No inop system

Step 1
Select the TakeOff module (F2).

Step 2
In the TakeOff module, enter the external conditions.

Step 3
Set the aircraft weight at the max certified weight.

Step 4
Check "OPT CONF", set the aircraft status.

Step 5
Set the runway conditions.

TIP: On the TakeOff page, note that both airport and runway are automatically set according to the flight number. You may have to change the RWY.

Step 6
Launch the computation.

Answer:

MTOW = … V1 = … VR = … V2 = … CONF = … TFlex = …

10.1.2. Exercise 2: Flex TakeOff

Determine the FLEX, corresponding speeds and optimum configuration.

Airport ORLY 08.

Weather

Wind 070/17 kt
Temperature 3°C
QNH 1005 hPa

Aircraft status

A/C weight 65.5 t
Air cond ON
Anti-icing OFF
RWY dry
CG > 25%
No inop system

Answer

TFlex = … V1 = … VR = … V2 = … OPT CONF = …

10.1.3. Exercise 3: Contaminated Runway TakeOff

Determine the MTOW, corresponding speeds and optimum configuration.

Airport ORLY 08.

Weather

Wind 020/10 kt
Temperature -4°C
QNH 1002 hPa

Aircraft status

Max certified weight: 75.5 t
Air cond ON
Anti-icing Engine & Wing
RWY covered with 11mm of slush
CG > 25%
No inop system

Answer

MTOW = … V1 = … VR = … V2 = … OPT CONF = … TFlex = …

TIP1: No Flex on contaminated runways.

10.1.4. Exercise 4: TakeOff with an Additional Obstacle

Determine the MTOW, corresponding speeds and optimum configuration.

Airport ORLY 08.

Weather

Wind 90/12 kt
Temperature 6°C
QNH 1018 hPa

Aircraft status

Max certified weight: 75.5 t
Air cond ON
Anti-icing OFF
RWY dry
CG > 25%
No inop system

NOTAM LFPO: OBSTACLE ERECTED. OBST: CRANE ERECTED PSN: AT 1390 M FROM THR 26 AND 100 M FROM AXIS OF RWY. HEIGHT: 200 FT ALT ON TOP: 482 FT.

Answer

MTOW = … V1 = … VR = … V2 = … OPT CONF = … TFlex = …

10.1.5. Exercise 5: TakeOff with an Inoperative Item

Determine the MTOW, corresponding speeds and optimum configuration.

Airport ORLY 08.

Weather

Wind 040/5 kt
Temperature 11°C
QNH 995 hPa

Aircraft status

Max certified weight: 75.5 t
Air cond ON
Anti-icing OFF
RWY dry
CG > 25%
One brake inop

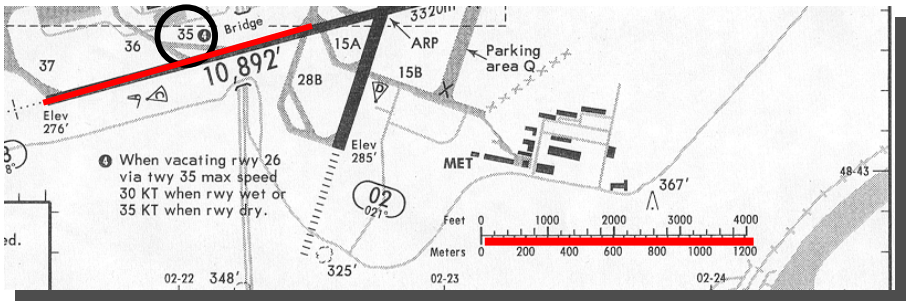
Answer

MTOW = … V1 = … VR = … V2 = … OPT CONF = … TFlex = …

TIP: Note the inoperative item is mentioned in red.

10.1.6. Exercise 6: TakeOff Shift

With the same conditions than in the previous exercise, can you TakeOff from the intermediate point, where you loose 1200 m of Takeoff length at runway start.



10.2. Weight & Balance Exercises

10.2.1. Exercise 1

Determine the ZFW, ZFCG, TOW, TOCG

Flight from Paris Orly (LFPO) to Cairo (HECA). Select flight number AI3214A
Dry operating weight: 42 500 kg.

AIRCRAFT LOADING CONDITION			
Passengers		Freight	
Total going to HECA	118 adults, 4 children	Total going to HECA	8 317 kg
Distribution	OA 18 OB 58 OC 46	Distribution	CP1 3 300 kg CP3 2 250 kg CP4 2 250 kg CP5 517 kg

Fuel on Board 11 640 kg.

Takeoff fuel 11 500 kg.
Fuel density 0.785.

Taxi fuel 140 kg.
Trip fuel 10 000 kg.

Step 1
Select the weight & balance module (F1).

Step 2
In the weight & balance module, enter the departure airport (it is automatically done when a flight number is chosen).

Step 3
Select your cabin configuration, here CONF CODE: STD and Crew : 2/5.

Step 4
Check DOW value and DOWCG position. Note that MTOW and MLW are linked to the TO and LAND flight preparation parts of the FOVE tool.

Step 5
Load the aircraft

Step 6
Enter number of passengers (118/4) and destination airport (HECA).

Step 7
Enter total cargo for Cairo (8 317) kg.

Step 8
Enter Takeoff fuel (11 500 kg).

Step 9
Enter trip fuel (10 000 kg). Check no overload.

Step 10
Observe the fuel distribution in the various tanks (F7).

Step 11
Distribute the load in the cabin zones and cargo compartments (F6).

TIP: Remaining passengers are automatically entered in last cabin compartment filed (OD).

Step 12
Launch the computation.

Answer

ZFW = …	ZFCG = …
TOW = …	TOCG = …
LW = …	LDCG = …

Check that these values are within the approved envelopes.

10.2.2. Exercise 2

Determine the ZFW, ZFCG, TOW, TOCG.

Flight from Paris Orly (LFPO) to Cairo (HECA). Select flight number AI3214B.
STD dry operating weight: 42 600 kg.
Weight deviation +100 kg/ 220 lb in zone E.

AIRCRAFT LOADING CONDITION			
Passengers		Freight	
Total going to HECA	105 adults, 5 children	Total going to HECA	5 482 kg
Distribution	OA 10 OB 50 OC 50	Distribution	CP1 3 000 kg CP3 1 500 kg CP4 500 kg CP5 482 kg

Fuel on board: 13483 kg.

Takeoff fuel: 13 343 kg.
Fuel density: 0.785.

Taxi fuel: 140 kg.
Trip fuel: 9 728 kg.

Step 1
Enter the departure airport.

Step 2
Select your cabin configuration, here STD and Crew : 2/5.

Step 3
Enter the weight deviation.

Step 4
Check DOW value and DOWCG position. Note that MTOW and MLW are linked to the TO and LAND flight preparation parts of the FOVE tool.

Step 5
Load the aircraft.

Step 6
Enter number of passengers for Cairo (105/5).

Step 7
Enter total cargo for Cairo (5 482) kg.

Step 8
Enter Takeoff fuel (13 483 kg).

Step 9
Enter trip fuel (9 728 kg), check no overload.

Step 10
Observe the fuel distribution in the various tanks (F7). Note that it cannot be modified.

Step 11
Distribute the load in the cabin zones and cargo compartments (F6).

TIP: No need to differentiate children from adults when distributing the passengers.

Step 12
Launch the computation.

Answer

ZFW = …	ZFCG = …
TOW = …	TOCG = …
LW = …	LDCG = …

Check that these values are within the approved envelopes.

10.2.3. Exercise 3

Determine the ZFW, ZFCG, TOW, TOCG following a last minute change.

Using the same data as in the previous exercise, can you accept 2 additional adult passengers in zone OB and 2 pieces (40 kg) of luggage in Cargo 5 ?

Step 1
Modify the loading to add the passengers and luggage.

Step 2
Enter the new number of passengers for Cairo (107/5).

Step 3
Enter the new total cargo for Cairo (5482/2p).
Check no overload.

Step 4
Distribute the extra passengers (OB) and luggage (CP5).

Answer

ZFW = … ZFCG = …
TOW = … TOCG = …
LW = … LDCG = …

These values being within the approved envelopes, we can accept the passengers.

10.3. Landing Exercises

10.3.1. Exercise 1

For dispatch purposes determine the MLW, RLD and ALD.

Airport CAIRO 23L (HECA).

Weather

Wind 230/15 kt
Temperature 25°C
QNH 1008 hPa

Aircraft status

Landing configuration FULL
Air cond ON
Anti-icing OFF

RWY condition: water 4mm
Center of Gravity CG>25%

Approach type Normal
Approach climb gradient: 2.1
VLS + 5
Landing Technique: Manual
No inop system

Step 1
Select the landing module (F3).

Step 2
Choose the airport and runway.

Step 3
Select the dispatch conditions.

Step 4
Enter the external conditions.

Step 5
Set landing configuration to FULL.

TIP: Observe that the approach configuration changes automatically.

Step 6
Set the aircraft status.

Step 7
Set the runway conditions.

Step 8
Check the approach type to Normal with approach climb gradient to 2.1.

Step 9
Check no inop items.

Step 10
Launch the computation.

Step 11
Check the detailed results (F10).

Answer

MLW = …, RLD = …, ALD = …, Approach Climb Gradient = …
Compare the RLD with the available runway length.

Note: a 15% margin is requested for FAA operators (ALD x 1.15 ≤ LDA), except in case of emergency.

10.3.2. Exercise 2

In flight, determine the ALD, and approach climb gradient in case of go around.

Airport CAIRO 23 L (HECA).

Weather	**Aircraft status**
Wind 235/26 kt Temperature 20°C QNH 985 hPa	Landing weight 60 272 kg Land CONF FULL Air cond ON Anti-icing OFF RWY 11 mm water Center of Gravity CG>25% Approach type CAT II Landing Technique: Manual Braking mode: Med No inop system

Step 1
Press F4 to set the in-flight conditions

Step 2
Enter the external conditions

Step 3
Enter the landing weight (60 272 kg)

Step 4
Set the aircraft status

Step 5
Set the runway conditions

Step 6
Check the approach type, approach climb gradient.

TIP 1:
Change of approach type modifies the approach climb gradient.

TIP 2:
VLS increment is consistent with QRH and FCOM.

Step 7
Check Landing Technique.

Step 8
Check breaking mode.

Step 9
Check no inop items

Step 10
Launch the computation

Answer

ALD = … Compare the ALD with the available landing distance.
Approach climb gradient = …

Note: a 15% margin is requested for FAA operators (ALD x 1.15 ≤ LDA), except in case of emergency.

10.3.3. Exercise 3

In flight, determine the ALD.

Airport Cairo 23 L (HECA)

Weather

Wind calm
Temperature 27°C
QNH 995 hPa

Aircraft status

Landing weight 60 272 kg
Air cond ON
Anti ice OFF
RWY dry
Center of Gravity > 25%
Approach type normal
Approach climb gradient: 2.1
Braking mode: Manuel
ABNEMER CONF:
- G +Y HYD LO PR

Step 1
Choose the airport and runway.

Step 2
Enter the external conditions.

Step 3
Set the aircraft status.

Step 4
Set the runway condition: dry.

Step 5
Check the CG position and an approach climb gradient equal to 2.1% for a normal approach type.

Step 6
Set the inop item.

TIP 1: Select the system from the scroll down menu and confirm by Enter.

TIP 2: On the system menu select the system by pressing Enter. Then press Enter to open the Failure Cases window. Use the space bar to validate the choice of a failure, confirm by pressing Enter.

TIP 3: Use the delete key to suppress a failure in the table.

Step 7
Launch the computation

Answer

ALD = …, CONF = … Compare the ALD with the available landing distance.

V APP = … (VREF +…) is only displayed in abnormal/emergency configuration.

Detailed results are not available when at least one abnormal/emergency configuration is set.

Note: a 15% margin is requested for FAA operators (ALD x 1.15 ≤ LDA), except in case of emergency.

10.4. Go-Around

10.4.1. Exercise 1

Determine maximum go-around weight. Refer to 3.05.35 P3

Airport elevation:	381 ft
Temperature:	40°C
CONF 3	

Step 1
Choose table corresponding to FLAPS configuration

Step 2
Enter column for airport pressure altitude, here 400 ft

Step 3
Enter line for OAT, here 40°C

Step 4
At intersection read the maximum Go Around weight, 82 300 kg in this case.
Check that it is above your actual l Go-Around weight.

Step 5
If applicable, apply corrections for Air conditioning, anti-ice, at bottom of the page.

10.4.2. Exercise 2

Determination of maximum Go-Around temperature Refer to 3.05.35 P3

Airport elevation:	381 ft
Estimated landing weight:	60 272 kg
CONF 3	

Step 1
Choose table corresponding to FLAPS configuration

Step 2
Enter column for airport pressure altitude, here 400 ft

Step 3
Find estimated landing weight value. In this case, last line reads 72 600 kg

Step 4
Read corresponding maximum Go-Around temperature in LH column.
Check it is above the OAT. Here 54°C is also T MAX.

Step 5
If applicable, apply corrections for Air conditionning, at bottom of the page.

10.5. Example 1: Flight Planning

10.5.1. Exercise 1

Trip	
Trip route	: Paris - Cairo
Distance	: 1 791 nm
Wind component	: + 30 kts
Cruise	: FL 350
	: M .78
Alternate route	: Cairo - Luxor
Distance	: 276 nm (ISA + 20), FL 390
Wind component	: + 30 kts
EZFW	: 56 657 kg

Step 1 - Determination of fuel for holding - Refer to 3.05.25 p 2

- Enter the table with FL 15 and GW = 60 720 kg
- Read the fuel flow: 1158 kg/h/engine (1/2 hour for two engines gives 1158 kg of fuel)

Step 2 - Determination of fuel for alternate

- Determination of the air distance: use of table 2.05.60 p 3 (enter with 300 nm and 30 kt of wind, read NAM = 270 nm
- Enter table 2.05.50 p 3 with 280 nm and FL 270, read fuel = 1 915 kg
- Correct for reference weight deviation: (62 - 55) x 18 = 126 kg
- Alternate fuel = (1 915 + 126) = 2 041 kg

Step 3 - Determination of fuel to destination - Refer to 2.05.40 p 10

- Determination of the air distance: use of table 2.05.60 p 2 (enter with 1 800 nm and 30 kt of wind, read 1 690 nm (interpolation)
- Enter table 2.05.40 p 10 with 1 700 nm and FL 350, read fuel = 9 210 kg
  Rq: Fcom extract "To obtain a flight plan at optimum cruise level, the highest Flight Level desired within the flight has to be selected in the table"
- Correct for reference weight deviation: (64 - 55) x 104 = 936 kg
- Trip fuel = (9 210 + 936) = 10 146 kg.

Step 4 - Reserves and taxi fuel

- Reserves = 5% of the trip fuel. Reserves = 5% of 10 146 kg = 507 kg

– Taxi = 140 kg (cf FCOM)

Step 5 - Total fuel

– Total fuel:	Holding	+	1 158
+	Alternate	+	2 041
+	Trip fuel	+	10 146
+	Reserves	+	507
+	Taxi	+	140
---	---	---	---
=	Total fuel	=	13 992 kg

10.6. Single Engine Strategy

10.6.1. Exercise 1

PURPOSE

Find the strategy to adopt.

SAT	: -39 (Δ ISA = + 15)
GW	: 68 000 kg
FL	: 350
MORA	: 24 000 ft

Step 1 – LRC Ceiling – Refer to 3.06.20 p 1

- Enter the table Weight 68 000 kg / ISA + 15
- Read LRC ceiling = 22 300 ft

Step 2 – Drift Down Ceiling – Refer to 3.06.40 p 4

- Enter the table Weight 68 000 kg / FL 350
- Read Drift Down Ceiling = 24 400 ft
- Initial speed = 236 kt

Answer

The drift down strategy has to be adopted.

Drift Down ceiling = 24 400 ft

Initial speed = 236 kt

10.7. Final Exercise: Flight Preparation using LPC

10.7.1. Exercise 1: Flt nbr AI3214, tail nbr S320CM

Determine the MTOW, speeds and flaps configuration.

Airport ORLY 24

Weather

Wind 250/9 kt
Temperature -3°C
QNH 988 hPa

Aircraft status

Max certified weight: 75.5 t
Air cond ON
Anti-ice: Engine & Wing
RWY: Slush 6 mm
CG > 25%
Trust Option: TOGA
No inop system

Answer

MTOW = … V1 = … VR = … V2 = … OPT CONF = …

Note that the TakeOff weight is not performance limited.

10.7.2. Exercise 2:

For dispatch purposes and according to the forecast conditions, determine the MLW, RLD and approach climb gradient.

Airport CAIRO 16 (HECA)

Weather	**Aircraft status**
Wind 140/5 kt Temperature 20°C QNH 998 hPa	Landing configuration FULL Air cond ON Anti-ice OFF No inop system RWY condition: water 11 mm Center of Gravity >25% Approach type normal Approach Climb Gradient: 2.1 Landing Technique: Manual

Answer

MLW = … RLD = … ACG = …
Compare these values with the available landing distance and minimum climb gradient.

10.7.3. Exercise 3:

Determine the ZFW, ZFCG, TOW, TOCG.
Flight from Paris Orly (LFPO) to Cairo (HECA).

Conf. Code: STD, Crew: 2/5.
Catering : CAT-fullpx
Miscellaneous: NONE

Dry operating weight: 42 500 kg.

AIRCRAFT LOADING CONDITION			
Passengers		Freight	
Total going to HECA	127 adults, 7 children	Total going to HECA	7 100 kg
Distribution	OA 23 OB 58 OC 53	Distribution	CP1 3 000 kg CP3 1 800 kg CP4 1 500 kg CP5 800 kg

Fuel On Board: 14 734 kg.
Fuel density: 0.785.
Taxi Fuel: 140 kg.
Trip fuel: 10 883 kg.

