

# DASSAULT AVIATION Mirage F1 in Falcon 4.0. Free Flacon 3



**WARNING:** Information included in this document are not related to any "Real Life" planes, but only to the flight model (FM) built to be used in the Falcon 4.0 simulator, excepted those indicated in blue, that are extracted from the DASSAULT Mirage F1 Flight Manual AIRCRAFT OPERATING INSTRUCTION (1F-F1K50CZ-1-1) published by FLIGHT-MANUAL-ON-CD Ltd (Wellington New-Zealand). This flight model has been built only from public data, it does not refer to any classified nor confidential information.

Special thanks to Jojo (C6) for the weapon section, and to all testers and reviewers

## **General Description.**

The Mirage F1 is the successor of the Mirage III, but it radically change the aerodynamic configuration, from a pure Delta to a more classical wing with high efficiency flaps devices, while the power plant remain based on the SNECMA ATAR 9, even in an upgraded version (9K50 instead of 9C).

Born as a high altitude interceptor with Mach2+ capacity (F1-C) it has moved to Air To Ground and Reco mission in the French Air Force.

Export versions are numerous, and not so different from the first generation of French F1.

## ***Versions***

First generation used in French Air Force:

- Mirage F1 C-100 : single seat without Air refueling capacity
- Mirage F1 C-200 : single seat with Air refueling capacity
- Mirage F1 B : two seat without Air refueling capacity (Training)

Export versions:

- Mirage F1 AZ : single seat Tactical version for South Africa
- Mirage F1 CZ : single seat Interceptor version for South Africa

Last generation used in French Air Force:

- Mirage F1 CR : single seat Reco version
- Mirage F1 CT : single seat Tactical version

## **Basic data**

- Dry weight : 7,845 kg / 17,320 lbs (F1-CZ)
- Shell : 300 lbs
- Pilot : 209 lbs
- Total weight without fuel : 17,830 lbs
- Internal Fuel Capacity : 3,397 kg / 7,500lbs
- Reference Area : 25.00 m<sup>2</sup> (272 sq.ft)
- Max Mach Number : 2.1
- Max Indicated Air speed (VNE) : 700 Kts, under FL200, 750 above
- Ceil: 55,000 ft
- Max. Load Factor : +7.2 / -3.0G (M < 1.0); +6.0/-3 (M > 1.0)

### Engine SNECMA ATAR 9K-50

- Static Dry Thrust : 48 kN (10,700 lbs)
- Static AB Thrust: 68 kN (15,350 lbs)

Radar: Thomson CSF Cyrano IV for F1-C (Interceptor versions), providing RWR, STT mode (no TWS) and Auto-Lock (ACM) with 3 sub modes (15x15, 30x15 and screw). Range and performance are unknown.

