Flex/Derate, Engine Bump and Derated climb

Related issues

Customer Services

AIRBUS

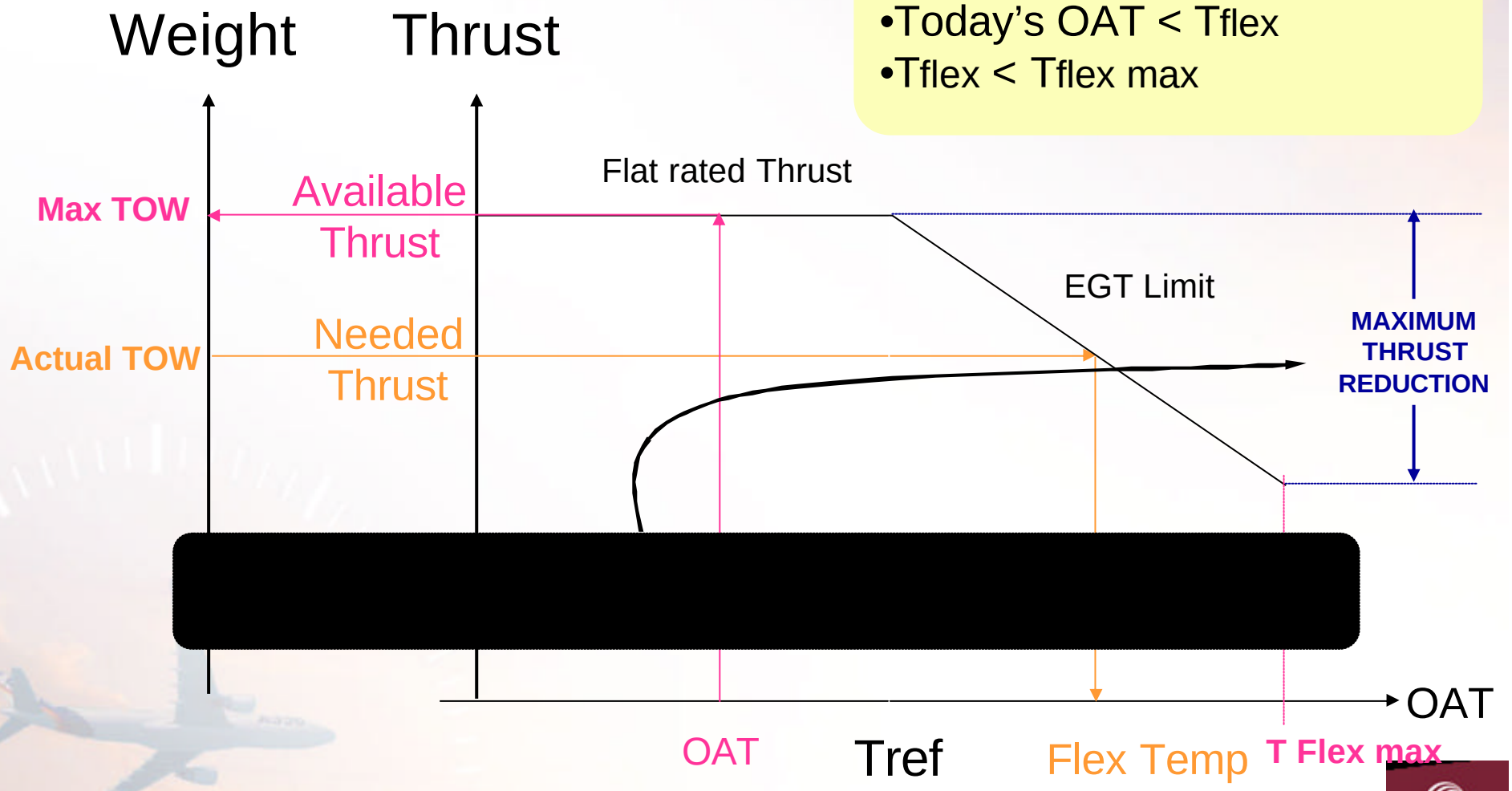
MAIN

- **FLEX TAKEOFF / DERATED TAKEOFF**
- **BUMP**
- **DERATED CLIMB**

Flexible Thrust Takeoff

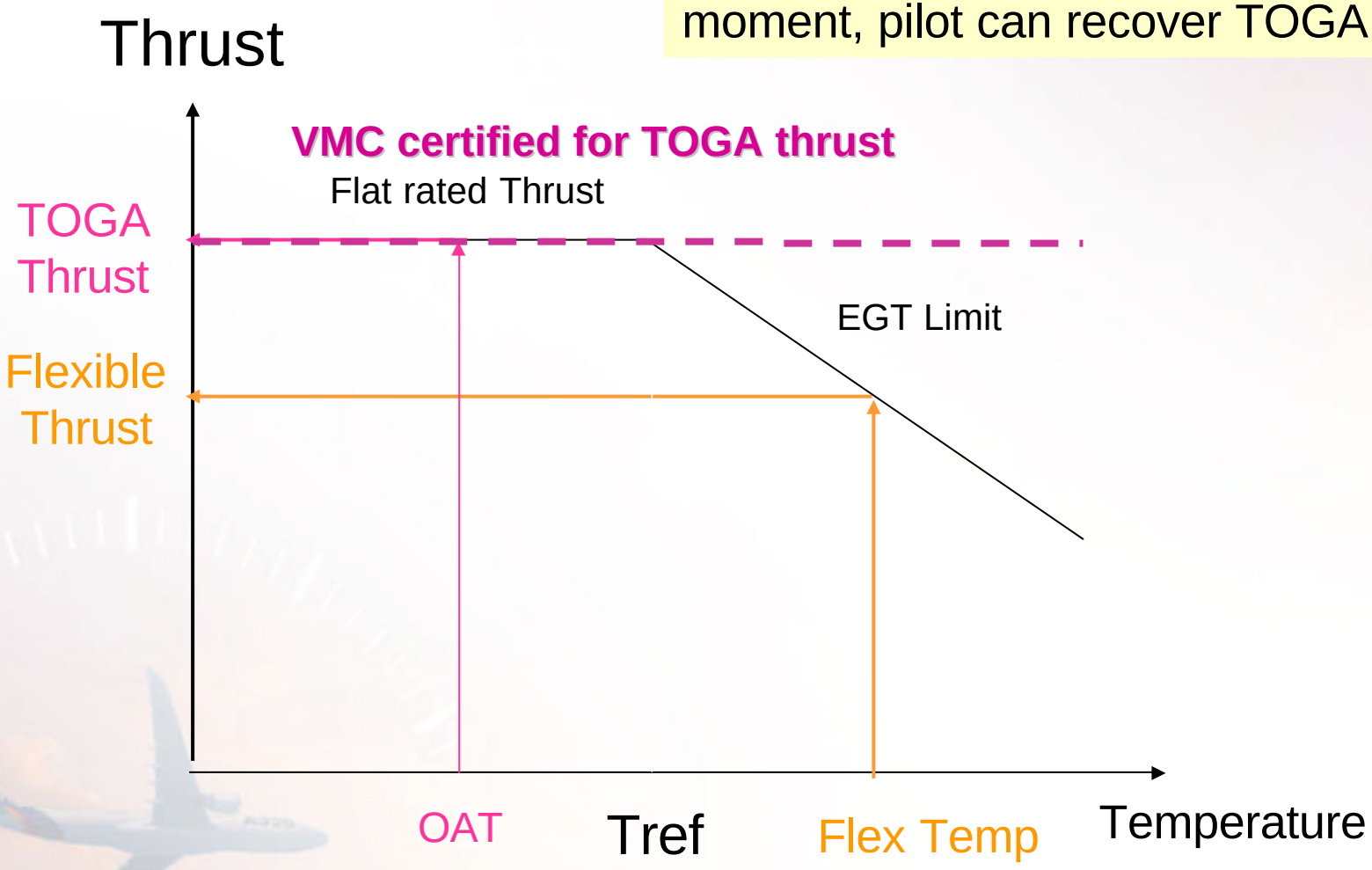
Conditions of application:

- T_{REF} < Tflex,
- Today's OAT < Tflex
- Tflex < Tflex max



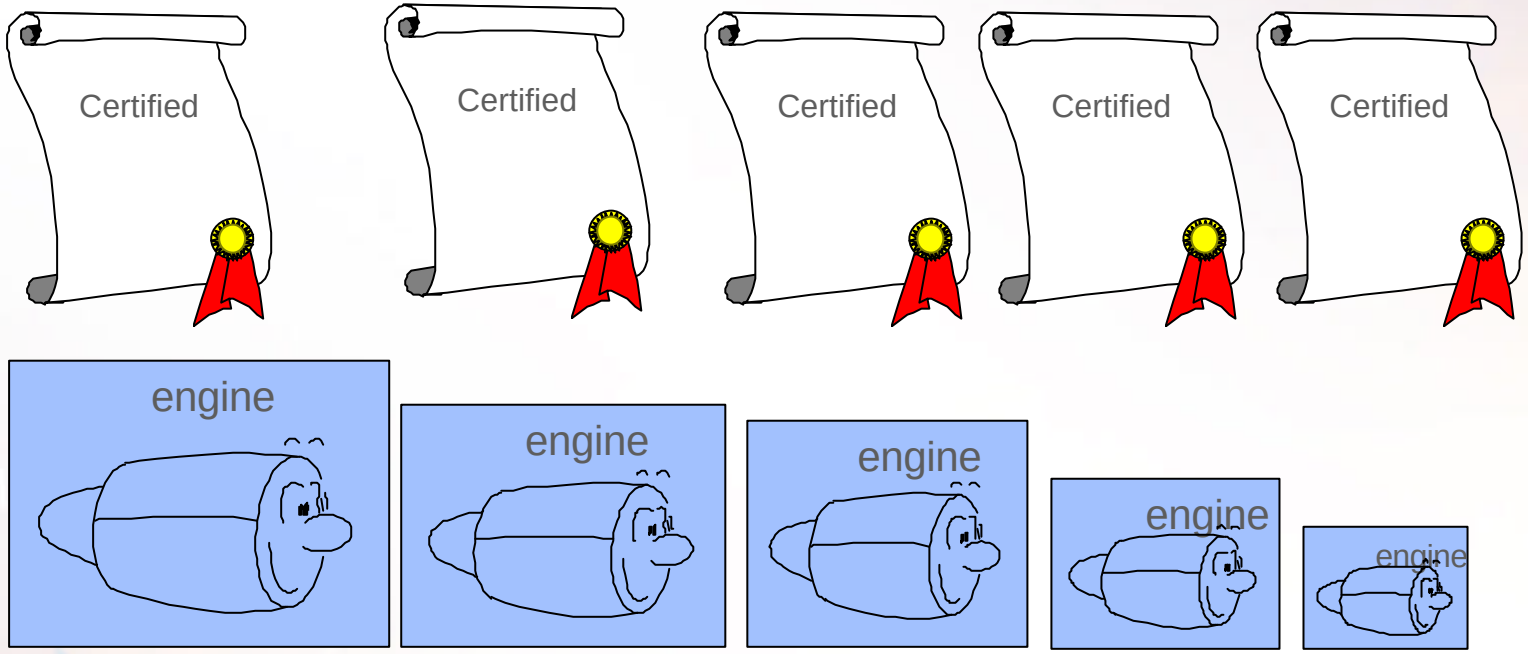
Flexible Thrust Takeoff

Flexible Takeoff procedure: at any moment, pilot can recover TOGA



Derated Thrust Takeoff

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



Let's have a look to the charts ...

RR TRENT 556 engines

TOULOUSE(BLAG) -

Elevation 497 FT TORA 3500 M
Isa temp 14 C TODA 3590 M
rwy slope -0.09% ASDA 3590 M

33L

2 obstacles

22.0.3 26-JAN-04
AA642A05 *V20

SLUSH 1/4"
CONF 3
TOGA

33L

2 obstacles

22.0.3 26-JAN-04
AA642A05 *V20

SLUSH 1/4"
CONF 3
D20

JAA RR TRENT 556 engines

1013.25 HPA
Off
Off
ers inoperative

TOULOUSE(BLAG) -

Elevation 497 FT TORA 3500 M
Isa temp 14 C TODA 3590 M
rwy slope -0.09% ASDA 3590 M

33L

2 obstacles

22.0.3 26-JAN-04
AA642A05 *V20

SLUSH 1/4"
CONF 3
D04

33L

2 obstacles

22.0.3 26-JAN-04
AA642A05 *V20

SLUSH 1/4"
CONF 3
D24

40642 - JAA RR TRENT 556 engines

NH 1013.25 HPA
r cond. Off
ti-icing Off
l reversers inoperative

TOULOUSE(BLAG) -

Elevation 497 FT TORA 3500 M
Isa temp 14 C TODA 3590 M
rwy slope -0.09% ASDA 3590 M

33L

2 obstacles

22.0.3 26-JAN-04
AA642A05 *V20

SLUSH 1/4"
CONF 3
D08

33L

2 obstacles

22.0.3 26-JAN-04
AA642A05 *V20

SLUSH 1/4"
CONF 3
D32

AT A340642 - JAA RR TRENT 556 engines

QNH 1013.25 HPA
Air cond. Off
Anti-icing Off
All reversers inoperative

TOULOUSE(BLAG) -

Elevation 497 FT TORA 3500 M
Isa temp 14 C TODA 3590 M
rwy slope -0.09% ASDA 3590 M

33L

2 obstacles

22.0.3 26-JAN-04
AA642A05 *V20

SLUSH 1/4"
CONF 3
D16

33L

2 obstacles

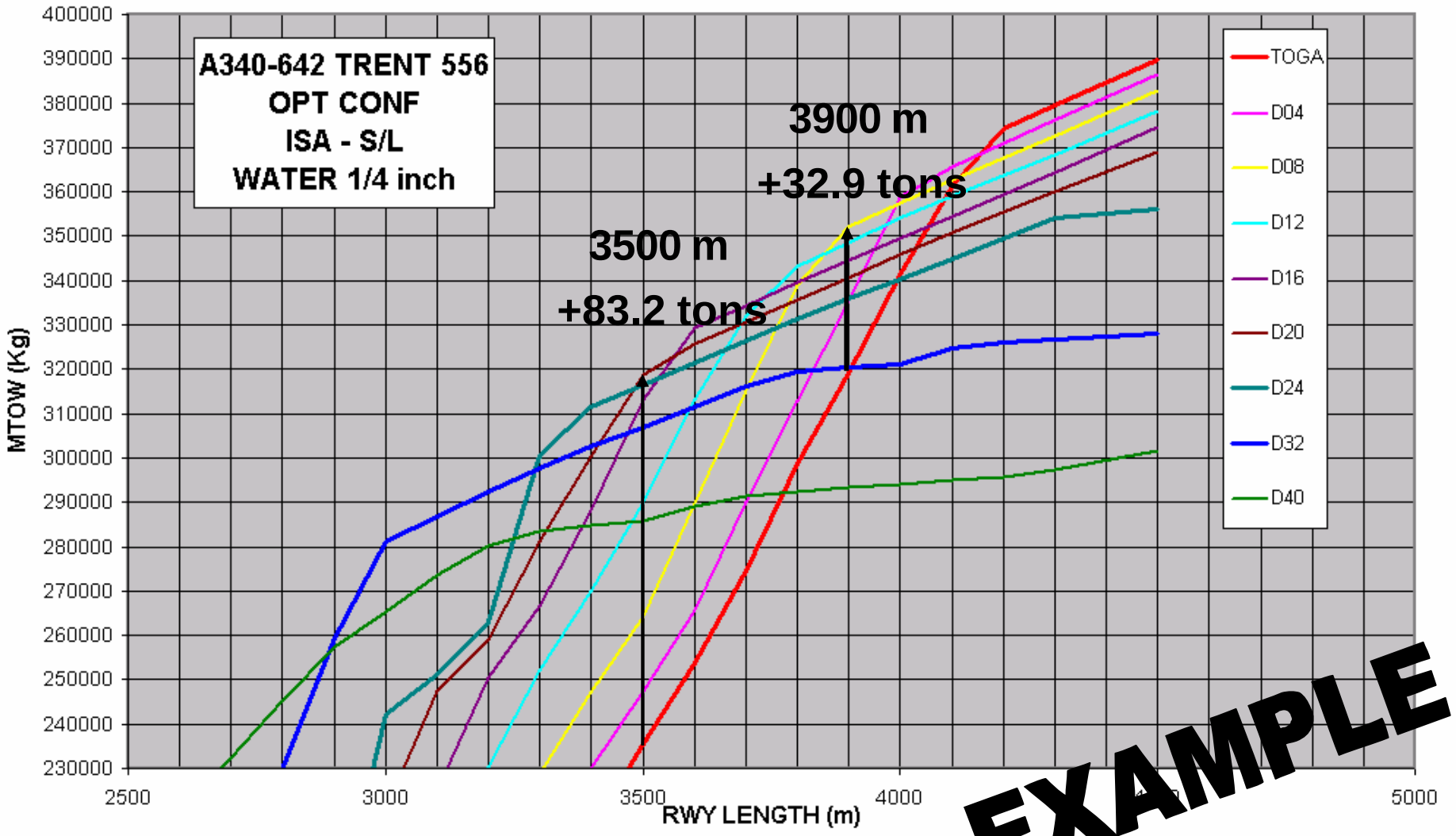
22.0.3 26-JAN-04
AA642A05 *V20

SLUSH 1/4"
CONF 3
D40

OAT C	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT	HEADWIND 20 KT
-5	350.0 3/9 137/62/74	366.2 3/9	376.6 3/4	288.2 3/4 146/64/71
0	345.1 3/9 136/61/73			287.9 3/4 145/63/70
5	340.7 3/9 135/60/72	139/64/76	142/68/79	287.5 3/4 144/62/69
10	336.3 3/9 134/59/71	350.8 3/9 137/63/75	366.5 3/3 141/67/78	286.9 3/4 142/61/68
15	332.2 3/9	346.1 3/9	361.4 3/9	286.1 3/4

