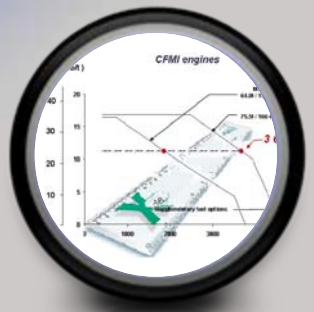
All About the A320 Family

Technical appendices

AIRBUS



Technical appendices

Technical appendices - Contents

- **A320 Family general data**
  - Key data — Page 4
  - Standard cabin layouts — Page 8
  - Lower deck — Page 11
  - Additional fuel capacity — Page 14
- **A320 Family technology features**
  - Flight deck — Page 16
  - Centralised Fault Display System — Page 22
  - Fly-by-wire system — Page 25
  - Wing movable surfaces — Page 27
  - Engines — Page 28
- **A320 Family performance**
  - Range capability — Page 31
  - Take-off performance — Page 39
  - Landing performance — Page 47

A318 Key data

Maximum take-off weight:	-basic -options	59 000 kg 61 500 kg 63 000 kg 64 500 kg 66 000 kg 68 000 kg	130 070 lb 135 580 lb 138 890 lb 142 200 lb 145 500 lb 149 900 lb
Maximum landing weight:	-basic -option	56 000 kg 57 500 kg	123 460 lb 126 770 lb
Maximum zero-fuel weight:	-basic -option	53 000 kg 54 500 kg	116 840 lb 120 150 lb
Fuel capacity:	-basic	24 210 litres	6 400 USG
Operating weight empty (typical):		39 500 kg	87 080 lb
Seats:	- typical two-class - maximum	107 132 (exit limit 145)	
Underfloor capacity:	- basic	21.21 m^3	749 ft^3
Powerplants:	- PW6000A - CFM56-5B	22 100 lb to 23 800 lb slst 21 600 lb to 23 300 lb slst	

Span	111ft	10in	34.10m
Length	103ft	2in	31.44m
Height	41ft	1in	12.51m
Fuselage width	13ft		3.95m

A319 Key data

Maximum take-off weight:	-basic -options	64 000 kg 68 000 kg 70 000 kg 75 500 kg	141 100 lb 149 920 lb 154 330 lb 166 450 lb
Maximum landing weight:	-basic -option	61 000 kg 62 500 kg	134 480 lb 137 790 lb
Maximum zero-fuel weight:	-basic -option	57 000 kg 58 500 kg	125 660 lb 128 970 lb
Fuel capacity:	- basic - options	24 210 litres up to 30 190 litres	6 400 USG up to 7 980 USG
Operating weight empty (typical):		40 800 kg	89 950 lb
Seats:	- typical two-class - maximum*	124 160	
Underfloor capacity:	-basic - option	27.62 m^3 976 ft^3 4 LD3-45(W) + 7.22 m^3/255 ft^3	
Powerplants:	- CFM56-5B - V2500-A5	22 000 lb to 27 000 lb slst 22 000 lb to 26 500 lb slst	

* with double overwing exit

Span	111ft 10in	34.10m
Length	111ft	33.84m
Height	38ft 7in	11.76m
Fuselage width	13ft	3.95m

A320 Key data

Maximum take-off weight:	-basic -options	73 500 kg 75 500 kg 77 000 kg 78 000 kg	162 040 lb 166 450 lb 169 750 lb 171 960 lb
Maximum landing weight:	-basic -option	64 500 kg 66 000 kg	142 200 lb 145 500 lb
Maximum zero-fuel weight:	-basic -option	61 000 kg 62 500 kg	134 480 lb 137 780 lb
Fuel capacity:	- basic - options	24 210 litres up to 30 190 litres	6 400 USG up to 7 980 USG
Operating weight empty (typical):		42 600 kg	93 920 lb
Seats:	- typical two-class - maximum	150 180	
Underfloor capacity:	-basic - option	37.41 m^3 1 322 ft^3 7 LD3-45(W) + 5.89 m^3/208 ft^3	
Powerplants:	- CFM56-5B - V2500-A5	22 000 lb to 27 000 lb slst 26 500 lb slst	

Span	111ft 10in	34.10m
Length	123ft 3in	37.57m
Height	38ft 7in	11.76m
Fuselage width	13ft	3.95m

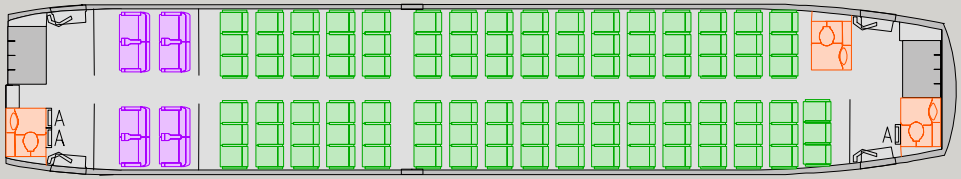
A321 Key data

Maximum take-off weight:	-basic -options	89 000 kg 93 000 kg 93 500 kg	196 200 lb 205 000 lb 206 130 lb
Maximum landing weight:	-basic -option	75 500 kg 77 800 kg	166 450 lb 171 520 lb
Maximum zero-fuel weight:	-basic -option	71 500 kg 73 800 kg	157 630 lb 162 700 lb
Fuel capacity:	- basic - options	24 050 litres up to 30 030 litres	6 350 USG up to 7 930 USG
Operating weight empty (typical):		48 500 kg	106 920 lb
Seats:	- typical two-class - maximum	185 220	
Underfloor capacity:	-basic - option	51.73 m^3 10 LD3-45(W) + 5.89 m^3/208 ft^3	1 828 ft^3
Powerplants:	- CFM56-5B - V2500-A5	30 000 lb to 33 000 lb slst 30 000 lb to 33 000 lb slst	

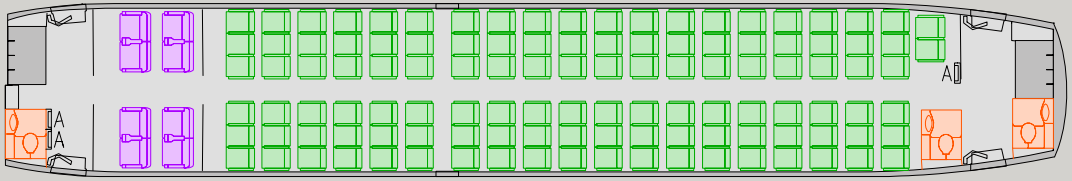
Span	111ft 10in	34.10m
Length	146ft	44.51m
Height	38ft 7in	11.76m
Fuselage width	13ft	3.95m

A320 Family standard cabin layouts

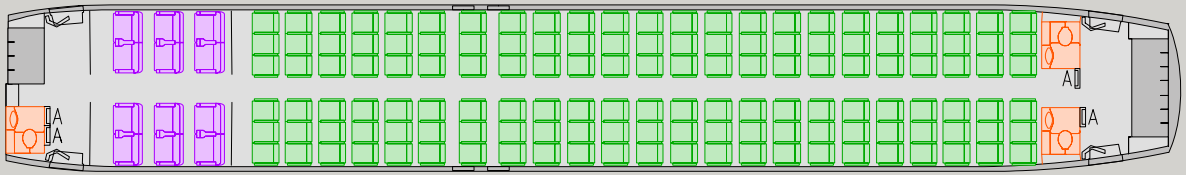
Typical two-class layouts



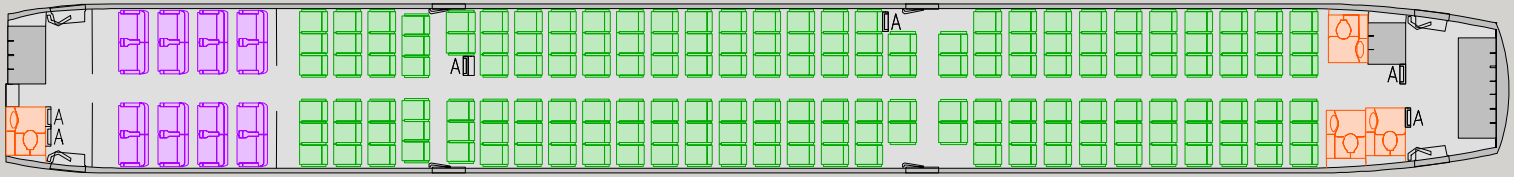
A318: 107 seats
8F at 38in + 99Y at 32in pitch



A319: 124 seats
8F at 36in + 116Y at 32in pitch



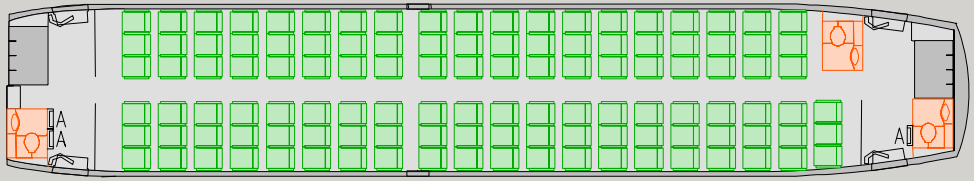
A320: 150 seats
12F at 36in + 138Y at 32in pitch



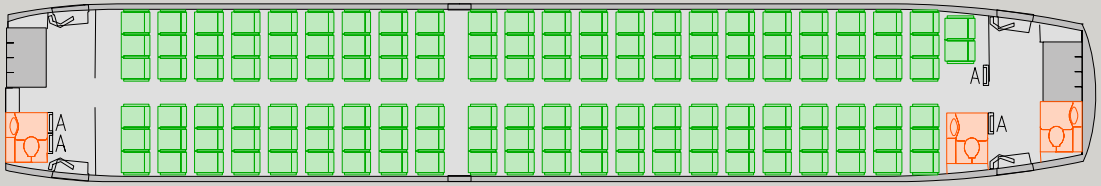
A321: 185 seats
16F at 36in
+ 169Y at 32in pitch

A320 Family standard cabin layouts

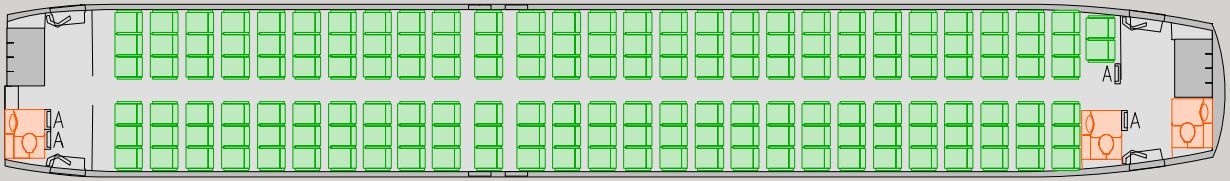
Single-class layouts



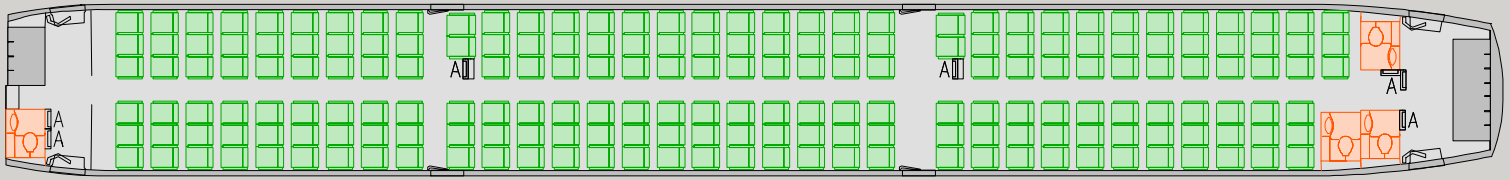
A318: 117 seats
117Y at 32in pitch



A319: 134 seats
134Y at 32in pitch



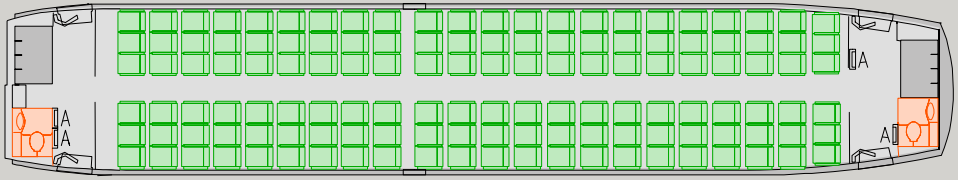
A320: 164 seats
164Y at 31/32in pitch



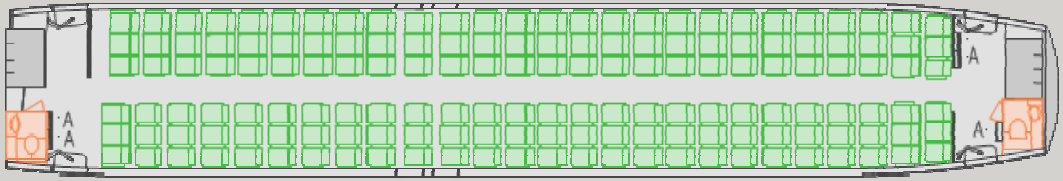
A321: 199 seats
199Y at 32in pitch

A320 Family standard cabin layouts

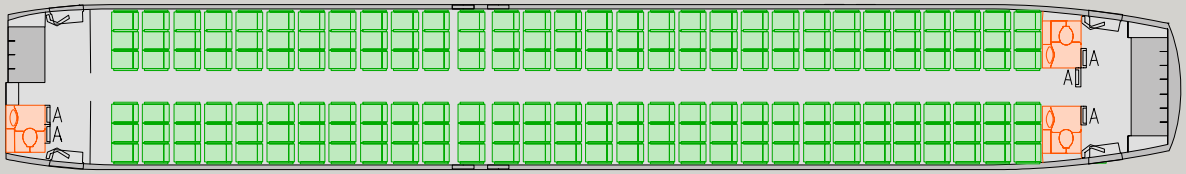
Single-class, high density layouts



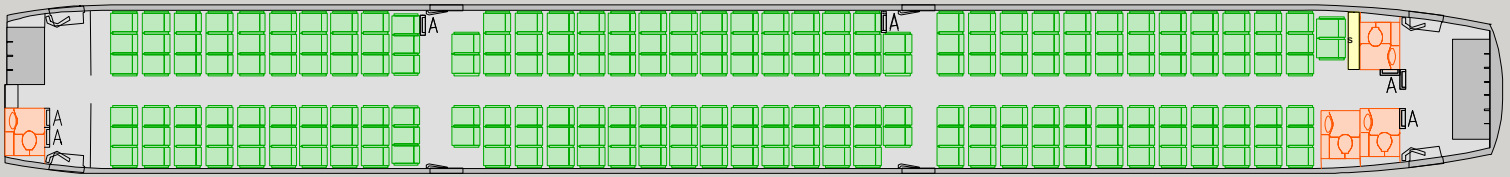
A318: 132 seats
132Y at 29/30in pitch



A319: 156 seats
156Y at 28/30in pitch



A320: 180 seats
180Y at 28/29in pitch
(179Y under FAA regulations)



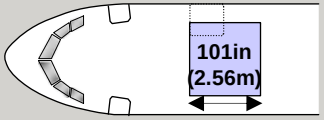
A321: 220 seats
220Y at 28/29in pitch

A320 Family lower deck

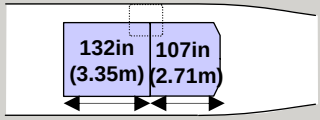
Basic bulk loading configuration

The wider cross-section of the A320 Family means that its cargo compartments offer more convenient working space and a larger loading area than any other single-aisle aircraft.

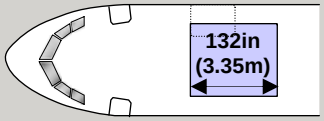
A318



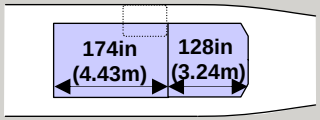
Bulk mode
Usable volume:
749ft^3



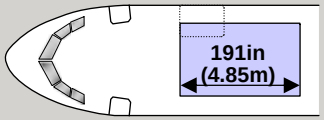
A319



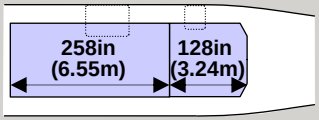
Bulk mode
Usable volume:
976ft^3



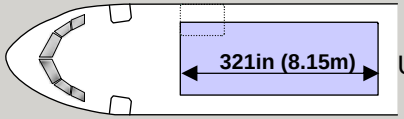
A320



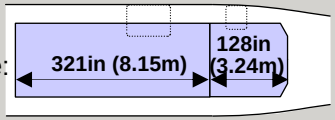
Bulk mode
Usable volume:
1 322ft^3



A321



Bulk mode
Usable volume:
1 828ft^3



Manual loading **advantages**:

- no investment
- maximum available volume
- no OWE impact
- little infrastructure needs

Can be easily loaded from a simple flat-bed truck

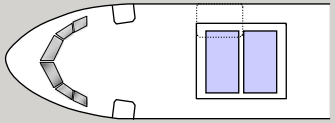
A319, A320 and A321 lower deck

Cargo loading system (CLS)

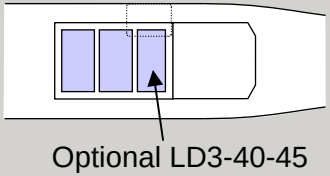
Turnarounds, with a full load of cargo and baggage, can be as short as 25 minutes. The container system is fully compatible with existing ground service equipment, thus reducing extra inventory costs.