Answer

ZFW = …, ZFCG= …

TOW = …, TOCG = …

LW = … ,LDCG = …

Check that these values are within the approved envelopes.

10.7.4. Exercise 4:

Determine the speeds and flaps configuration with the actual TO conditions.

Airport ORLY RWY 24.

Weather	**Aircraft status**
Wind 250/7 kt Temperature -3°C QNH 995 hPa	Air cond ON Total anti-ice ON RWY: 6 mm of slush CG > 25% No inop system

TIP: TOW and CG position come automatically from Weight & Balance module.

Answer

TOW = … V1 = … VR = … V2 = … OPT CONF = …

10.7.5. Exercise 5:

In flight, approaching to destination determine the ALD.

Airport CAIRO 16 (HECA).

Weather

Wind 150/7 kt
Temperature 23°C
QNH 998 hPa

Aircraft status

Landing configuration FULL
Air cond ON
Anti-ice OFF
RWY condition: Water 6 mm

Approach type Normal
Approach Climb Gradient: 2.1
Landing Technique: Manual
Braking Mode: Med

No inop system

TIP: Landing weight and CG position come automatically from Weight & Balance module.

Answer

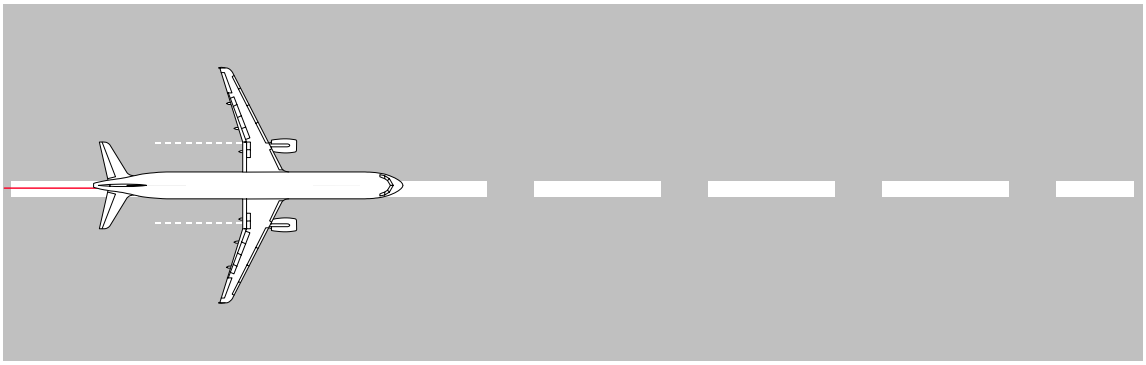
ALD = … RLD = …
Compare the ALD with the available landing distance and the ACG with the minimum required: 2.1%.

11. TAKEOFF PERFORMANCE REMINDER

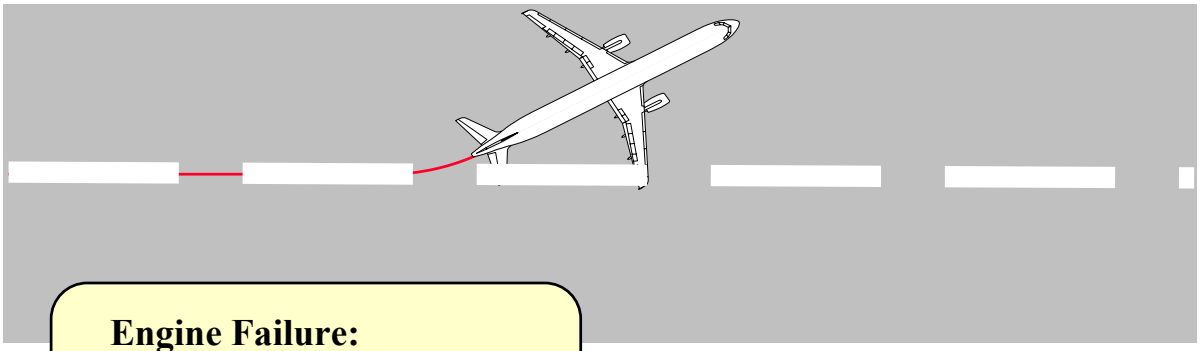
CONTENTS:

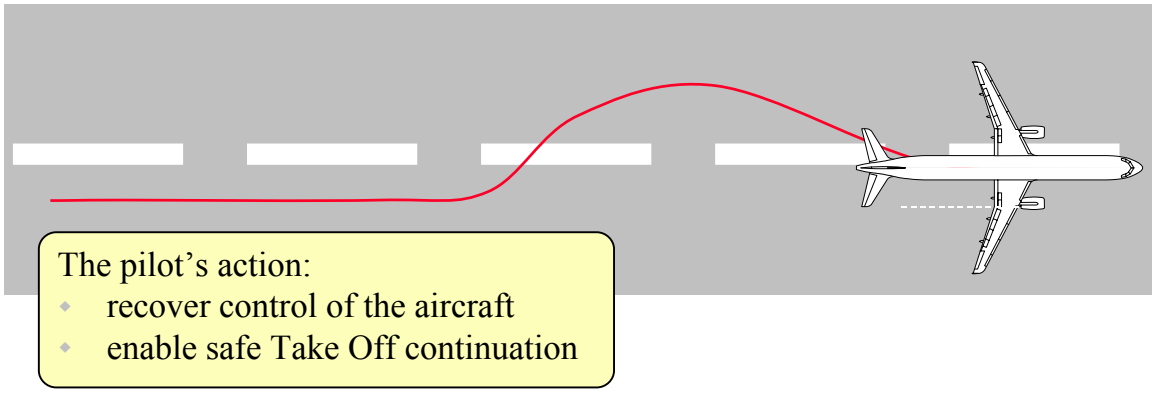
11.1. Limiting Speeds

11.1.1. Limiting Speeds: V_{MCG}

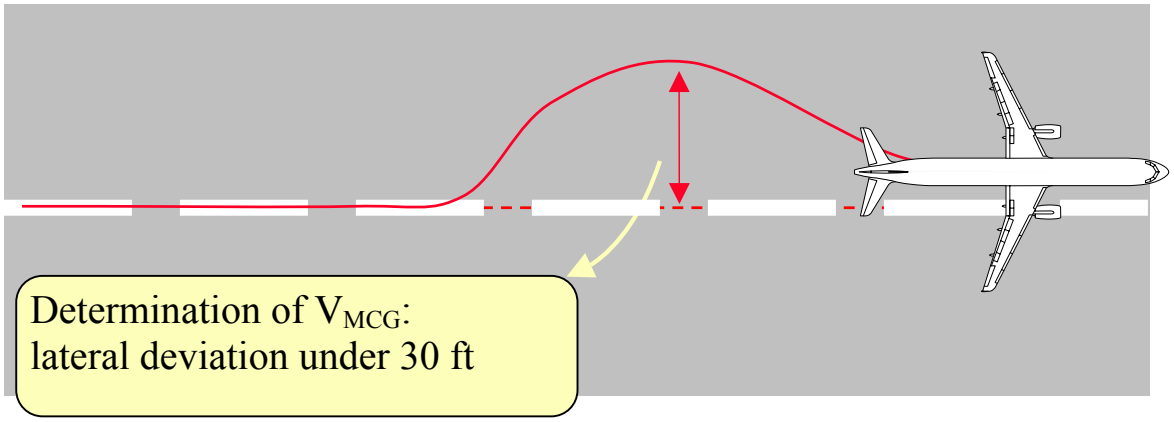


Minimum Control speed on Ground from which a sudden failure of the critical engine can be controlled by use of primary flight controls only, the other engine remaining at TakeOff power.



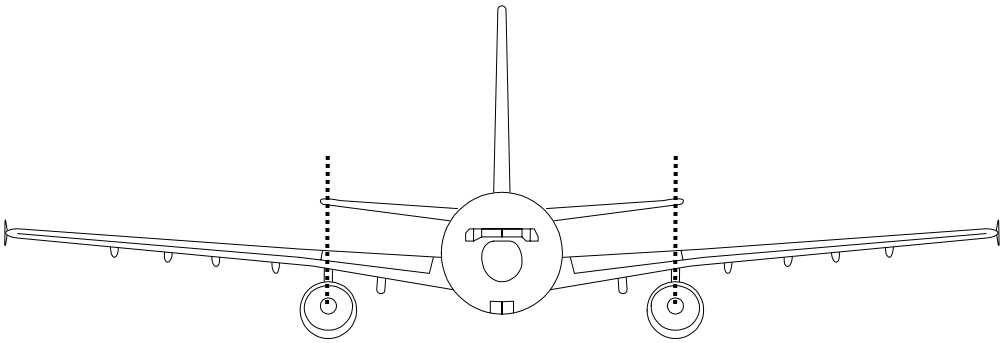


The pilot's action:
- recover control of the aircraft
- enable safe Take Off continuation

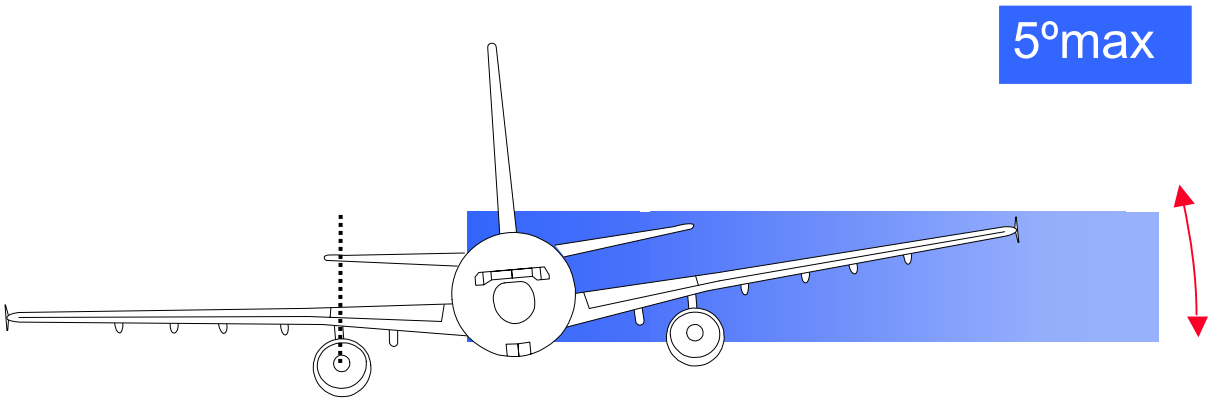


Determination of V_{MCG}:
lateral deviation under 30 ft

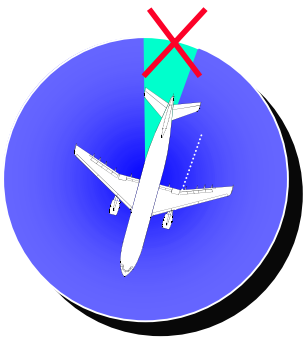
11.1.2. Limiting Speeds: V_{MCA}



Minimum Control speed in the Air at which aircraft can be controlled either:



- with a 5^0 maximum bank angle, or:



- with zero yaw.

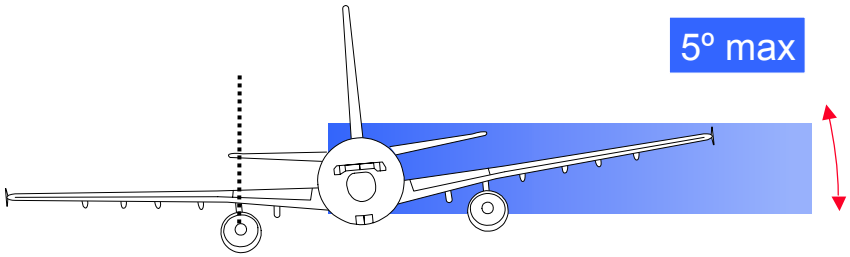
Summary:

Limiting speed: V_{MCA}

Definition: Minimum Control speed in the Air at which aircraft can be controlled either:

- with a 5^0 maximum bank angle, or
- with zero yaw.

... in case of failure of one engine, the other engine remaining at TakeOff power.

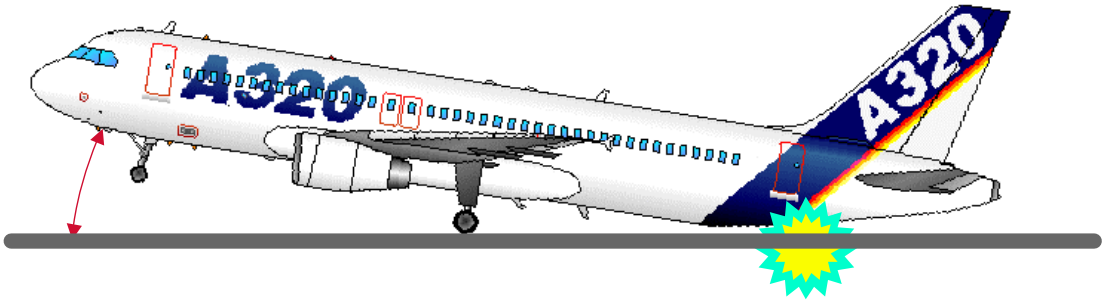


11.1.3. Limiting Speeds: V_{MU}

Minimum Unstick speed is the lowest calibrated airspeed at and above which the aircraft can safely lift off the ground and continue the TakeOff without encountering critical conditions.

What are these critical conditions ?

- the necessary angle of attack is too great: the rear of the A/C can hit the ground.



- Insufficient lateral control, may cause engine or wing to hit the ground.

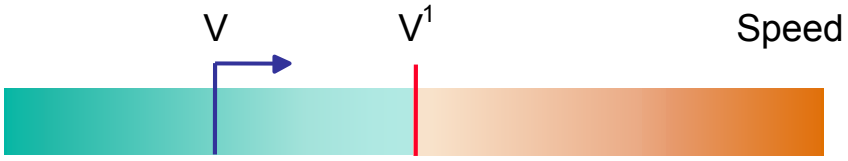
11.2. Operating Speeds: V_1, V_R, V_2

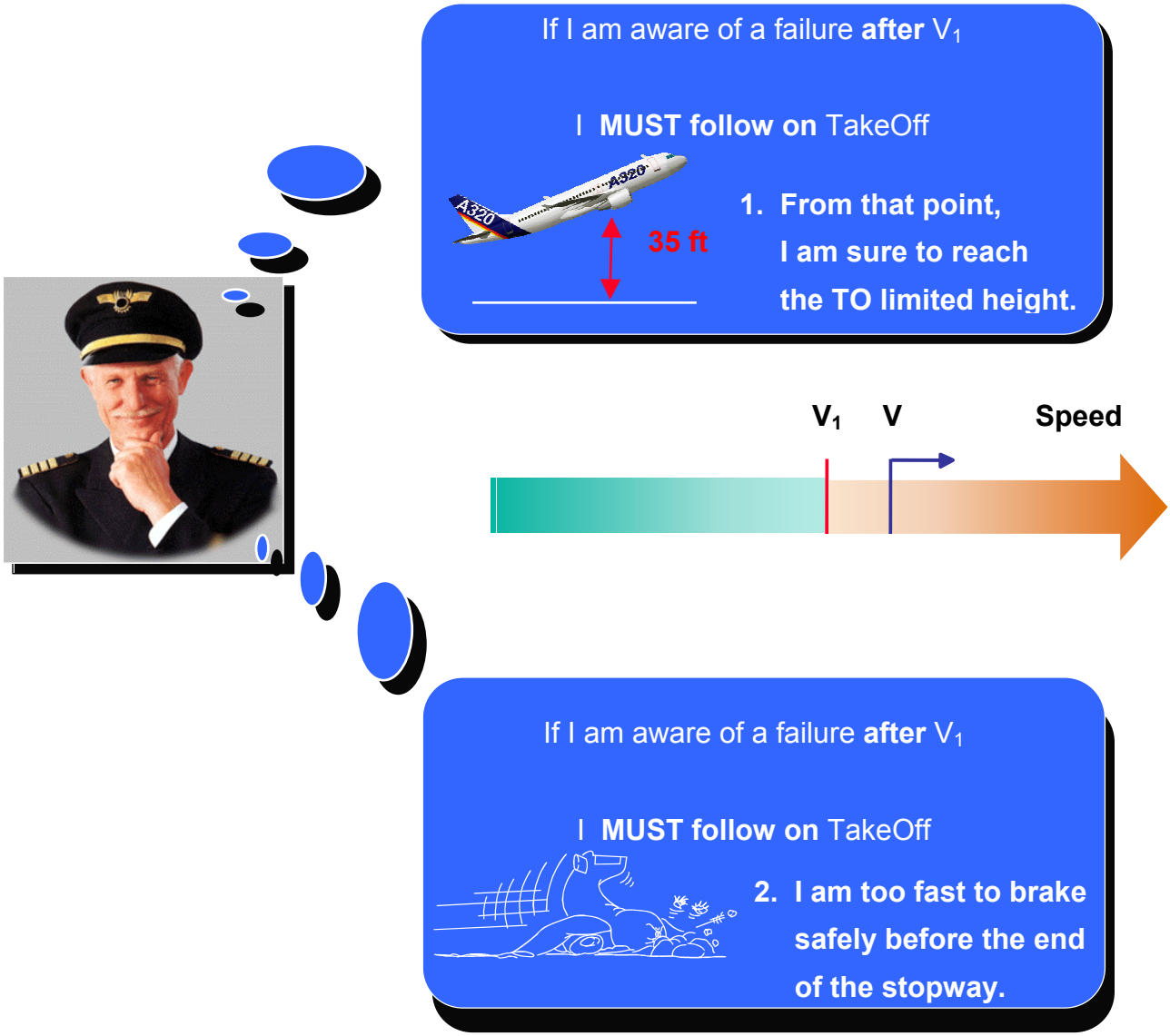
11.2.1. Operating Speeds: V_1

Definition:

TakeOff decision speed chosen by the applicant.