For the A340-500/600, two new derate levels have been added: 32% and 40%

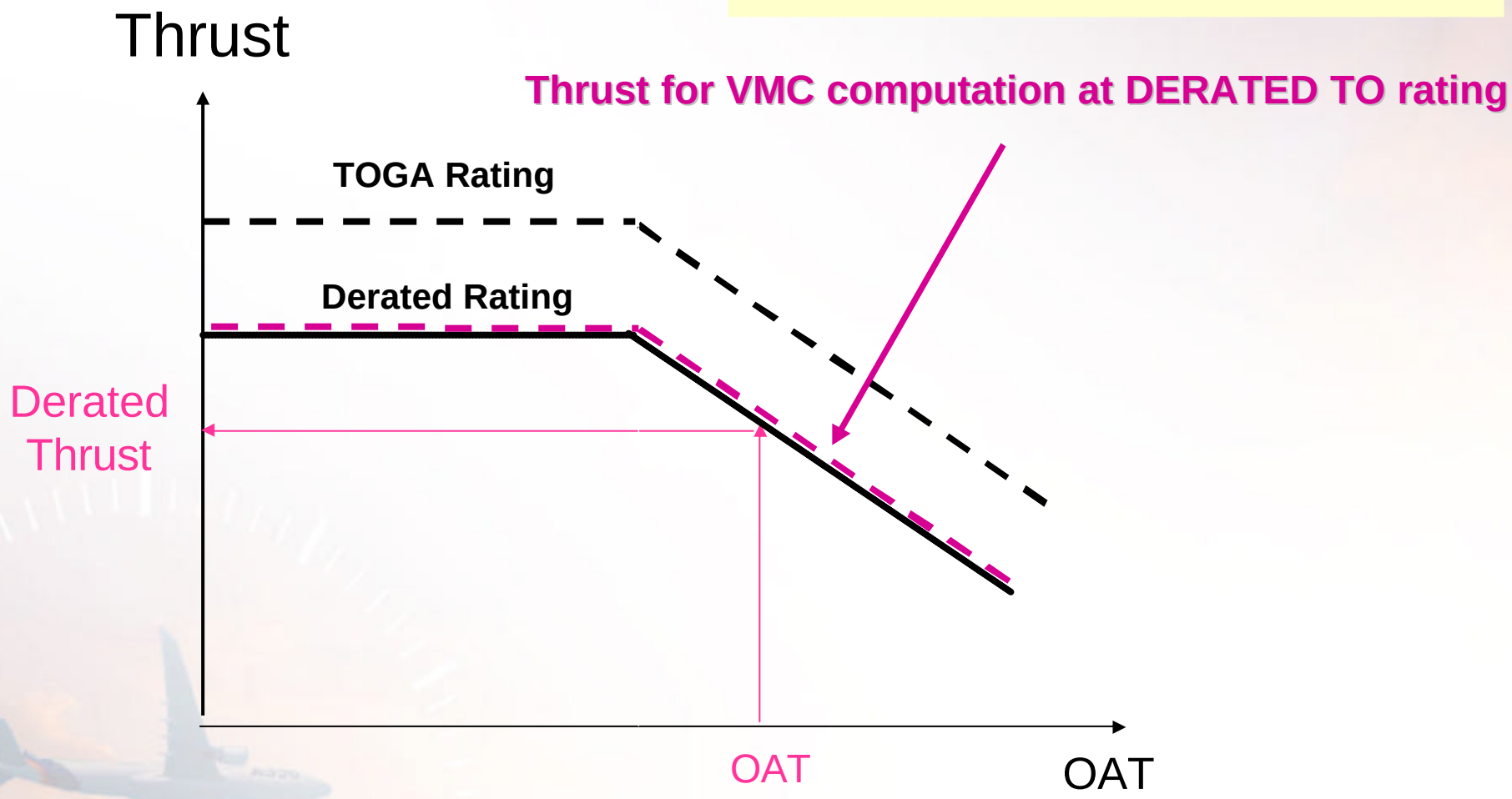
Derated Thrust Take-off on short and contaminated runways



EXAMPLE

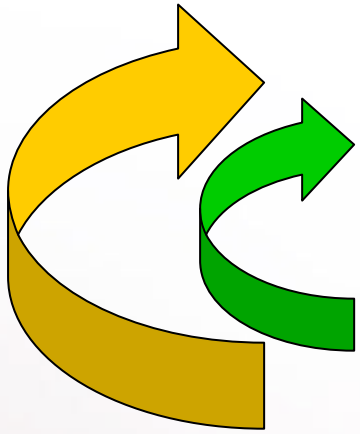
Derated Thrust Takeoff

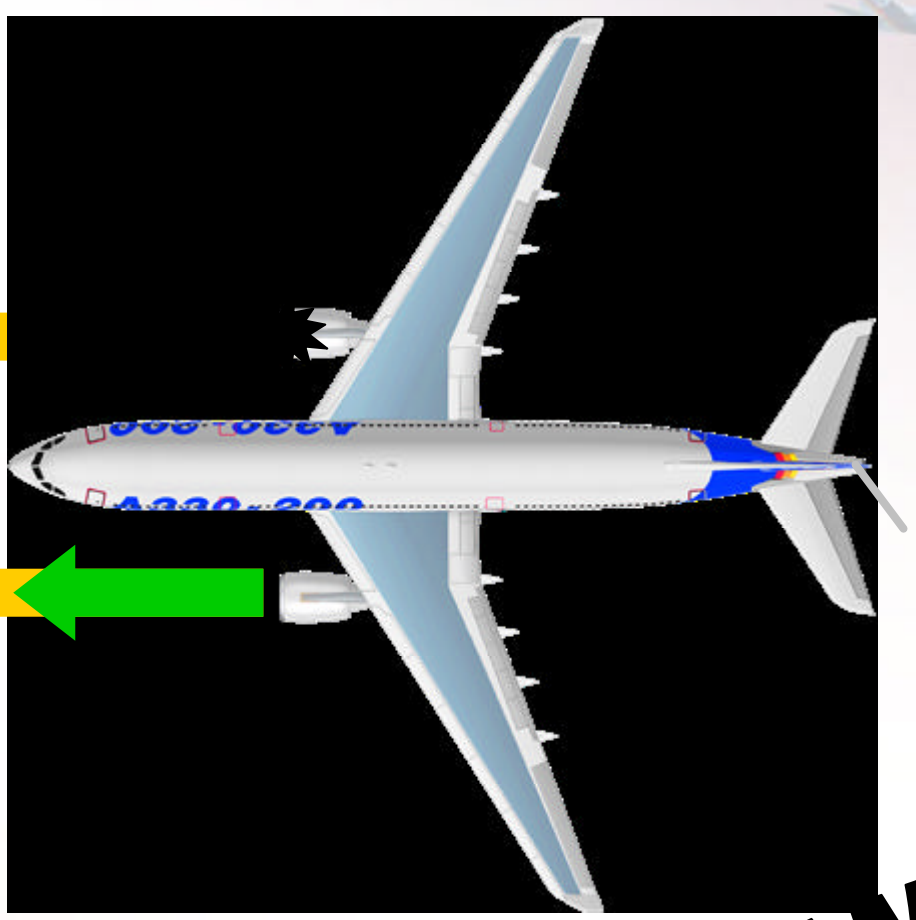
Derated Takeoff procedure: pilot cannot recover TOGA.