A319

Five ULDs (containers or pallets)

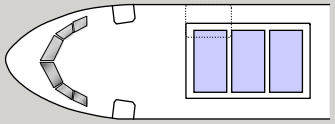


Usable volume:
520(+ 80) ft³
+ 255ft³ bulk

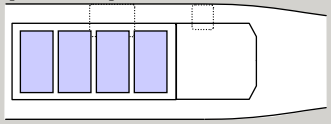


A320

Seven ULDs (containers or pallets)

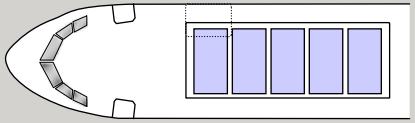


Usable volume:
910ft³
+ 208ft³ bulk

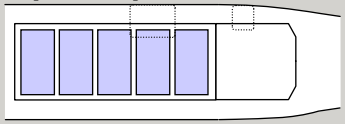


A321

Ten ULDs (containers or pallets)



Usable volume:
1 300ft³
+ 208ft³ bulk



CLS **advantages**:

- Faster turnarounds
- Increased revenue potential
- Better bad-weather operations
- Reduced damage to payload
- Reduced labour costs
- Improved working environment
- Widebody interline capacity

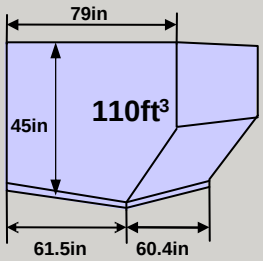
CLS in action

Standard containers

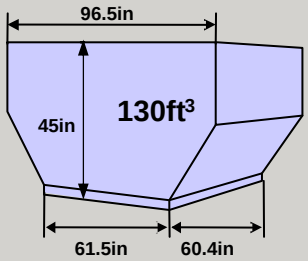
A320 Family container system

A320 Long range-compatible unit load devices :

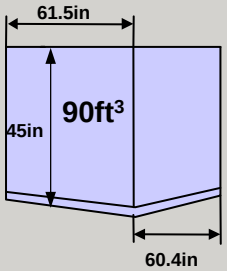
LD3-45 container
(one door)



LD3-45W container or pallet
(one or two doors)



LD3-45 rectangular
container or pallet to 45in high



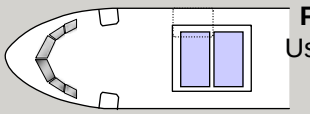
		LD3-45	**LD3-45W**			**LD3-45** rectangular		
Max. gross weight	kg	1134	container	1134	pallet	container	1134	pallet
	lb	2500		2500			2500	
Internal volume	m^3	3.1	3.6		3.6	2.5		2.4
	ft^3	110	130		130	90		84

Additional fuel capacity

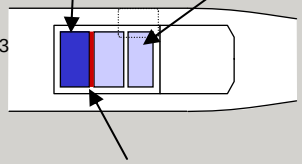
- The A319, A320 and A321 can be fitted with one or two Additional Centre Tanks (ACTs) each holding around 3000 litres, providing operators with extra range.
- Operators can match various market requirements for more range or more cargo with a single aircraft.
- For example, an airline can use the cargo capacity on its network during the winter and then take advantage of the ACTs and increase range to make charter operations viable during the summer.
- The ACTs can be installed either in bulk and / or CLS mode.

A319 lower deck with ACTs

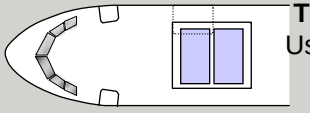
One additional centre tank



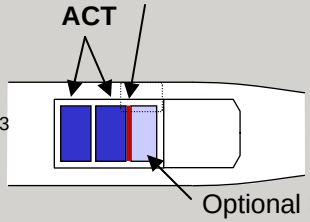
Four ULDs (containers or pallets):
Usable volume: 390 (+80) ft^3 + 255ft^3
Bulk mode:
Usable volume: total 810 ft^3



Two additional centre tanks



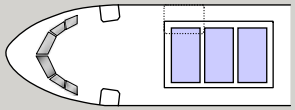
Three ULDs (containers or pallets):
Usable volume: 260 (+80) ft^3 + 255ft^3
Bulk mode:
Usable volume: total 664 ft^3



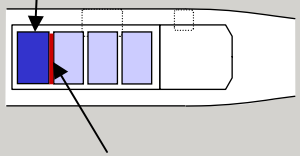
Additional fuel capacity

A320 lower deck with ACTs

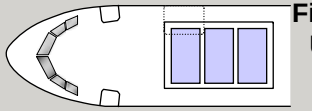
One additional centre tank



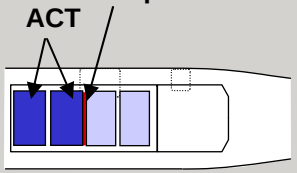
Six ULDs (containers or pallets):
Usable volume: 780 ft^3 + 208ft^3
Bulk mode:
Usable volume: total 1156 ft^3



Two additional centre tanks

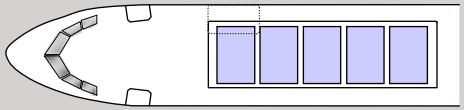


Five ULDs (containers or pallets):
Usable volume: 650 ft^3 + 208ft^3
Bulk mode:
Usable volume: total 990 ft^3

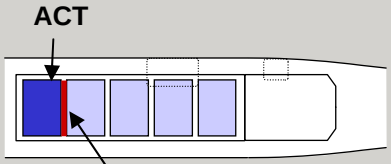


A321 lower deck with ACTs

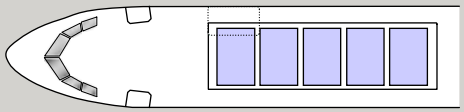
One additional centre tank



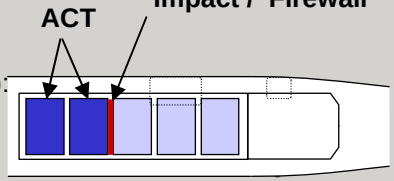
Nine ULDs (containers or pallets):
Usable volume: 1170 ft^3 + 208ft^3
Bulk mode:
Usable volume: total 1662 ft^3



Two additional centre tanks



Height ULDs (containers or pallets):
Usable volume: 1040 ft^3 + 208ft^3
Bulk mode:
Usable volume: total 1496 ft^3



A320 Family flight deck

- The advanced flight deck of the A320 Family is virtually identical to that of the A330 and A340 Families and has a very high commonality with the one of the A350 XWB and A380 Families.

- An optimised layout of six LCD (Liquid Crystal Display) screens ensures that the two-person crew can easily assimilate all relevant data
  - EFIS displays, for flight information
  - ECAM displays, for systems, engine and warnings information
  - All six LCDs are interchangeable, functionally and by part number.

- The absence of heavy, bulky control columns between the pilots and their instruments, ensures an unimpeded view.

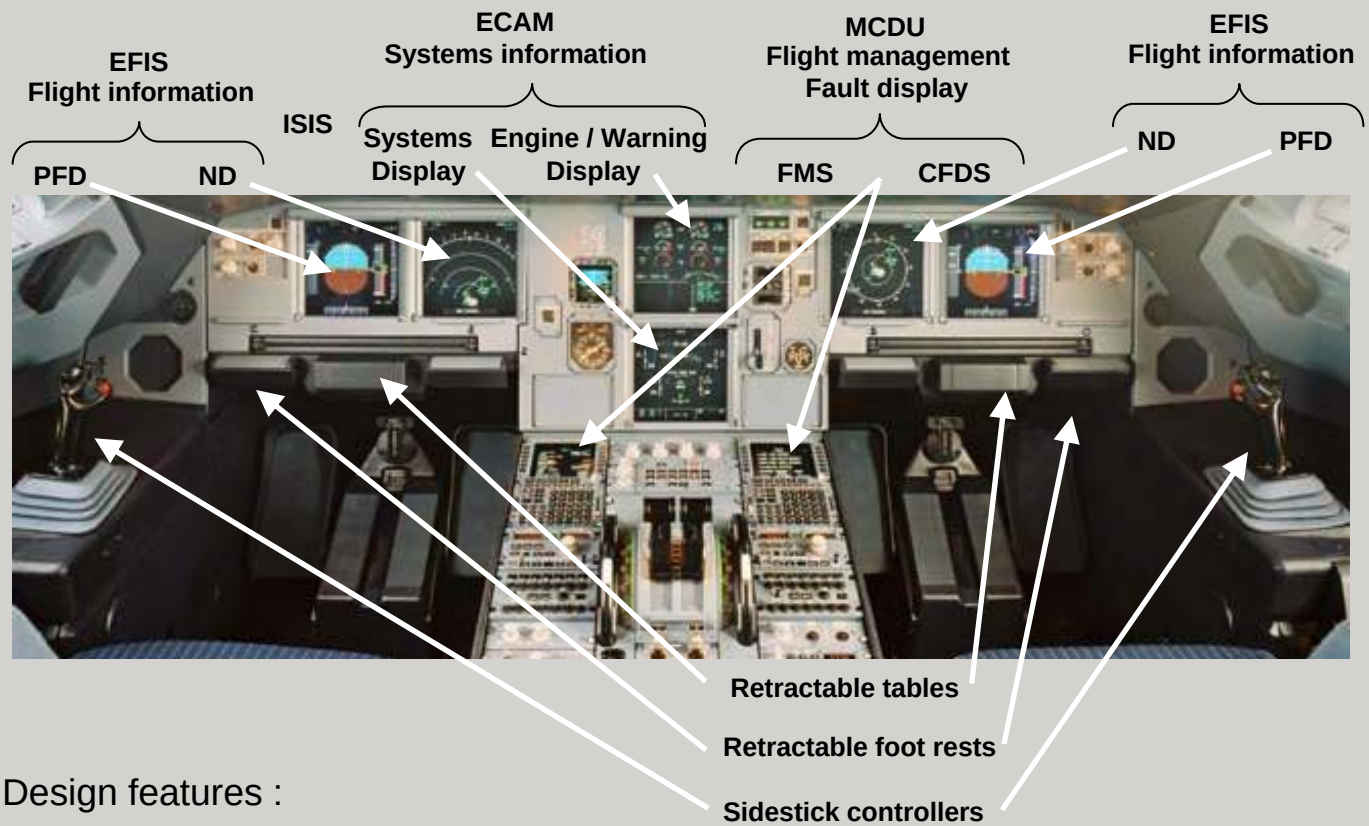
- Two Multipurpose Control and Display Units (MCDU) on the pedestal, in addition to accessing the Flight Management System (FMS), are used to give systems maintenance data, in the air and on the ground, upon request.

- The system is coupled to a printer and can also be coupled to an optional Aircraft Communication Addressing and Reporting System (ACARS) link.

Main instrument panel

- Real time flight and systems data are displayed to the pilots on six LCDs.
- Flight information is provided by the Electronic Flight Instrument System (EFIS) comprising:
  - Primary Flight Display (PFD)
  - Navigation Display (ND) in front of each pilot.
- Systems information is provided by the Electronic Centralised Aircraft Monitor (ECAM) comprising:
  - Engine instrumentation and warnings on the upper screen
  - Aircraft systems on the lower screen.
- The EFIS-ECAM six-LCD design brings:
  - Lower spares investment
  - Higher dispatch reliability and enhanced safety
  - Lower crew workload.
- Features Integrated Stand-by Instrumentation System (ISIS) on one additional LCD screen.

Main instrument panel

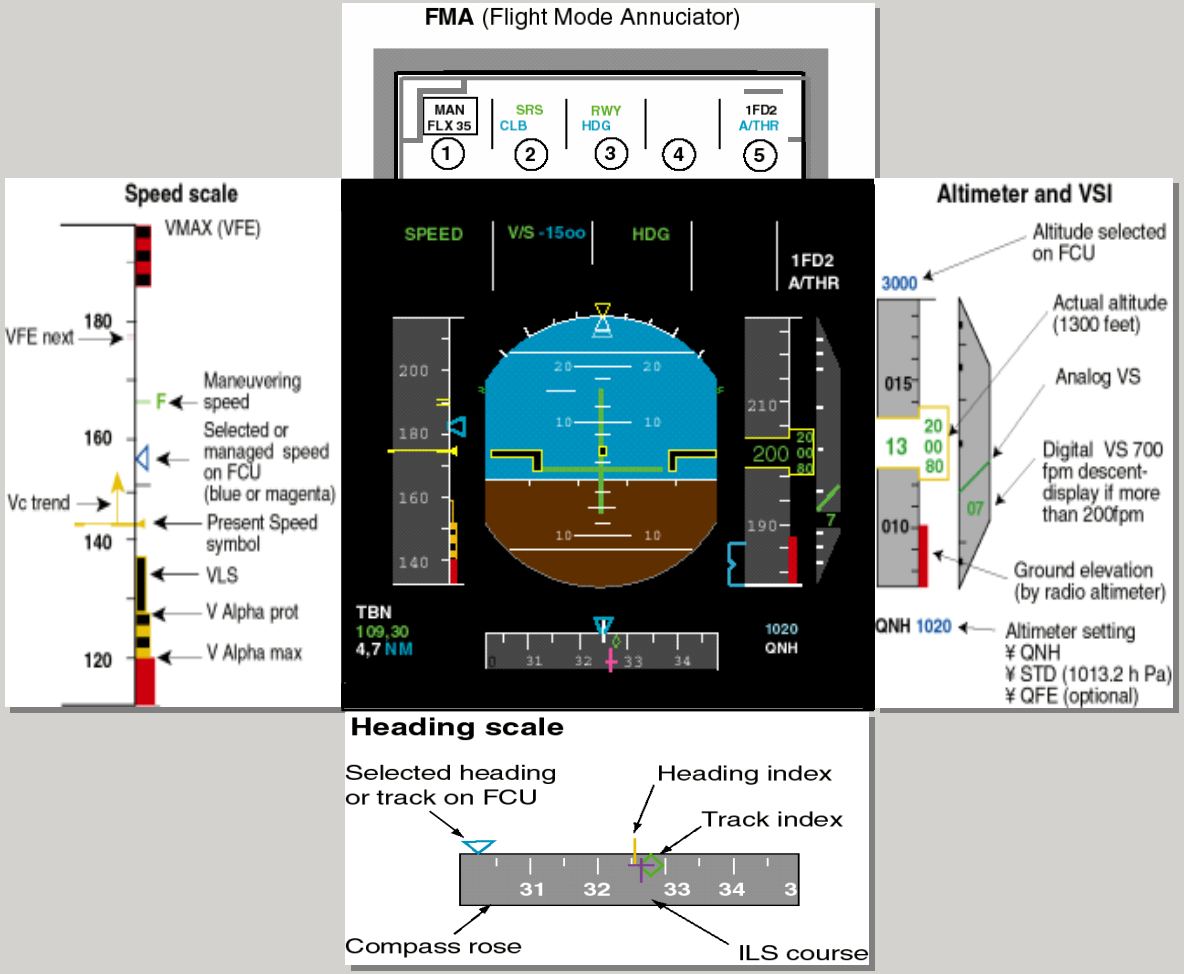


Design features :

- Only 12 main-panel instruments
- LCDs identical and interchangeable
- Automatic display reconfiguration in event of CRT failure
- Excellent ergonomics ease interface between pilot and machine

Primary Flight Display

The Primary Flight Displays provide clear and accurate information on a range of parameters including air speed, altitude, attitude and guidance information and heading of the aircraft.