V_1 is the speed limit at which the pilot can interrupt TakeOff in case of failure.





Summary:

Operating speed: V_1

Definition: TakeOff **decision** speed chosen by the applicant.

V_1 is the speed limit at which the pilot can interrupt TakeOff in case of failure.

11.2.2. Operating Speeds: V_R

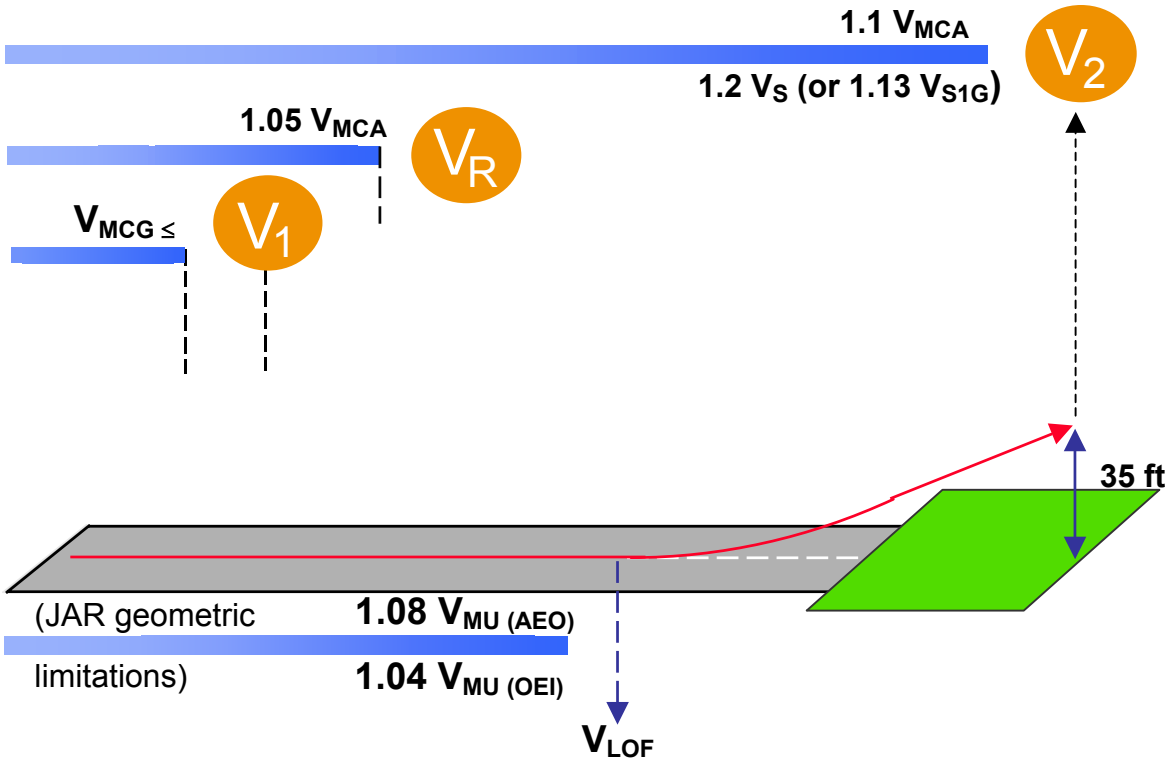
Definition:
V_R is the Rotation speed at which the aircraft is rotated for lift off.

11.2.3. Operating Speeds: V_2

Definition:
V_2: TakeOff climb speed.

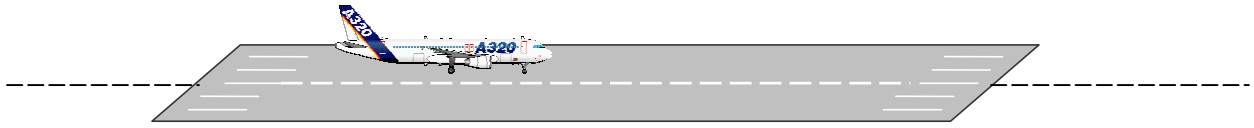
To be reached before the 35 ft TakeOff height above T.O.D.
Maintained during 1st and 2nd segment, until the minimum acceleration height is reached (at least 400 ft).

11.2.4. Limiting/Operating Speeds: Relative Positions



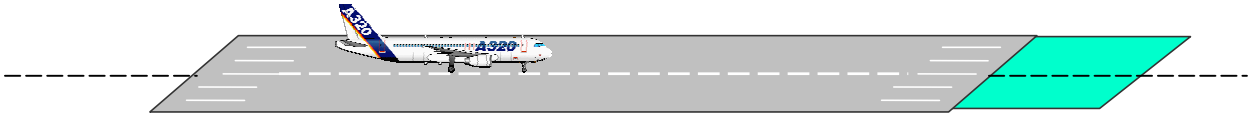
11.2.5. TakeOff Lengths

11.2.5.1. Runway:



" Rigid or flexible rectangular area made of concrete or asphalt used for TakeOff and landing "

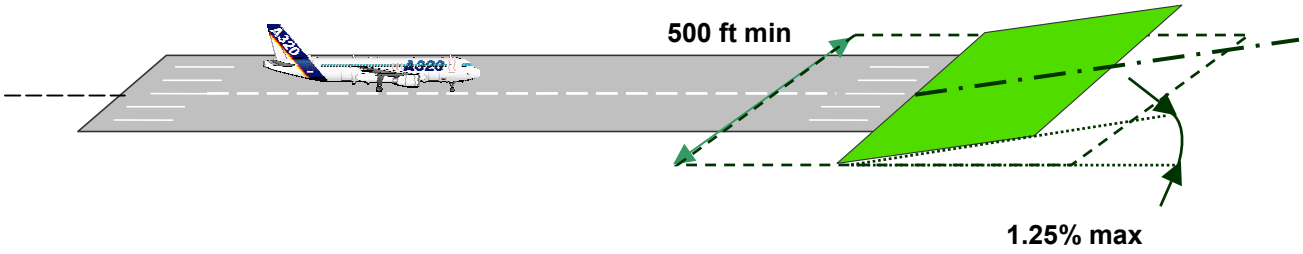
11.2.5.2. Stopway



Rectangular area beyond the TakeOff runway:

Centered on the same (center)line, at least as wide as the runway, designated by the airport authorities for use in decelerating the aircraft in case of aborted TakeOff.

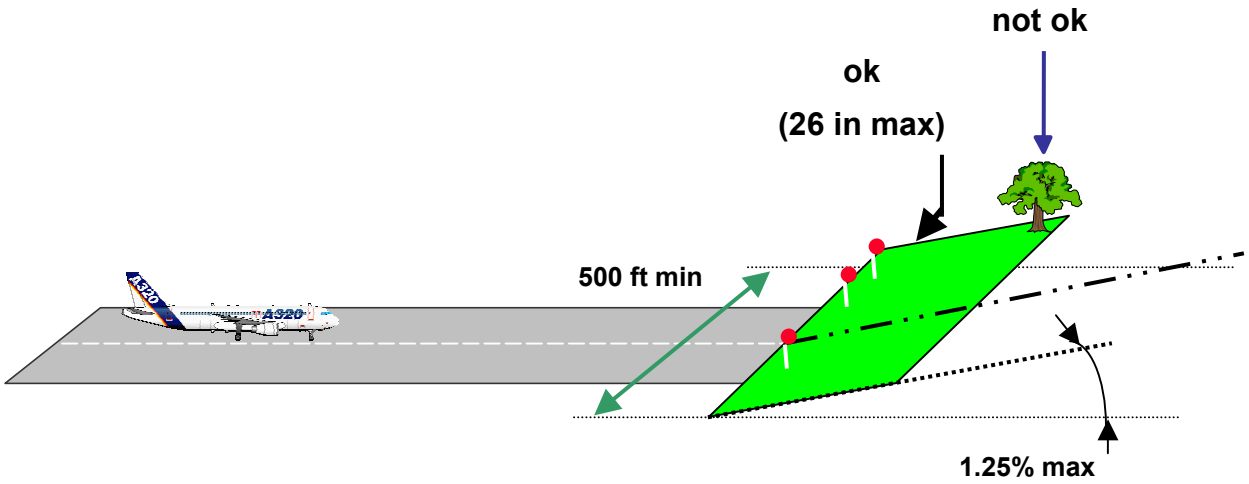
11.2.5.3. Clearway



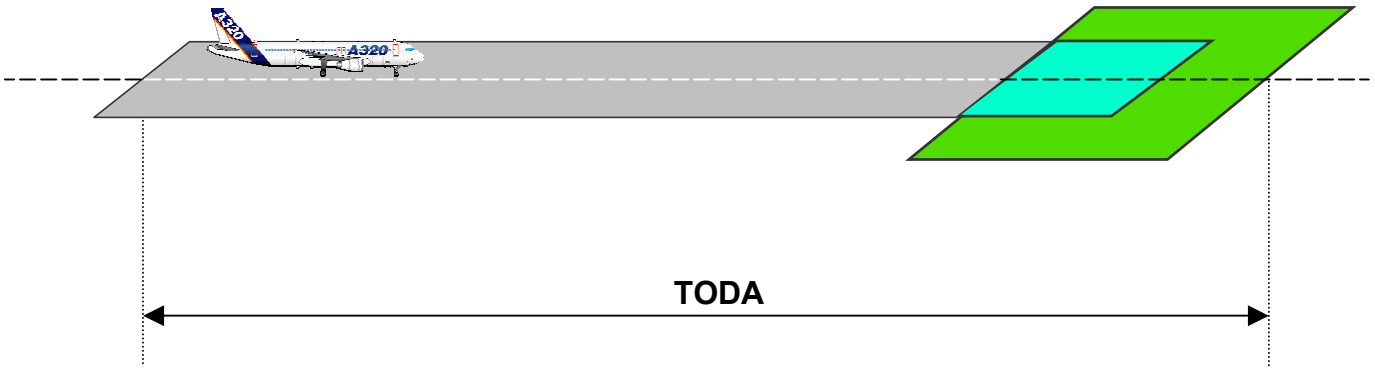
Rectangular area beyond the runway, located on the same centerline, and under control of the airport authorities, featuring:

- Minimum width: 500 ft
- Slope < 1.25%

- No prominence except threshold lights (if < 26 in above surface)

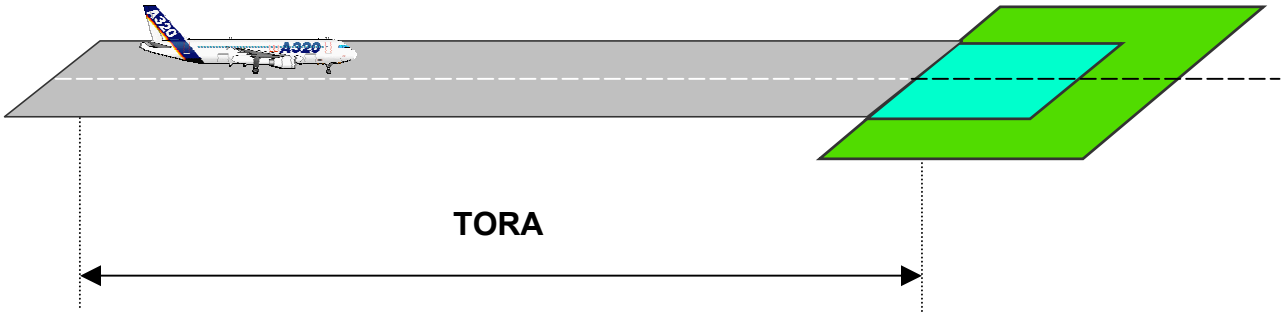


11.2.5.4. TakeOff Distance Available



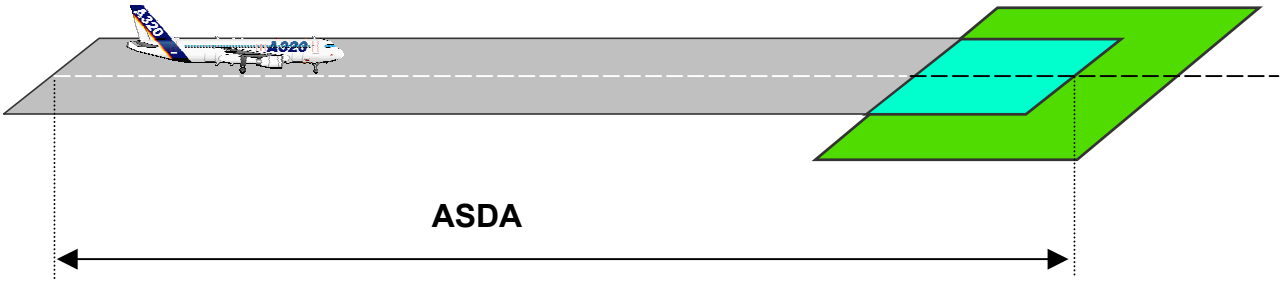
It is the Runway + Clearway lengths.

11.2.5.5. TakeOff Run Available



It is the Runway length only.

11.2.5.6. Acceleration Stop Distance Available



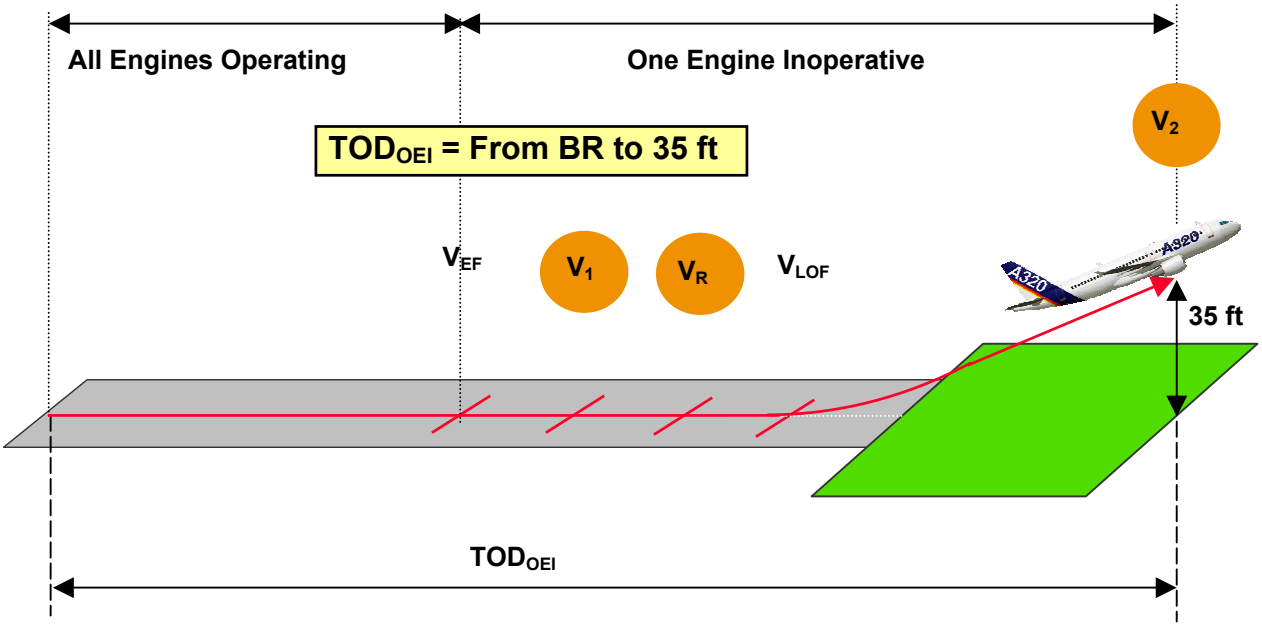
It is the Runway + Stopway lengths.