TOGA : VMCG = 105 kts

DERATE : VMCG = 100 kts





EXAMPLE

TOGA

DERAT

A340642 - JAA	RR TRENT 556 engines	TOULOUSE(BLAG) -	33L	22.0.3 26-JAN-04 AA642A05 *V20
QNH 1013.25 HPA		Elevation 497 FT TORA 3500 M		SLUSH 1/4"
Air cond. Off		Isa temp 14 C TODA 3590 M	2 obstacles	CONF 3
Anti-icing Off		rwy slope -0.09% ASDA 3590 M		TOGA
All reversers inoperative				

OAT C	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT
5	336.3 3/9	381.5 3/9	397.8 3/9 146/73/86
			392.4 3/9 145/72/84
			387.1 3/9 144/70/83
			381.7 3/9 142/69/82
			376.4 3/9 141/68/81

height 420 FT Min QNH alt 917 FT
height 4955 FT Max QNH alt 5452 FT

Min V1/VR/V2 = 141/41/43
CHECK VMU LIMITATION
Correct. V1/VR/V2 = 0.2 KT/1000 KG

[redacted]

A340642 - JAA	RR TRENT 556 engines	TOULOUSE(BLAG) -	33L	22.0.3 26-JAN-04 AA642A05 *V20
QNH 1013.25 HPA		Elevation 497 FT TORA 3500 M		SLUSH 1/4"
Air cond. Off		Isa temp 14 C TODA 3590 M	2 obstacles	CONF 3
Anti-icing Off		rwy slope -0.09% ASDA 3590 M		D24
All reversers inoperative				

OAT C	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT
-5	342.3 3/4 136/62/72	348.4 3/4 141/63/74	351.8 3/4 145/66/76
0	338.3 3/9 135/61/71	346.1 3/4 139/63/73	351.0 3/4 143/65/75
5	334.1 3/9 134/59/70	343.8 3/4 138/62/73	349.9 3/4 142/64/74
10	330.1 3/9 133/58/69	341.4 3/4 137/62/72	347.5 3/4 141/63/73
15	326.1 3/9 133/57/68	339.0 3/4 136/61/71	345.1 3/4 140/63/73

LABEL FOR INFLUENCE	MTOW(1000 KG) codes V1 mean/VR/V2 (kt)	VMC LIMITATION	Tref (OAT) = 29 C Tmax (OAT) = 54 C	Min acc height 418 FT Max acc height 2882 FT	Min QNH alt 915 FT Max QNH alt 3379 FT
DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT)	LIMITATION CODES: 1=1st segment 2=2nd segment 3=runway length 4=obstacles 5=tire speed 6=brake energy 7=max weight 8=final take-off 9=VMU				

Min V1/VR/V2 = 126/26/29
CHECK VMU LIMITATION
Correct. V1/VR/V2 = 0.2 KT/1000 KG

DO NOT USE THESE FIGURES AS A REFERENCE

AIRBUS

ECAM Message

Therefore the use of TOGA together with a set of V1/Vr/V2 for DERATE takeoff must be prevented

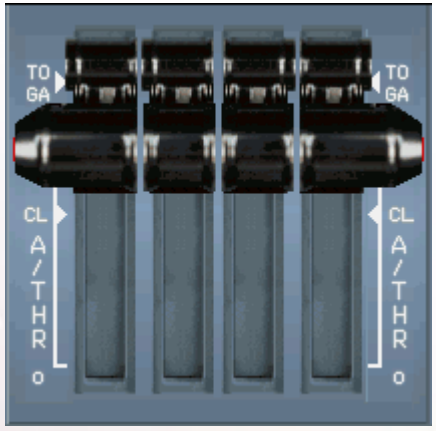
The aircraft protects the crew against MCDU typing errors during cockpit preparation

[redacted]

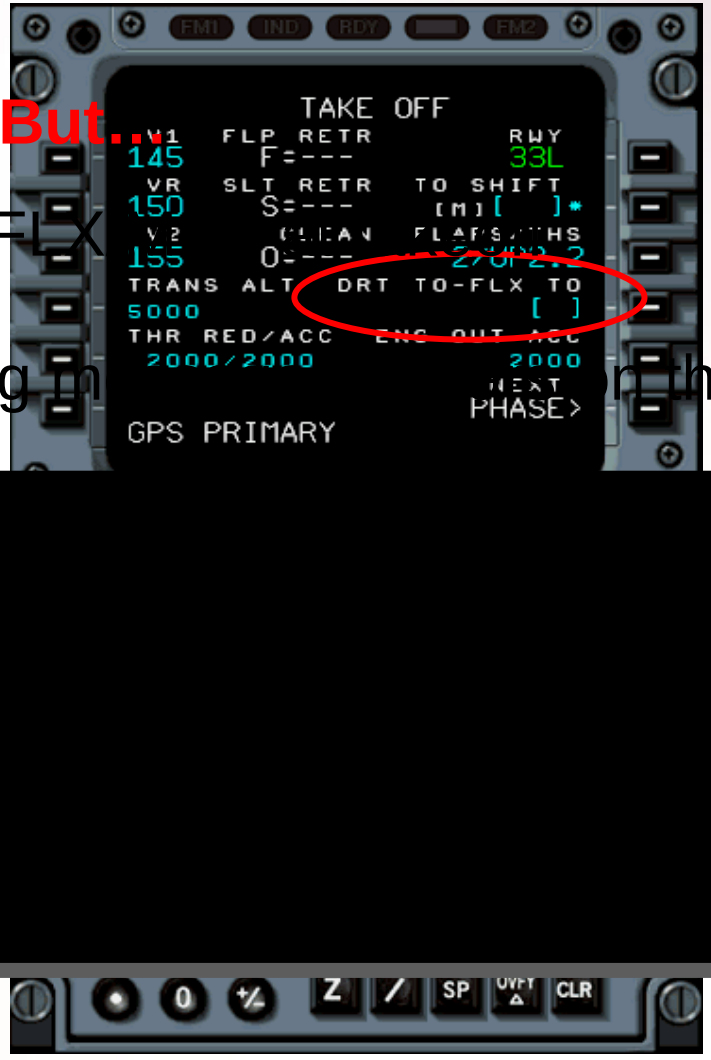
ECAM Message

- Let's assume that <u>no</u> FLEX/DERATE level has been entered into the FMS

- The thrust level is set to FLX



A warning m[illegible] on the ECAM



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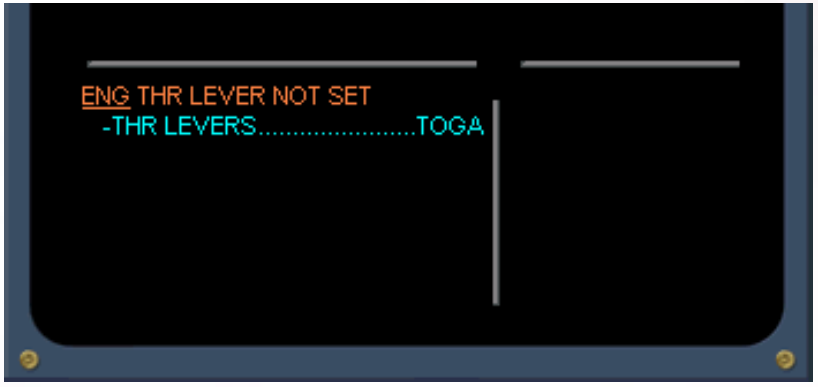
ECAM Message

- For aircraft <u>without</u> the DERATED TAKOFF option on board:

The message request the pilot to set TOGA

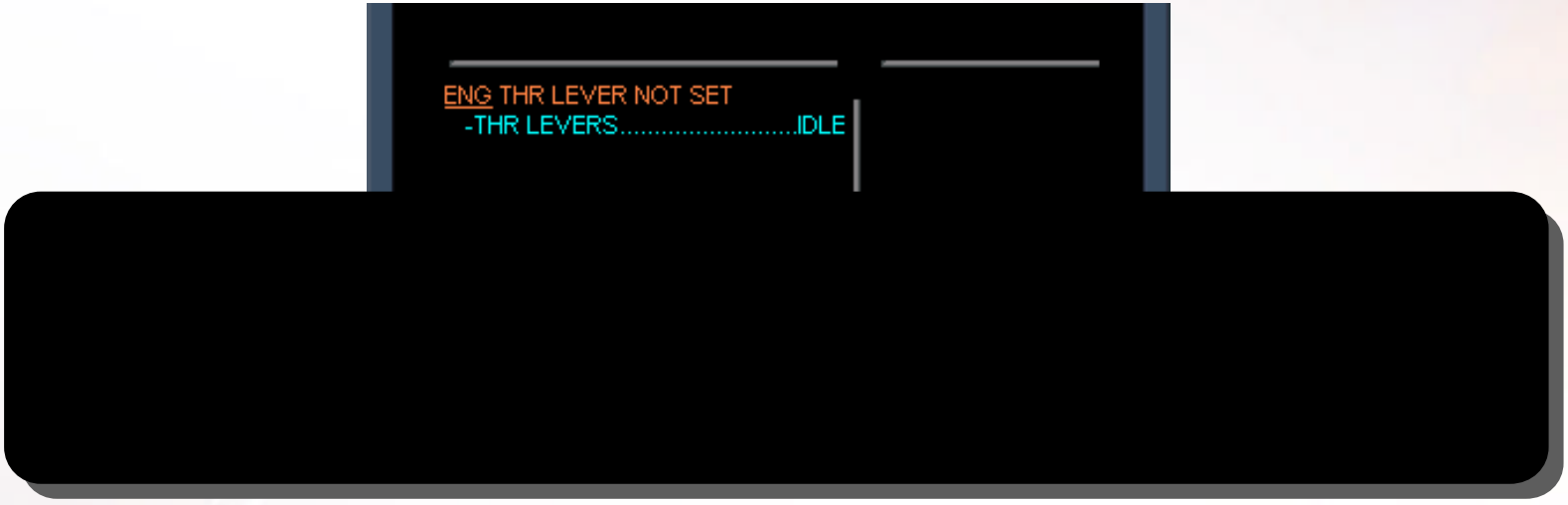


Even if FLEX takeoff was envisaged by the pilot, TOGA is proposed when the FLEX information is missing in the FMS