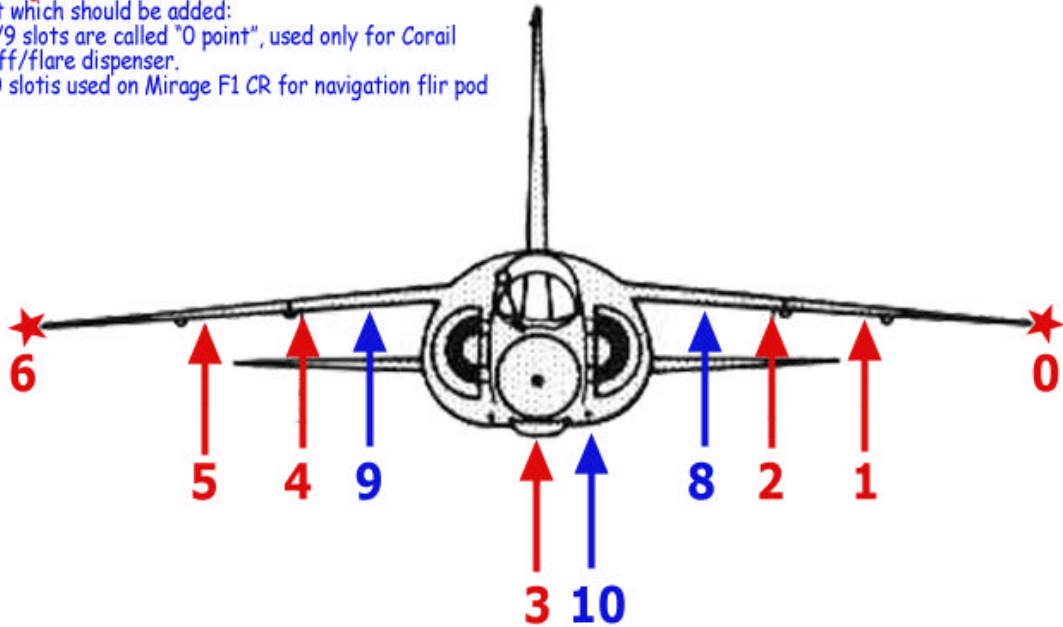
## Weapon Loads

**Existing slot**

Slot which should be added:

\* 8/9 slots are called "0 point", used only for Corail chaff/flare dispenser.

\* 10 slot is used on Mirage F1 CR for navigation flir pod



Hard point	6	5	4	9	3	10	8	2	1	0
Max weight (kg)	127	500	1270	?	2040	?	?	1270	500	127
<b>Various pod</b>										
Barax (jammer)									1	
Phimat (chaff)		1								
Corail (chaff/flare) <i>250 chaff, 120 flare or arrangement of both.</i>				1			1			
FLIR (F1 CR)						1				
Atlis (F1 EQ)					1					
TV laser targeting pod										
<b>Air to air weapons</b>										
Matra R 530 (RF/IR) <i>2 or 1 carried, not 3</i>			1		1			1		
Super 530 F			1					1		
Magic 2	1									1

<b>Air to ground weapons</b>									
Mk 82		1	2		4			2	1
Gbu-12			1					1	
Blg-66 Belouga		1	1		2			1	1
BLU-107 Durandal		1	1		4			1	1
SAMP 400		1	1		4			1	1
AM 39 Exocet (F1 EQ5)					1				
AS 30 L (F1 EQ)			1					1	
Bgl 250 (F1 EQ)			1					1	
Bgl 400 (F1 EQ)			1					1	
Bgl 1000 (F1 EQ)			1					1	
Matra F1(36x68 mm rockets)			1					1	
Matra F4(18x68 mm rockets)		1	1					1	1
100mm rockets			4					4	
BAP 100 (anti-runway)			18		18			18	
BAT 120			18		18			18	
MARTEL					1				
<i>If you really want an ARM missile</i>									
<b>Fuel tanks</b>									
1200 l			1		1			1	
2200 l					1				

- Internal Gun: two 30.00mm DEFA with 125 rounds each.
- 3 wet load points
- F1 are GBU/BGL capable, but French FA-CT &CR are not able to hold the Laser designation Pod, that means than an other designation device (airplane or other) is necessary, so my recommendation in Falcon is not to use precision weapon with French Mirage F1 (Laser bomb delivery under external designation is not possible in F4). In the other hand, Iraqis F1 hold ATLAS pod at load point 3, allowing autonomous GBU handling.

## Typical weapon loads

Typical weapon loads										
Hard points	6	5	4	9	3	10	8	2	1	0
ECM and self defense weapons (almost mandatory whatever the mission is)										
Barax				1					1	
Phimat		1		1						
Corail*				1			1			
Magic 2	1			1						1
Air defense										
Super 530 F (1200 l fuel tank)			1	1					1	
R 530 (1200 l fuel tank)			1	1					1	
R 530 (1200 l fuel tank)				1						
R 530 (1200 l fuel tank)			1	1					1	
CAS										
Mk 82/Samp 250/Samp 400 Fuel tank (1200 l or 2200 l***)			1	1					1	
Mk 82 (Rafaut AUF 2**) Fuel tank (1200 l or 2200 l***)			2	1					2	
Mk 82/Samp 400 1200 l fuel tank				4						
Blg-66 Belouga Fuel tank (1200 l or 2200 l)			1	1					1	
Blg-66 Belouga 1200 l fuel tank				2						
			1	1					1	