1. Autothrust modes
2. AP/FD longitudinal modes
3. AP/FD lateral modes
4. Approach capability + DH/MDA
5. AP/FD/A/THR engagement status

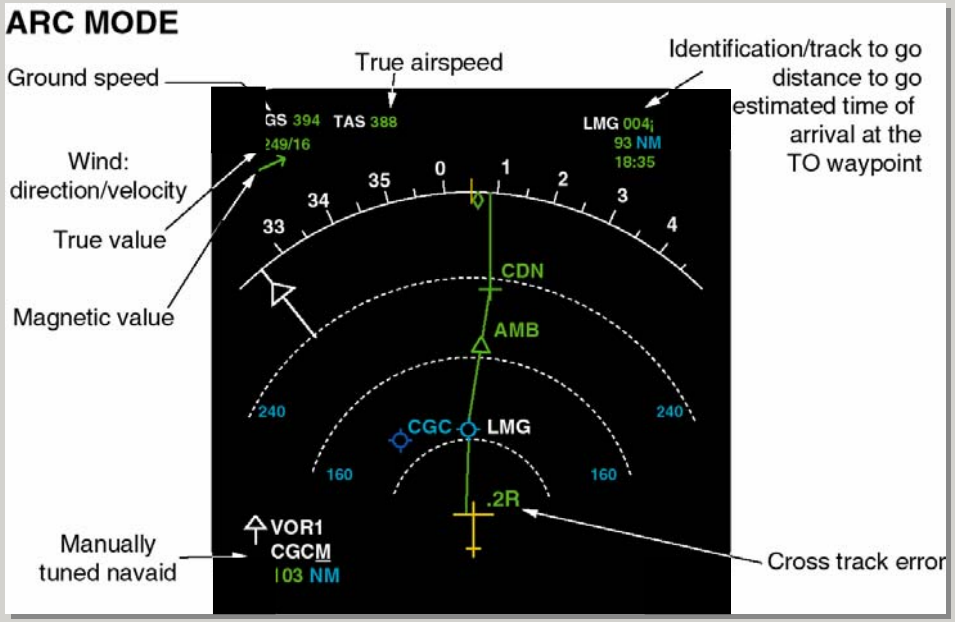
modes on first line are active modes (green)

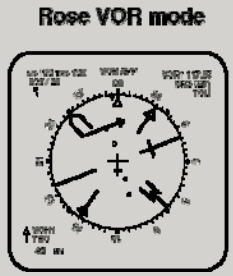
modes on second line are armed modes (blue)

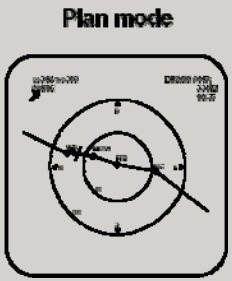
Navigation Display

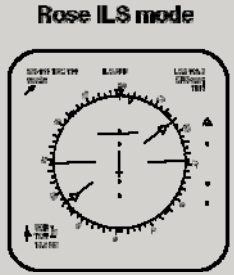
- The Navigation Displays are located inboard of each Primary Flight Display and provide the pilots with data on the aircraft's position and course.

- The ND has three selectable modes:
  - Arc mode: Heading up, horizon limited to a 90° forward sector, with weather radar available
  - Rose mode: (ILS, VOR, or NAV): Heading up, aircraft symbol in screen centre, with weather radar available
  - Plan mode: Display is centred on the selected waypoint, north up.





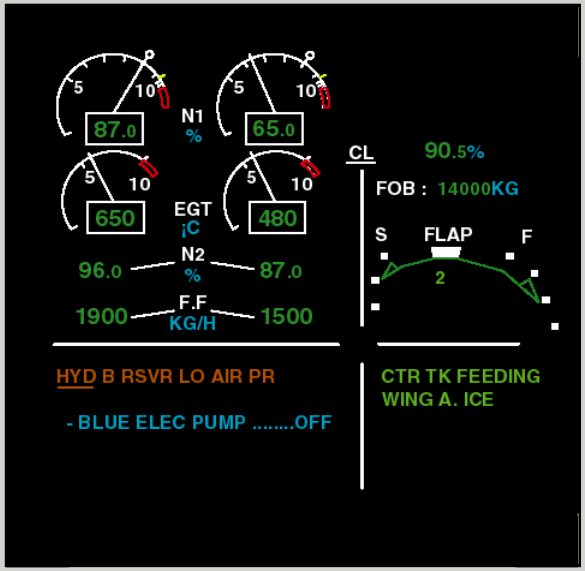




Electronic Centralised Aircraft Monitor (ECAM)

Systems information is presented by the ECAM on two screens on the centre console. Sensors throughout the aircraft continuously monitor the systems and, if a parameter moves out of the normal range, automatically warn the pilot. The ECAM system is unique to Airbus aircraft.

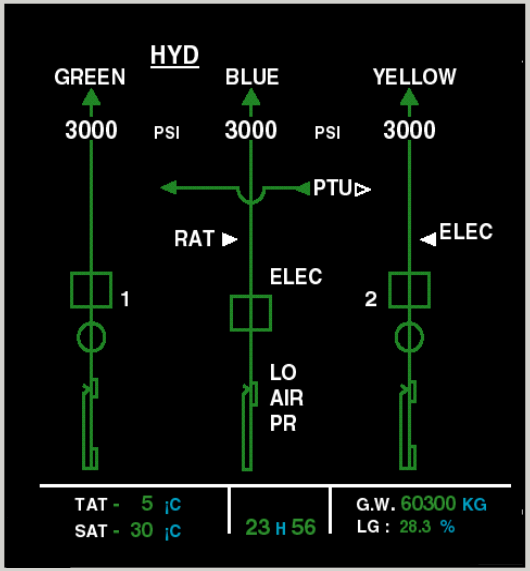
Upper display



Engine / warning display

- Primary engine parameters operational status
  - N1 limit mode,
  - fuel quantity,
  - flap/slat settings
- Memo and warning information

Lower display



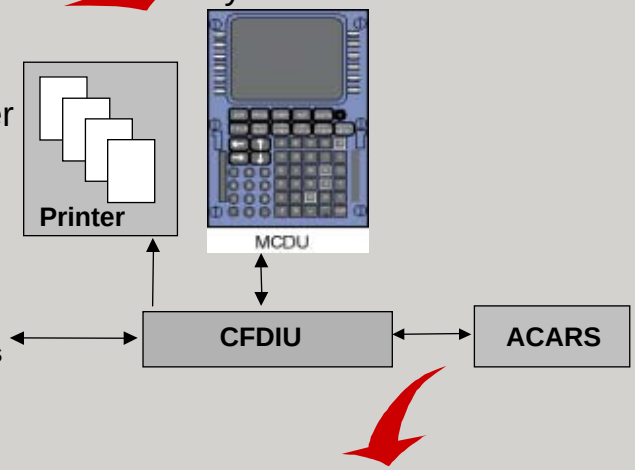
System display

- Flight phase related systems data
- System pages selectable on demand
- Automatic display of a system page in the event of a malfunction

Centralised Fault Display System (CFDS)

The Centralised Fault Display Interface Unit (CFDIU), can be interrogated from the cockpit through the Multi purpose Control and Display Unit (MCDU) and the information provided on the on-board printer

The MCDU is the interactive interface between the maintenance crew and the systems



The computers in each system have Built-In Test Equipment (BITE) which send the results of their tests to an interface unit, the CFDIU

The CFDIU can also be interrogated from a ground station and the information transmitted via Aircraft Communication and Reporting System (ACARS)

CFDS functions and advantages:

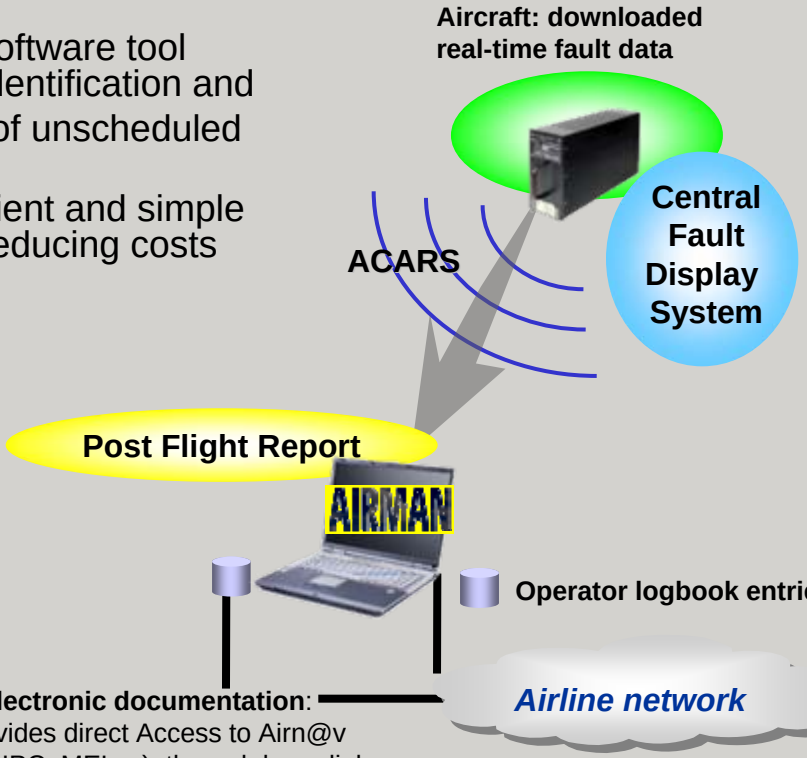
- Identification of failed components
- Display / print-out of data
- Real-time reporting of data to ground facilities
- Unjustified removal of components minimised
- Improved troubleshooting
- Quicker turnarounds
- Simple to use
- First-time fault-finding

The A320 demonstrates class leading reliability and has the lowest maintenance costs in its class

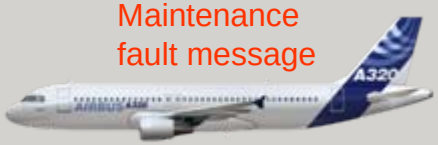
AIRMAN

The CFDS is complemented by AIRMAN (AIRcraft Maintenance ANalysis):

- A ground-based software tool dedicated to the identification and the management of unscheduled maintenance
- It allows fast, efficient and simple trouble-shooting reducing costs



Maintenance fault message



CFDS is connected with the ACARS system

Information can be transmitted to the ground in real time

Fault analysis and parts logistics done before the aircraft lands

Integrated electronic documentation:
AIRMAN provides direct Access to Airn@v (AMM, TSM, IPC, MEL…) through hyperlinks.

AIRMAN is the definitive tool for fast, efficient trouble-shooting

Maintenance optimisation

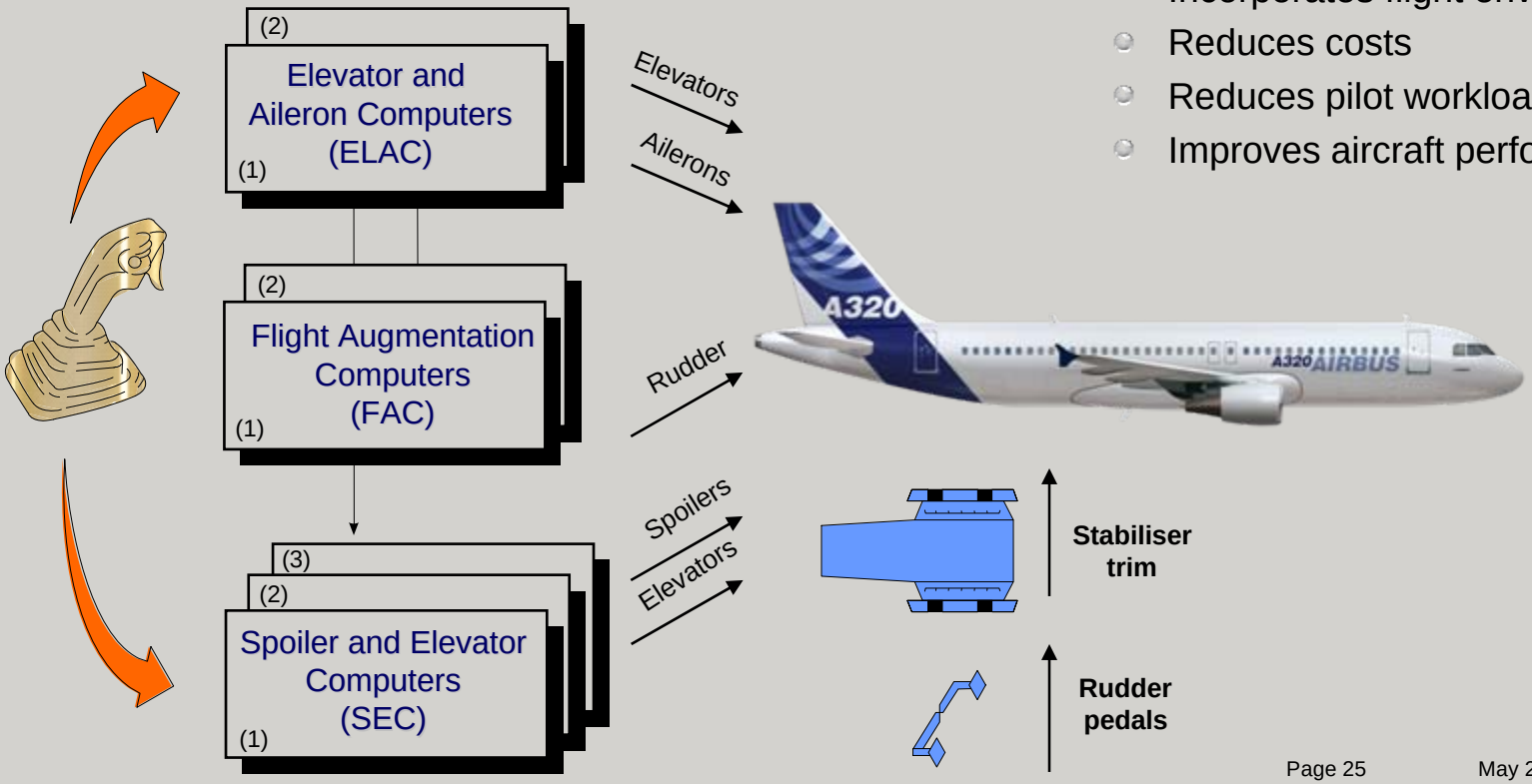
- The A320 Maintenance check intervals have been escalated several times since entry into service.
  This is proof of the low-level of non-routine findings in A320 maintenance.
- A more flexible maintenance program (non “letter check”) is available to all operators since Jan 2005.
  Usage parameters (days or months/ Flight hours/Flight cycles) are now used in order to optimise the resulting intervals for each Operator’ utilisation.
- The tasks of former A and C checks are split between 3 different sub-groups which have their interval expressed in the corresponding usage parameter (calendar / hourly / cyclic).
- Each Operator is therefore able to optimise the Checks intervals depending on their own aircraft utilisation.

	Entry into service	Until Dec 2004	Current position
Daily **Weekly**	36 hours 8 cal. days	36 hours 8 cal. Days	36 hours 8 cal. Days
A check **C check**	350 FH 15 mths	500 FH 15 mths	600FH/750FC/100 days 20 mths/4500FC/6000FH
Zonal/Structure	4/8 years	5/10 years	6/12 years
Fatigue threshold	20 000 FC	24 000 FC	24 000 FC
Landing gear overhaul	10 years / 20 000 FC		

Fly-by-wire flight controls

Airbus was the pioneer in electrical flight control systems on commercial aircraft. The advantages of this method of control are such that it is a feature of all current major passenger aircraft - except the 737 NG.