ECAM Message

- For aircraft <u>with</u> the DERATED TAKOFF option on board:

The message requests that the pilot sets IDLE

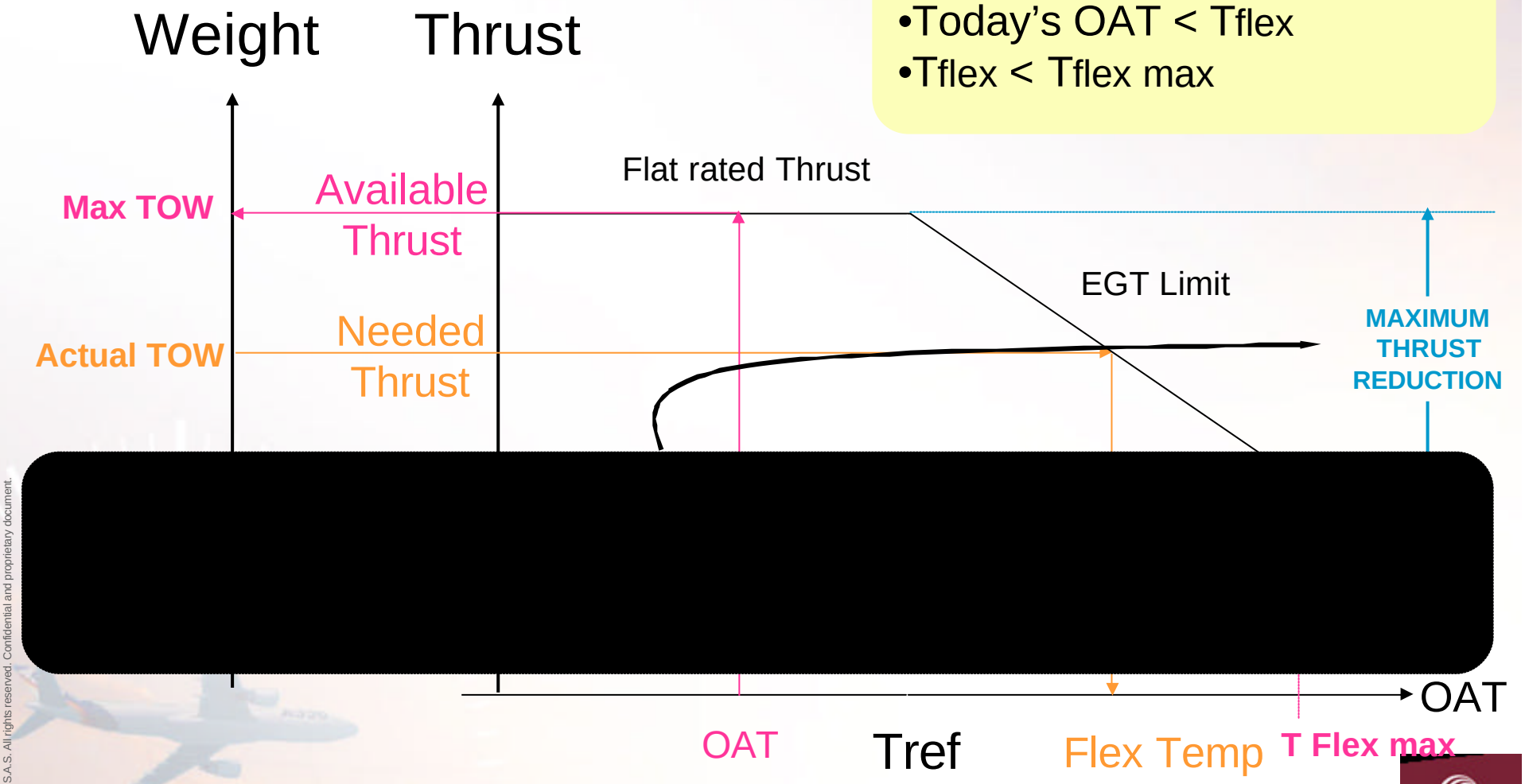


In this case, the risk of performing a TOGA takeoff with DERATE takeoff speeds exists, the takeoff must be aborted

Reduced Thrust Level

Conditions of application:

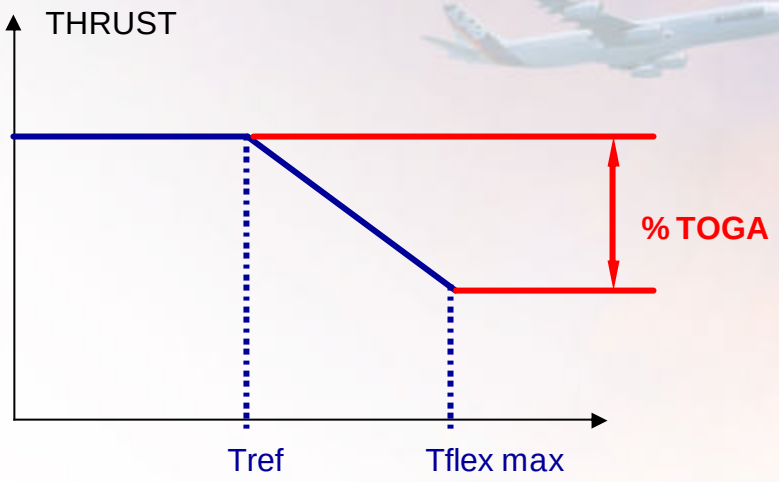
- T_{REF} < Tflex,
- Today's OAT < Tflex
- Tflex < Tflex max



Reduced Thrust Level

ACTUAL SITUATION:

- A318/319/320/321 25% (Flex only)
- A330-200/300 25%
- A340-200/300 25%
- A340-500/600 40%



PLANNED EVOLUTIONS		AVAILABILITY DATE
A319-200/300	**25%** (24% Derate)	Upon Request from MID 2004
A320-200/300	**25%** (24% Derate)	Upon Request from MID 2004
A321-200/300	**25%** (24% Derate)	Upon Request from MID 2004
A330-200/300	**40%**	Under evaluation

Transition to CLIMB THRUST

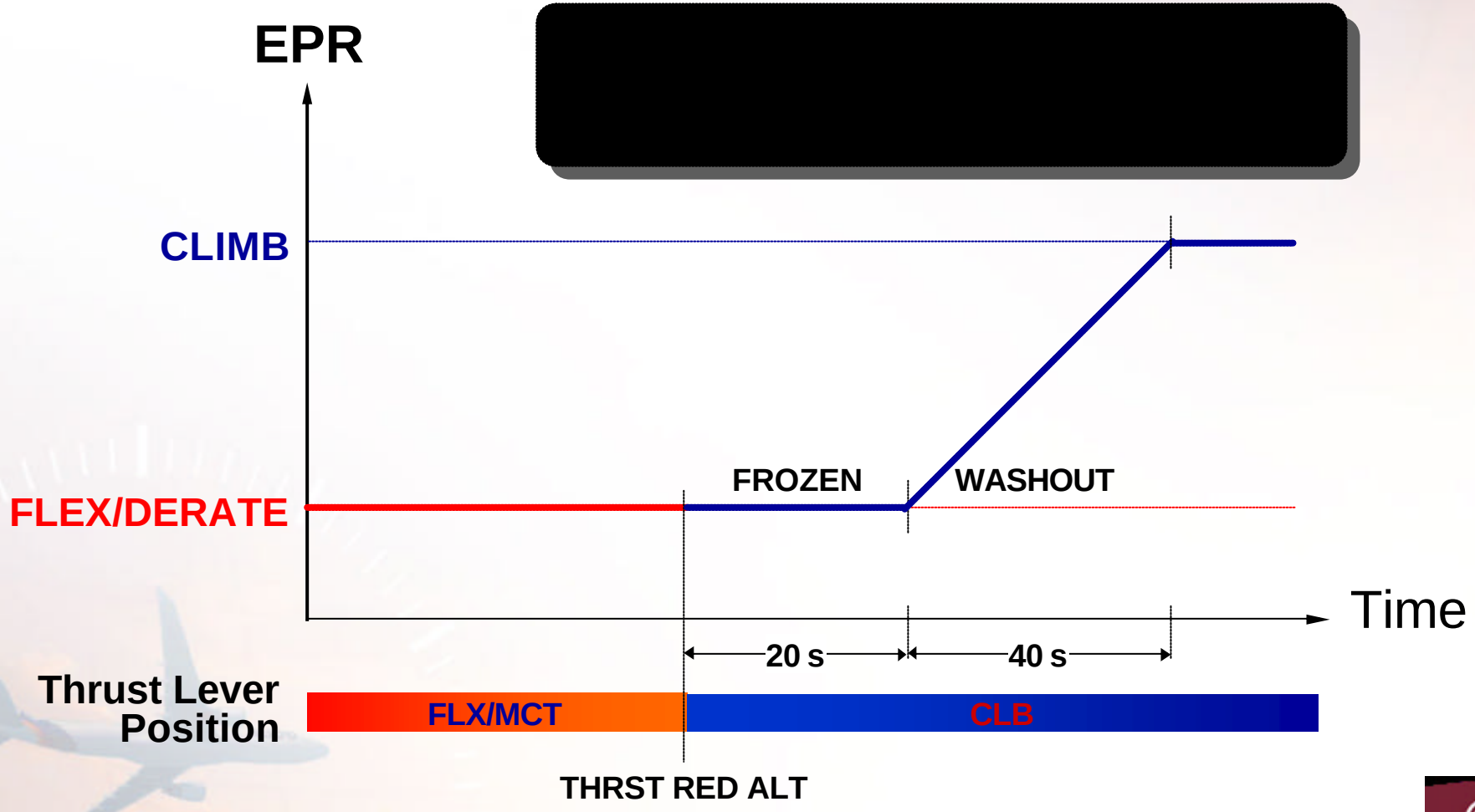
- At high levels of DERATE, the TAKEOFF THRUST may fall below the CLB THRUST
- An increase of thrust must be avoided when pulling the lever to the CLB detent
- An automatic transition sequence to MAX CLB has been implemented for the different engine models