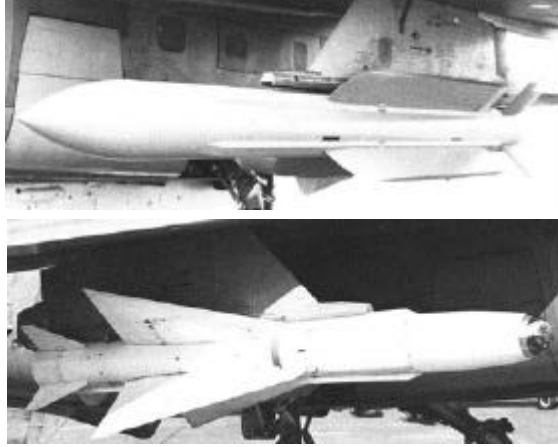
\* Available on Mirage F1 CR/CT/AZ.

\*\* Rafaut AUF 2 twin bomb adaptator is specific to french Mirage F1 CR/CT.

\*\*\* 2200 l fuel tank is available only on French and Iraqi Mirage F1.

## ***Pylons***

Air to air missile rail: used on hardpoints 2 and 4 for Super 530 F and R 530



Alkan 915 (hardpoints 2,4) AG weapons and fuel tanks:



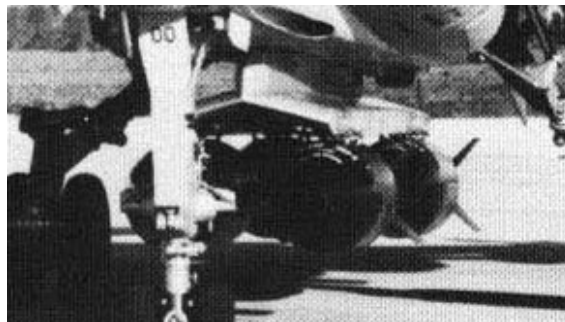
Alkan 910 (hardpoint 3) AG weapons and fuel tanks:








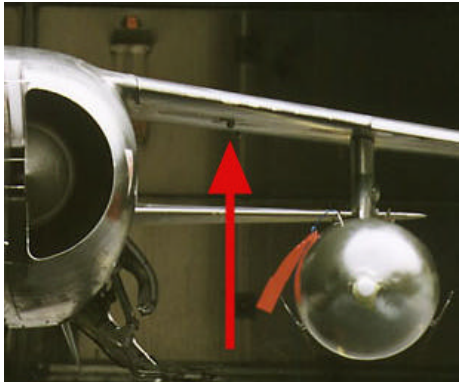
Rafaut AUF 2 (here with 2 Gbu-12 on Mirage 2000 D), mounted beneath Alkan 915:



4 bombs pylon: used for Mk 82 x4, Samp 250/400 (on the photo) x4, BLU-107 Durandalx4, Blq-66 Belouga x2

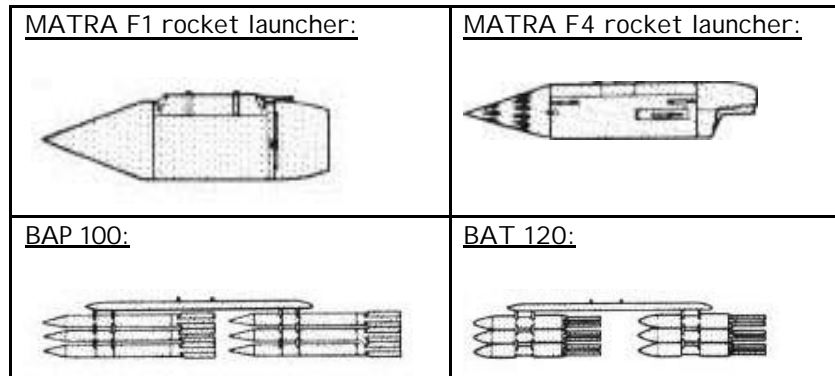


## Pods

<p><b><u>Barax</u></b> (jammer):</p> 	<p><b><u>Phimat</u></b> (chaff dispenser):</p> 
<p><b><u>Atlis</u></b> (TV laser targeting pod):</p> 	<p><b><u>Flir</u></b></p> 
<p><b><u>Corail</u></b></p> 	<p><i>Corail pod should be mounted here</i></p> 