Basic architecture of Fly-by-wire



A320 Family fly-by-wire advantages:

- Incorporates flight envelope protection
- Reduces costs
- Reduces pilot workload
- Improves aircraft performance

Fly-by-wire flight controls

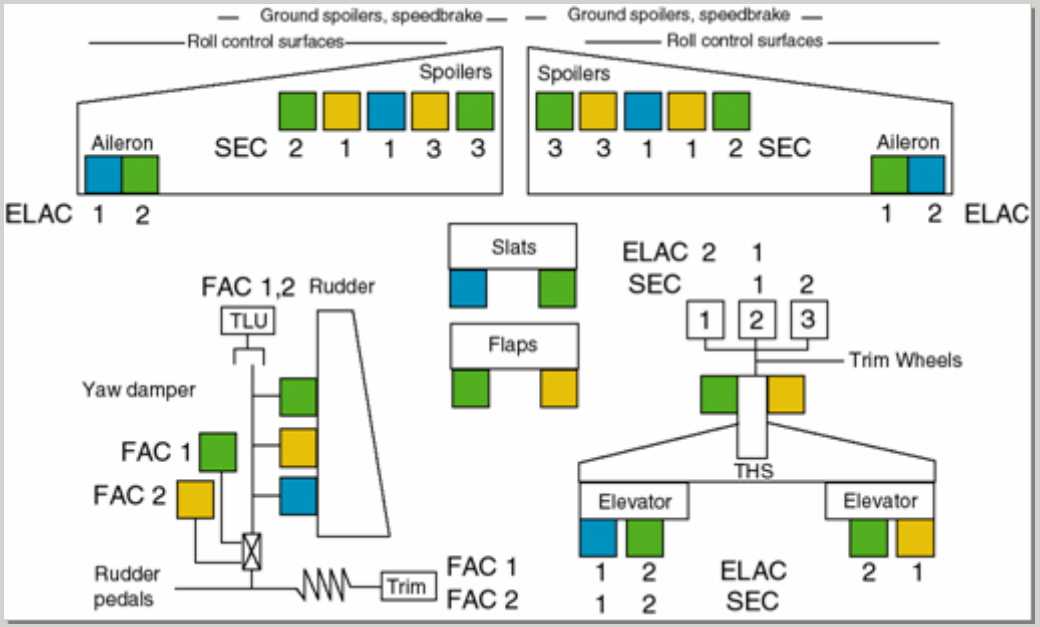
Safety concepts:

- High level of redundancy
- Use of dissimilar redundancy (different computer types, different micro-processor types, different vendors)
- Each computer divided into two physically separate units
- Segregated power supply sources
- Maximum physical segregation in signalling lanes

Seven computers:

- 2 ELAC (Elevator and Aileron Computer)
- 2 FAC (Flight Augmentation Computer)
- 3 SEC (Spoiler and Elevator Computer)
- Three hydraulic systems, Blue, Green and Yellow are used to control the flight control surfaces

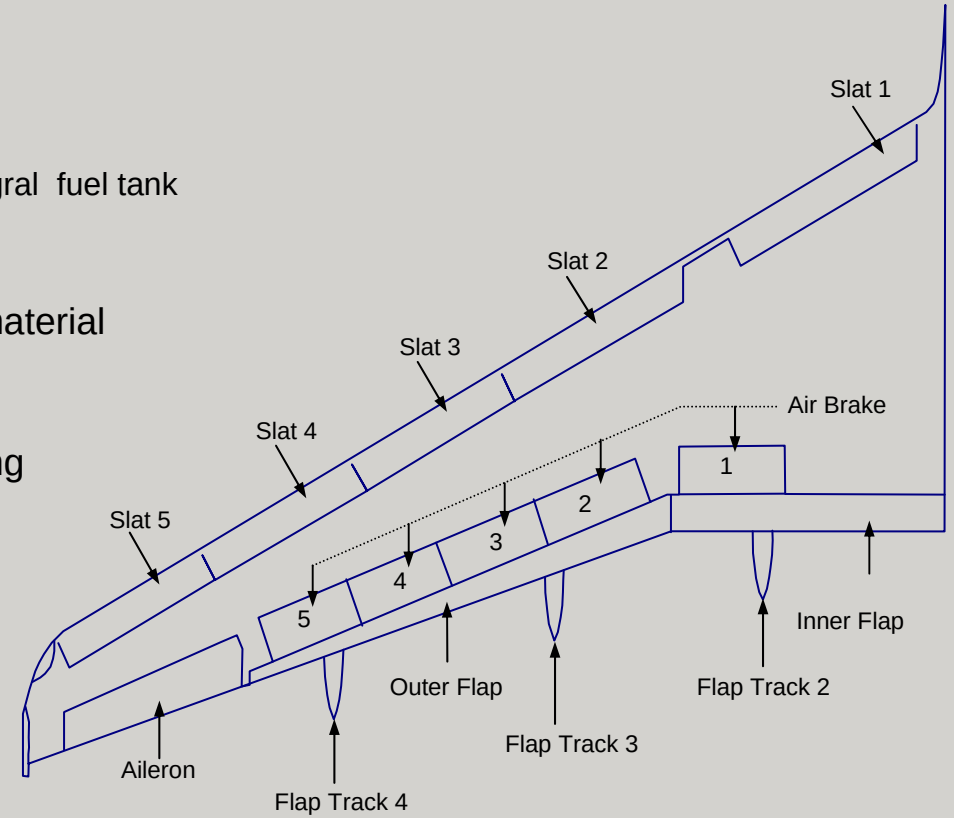
Flight controls - Schematic



Wing movable surfaces

The A320 Family wing features state-of-the-art leading and trailing edge devices :

- Inner and outer flaps, of composite material
  - Removable without requiring access to integral fuel tank
  - Deployment up to 40 degrees
- Full span slats in five sections, of aluminum alloy material
  - Deployment up to 27 degrees
- Five composite air brakes for roll control and braking
- Electrically signaled aileron, of composite material
- Removable wing tip
- Advanced drag-reducing wingtip devices are standard

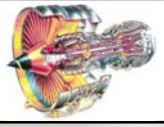


A318/A319/A320 wing shown

Competitive choice of engines on A320 Family

- The A320 was designed from the beginning to have the most advanced high by-pass-ratio fan engines, from two manufacturers, CFM International or International Aero Engines. Now, Pratt & Whitney have joined the family with the PW6000A for the A318.

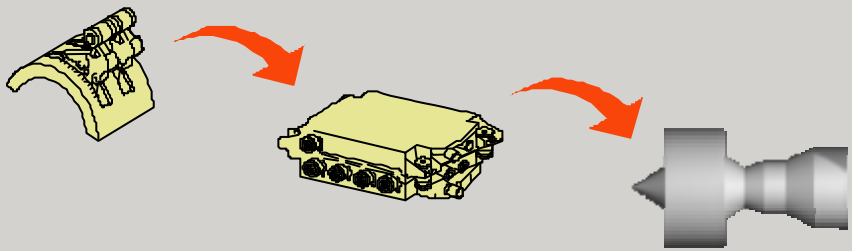
- The uncompromised design of the engine installation combined with the advanced aerodynamic design of the wings means that the A320 Family uses less fuel per seat than its nearest competitors, conserving fuel and at the same time generating less pollution.

Engine characteristics			
	PW6000A	**CFM56-5B**	**V2500-A5**
Aircraft applications	A318	A318/A319/A320/A321	A319/A320/A321
Nominal thrust range-lbt	22100/23800	21600/33000	22000/33000
Fan diameter-in	56.5	68.3	63.5
Configuration	1.4.5.C.1.3	1.4.9.C.1.4	1.4.10.C.2.5
Nacelle	Mixed flow	Separate flow	Mixed flow
Thrust reverser Reverser actuation Gearbox	Clamshell Hydraulic Fan mounted	Pivoting door Hydraulic Fan mounted	Cascades Hydraulic Fan mounted
Controls	FADEC	FADEC	FADEC

Advanced engine control

Full Authority Digital Engine Control (FADEC) functions:

- Full engine fuel control
- Thrust setting computation
- Engine limit protection
- Automatic start sequencing / monitoring
- Thrust reverser control / feedback
- Flight deck indications
- Engine health monitoring



FADEC advantages:

- Substitution of hydromechanical control system
  - ⇨ reduced weight and fuel burn
- Increased automation
  - ⇨ reduced pilot workload
- Optimised engine control
  - ⇨ reduced maintenance cost

FADEC lowers costs and increases engine life

A320 Family APU

- The Auxiliary Power Unit (APU) provides:
  - Electrical power on ground and in flight
  - Bleed air to the pneumatic system for engine start and / or cabin control
  - Free park-group ground operations capability
  - In flight relight capability

- The A320 Family provides competition for the APU. Three APUs are available:
  - Honeywell GTCP36-300A (standard)
  - APIC APS 3200 (standard option)
  - Honeywell GTCP131-9A (standard option).

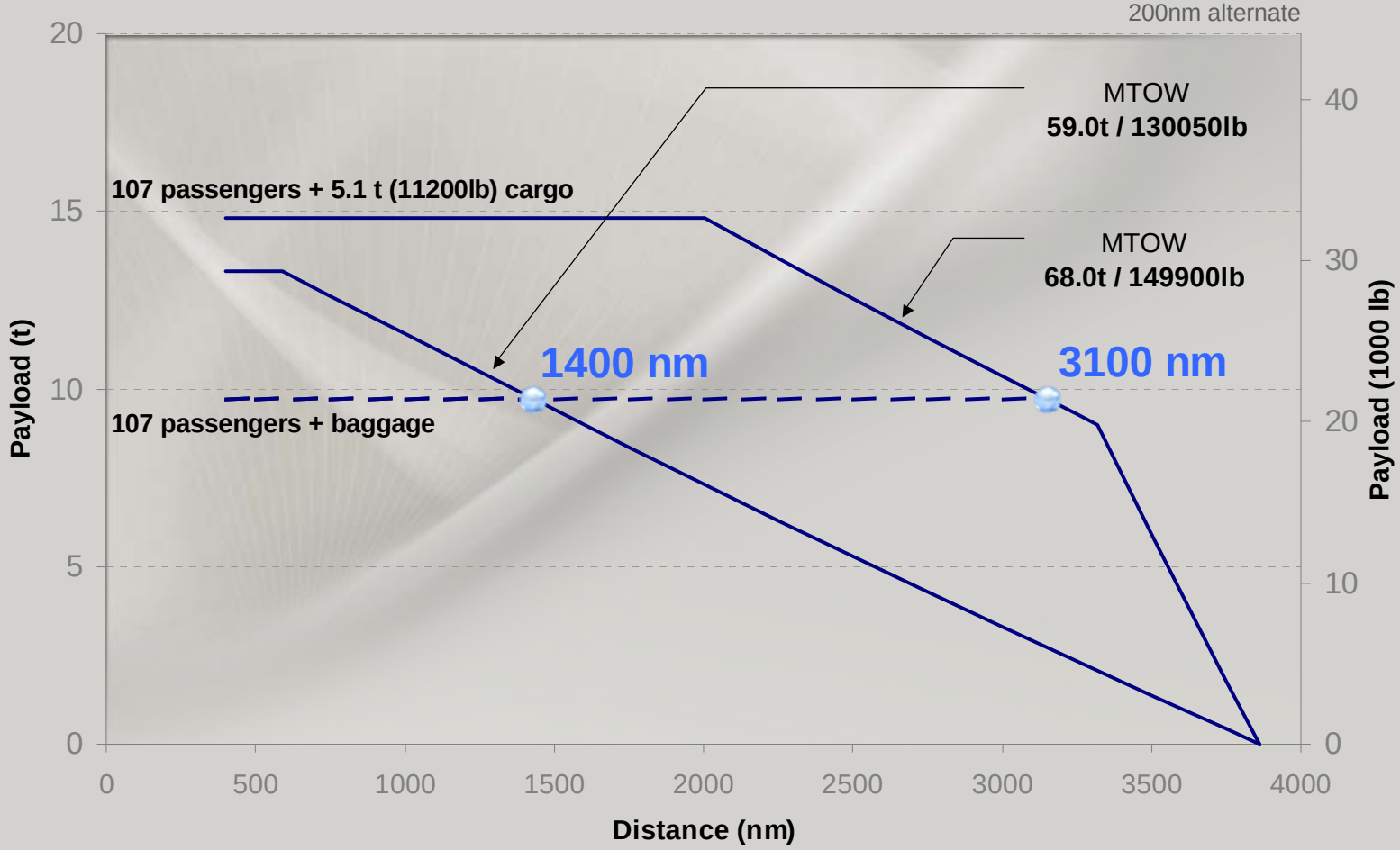
- Commonality and interchangeability
  - A321 APU standard can be used without conversion on A320, A319 or A318 and vice versa.
  - APIC and Honeywell APUs, including their ECBs, are interchangeable on A318/A319/A320/A321.
  - APU change does not require modification of any other system (Drop-In interchangeability).
  - Total modification is contained within the APU/ECB system.
  - The Honeywell APU 131-9A is Drop-In equipment for the A318/A319/A320/A321 with no change to the aircraft structure.