11.3. TakeOff Distances

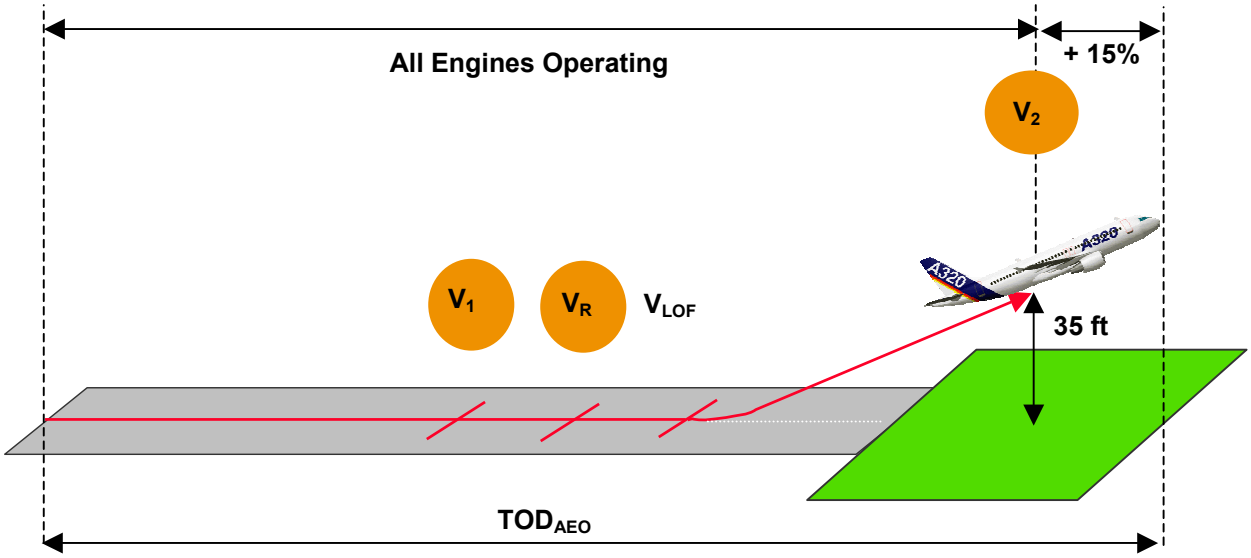
11.3.1. TakeOff Distances (TOD)

- TakeOff Distance (TOD)
- TakeOff Run (TOR)
- Acceleration Stop Distance (ASD)

11.3.1.1. One Engine Inoperative

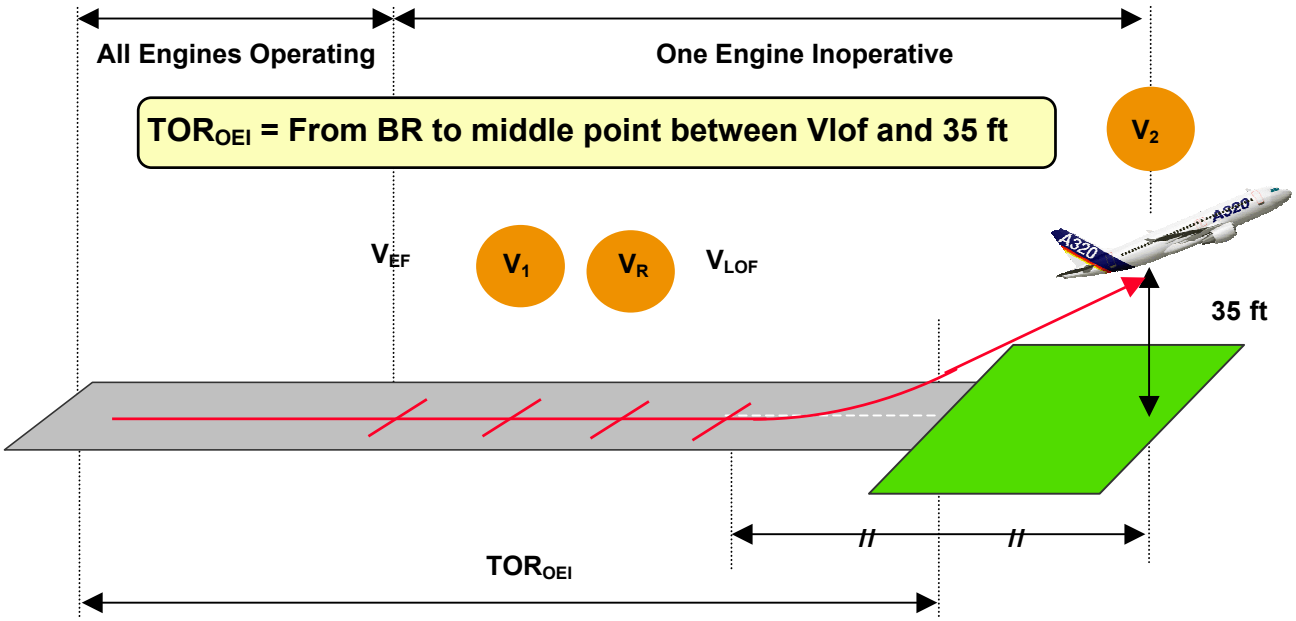


11.3.1.2. All Engines Operating

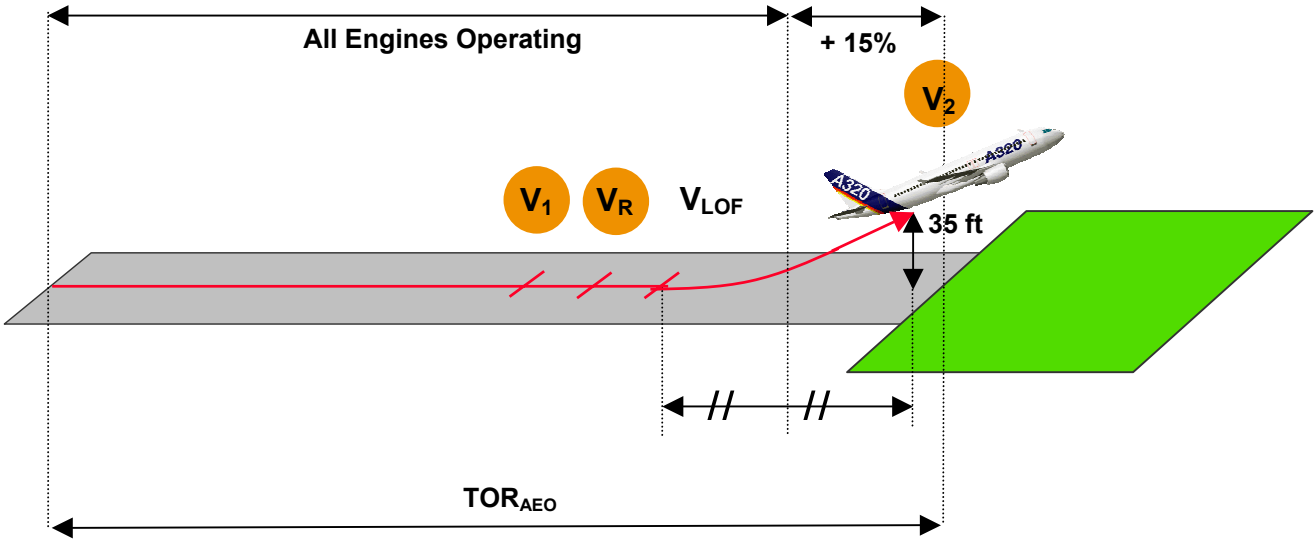


11.3.2. TakeOff Run Distances (TOR)

11.3.2.1. One Engine Inoperative

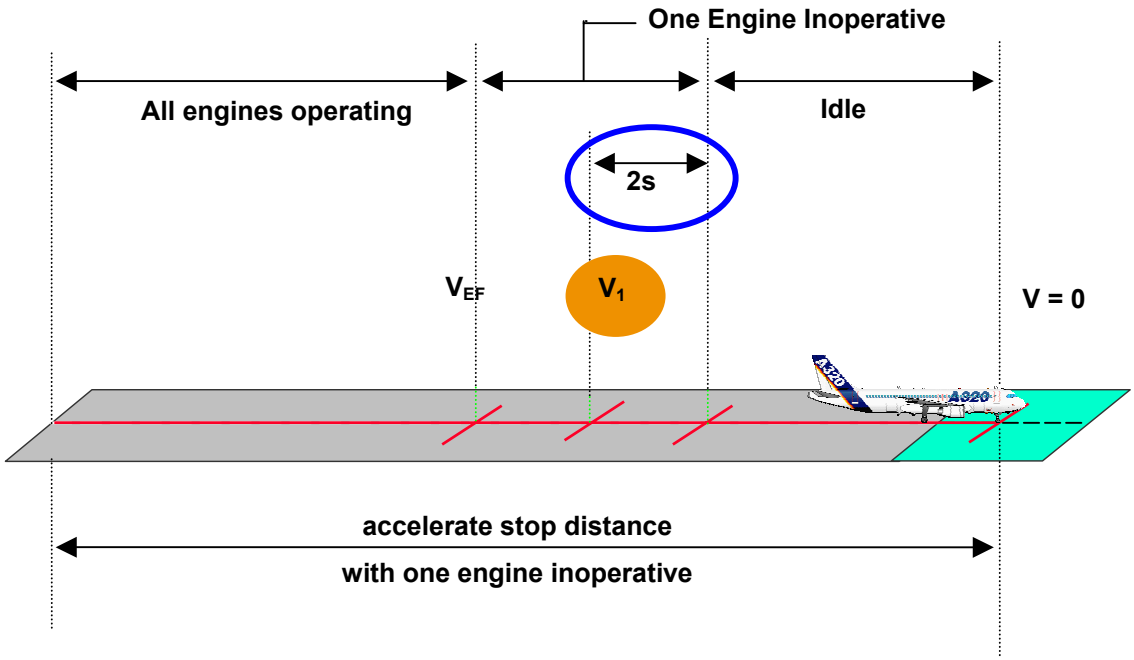


11.3.2.2. All Engines Operating

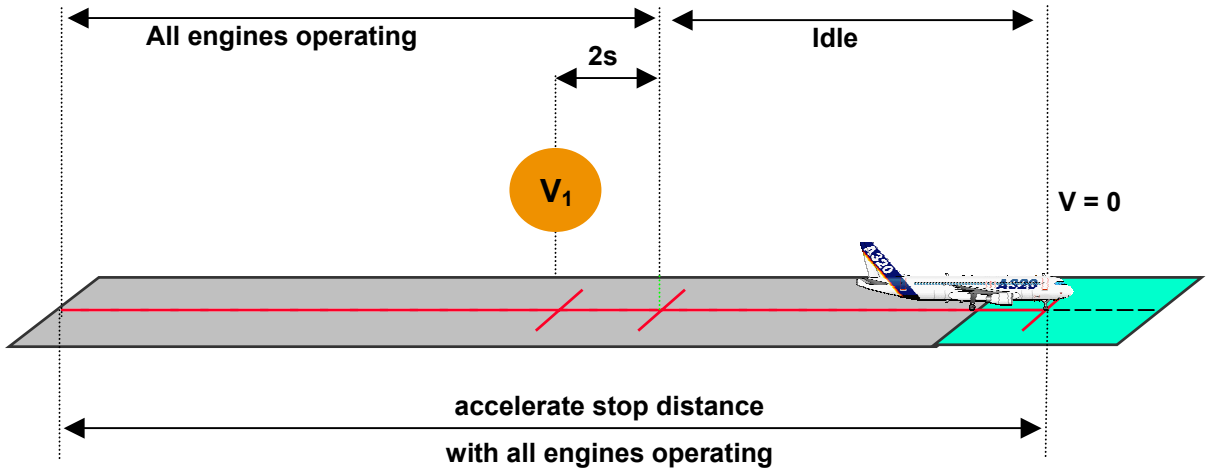


11.3.3. Accelerate Stop Distance (ASD)

11.3.3.1. One Engine Inoperative at V_{EF}



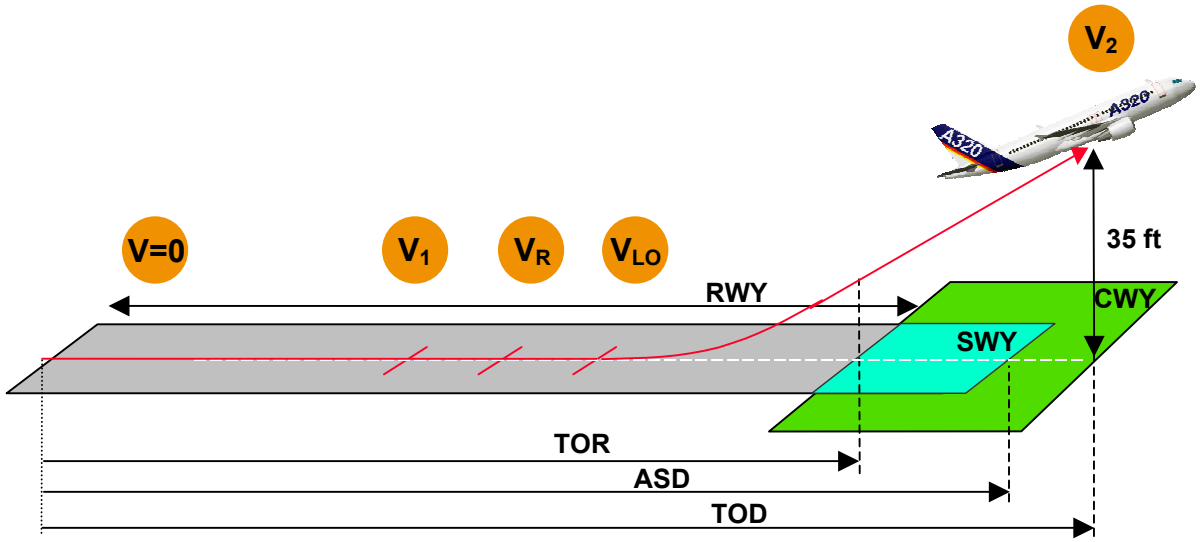
11.3.3.2. All Engines Operating



Braking means:

- Wheel brakes,
- Spoilers,
- Reversers:
  . not on dry runways,
  . certified on wet runways,
  . mandatory on contaminated runways.

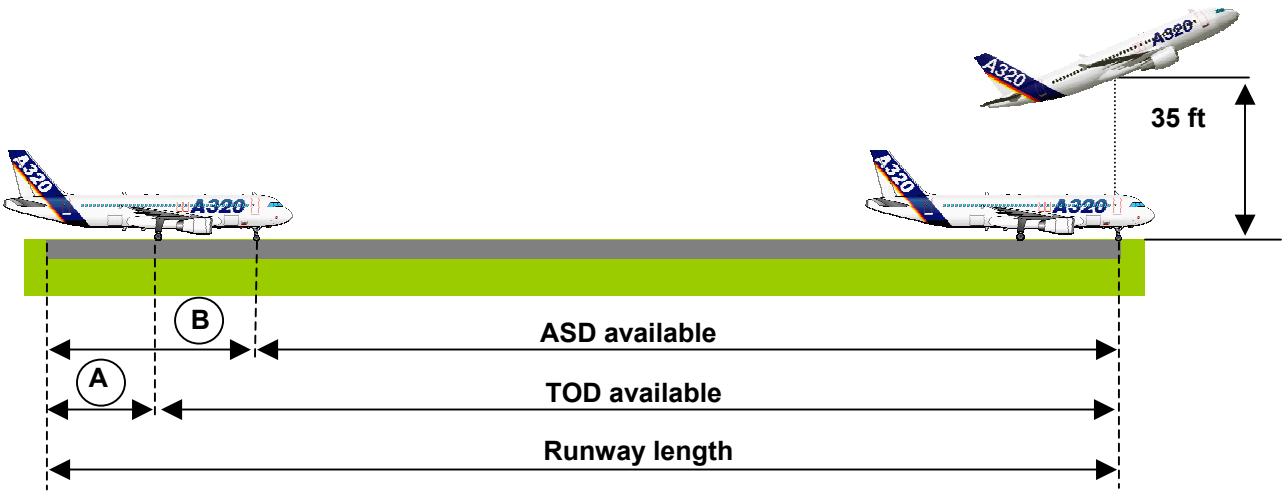
11.3.4. Association of TakeOff Distances and Lengths



11.4. Line Up Allowances

It is necessary to take into account the runway length decrease due to the line up. The calculation of TODA, ASDA and TORA do not take into account the aircraft line up on the runway considered for Take Off. This line up distance depends on aircraft design and the access possibility on the runway.

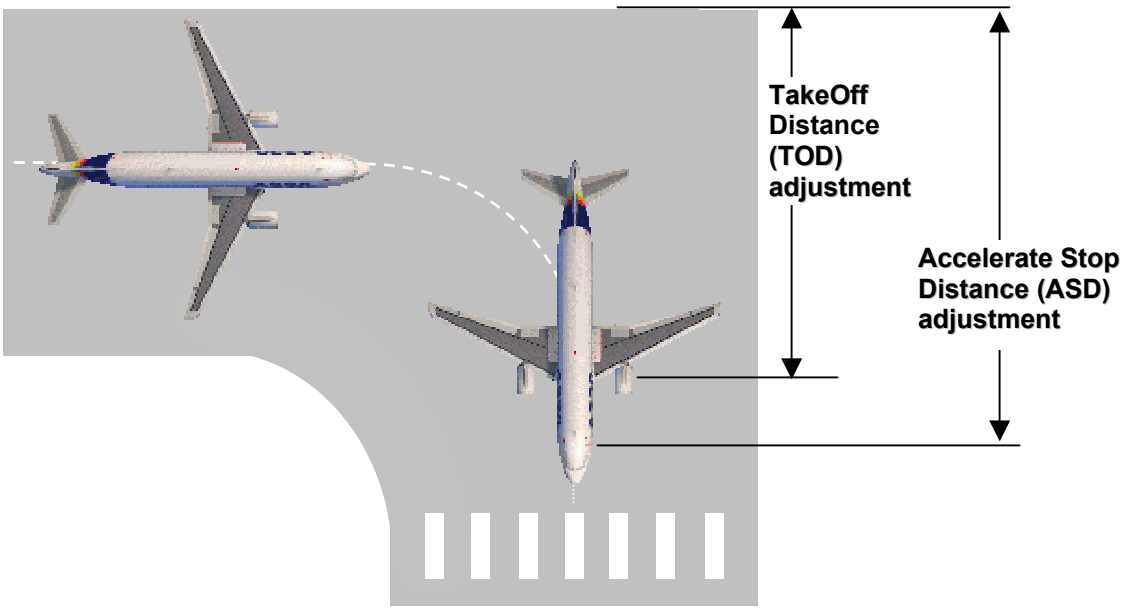
Two cases are studied, and in both cases, two distances are considered:



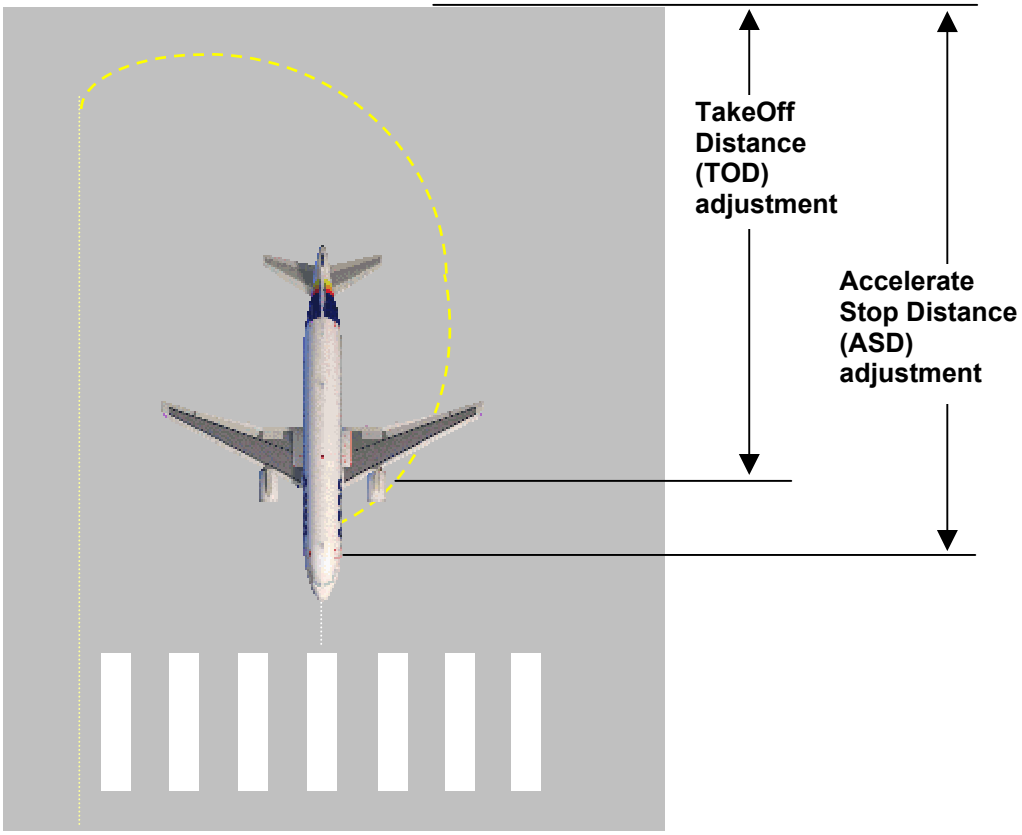
A Adjustment to TakeOff distance

B Adjustment to accelerate stop distance

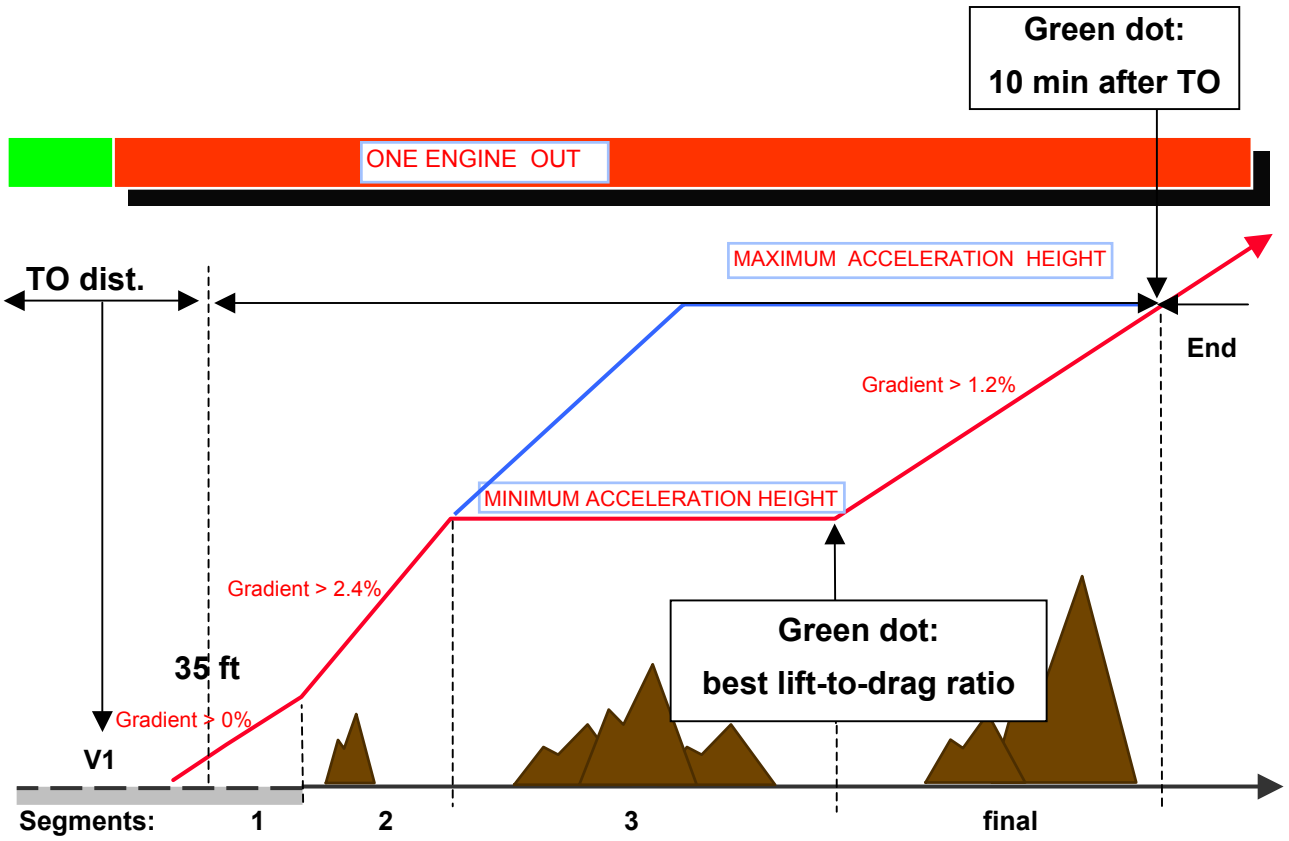
90° runway entry		
aircraft model	minimum line up distance correction	
	TODA (m)	ASDA (m)
A320	12	26



180° turnaround		
aircraft model	minimum line up distance correction	
	TODA (m)	ASDA (m)
A320	18	32

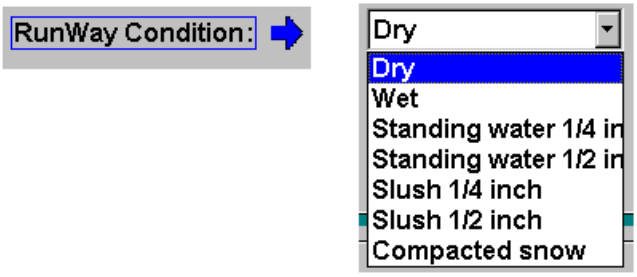


11.5. TakeOff Trajectory



11.6. Runway Condition

11.6.1. LPC List Box



11.6.2. Runways Wet and Contaminated

Runway :	Wet	Contaminated
Water	< 3 mm	3 - 13 mm (½')
Slush	< 2 mm	2 - 13 mm (½')
Wet snow	< 4 mm	4 - 25 mm (1')
Dry snow	< 15 mm	15 - 25 mm (2')
Comp Snow		all

11.7. Factors of Influence

Sustained parameters:

- Temperature,
- Pressure Altitude,
- Air bleed,
- Wind,
- Moisture,
- Runway condition.

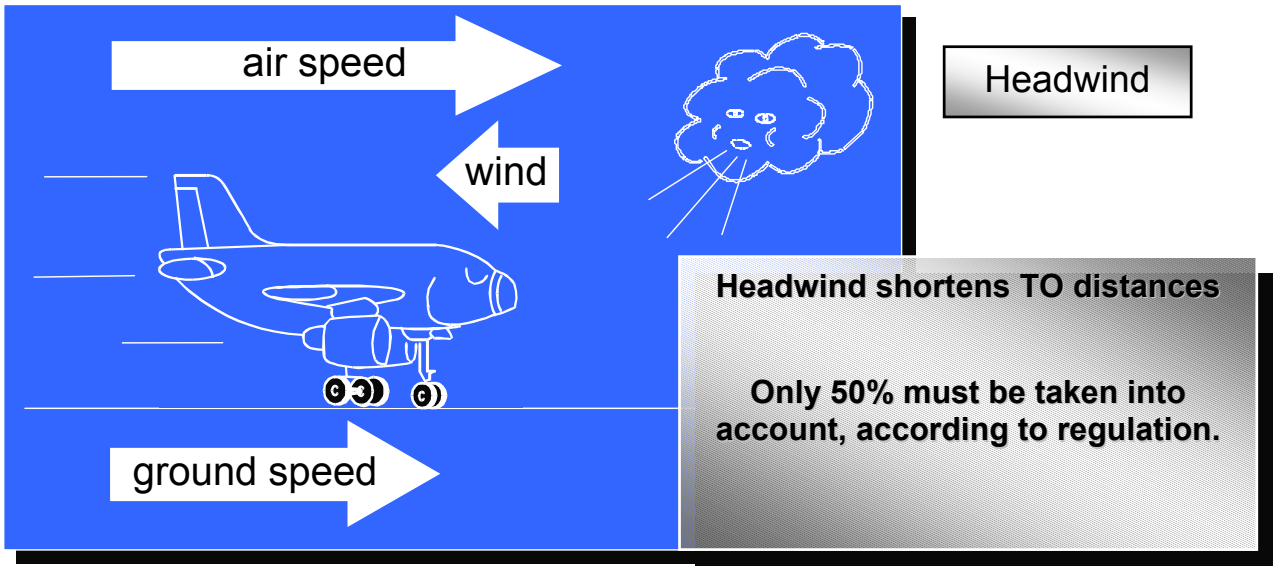
Chosen parameters:

- Flap setting,
- Decision speed V_1,
- V_2 / V_s ratio.

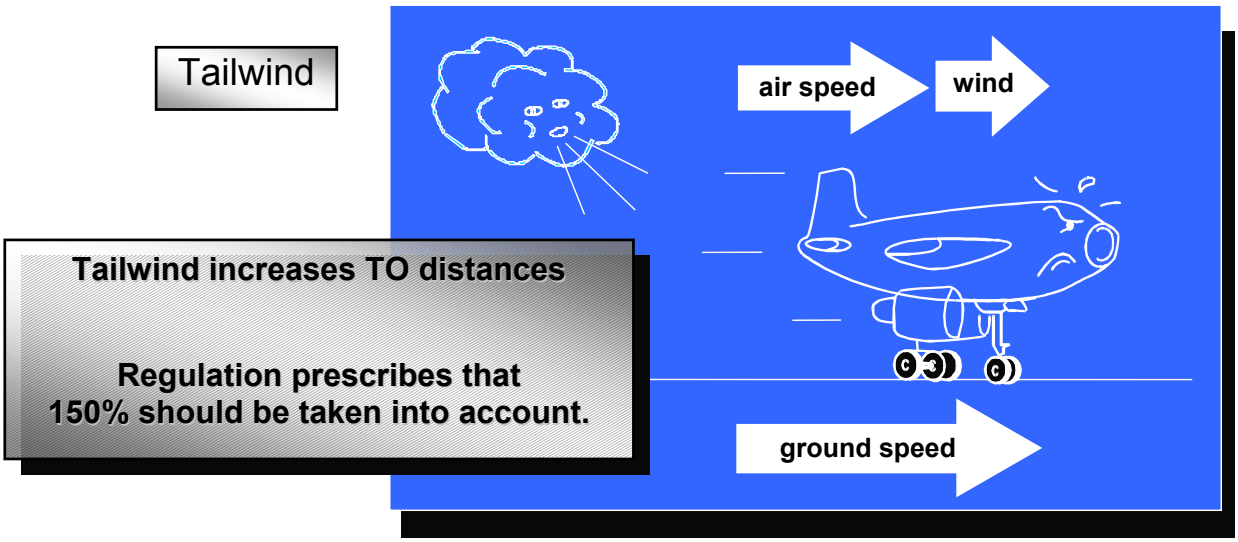
11.7.1. Wind and Moisture:

Effect on TO distances (TOD, TOR, ASD):

11.7.1.1. Headwind



11.7.1.2. Tailwind



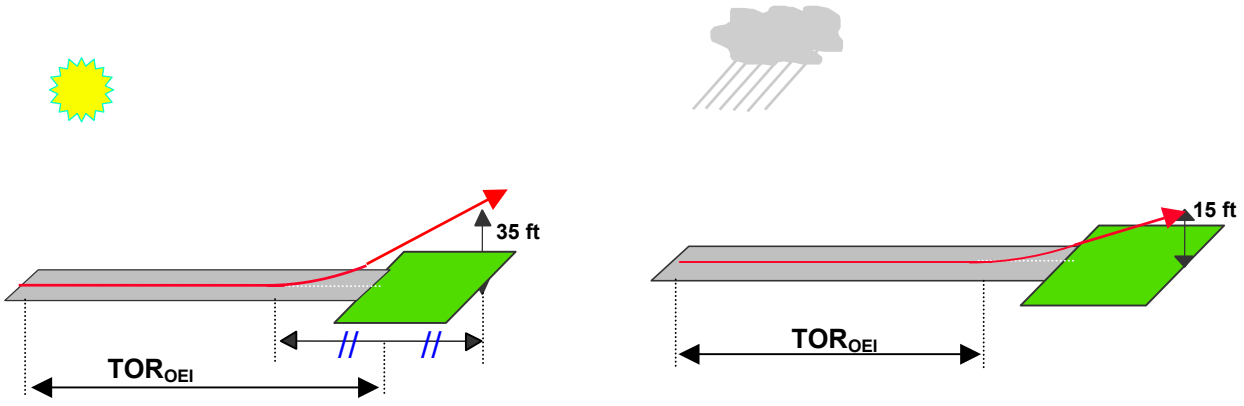
11.7.1.3. Regulation Changes on Wet and Contaminated Runways

- Performance depends on the depth of the contaminant.

Wet and contaminated runways.

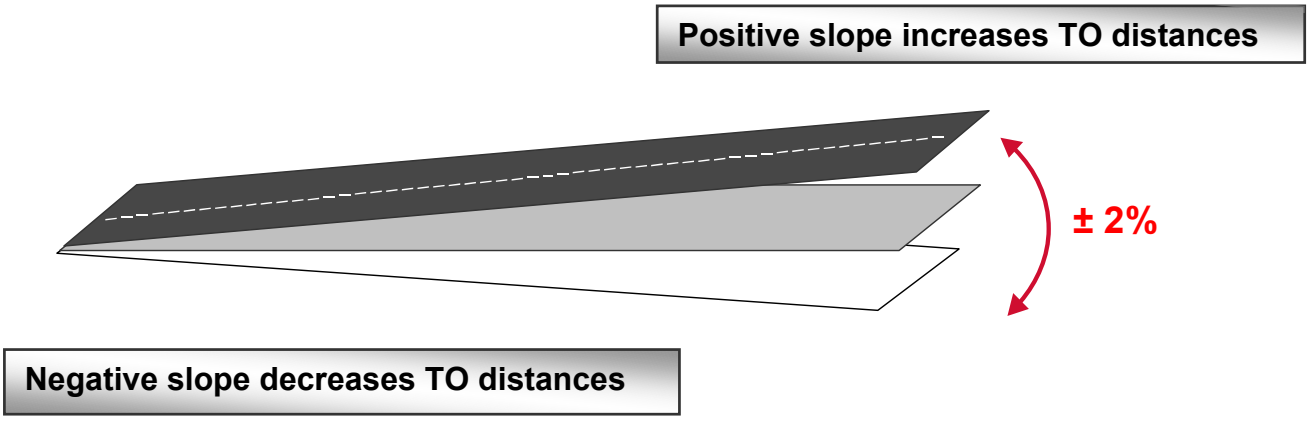
- All Engines Operating TOD, TOR, and ASD, are the same, whatever the runway condition.
- One Engine Inoperative: TOD, TOR are different.

TOD: screen height = 15 ft
TOR: It ends at V_{LOF}



11.7.1.4. Runway Slope

It mustn't exceed ± 2%



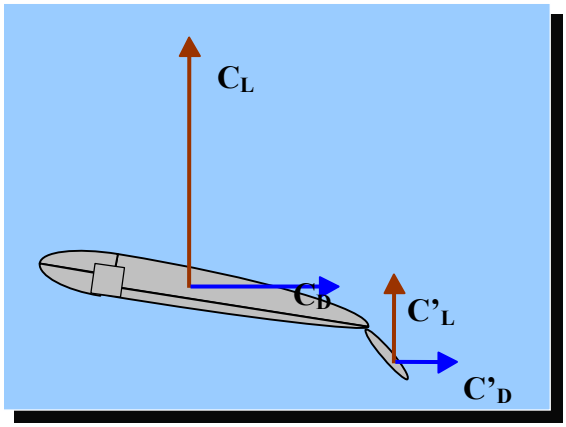
11.7.1.5. Flap Setting

Flaps increase lift...

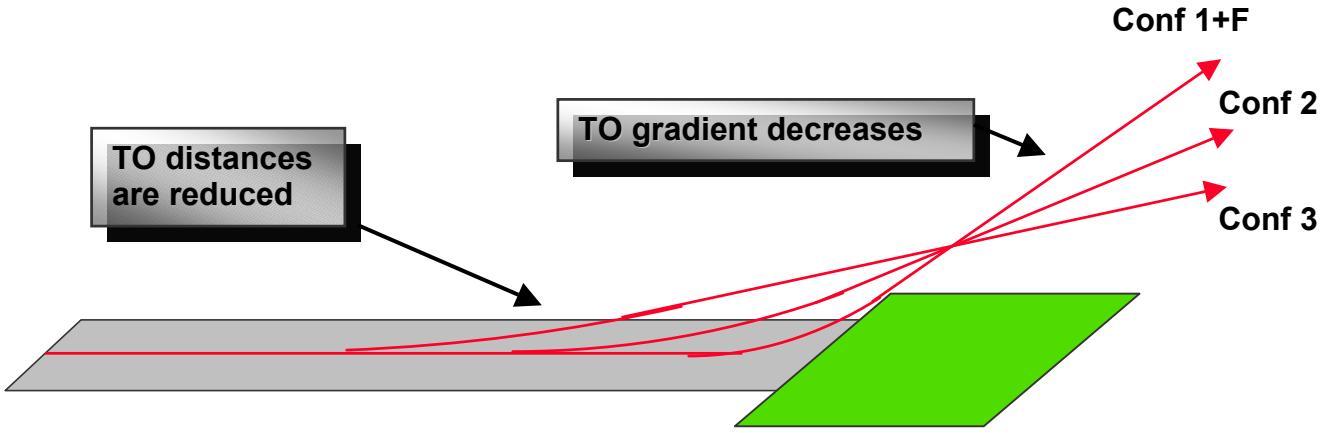
- TO distances are reduced.