LET'S SEE HOW THIS WORKS….

Transition to CLIMB THRUST

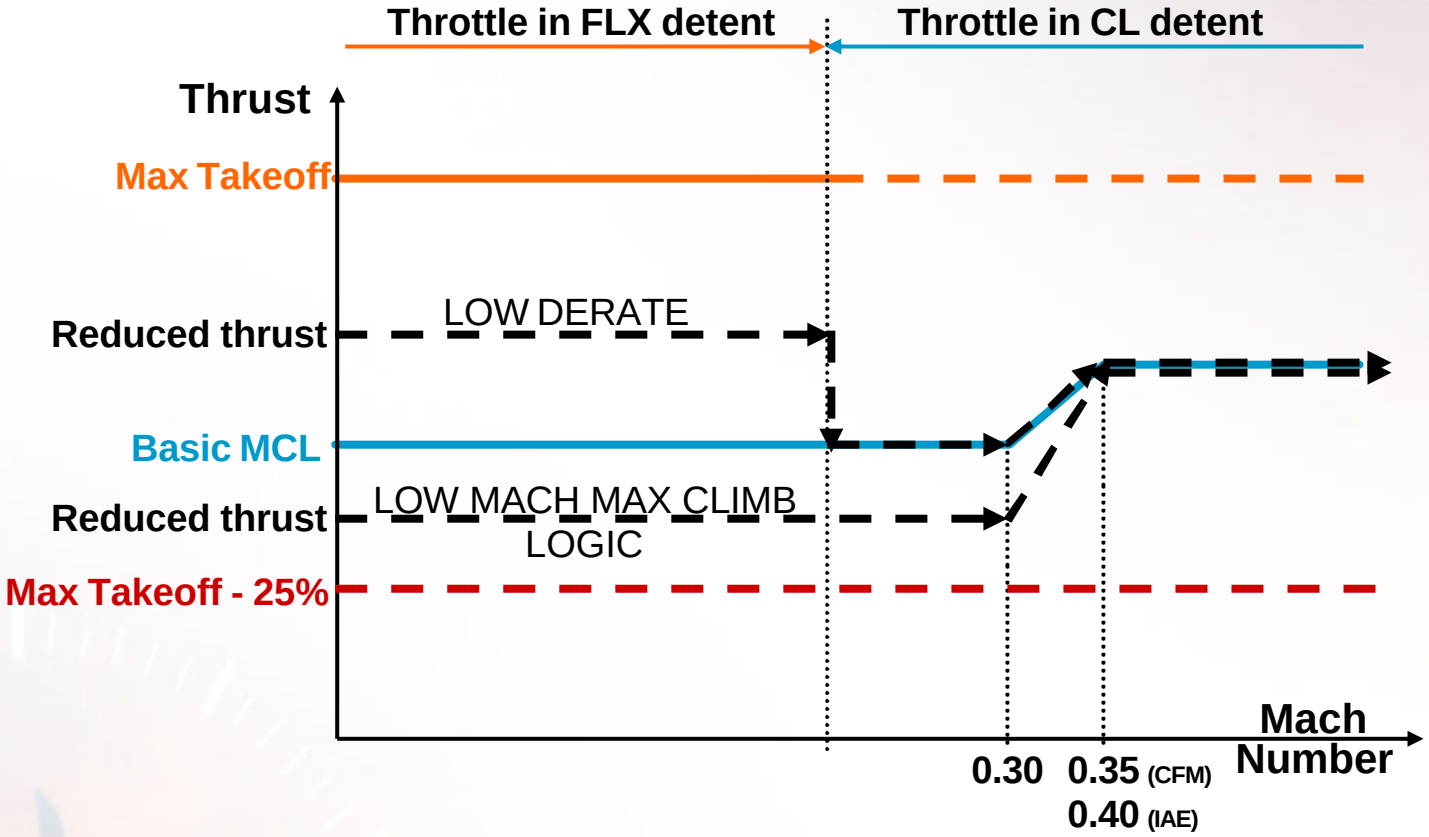
TRENT 500 : CLIMB ADJUSTEMENT

[redacted]



Transition to CLIMB THRUST

A319: Low Mach Max Climb Logic



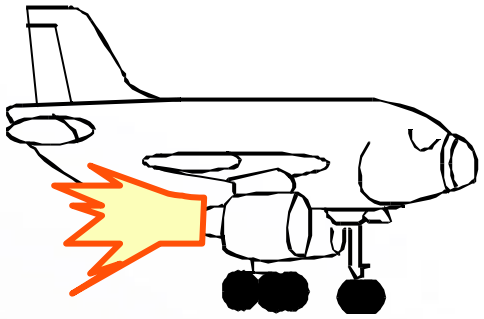
- On A320 and A321, the current Max Climb rating provides sufficient room for 25 % thrust reduction.
- For future evolutions, similar solutions will be applied (25%® 40% for A330)

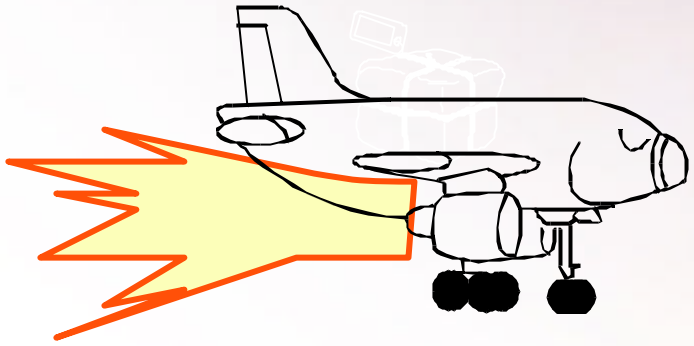
MAIN

- FLEX TAKEOFF / DERATED TAKEOFF
- **BUMP**
- DERATED CLIMB

Bump

- The bump is an increased takeoff thrust .





- The bump can be occasionally used when the basic maximum takeoff thrust does not provide the required performance.

- There is no possibility to set an intermediate thrust between the basic maximum takeoff thrust and the bump

Bump

- Various bumps were defined for the early A320 models, as a function of the customers requirements.

- For the latest A320 family models, the bump can be made available on the following models:
  - A321-211
  - A321-231
  - A320-214
  - A320-233

Bump

- These bumps provide between 6 and 10% more thrust than the basic one.

- They are available only with specific FADEC standards:
  - IAE engines: SCN18
  - CFM engines: 5BL

- These bumps are available, but not yet certified as no customer has ordered this option yet.