A318 range capability

CFMI engines

JAR3% flight profile

200nm alternate

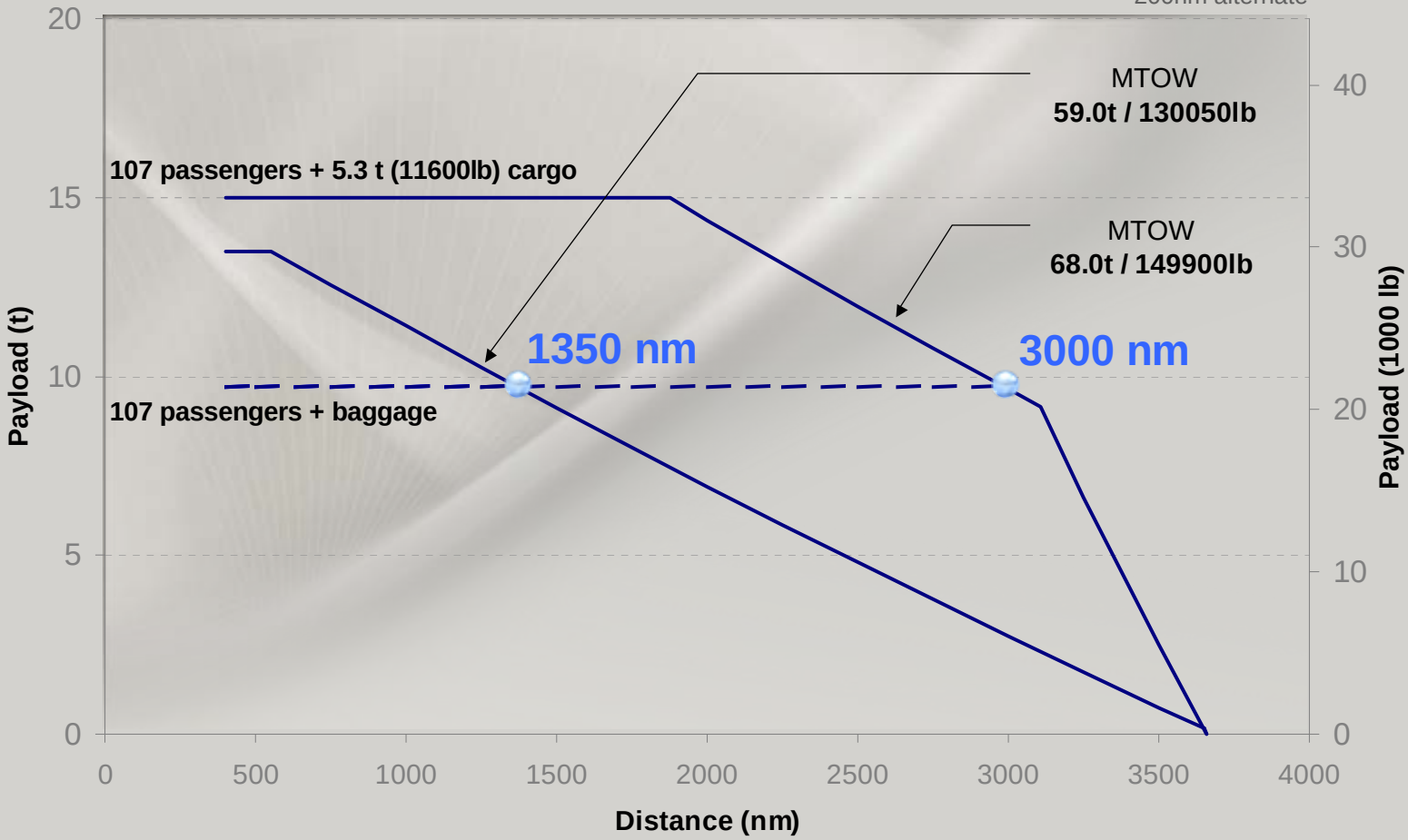


A318 range capability

PW engines

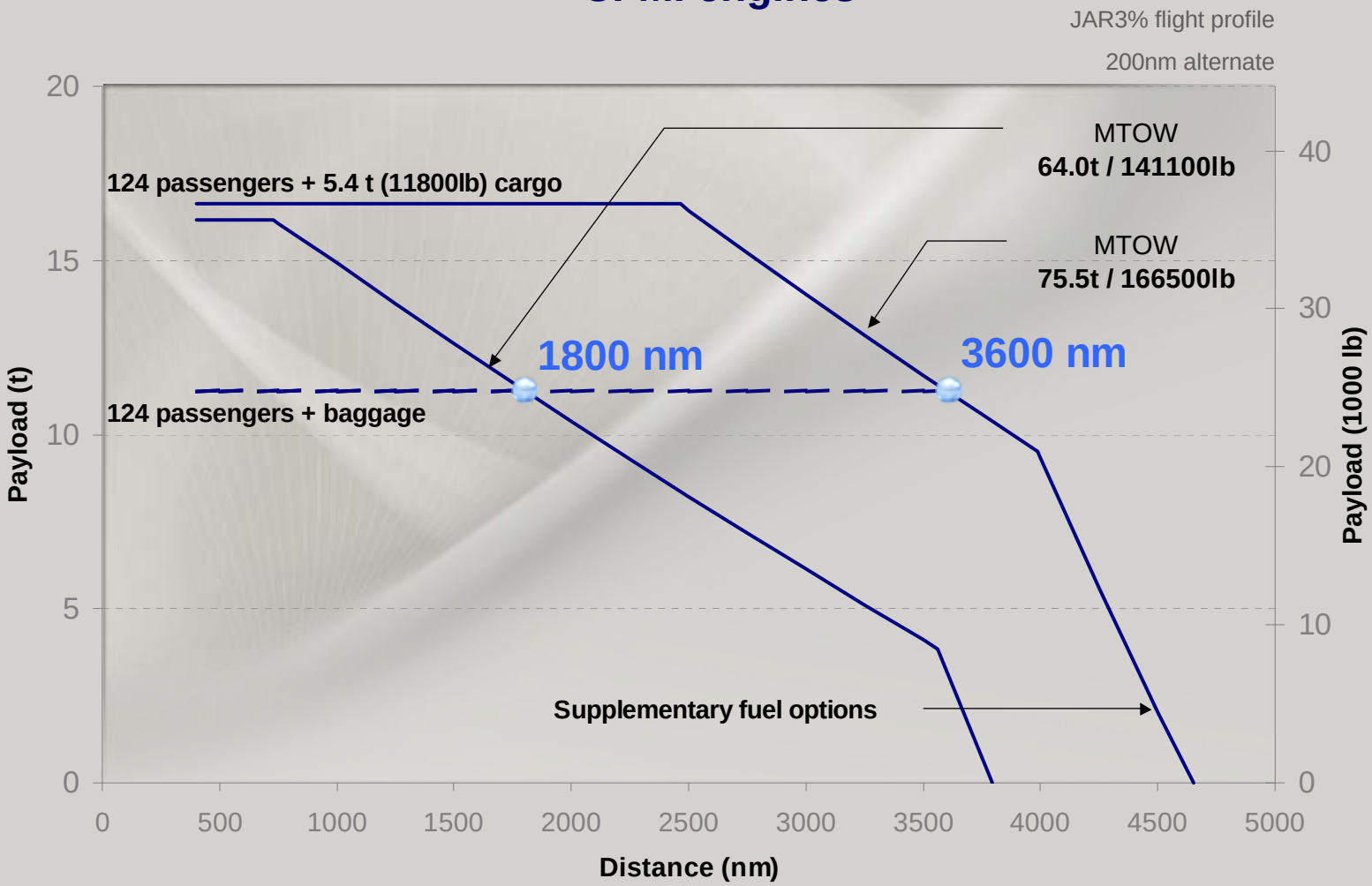
JAR3% flight profile

200nm alternate



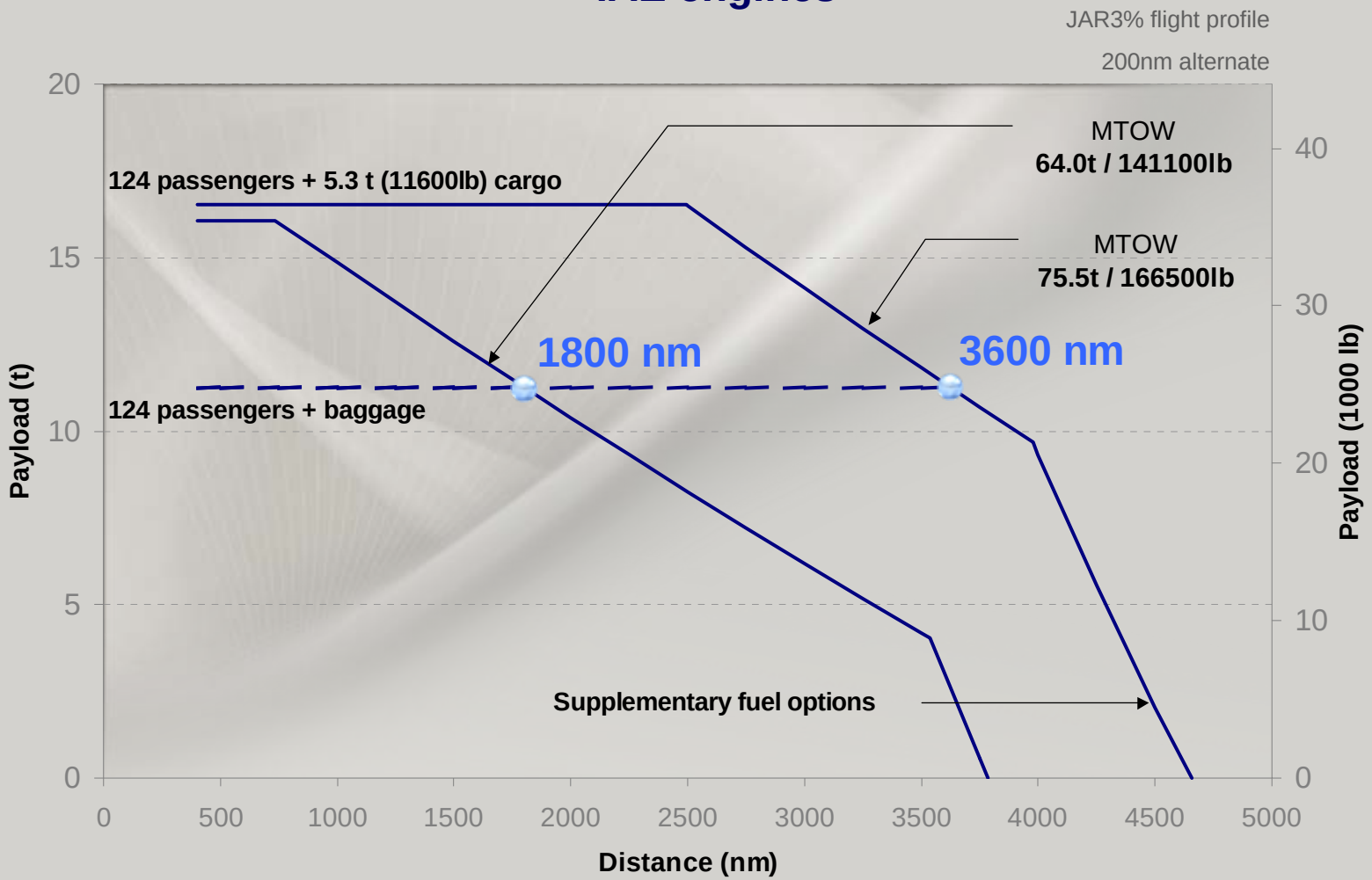
A319 range capability

CFMI engines



A319 range capability

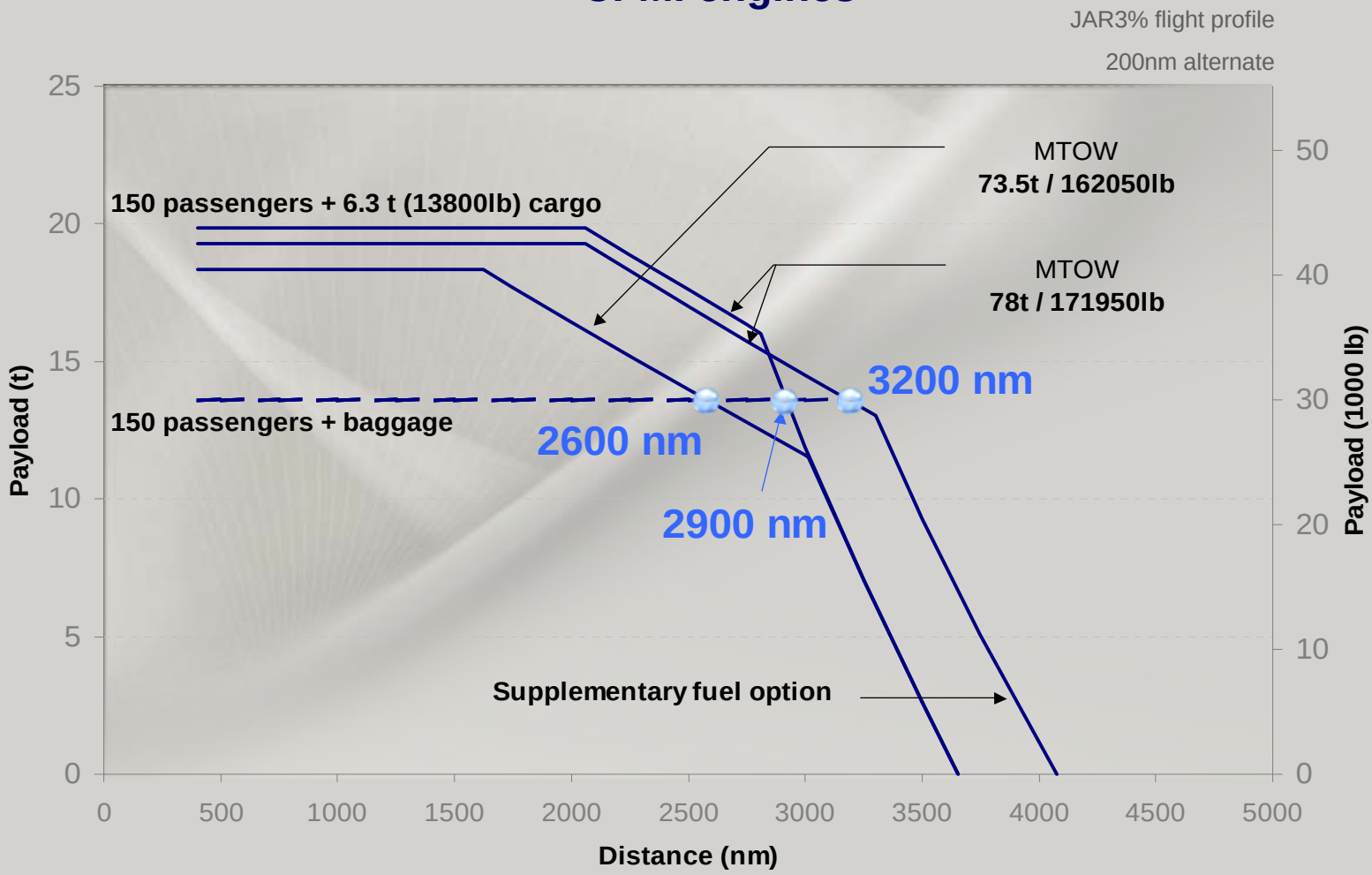
IAE engines



AIRBUS

A320 range capability

CFMI engines

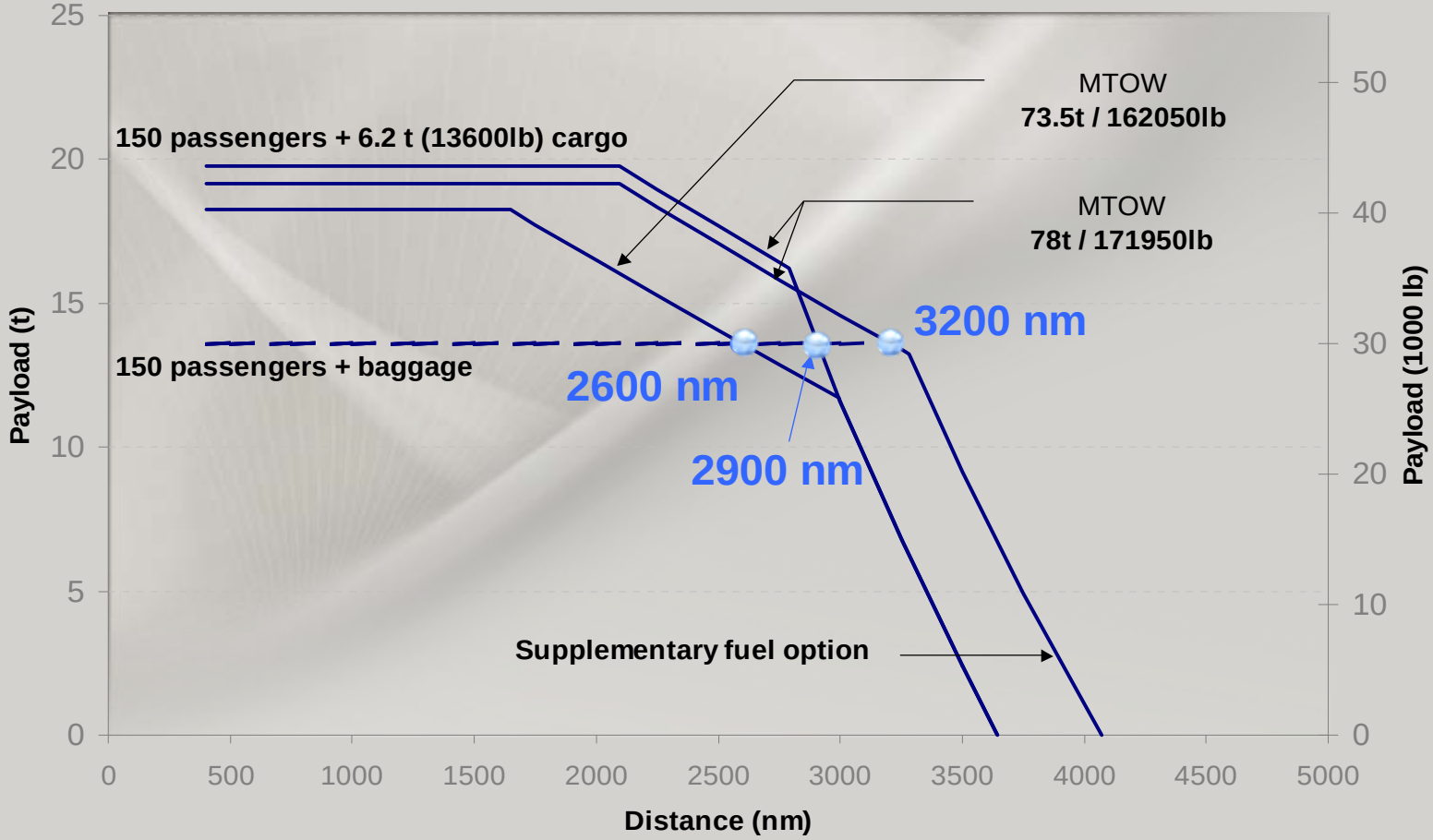


A320 range capability

IAE engines

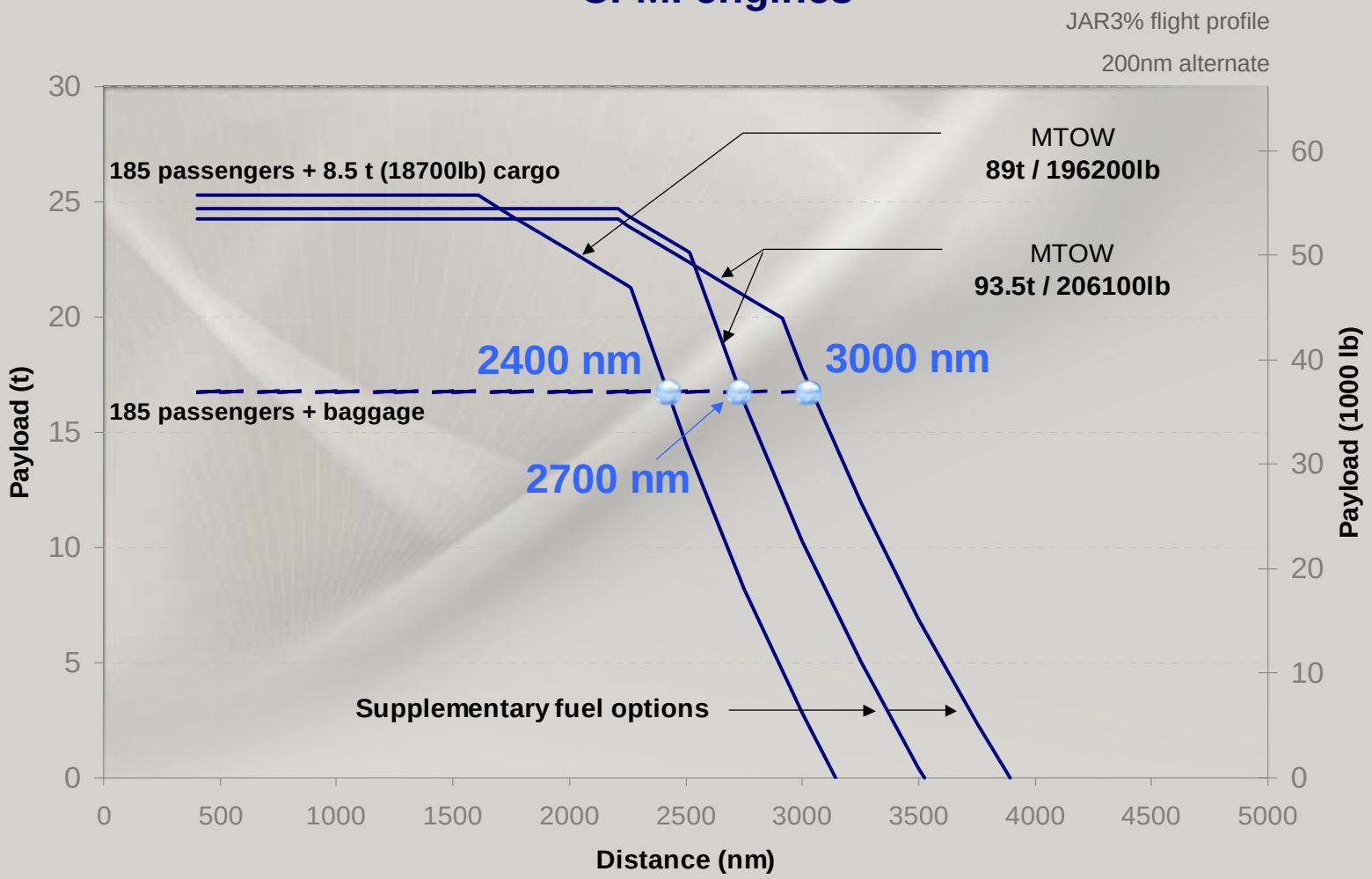
JAR3% flight profile

200nm alternate



A321 range capability

CFMI engines