Flaps increase drag...

- TO gradient decreases.

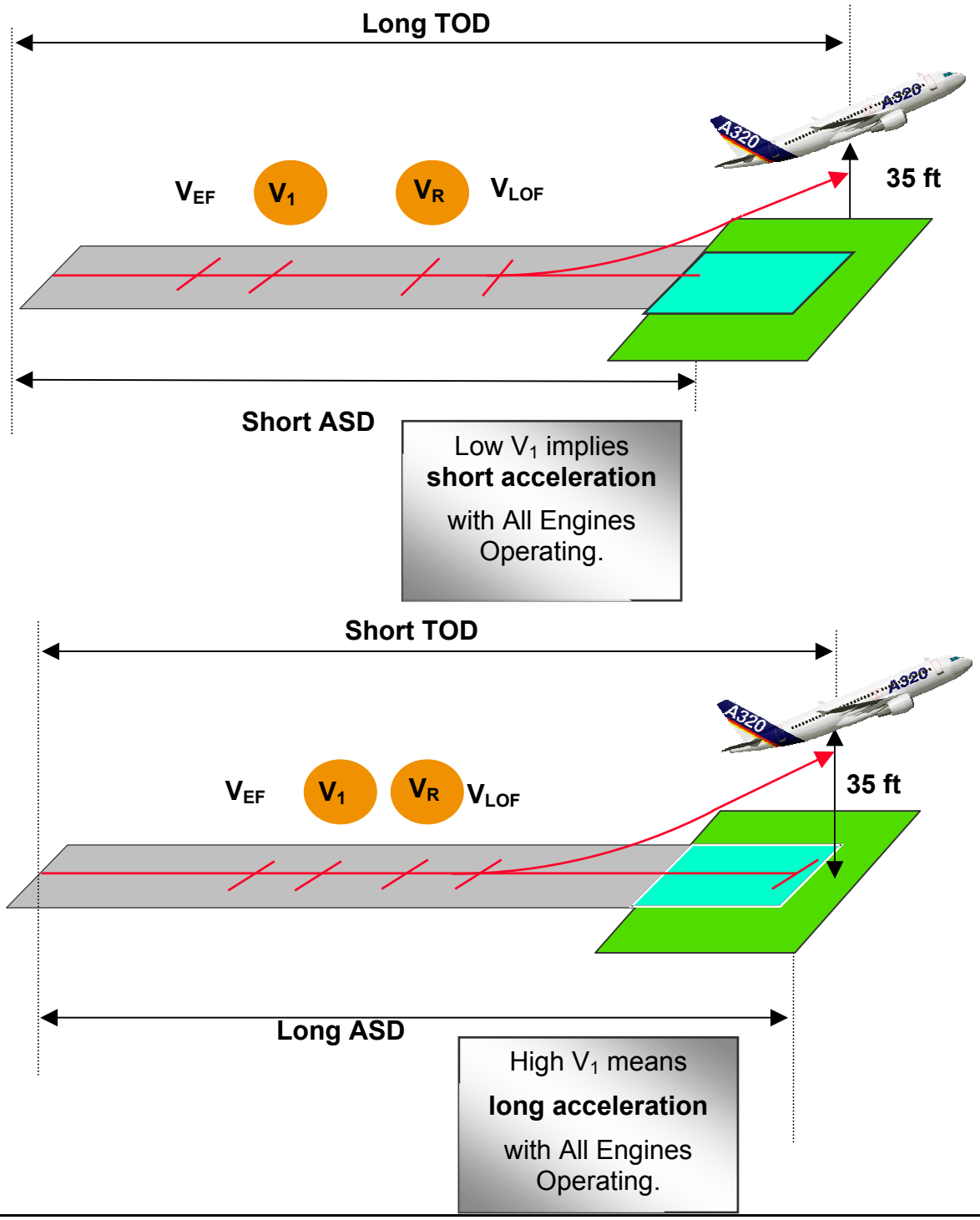


TakeOff configurations on Airbus family:



11.7.1.6. Decision Speed V_1

The most penalizing conditions are taken into account: the failure (V_{EF}) occurs 1 second before V_1.



11.7.1.7. V_2 / V_s Ratio

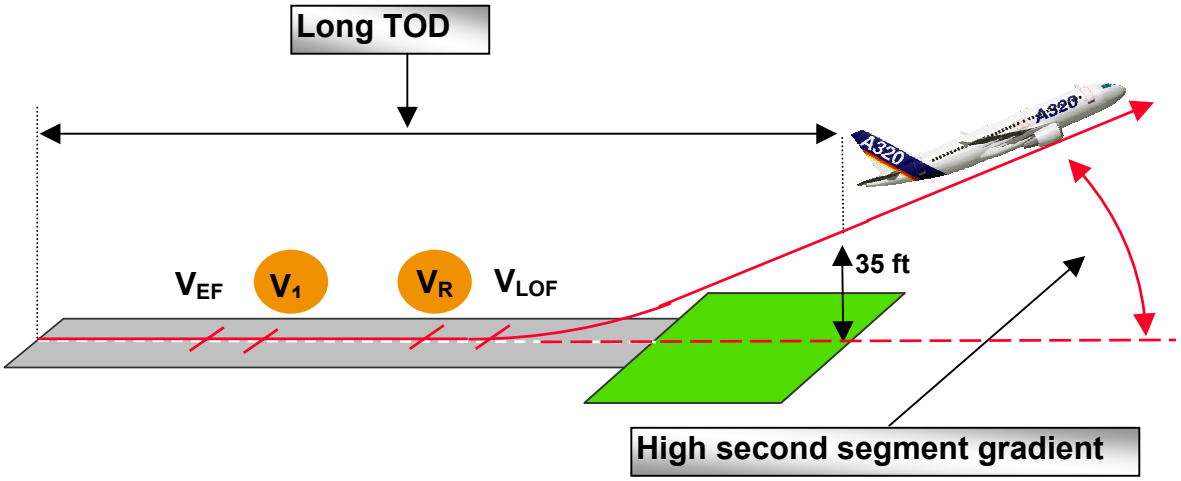
Being limited by V_S, V_2 is set through the V_2/V_S ratio.

V_2 is the speed required when reaching 35 ft height.

V_2 is determined by V_R, as no TO parameters can be changed after lift off: **high V_2 ⇒ high V_R**

High V_2 / V_S

V_2/V_S influence:		
High ratio	long TOD	high 2nd segment slope
Low ratio	short TOD	low 2nd segment slope



11.8. TakeOff Optimization

11.8.1. Runway Length:

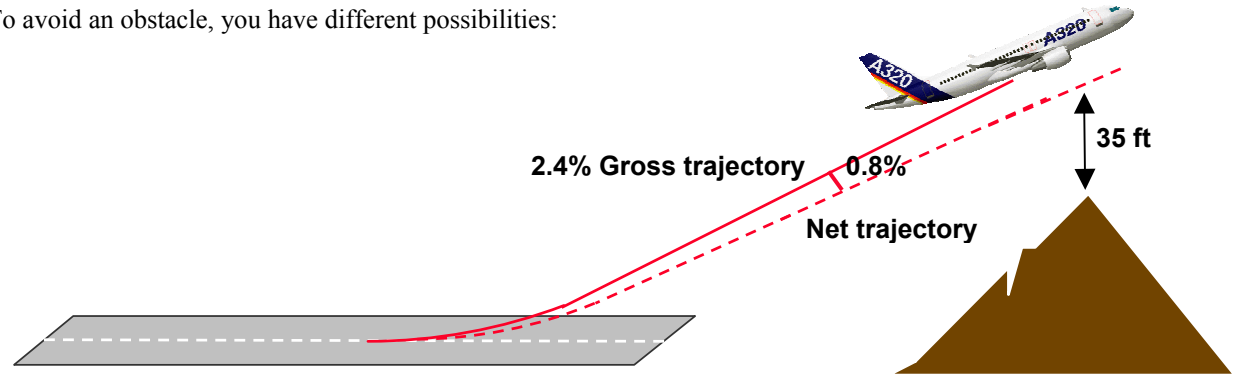
- ASD
  - ASD 1 E/O ≤ **ASDA**, and
  - ASD all engines ≤ **ASDA**
- TOD
  - TOD 1 E/O ≤ **TODA**, and
  - TOD all engines ≤ **TODA**
- TOR
  - TOR 1 E/O ≤ **TORA**, and
  - TOR all engines ≤ **TORA**

11.8.2. Other Limitations:

- speeds,
- 1st segment gradient (> 0%),
- 2nd segment gradient (> 2.4%),
- brake energy,
- obstacle,
- tire speed,
- final TakeOff (> 1.2%).

11.8.3. Obstacles:

To avoid an obstacle, you have different possibilities:



	TOD	ASD	Climb grad
Flaps ↘	increases	increases	increases
TO Weight ↘	decreases	decreases	increases
V1 ↗	decreases	increases	no change
V2 ↗	increases	no change	increases

11.8.4. Result

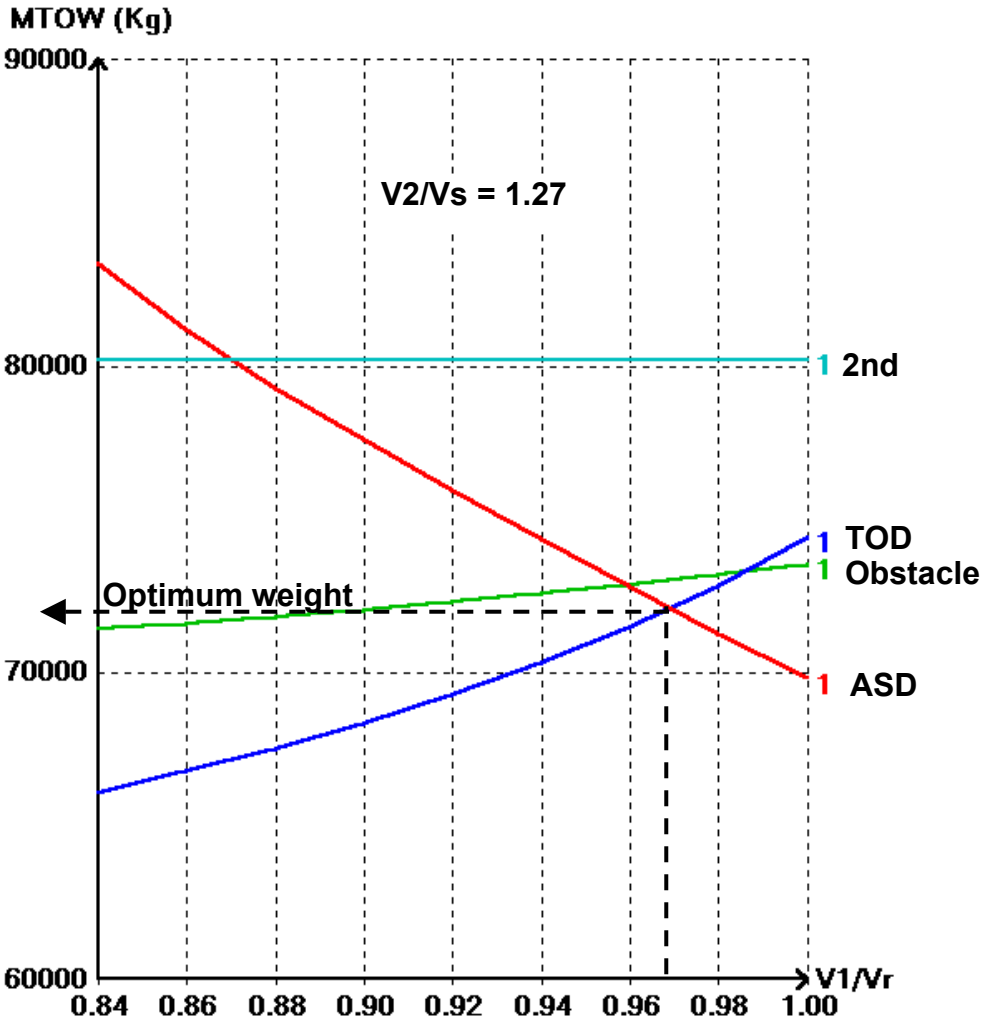
Optimization

Limitations for given:

- runway,
- wind,
- temperature,
- pressure,
- flaps setting,
- V2/Vs ratio.

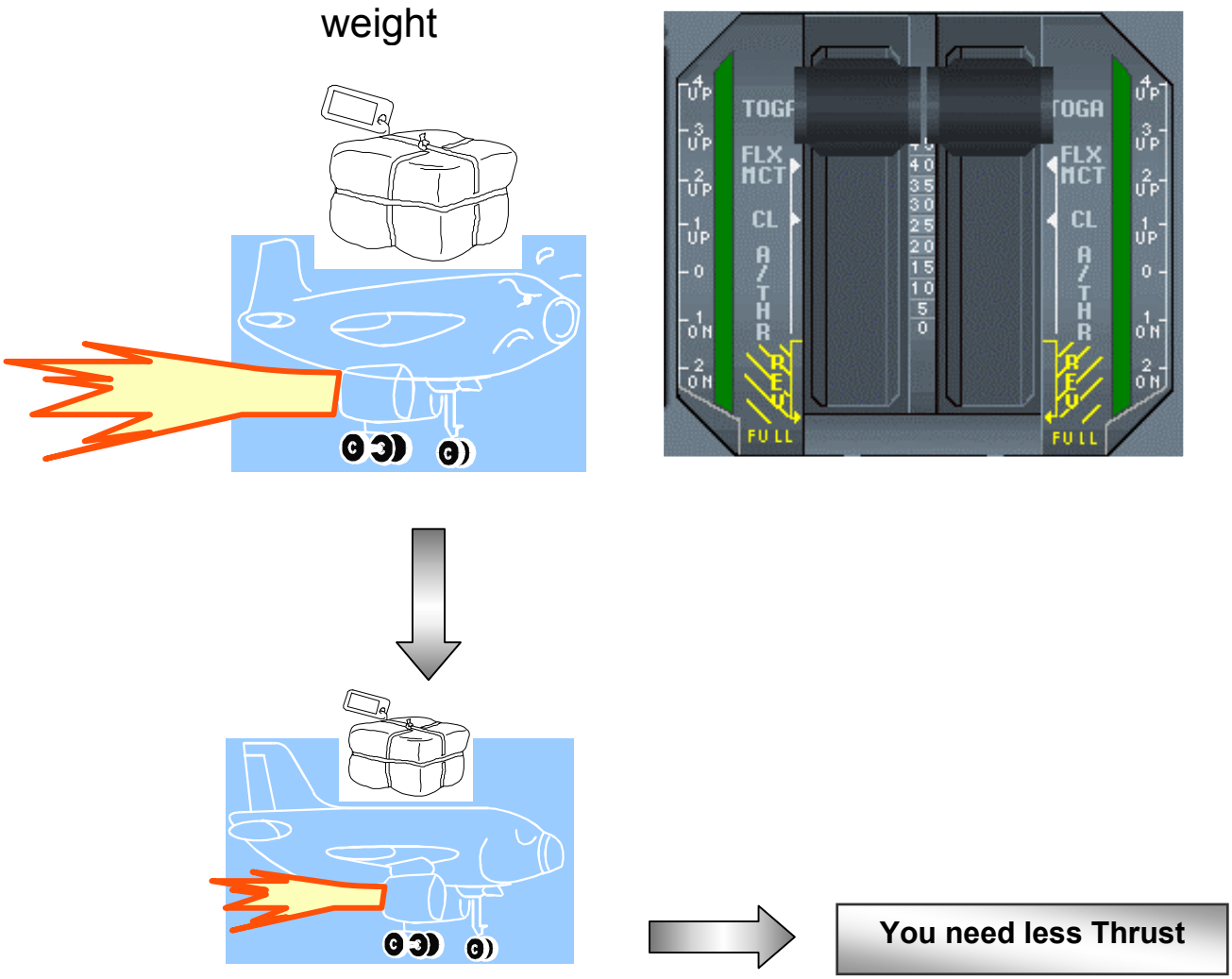
At a given V2/Vs ratio, we have an optimum weight.

Just explore all the range of V2/Vs to have the MTOW.