- A lead time of about 9 months will be necessary once we get a customer order

Bump

- Long range aircraft:
  - A340:

    Presently, a bump is available only for the A340-313 gross weight.
  - A330:

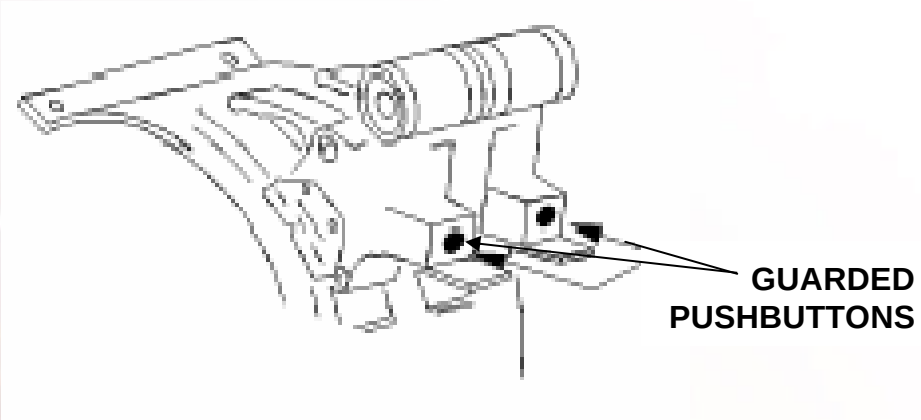
    A bump will be certified mid-2004 on the A330-202. It will provide the thrust of the CF6-80E1A3.

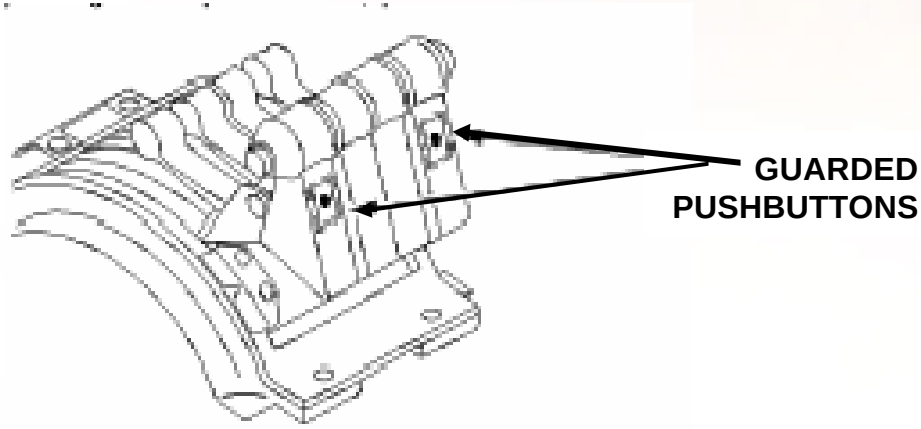
Bump

- Bump activation:

The bump is activated by two guarded pushbuttons, placed on the thrust levers on the A320 Family and on the external thrust levers on the A340.

It can be used with all engines operating and remains active in case of one engine failure.



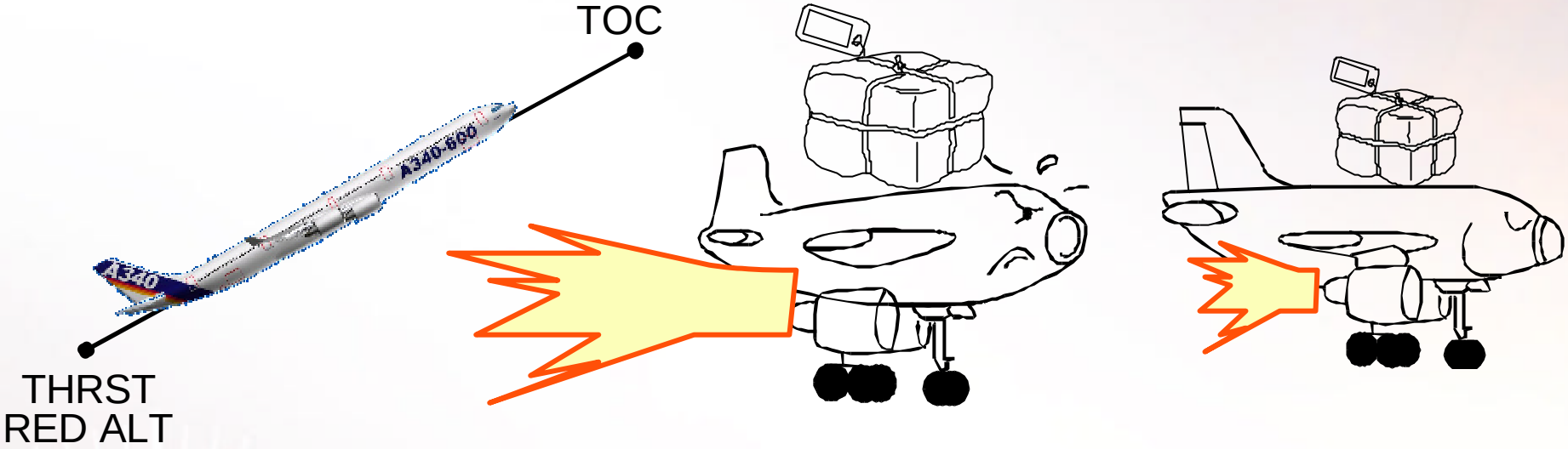


MAIN

- FLEX TAKEOFF / DERATED TAKEOFF
- BUMP
- **DERATED CLIMB**

Principle of thrust reduction

When the MAX CLB thrust is not necessary during the CLIMB phase, it can be performed with less thrust.



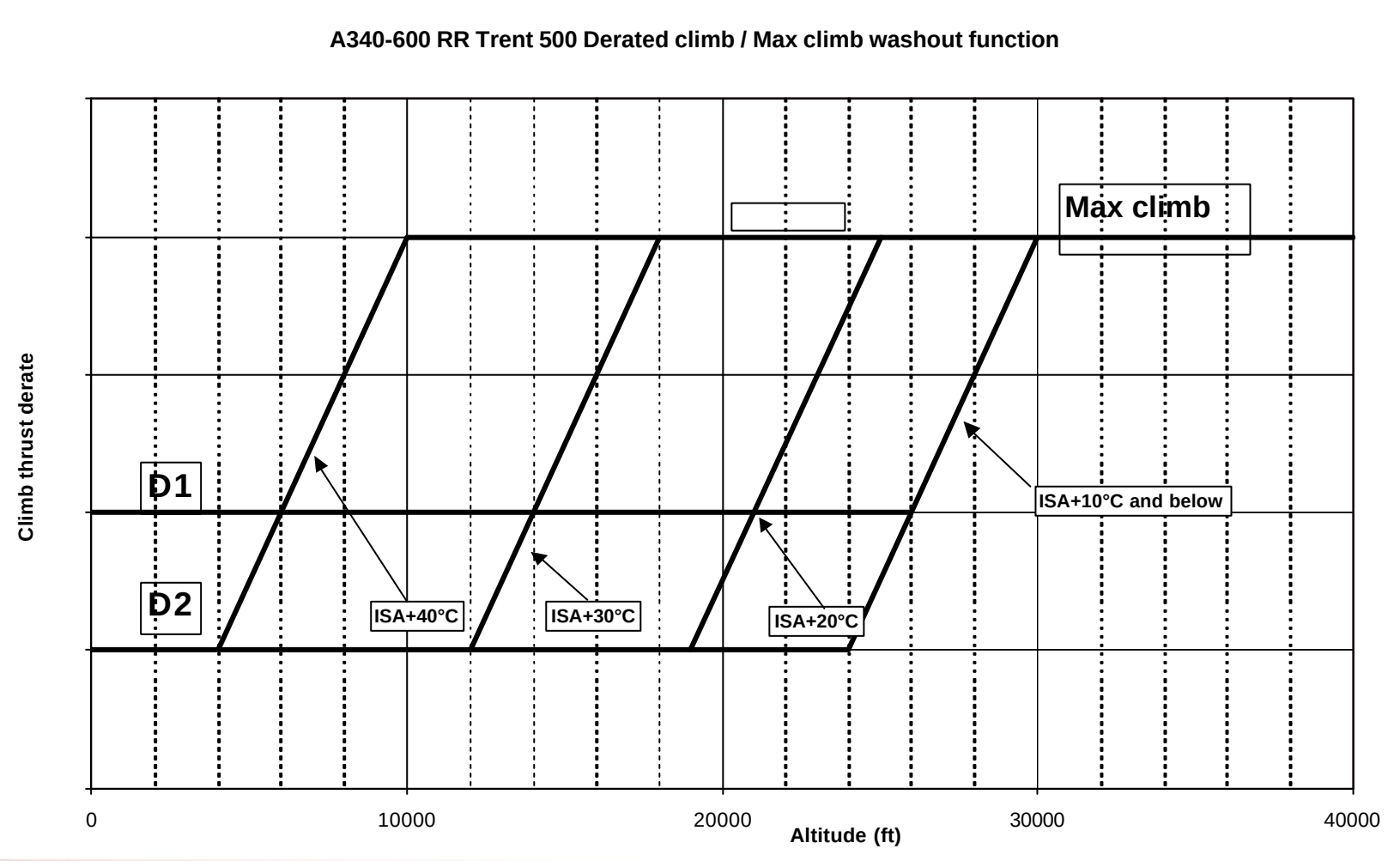
- <u>It applies to the climb phase, so its use is completely independent of that of the DERATED TO</u>
- Benefits of thrust reduction
  - save the engine life (↘ engine stress)
  - reduce maintenance costs