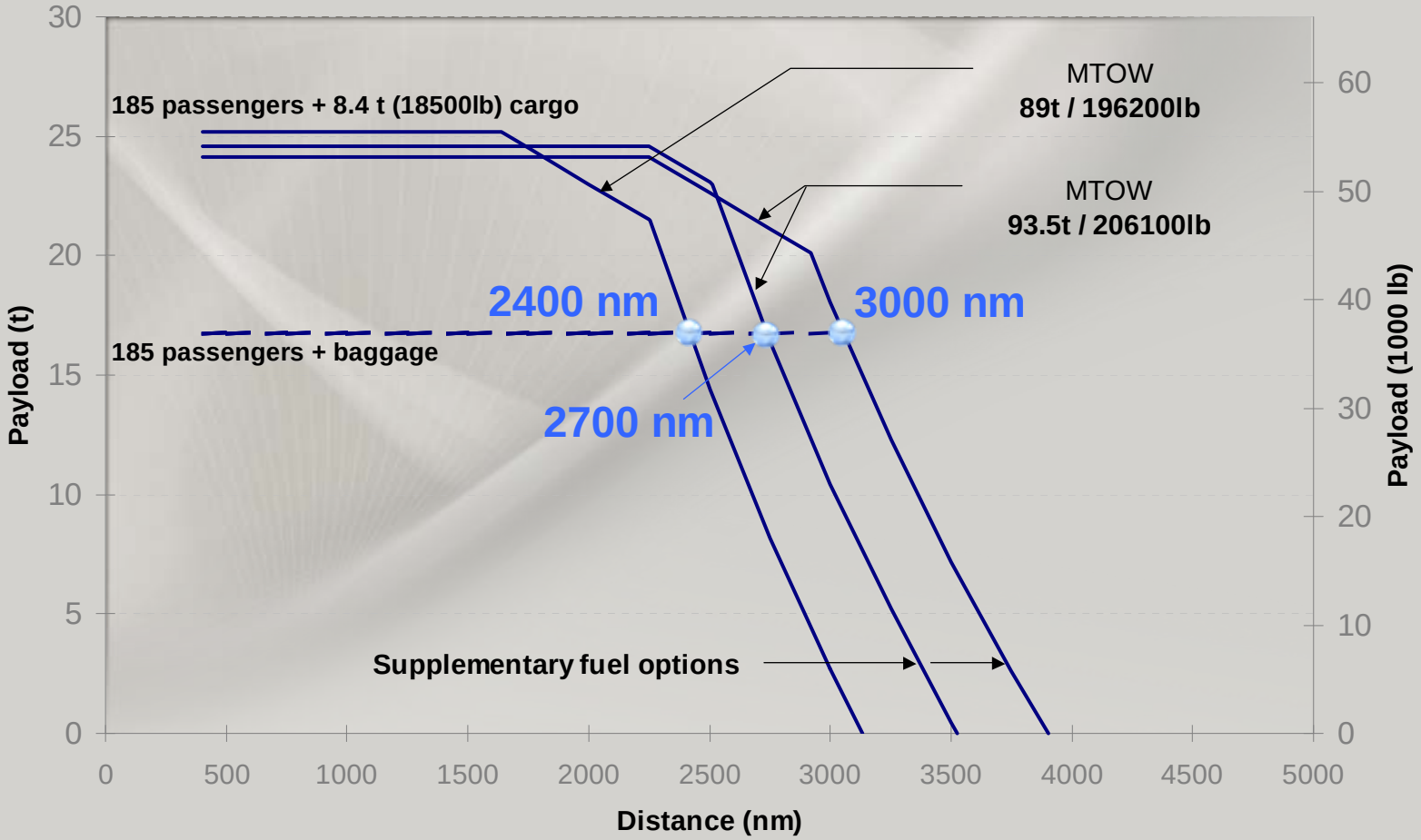


A321 range capability

IAE engines

JAR3% flight profile

200nm alternate



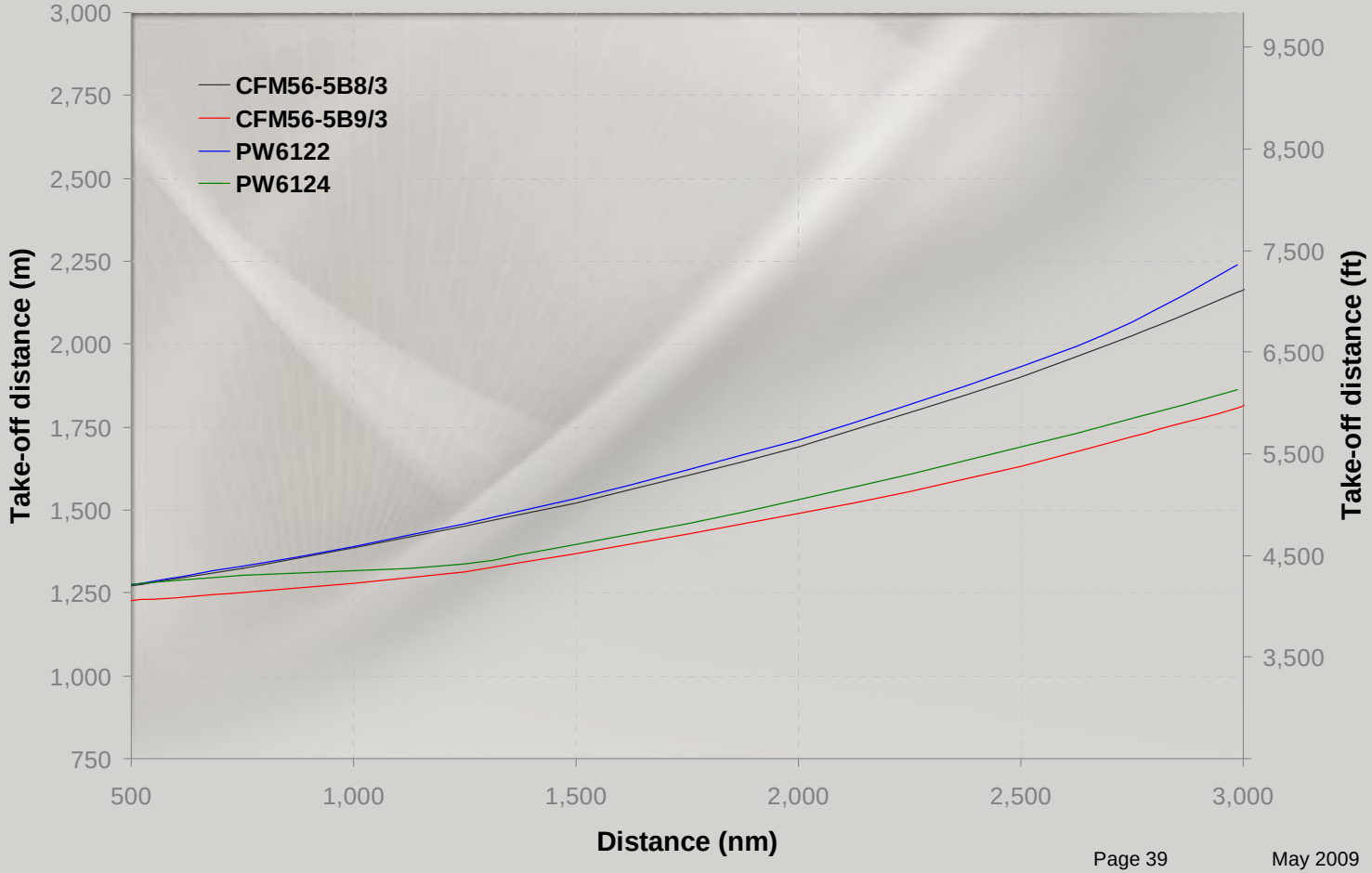
A318 Take-off performance

Sea level, ISA+15°C

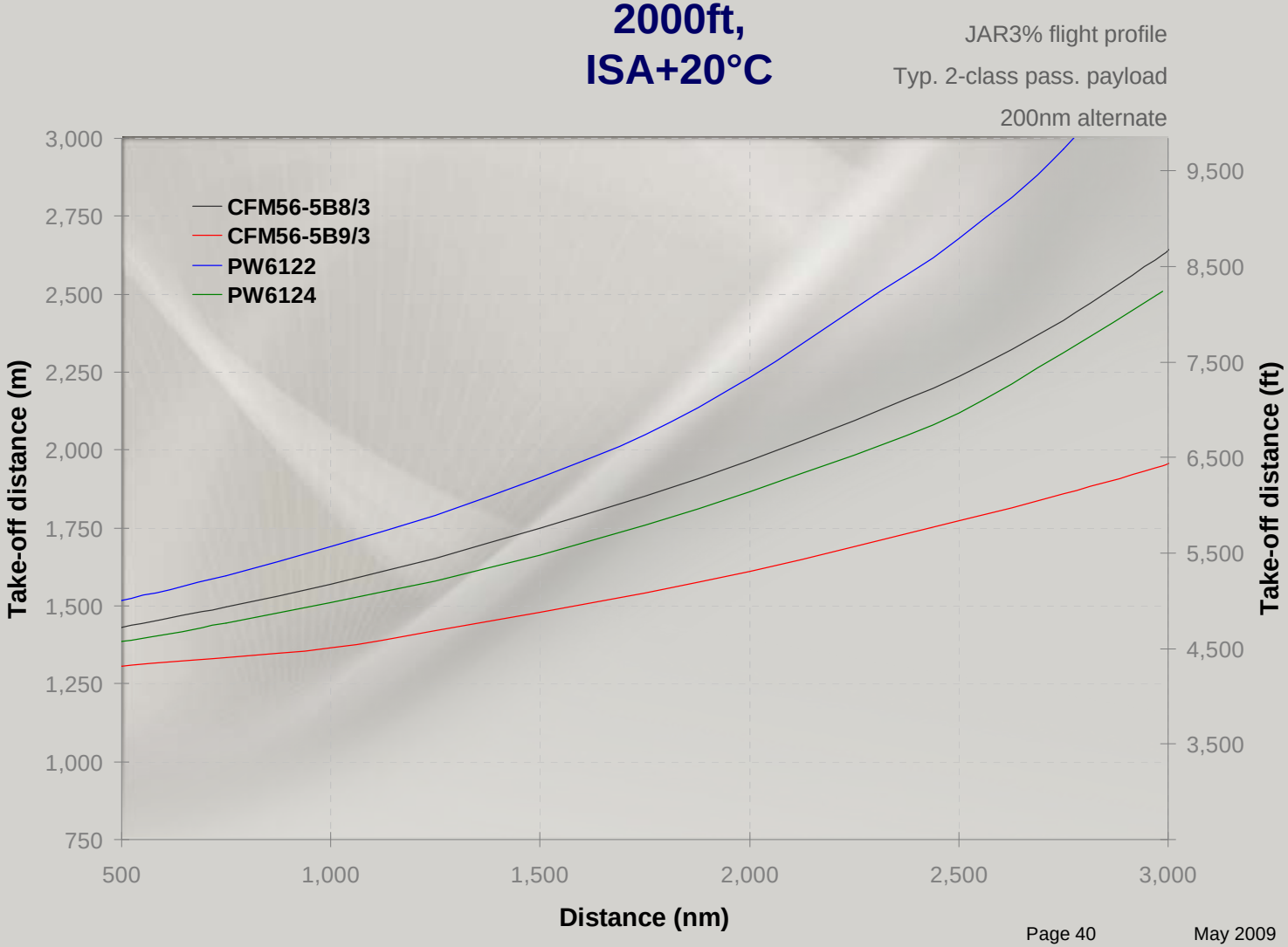
JAR3% flight profile

Typ. 2-class pass. payload

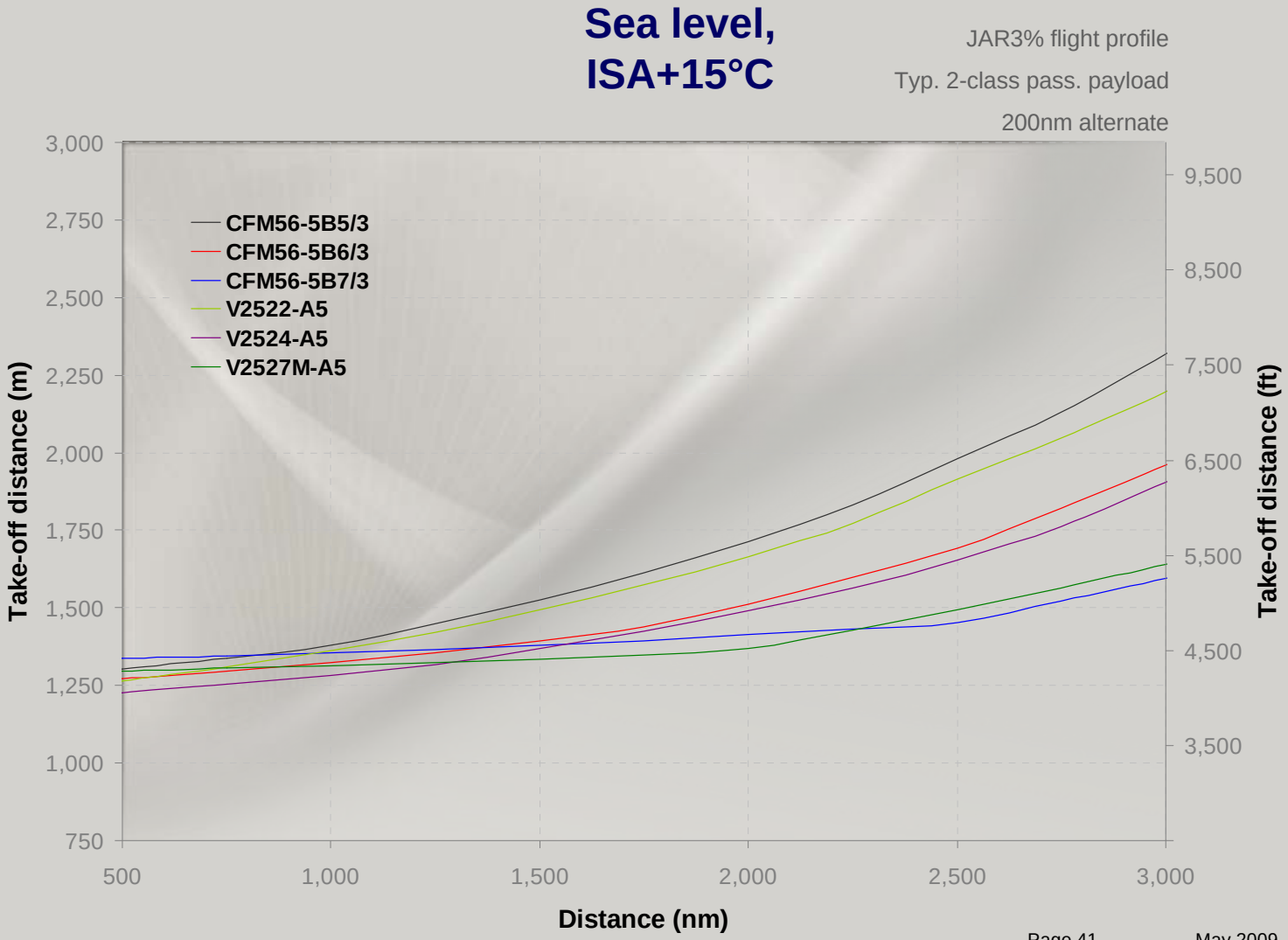
200nm alternate



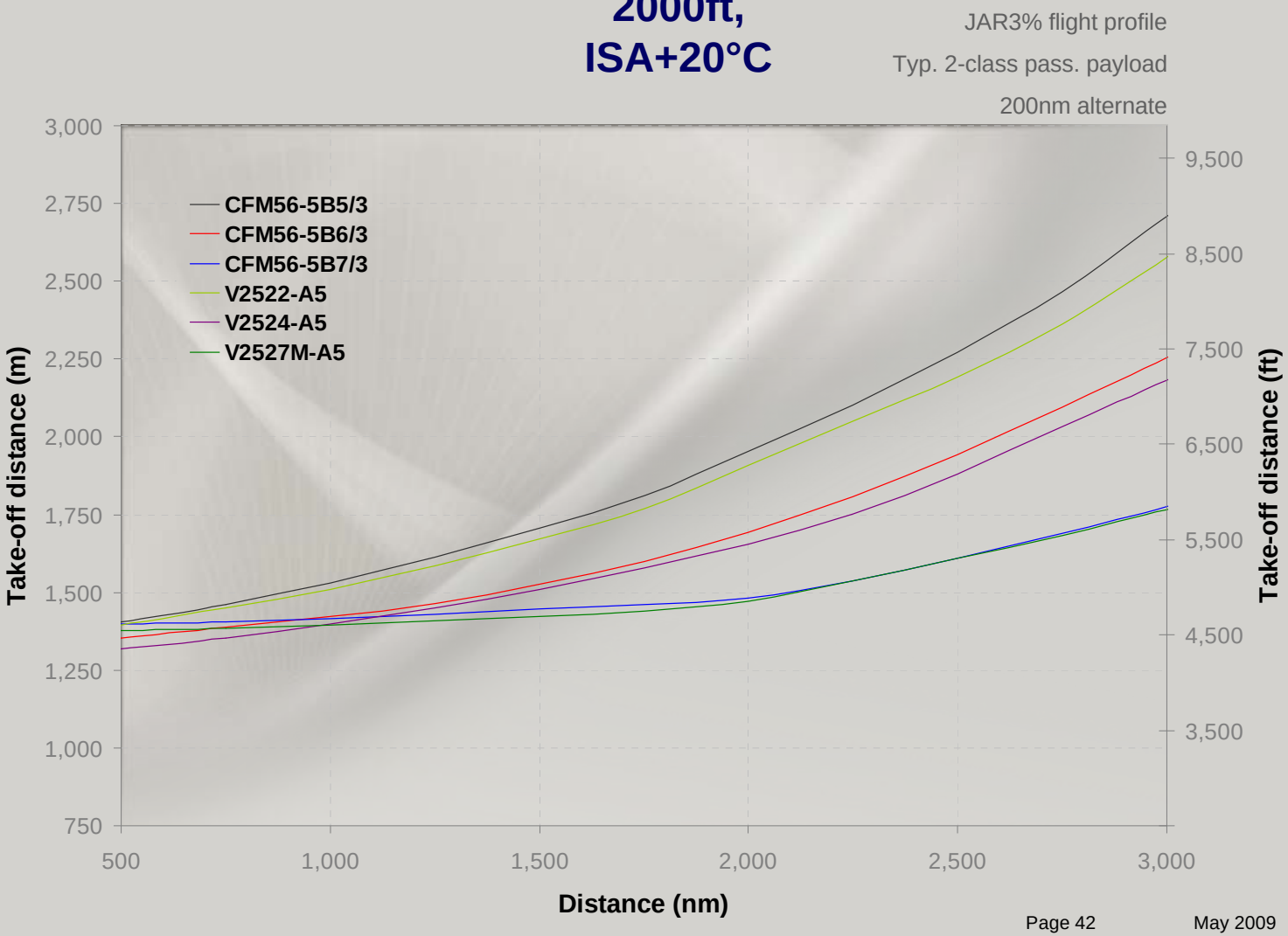
A318 Take-off performance



A319 Take-off performance



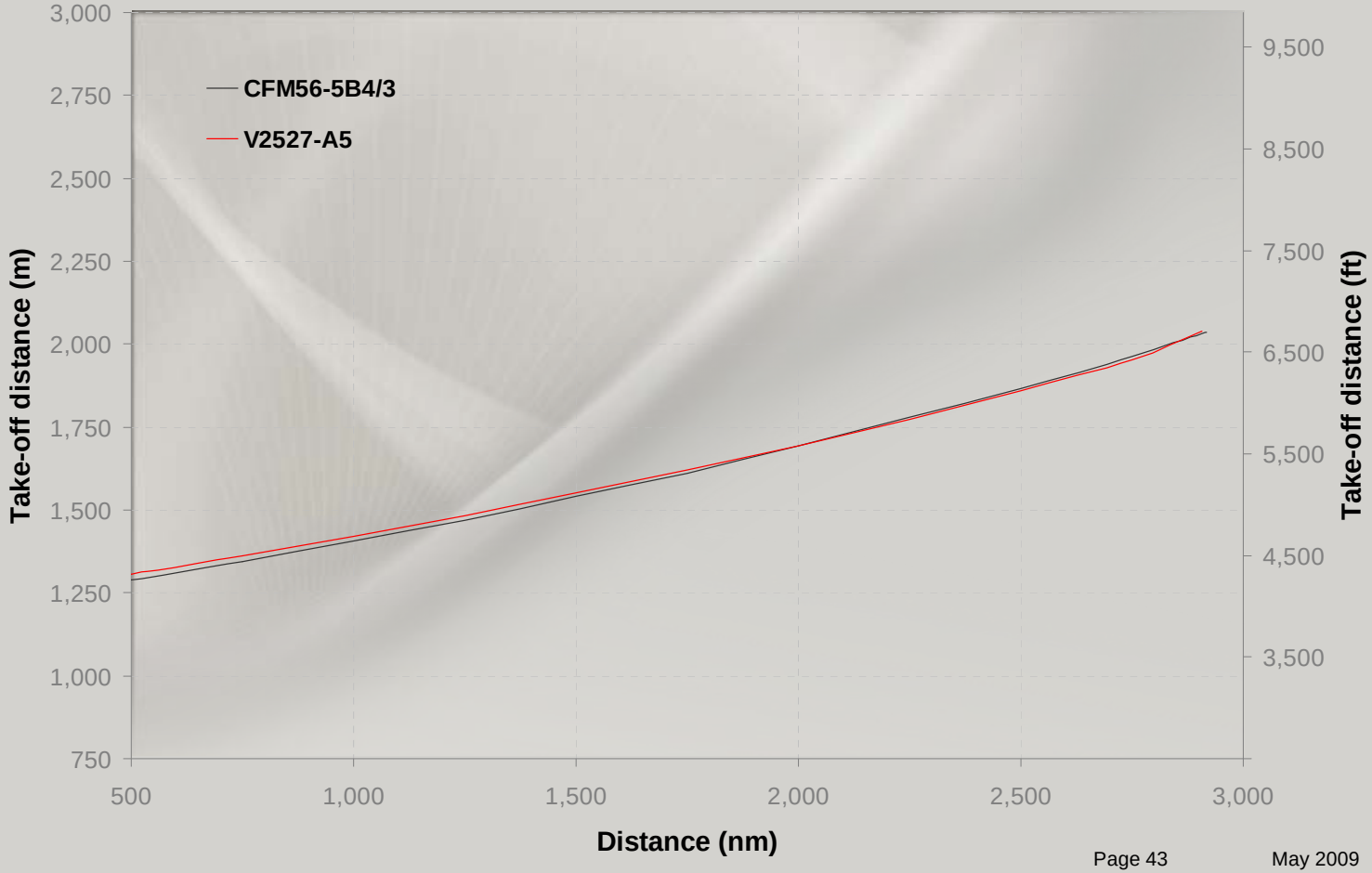
A319 Take-off performance



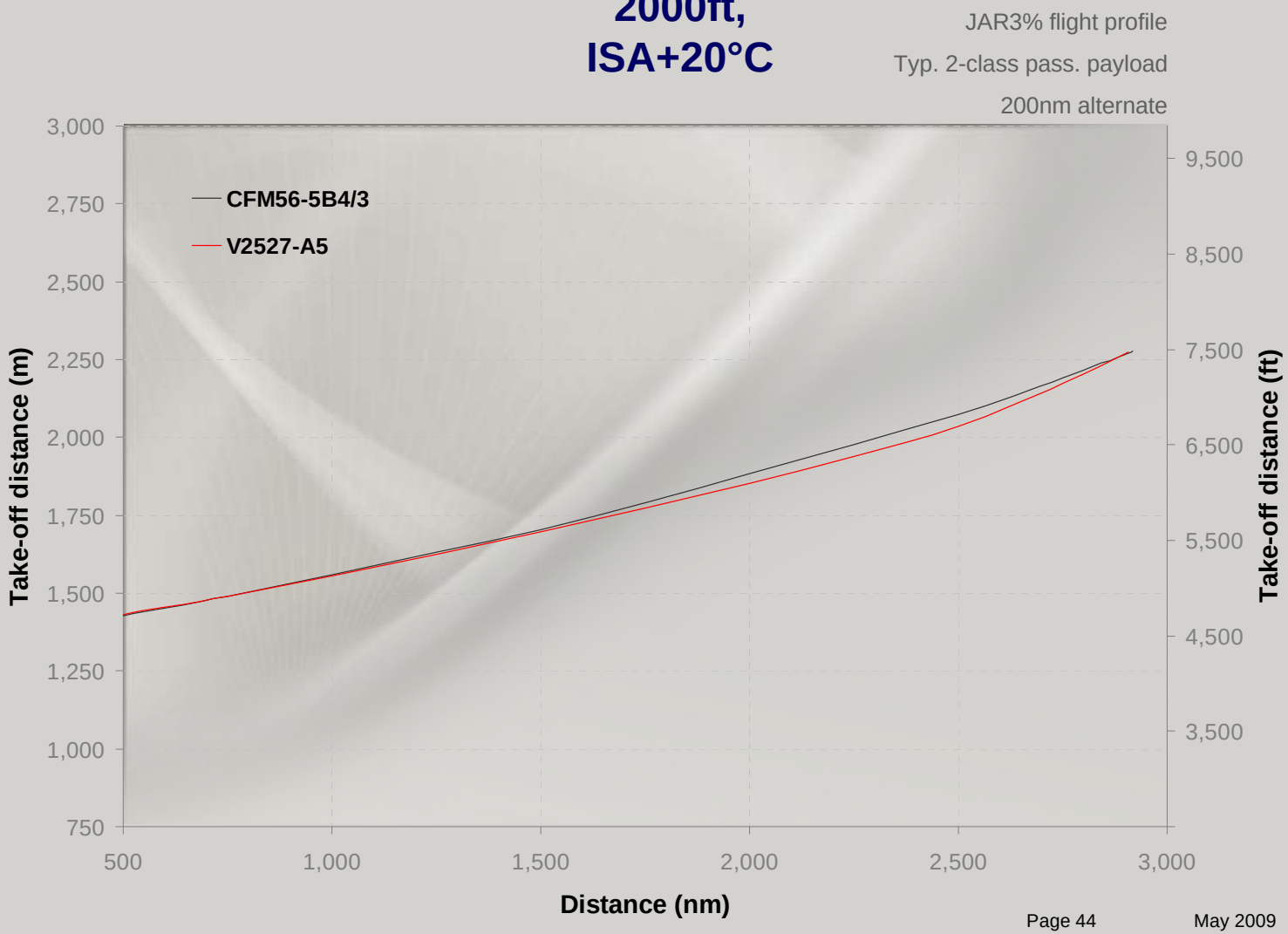
A320 Take-off performance

Sea level, ISA+15°C

JAR3% flight profile
Typ. 2-class pass. payload