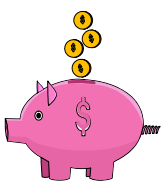
11.9. Engine Performance

11.9.1. Principle

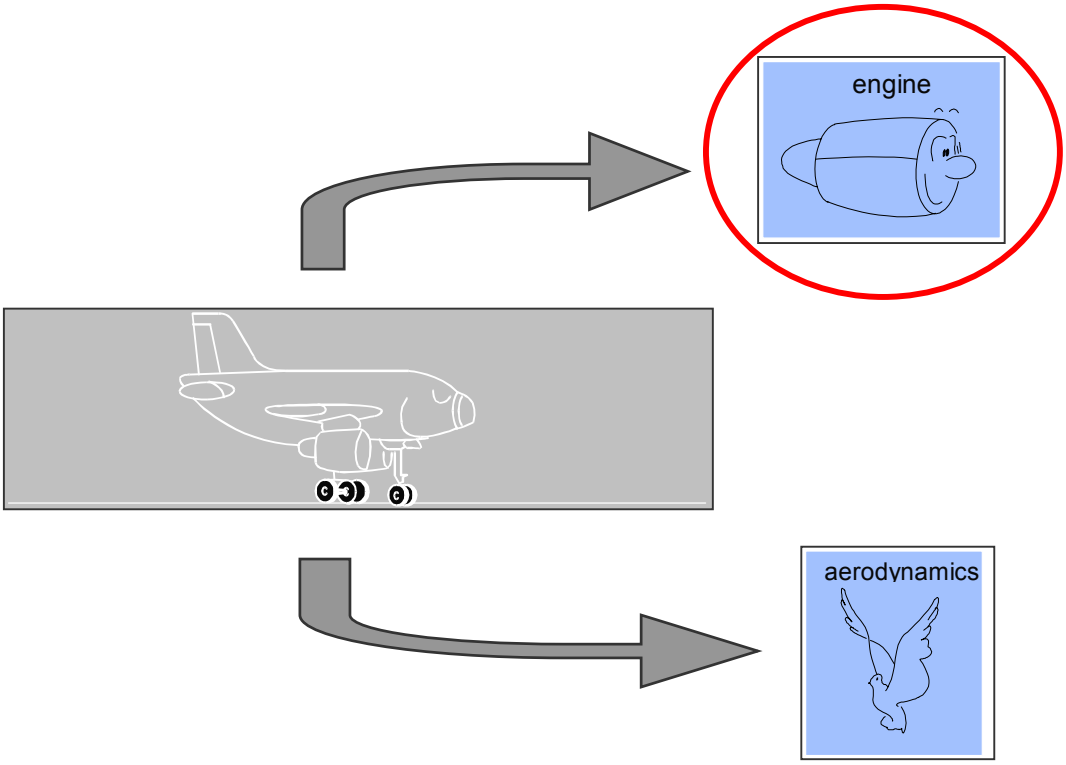


When your **Actual** TakeOff Weight is **lower** than the **Maximum TakeOff Weight**, you can perform a TakeOff with less than the max TakeOff thrust.

This thrust reduction improves engine life and reduces maintenance costs.

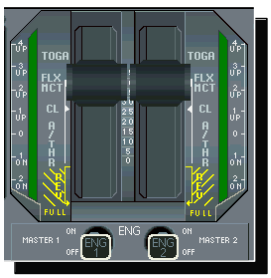


Which part of the aircraft is concerned ?

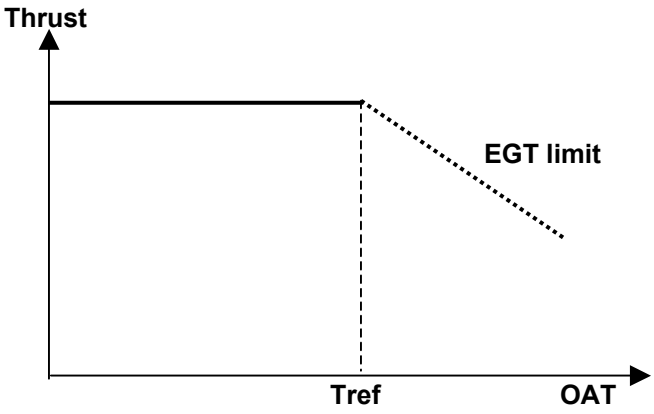


11.9.1.1. Reminder about engines and thrust

Trust levers



Thrust variation with OAT

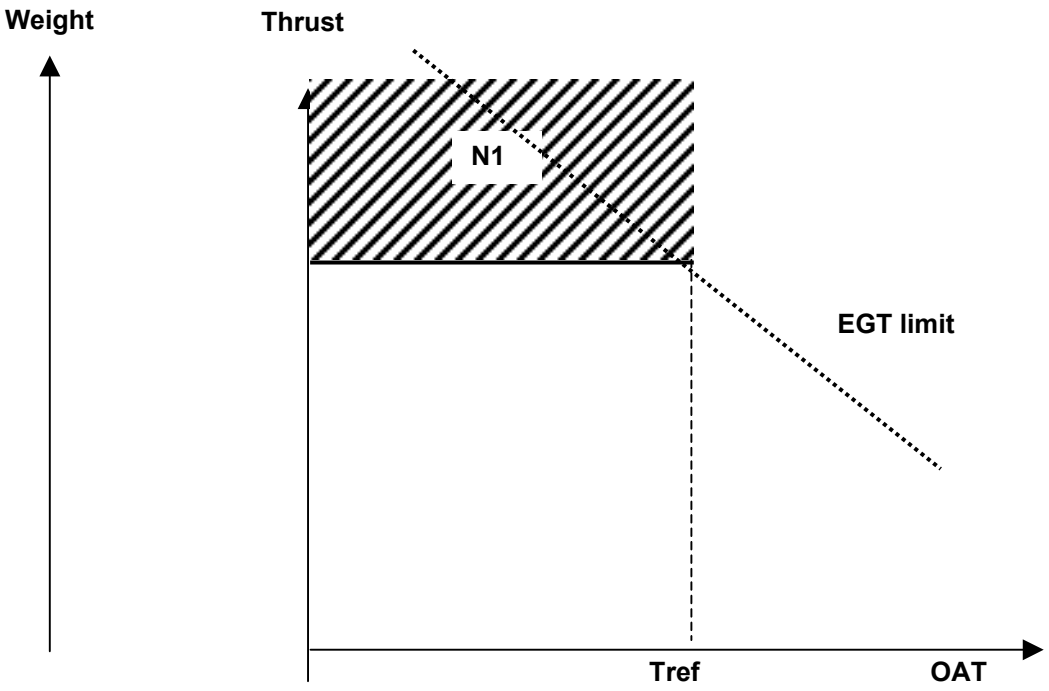


Trust levers

Five positions on Airbus aircraft:

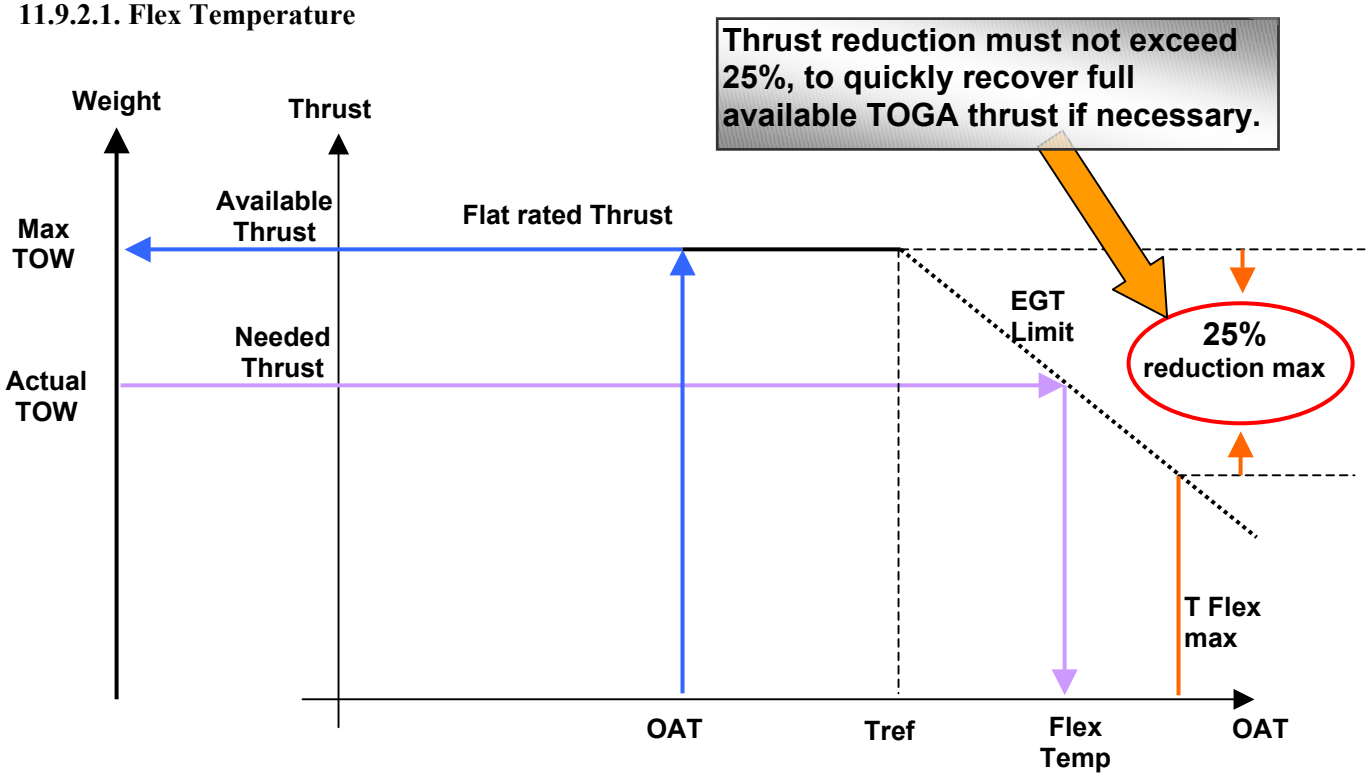
- TOGA: TakeOff - Go Around
  Maximum thrust available.
  Its use can't exceed 10 min.
- MCT: Maximum Continuous Thrust
  FLX: Flex TO Thrust...
  Maximum thrust for long use.
- CL: Climb Thrust.
- Idle: No power.
- Max reverse.

Thrust variation with OAT



11.9.2. Flexible TakeOff

11.9.2.1. Flex Temperature



Flex TakeOff: what for ?

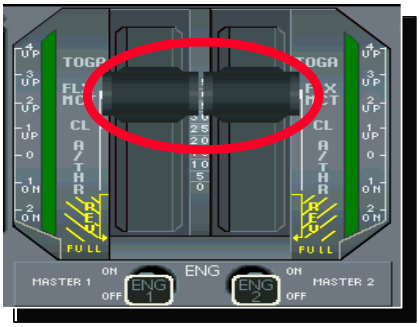
TakeOff without using full thrust reduces:

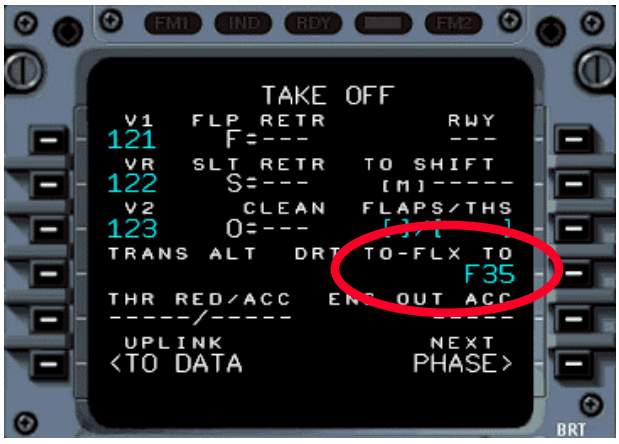
- the probability of a failure (safety aspect),
- the engine deterioration rate and associated maintenance costs (economic aspect).

Flex TakeOff:

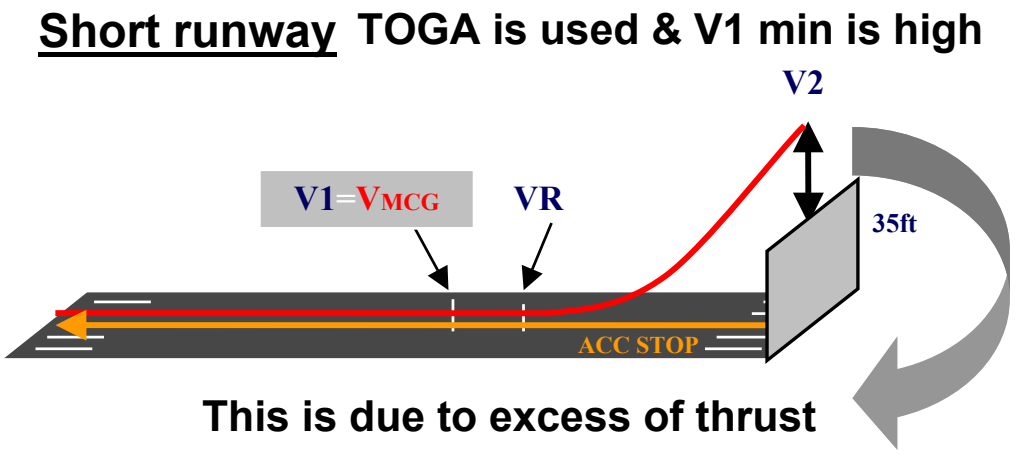
The pilot types the Flex. Temp. in the MCDU:

Setting thrust levers on FLX will provide the necessary thrust for TakeOff.

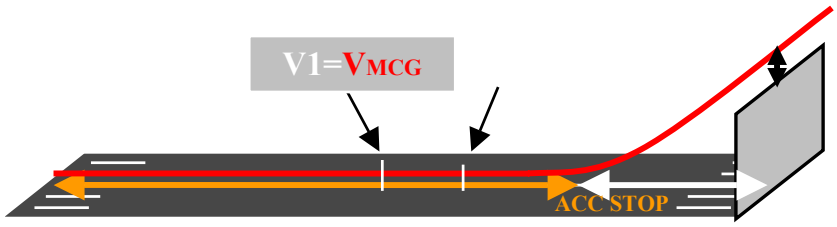




11.9.3. Derated Takeoff



The present take off weight is V_{MCG} limited, because of a short ASD and a high V_1 min.
We can observe a large excess of thrust after lift off.
This excess of performance (thrust) is penalizing on ground and not necessary after lift off.



If, for the same TO weight, the maximum TO thrust is reduced or derated by a given percentage of X%, the associated VMCG is decreased.

Consequently:

- V1 may be reduced,
- ACC/STOP distance is decreased accordingly,
- climb out performance may still be met.

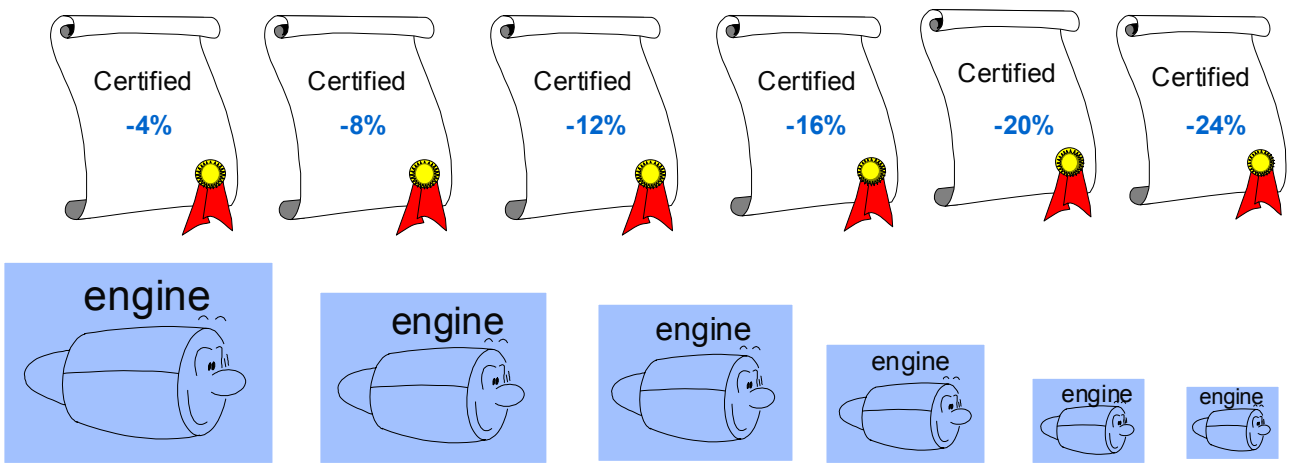
Thus derated take off may allow to increase TO weight

The Derated TO thrust is therefore to be considered as the maximum TO thrust rating available for a given take off. It determines the new VMCG and the new VMCA applicable during that take off.

The use of Derated take off thrust:

- increases payloads when operating on:
  - short runways,
  - contaminated runways.
- also saves engine life.