Derated Climb concept

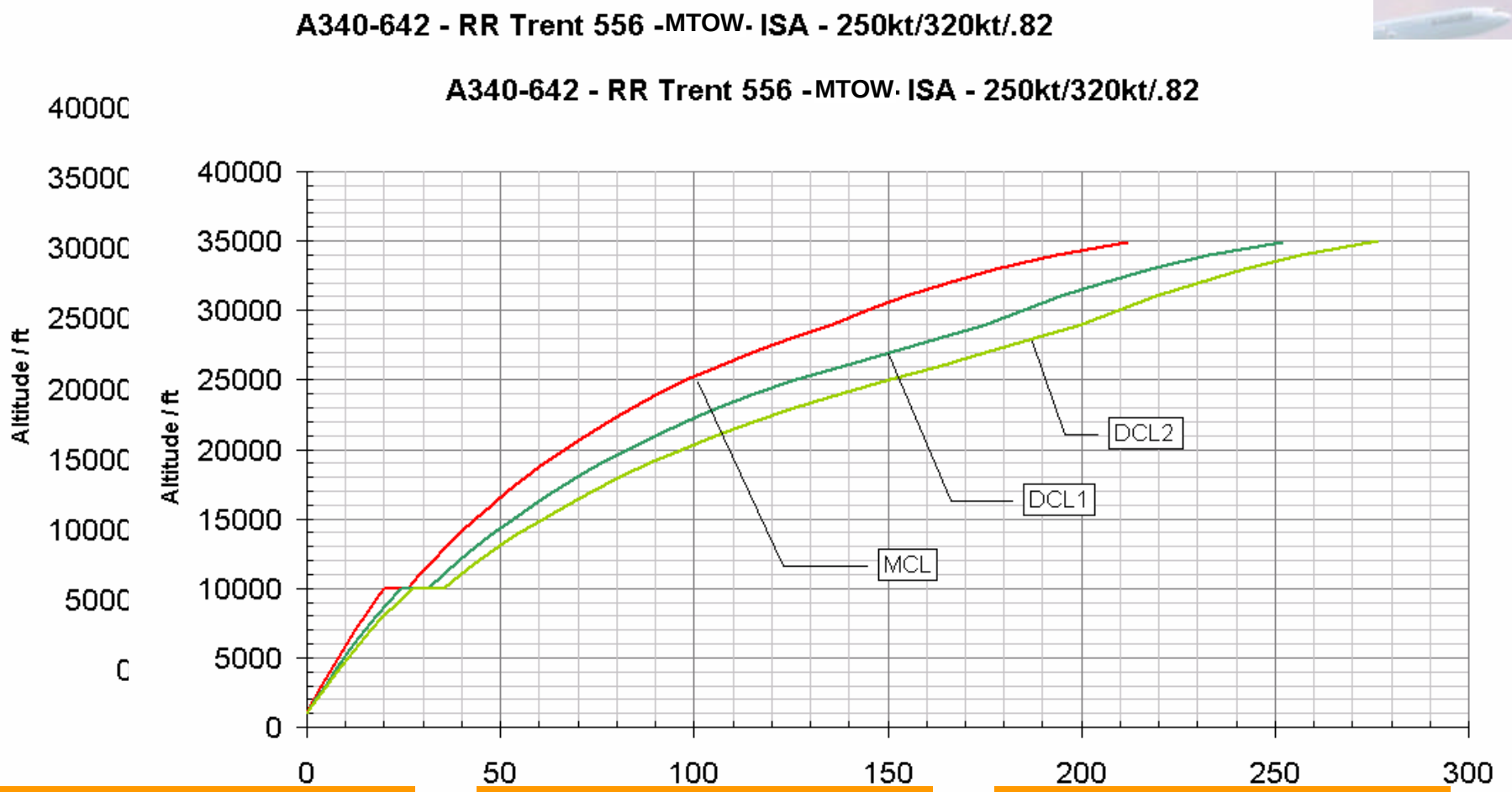
- Two levels of derated climb available through MCDU
- Implementation: EPR/N1 decrement applied on MCL EPR/N1
- Decrement is function of pressure altitude, delta ISA and engine bleed configuration.
- Result:
  - less severe engine operations and resulting lower engine DMC,
  - slightly increased climb fuel/time to reach the same flight level.
- The DERATED CLIMB is basic in the LR family since 1997
- This option is not available in the SA family

Engine strain reduction

In order to maintain the same climb capabilities, the Derated Climb features a Washout function:

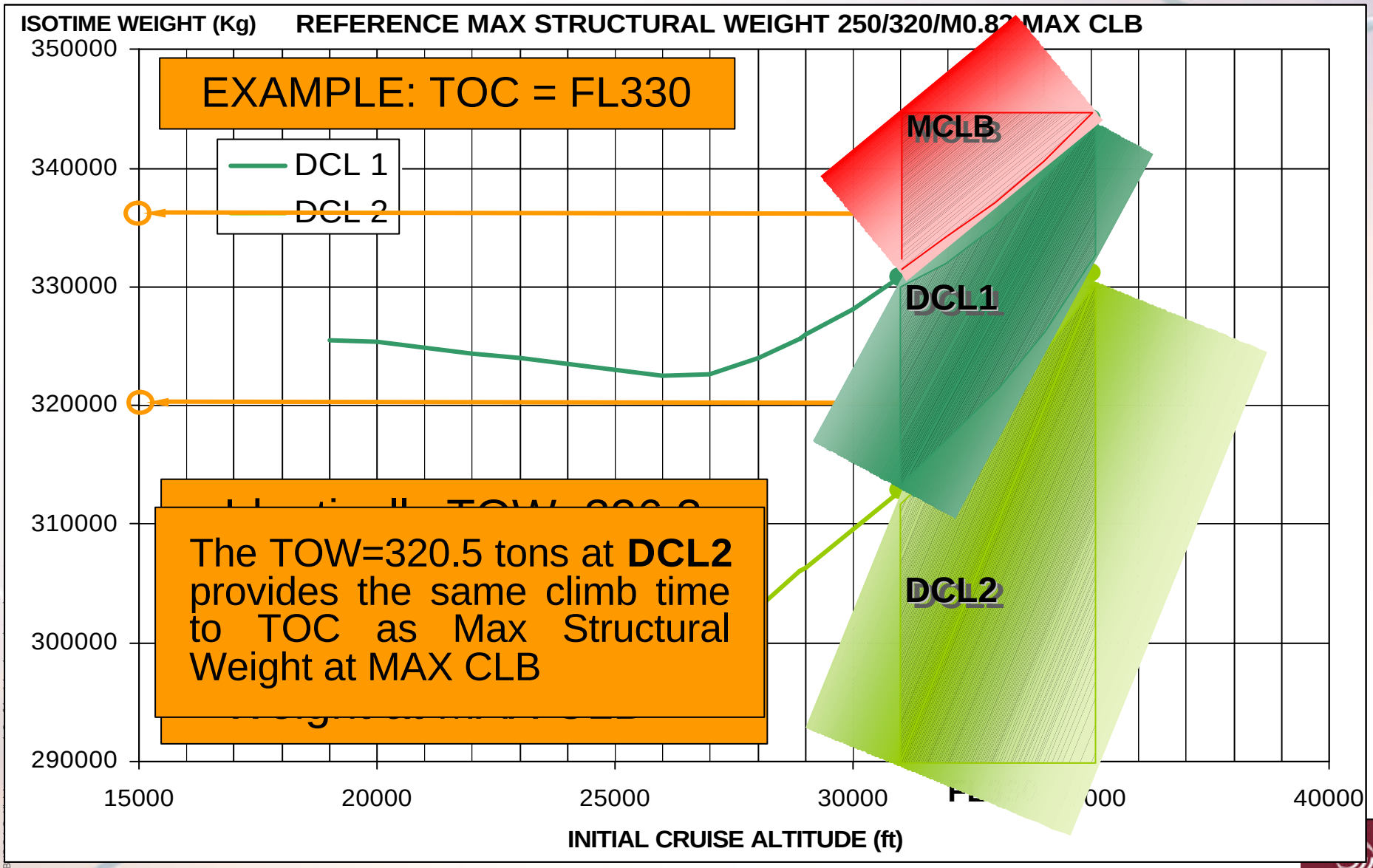


Derated climb operational effect



Time to TOC	Distance to TOC	Fuel (const dist)
DCL1: +6min	DCL1: +40nm	DCL1: +89kg
DCL2: +10min	DCL2: +64nm	DCL2: +184kg

AIRBUS Derated Climb Recommendations



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WITH BAE SYSTEMS