200nm alternate



A320 Take-off performance



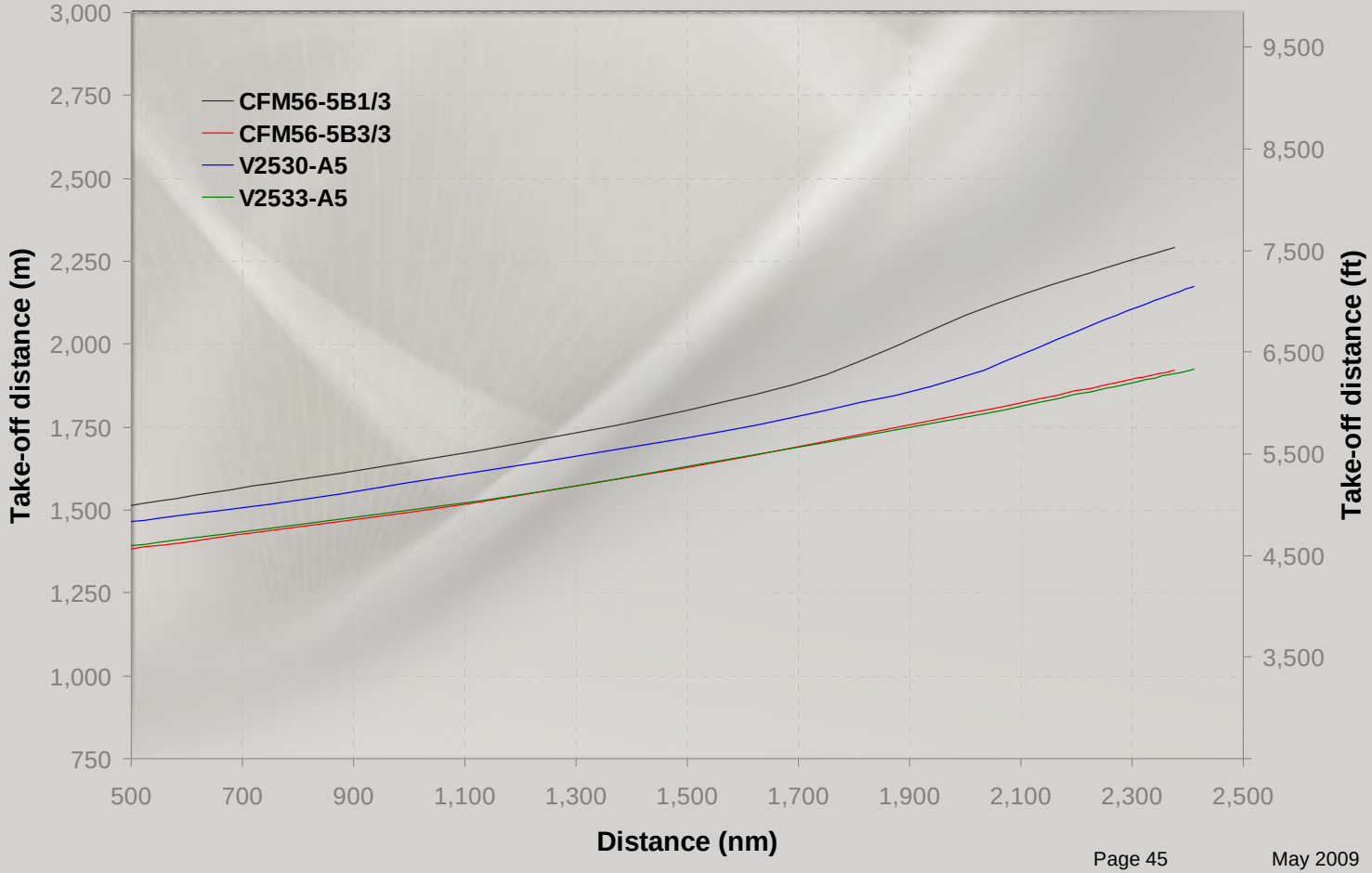
A321 Take-off performance

Sea level, ISA+15°C

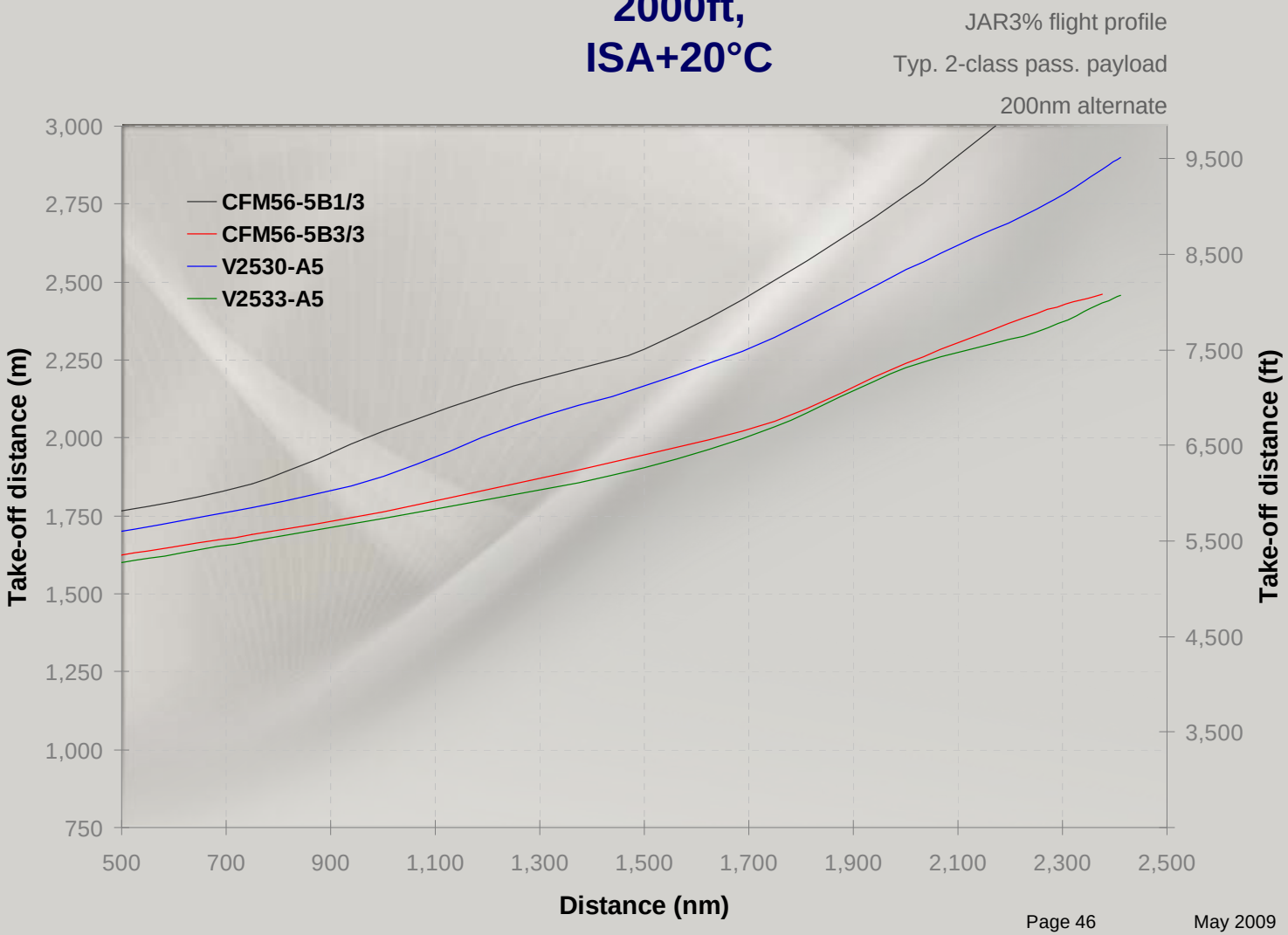
JAR3% flight profile

Typ. 2-class pass. payload

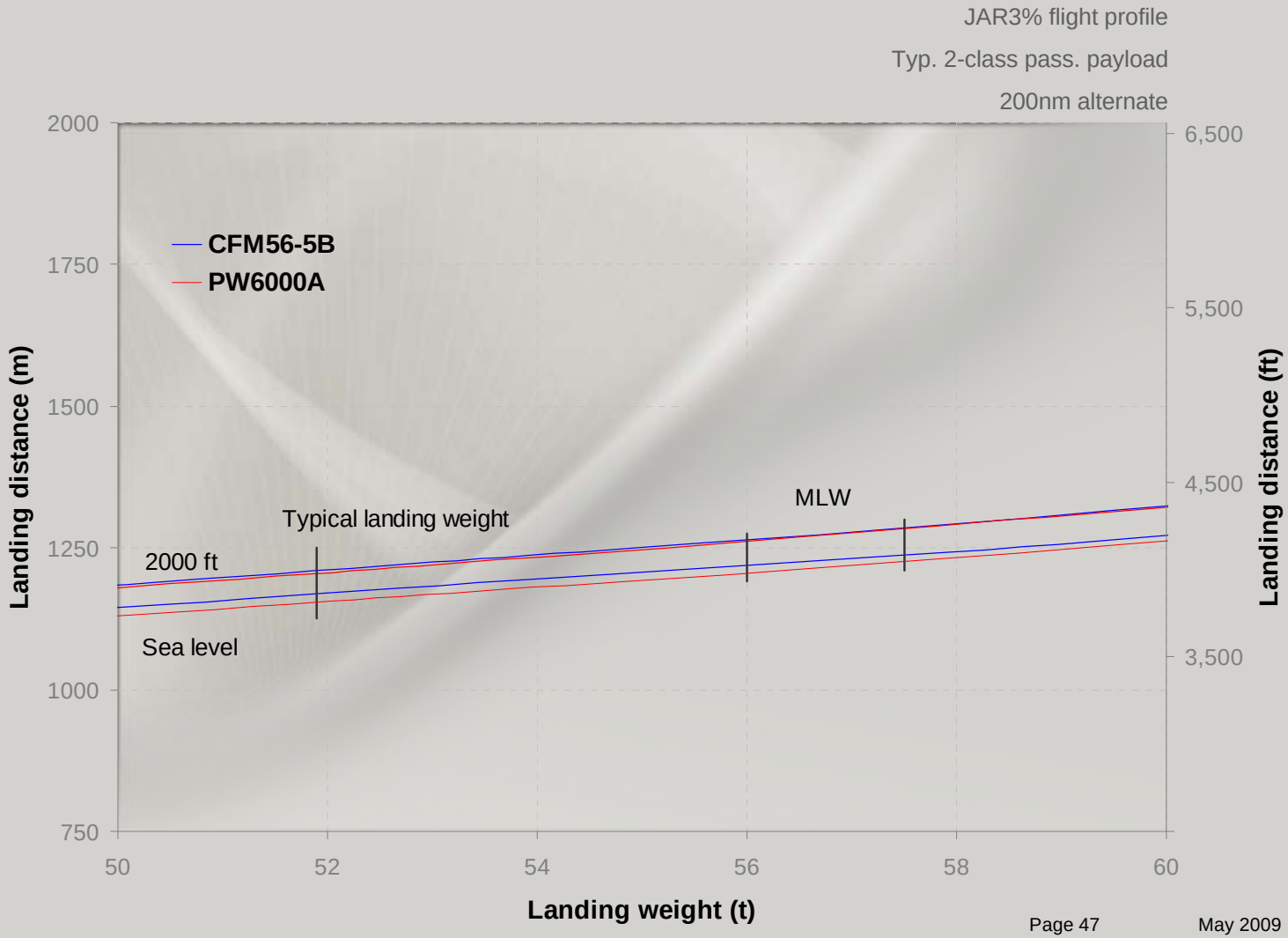
200nm alternate



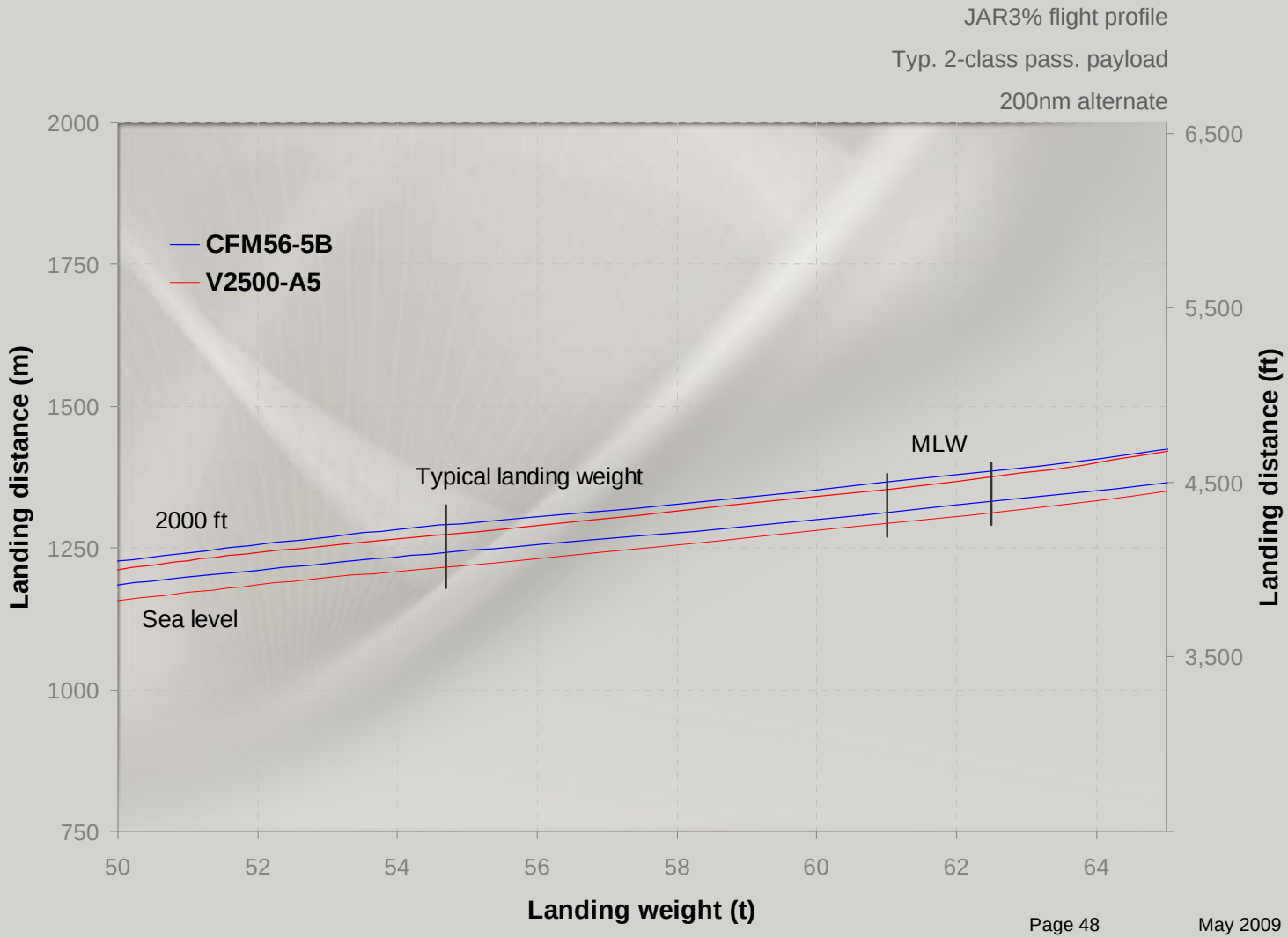
A321 Take-off performance



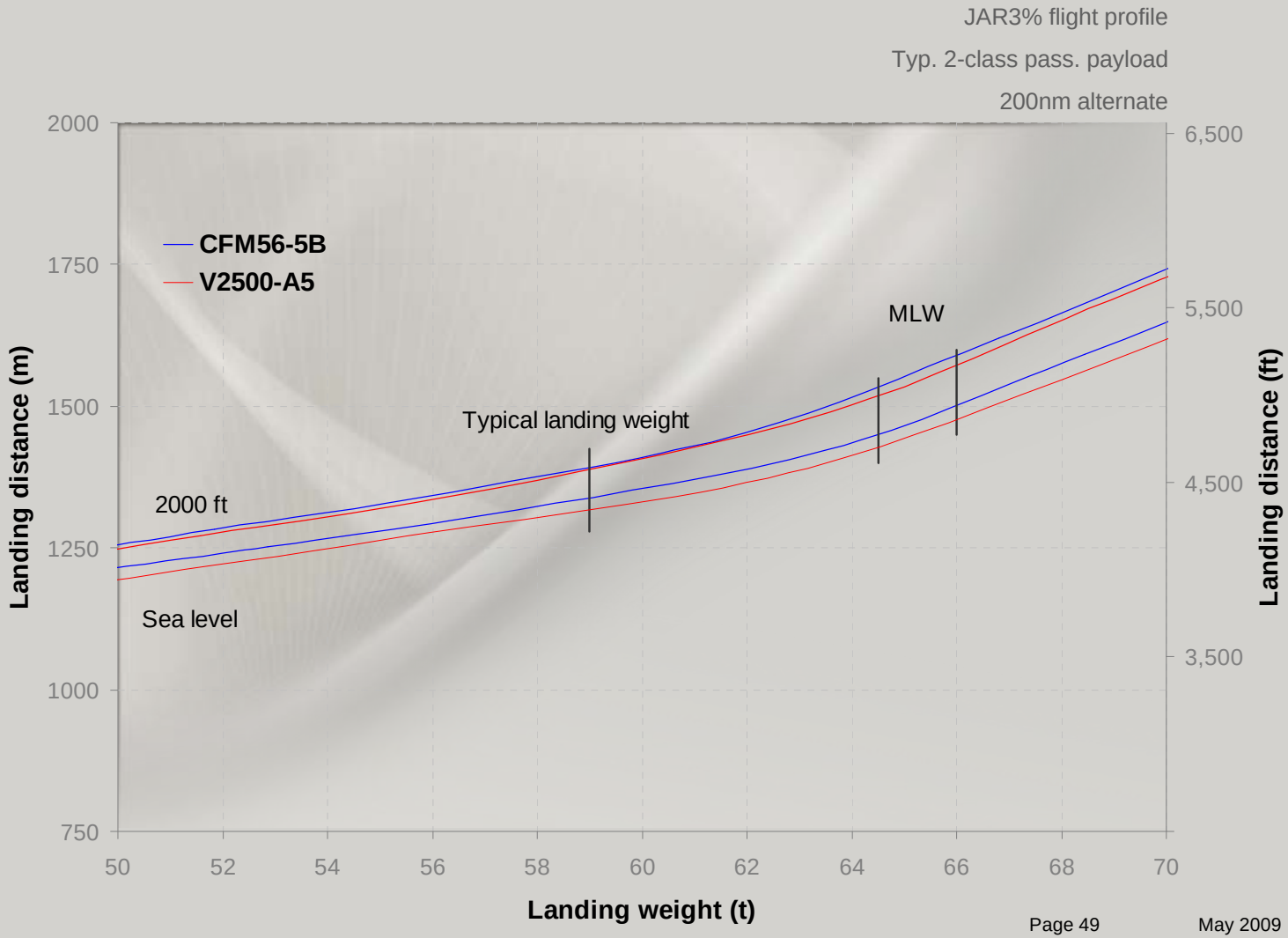
A318 Landing performance



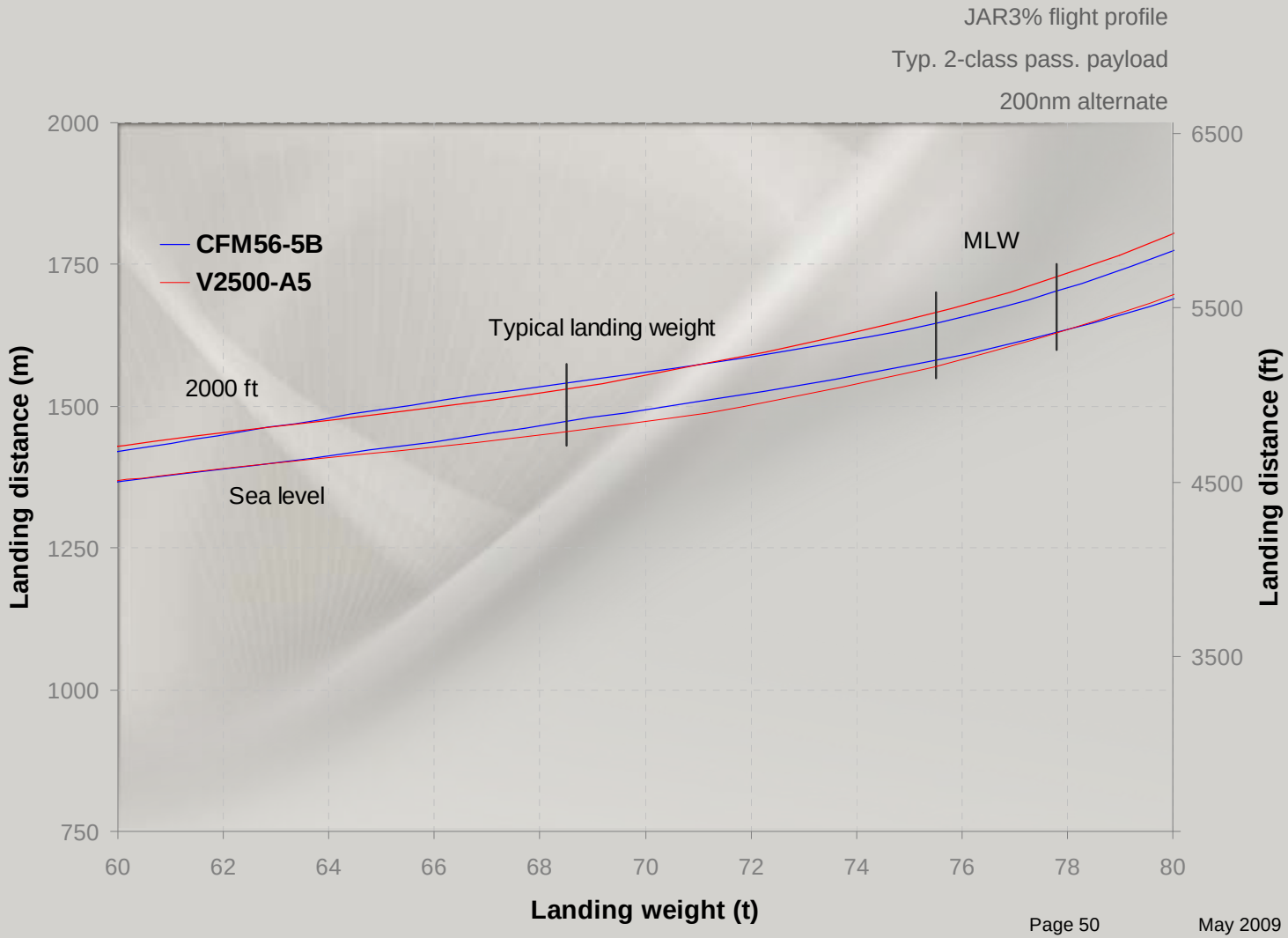
A319 Landing performance



A320 Landing performance



A321 Landing performance



Assumptions

Performance assumptions ("typical airline" rules)

- Weight standards: OWEs are to "typical airline" assumptions including an allowance for cabin changes and option selection. Cabin layouts are as shown in the cabin section.

- Flight profile: En-route profile includes engine start and taxi-out, take-off, climb, cruise, descent, approach, landing and taxi-in. Sector distance comprises the climb, cruise and descent phases.

- Payloads: Passenger + baggage weights are 90.7kg / 200lb. Volumetric payloads assume an average baggage volume of 3.0ft^3 per passenger, a bulk and ULD loadability of 85% and cargo with an average density of 10ft^3.

AIRBUS S.A.S.
31707 BLAGNAC CEDEX, FRANCE
REFERENCE CSMS_PR0907198_V1
May 2009
PRINTED IN FRANCE