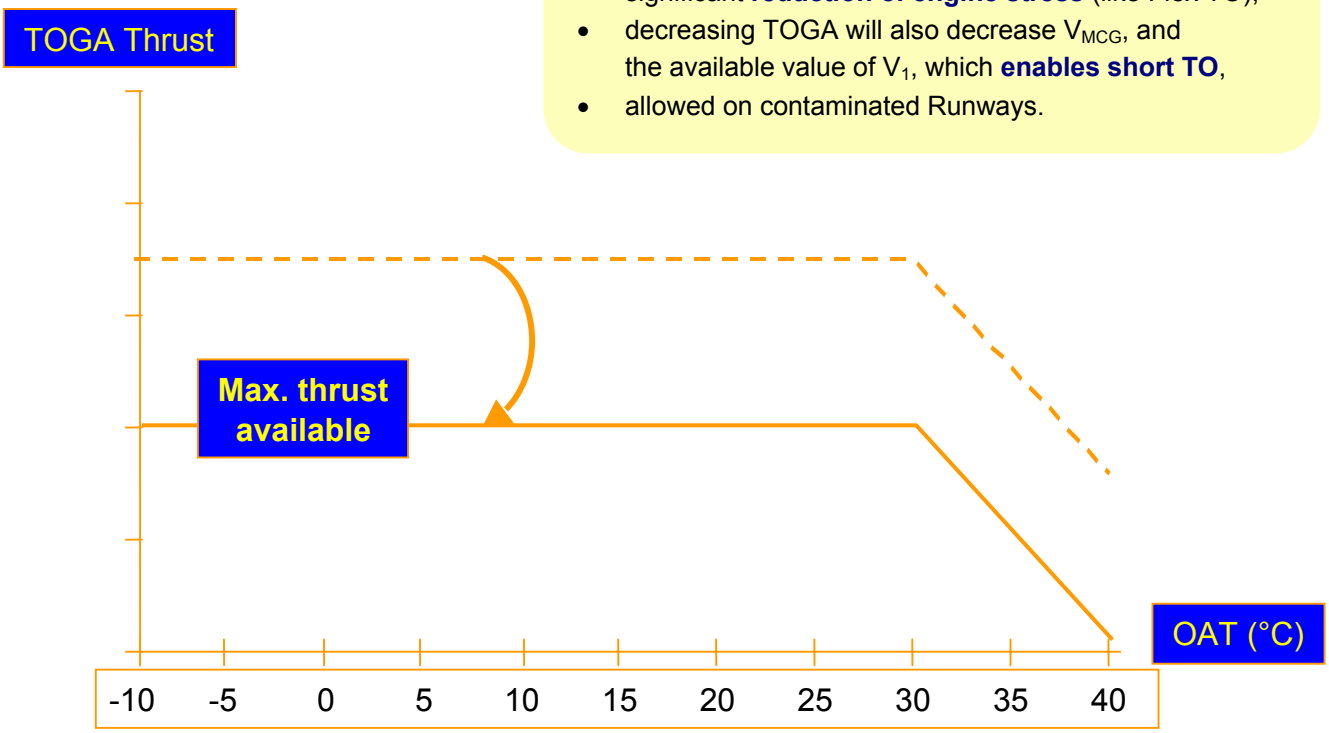
Each derate level is certified and is associated to a new set of performance data



Principle

Advantages of derated take off :

- significant **reduction of engine stress** (like Flex TO),
- decreasing TOGA will also decrease V_{MCG}, and the available value of V_1, which **enables short TO**,
- allowed on contaminated Runways.



6 level of derate available: 4%,8%,12%,16%,20%,24%.
The original TOGA will never be available during TO.

Flexible thrust	Derated thrust
• Thrust level is less than TOGA • Performance for a flex Take-Off is computed by adjusting the max Take-Off thrust performance. • At any moment it is possible to recover TOGA. • Thrust setting parameters for flex Take-Off are not considered as Take-Off operating limits. • Flex Take-Off cannot be performed on contaminated runways.	• Thrust level is less than TOGA • A new set of performance data is provided in the Flight Manual for each derate level. • TOGA selection is not possible during Take-Off. • Thrust setting parameters are considered as an operating limit for Take-Off. • Derated Take-Off is allowed on contaminated runways.

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12. LANDING PERFORMANCE REMINDER

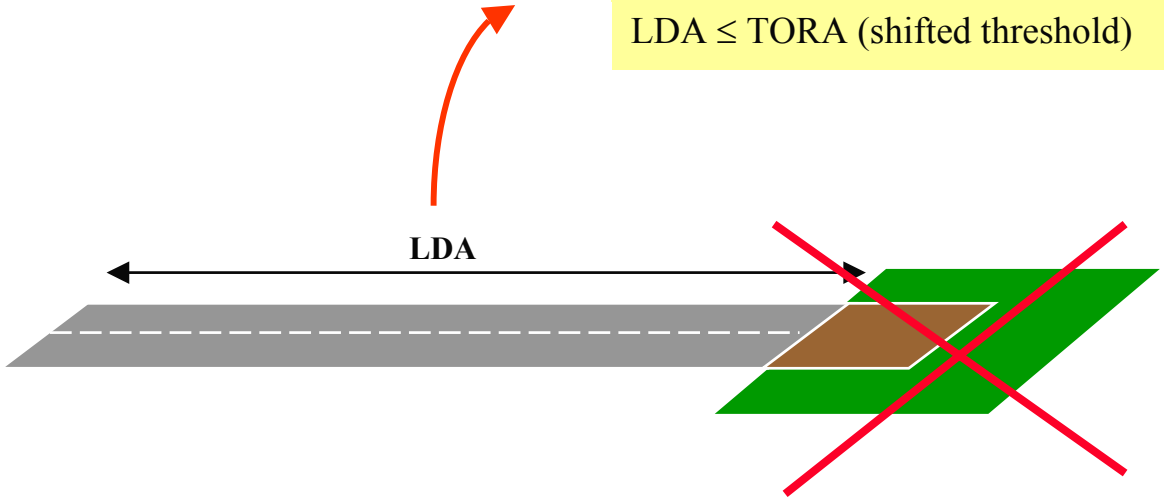
CONTENTS:

12.1. Definitions

12.1.1. Landing Distance Available

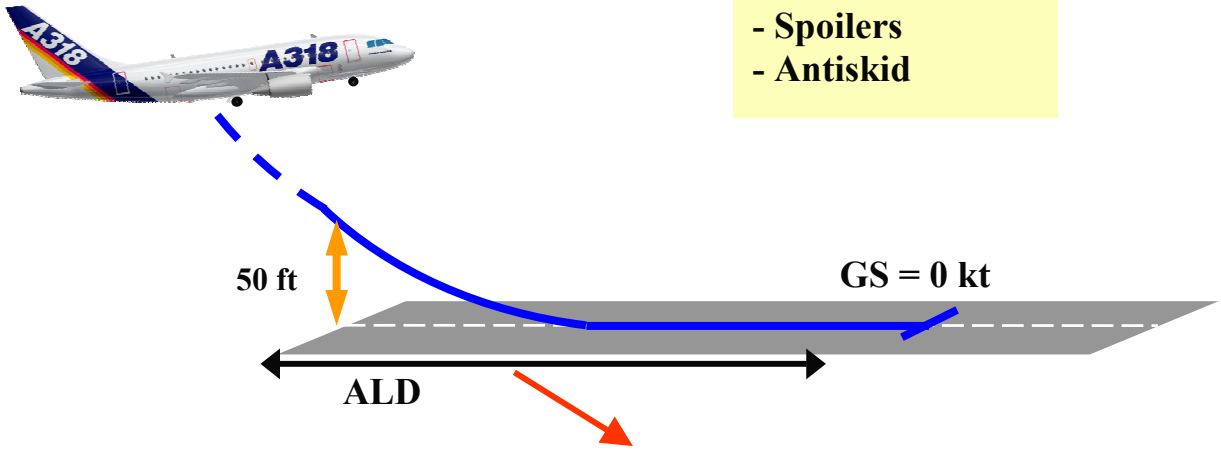
LDA = Landing Distance Available

LDA ≤ TORA (shifted threshold)

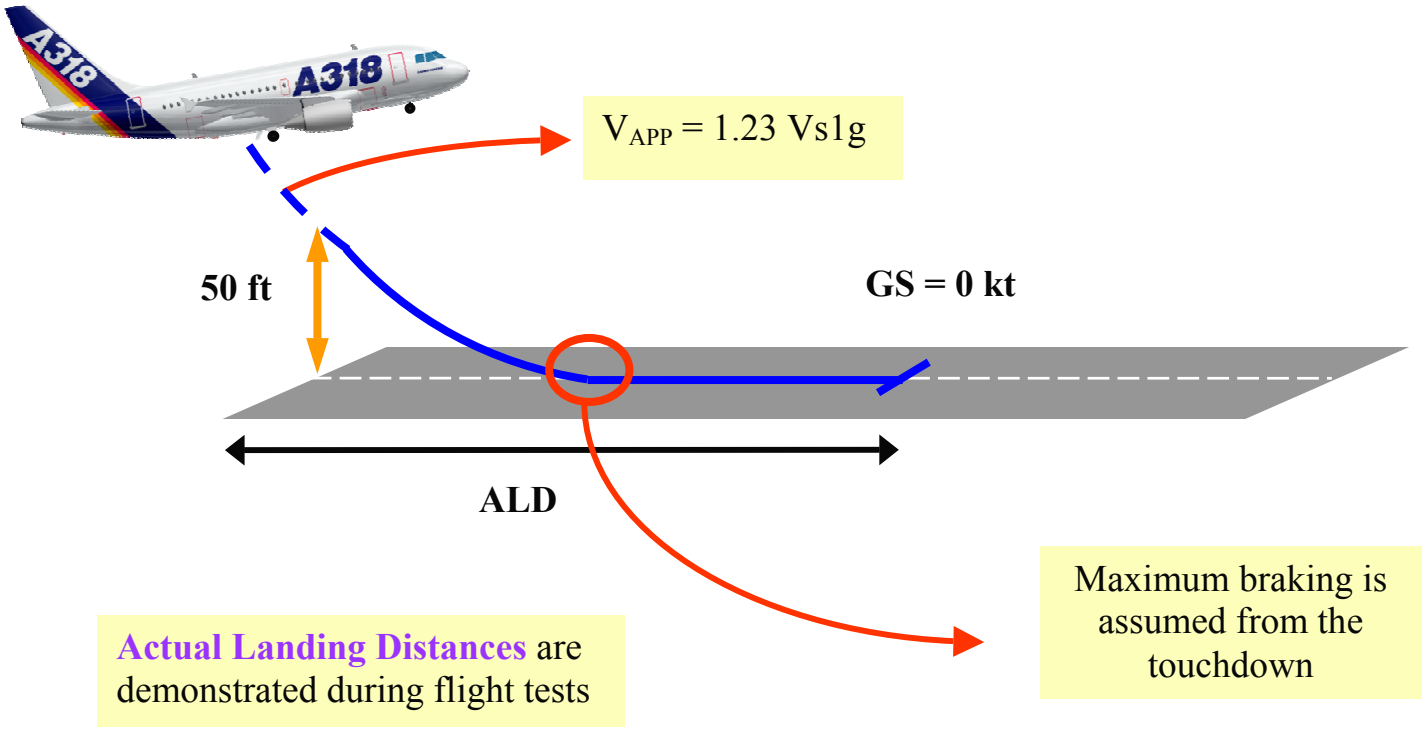


12.1.2. Actual landing distance

Braking means :
- **Brakes**
- **Spoilers**
- **Antiskid**



The Actual Landing Distance (ALD) is the distance required to land and bring the aircraft to a complete stop from a height of 50 ft above the runway



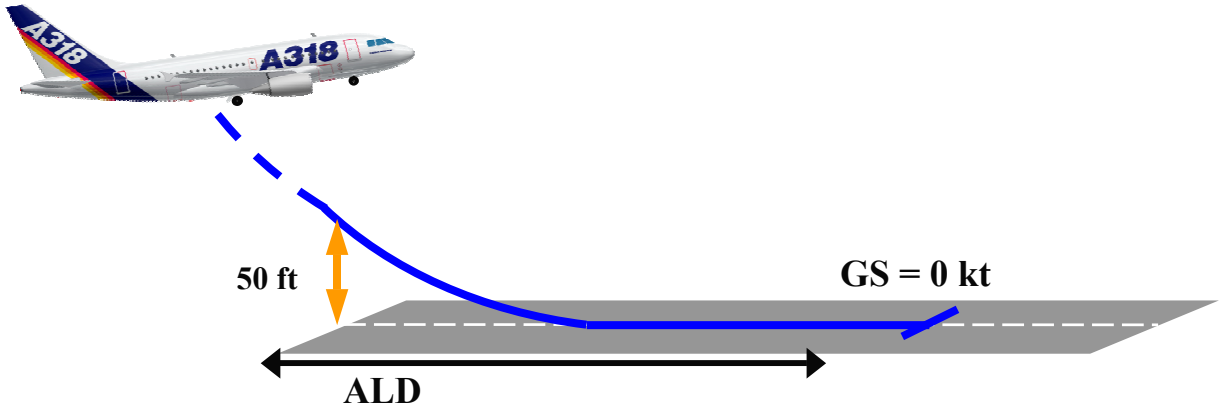
Actual Landing Distance: factors of influence

Landing distance calculation is made for :

- **ISA temperature**
- **slope = 0%**
- **standard QNH**

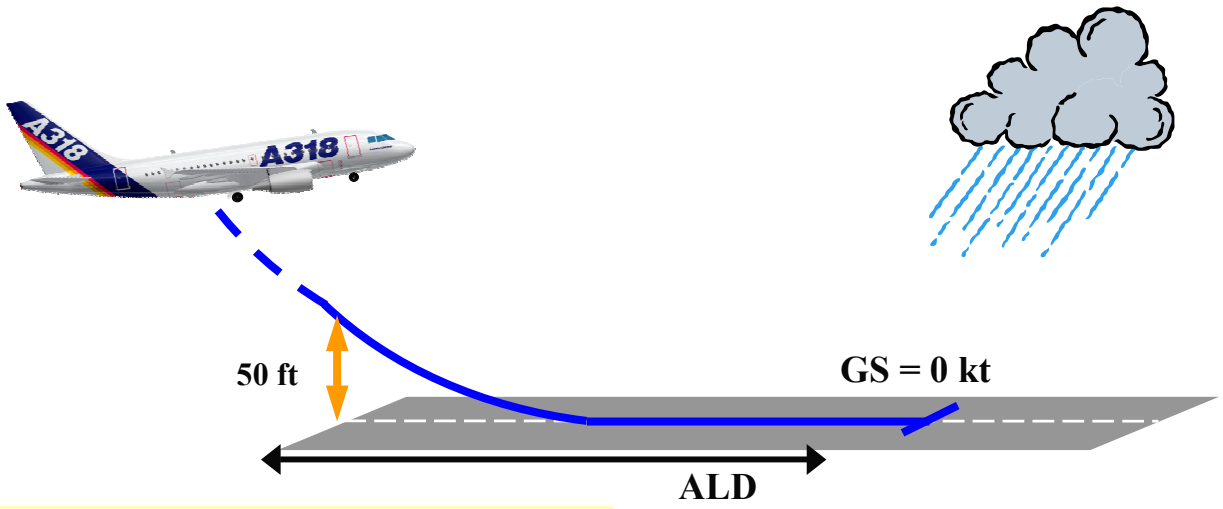
- **landing weight (LW)**
- **wind**
- **airport elevation**

12.1.3. Required Landing Distance



Dry Runway (No reversers):

$$RLD_{DRY} = \frac{ALD_{DRY}}{0.6} = 1.667 \times ALD_{DRY}$$

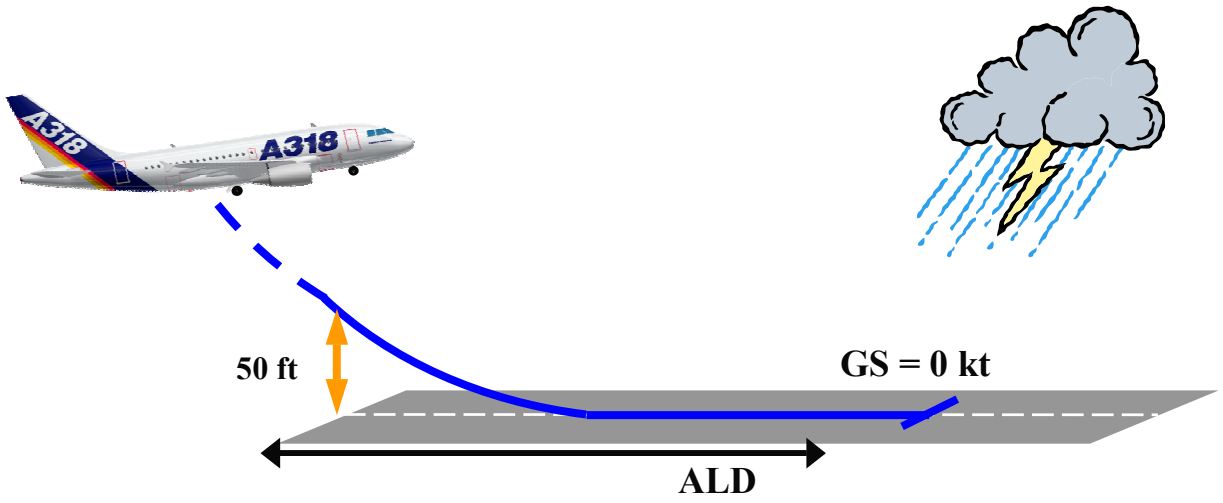


Wet Runway (No reversers):

$RLD_{WET} = 1.15 \times RLD_{DRY}$

$RLD_{WET} = 1.15 \times 1.667 \times ALD_{DRY}$

$RLD_{WET} = 1.917 \times ALD_{DRY}$



Contaminated Runway (With or without reversers):

$RLD_{CONTA} = MAX\ (1.15 \times ALD_{CONTA}\ ;\ RLD_{WET})$ *JAR-OPS only*

12.2. Dispach Requirements

12.2.1. Required Landing Distance

In all cases, and for both regulations (JAR and FAR), the requirement is:

$$RLD \leq LDA$$

On Dry Runways:

$$RLD_{dry} = ALD / 0.6 \leq LDA$$

On Wet Runways:

$$RLD_{wet} = 1.15\ RLD_{dry} \leq LDA$$

On Contaminated Runways (JAR-OPS operators only):

$$RLD_{contaminated} = \text{the greatest of} \begin{cases} ALD_{contaminated} \times 1.15 \\ RLD \end{cases} \leq LDA$$

For contaminated runways, the manufacturer must provide landing performance data and detailed instructions about the use of antiskid, reverse, airbrake or spoilers.

12.3. In Flight Requirements

12.3.1. Actual Landing Distance

JAR → **ALD x coefficient** (system failure) ≤ LDA

The safety margin remains at the Captain's discretion.

FAR → **ALD x coefficient** (system failure) x 1.15 ≤ LDA

The 1.15 factor is not requested in case of emergency (to be evaluated by the flight crew).
« NEW RULE » (Safety Alert For operators from 31st Aug 2006)

ALD must account for:

- Pressure altitude
- Wind
- Surface condition (dry, wet or contaminated)
- Approach speed
- Landing weight & configuration
- Planned use of airplane ground deceleration devices (brakes, spoilers, antiskid, reversers)

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