## ***Air to ground weapons***



## Flight Model

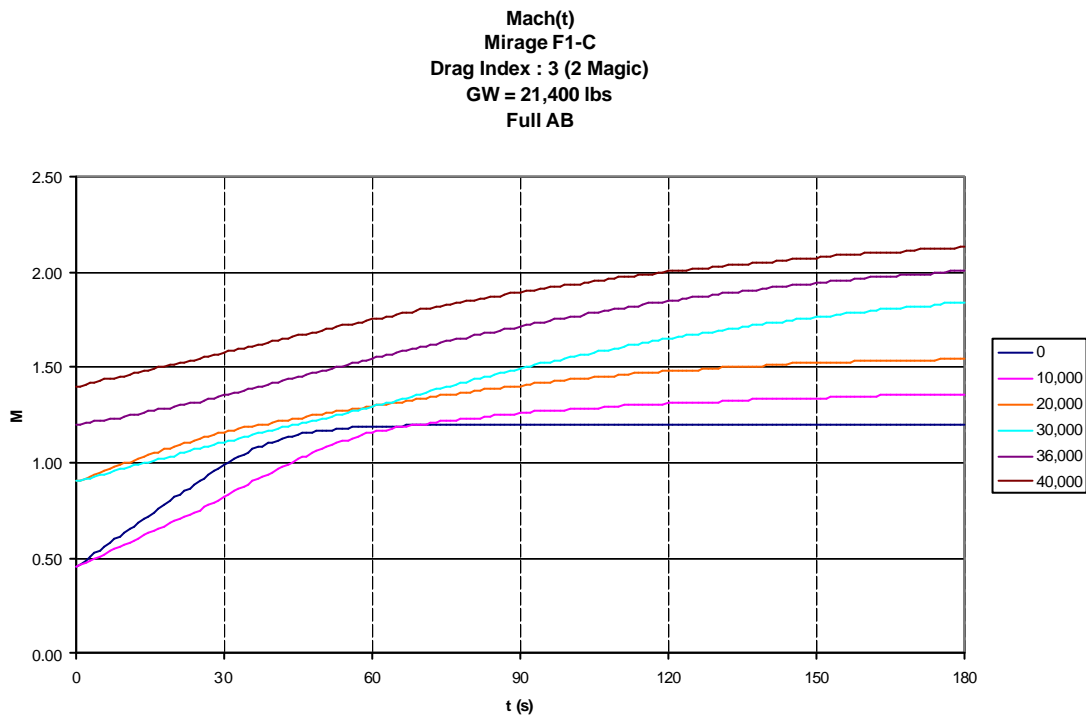
### 1G Acceleration table

#### Real Life data:

Clean configuration (DI=0), 50% internal fuel, sea level:

- Full AB from 300Kts to 450Kts in 10-12 sec. (Computed : 13 s with 2 R550 at sea level)
- Full AB from 400Kts to 655Kts speed increase of 15Kts per sec. (Computed : average speed increase of 11.5 Kts/s with 2 R550 at sea level between 404 and 657 Kts in 22s)

Set of curves giving Indicated speed or Mach number along time from horizontal flight at M=0.9, then switch to Full AB



## Mach number versus Angle of Attack

### Real Life data:

Clean configuration (DI=0), GW=22,045 lbs, sea level:

- 7,300 rd/min (80% MIL) 300 Kts (M=0.45), AoA=5.0 (Computed 5.11)
- 7,500 rd/min (85% MIL) 350 Kts (M=0.53), AoA=3.0 (Computed 2.99)
- 7,750 rd/min (90% MIL) 450 Kts (M=0.68), AoA=2.0 (Computed 1.99)
- 8,400 rd/min (100% MIL) 625 Kts (M=0.95), AoA=0.75 (Computed 1.08)

Clean AoA=7.0 (CL/CD=10)

GW=22,045 lbs, 10,000 ft => 270Kts(IAS) (M=0.49)

GW=22,045 lbs, 30,000 ft => 280Kts(IAS)

GW=19,840 lbs, 10,000 ft => 255Kts(IAS)

GW=19,840 lbs, 30,000 ft => 265Kts(IAS)

Combat Tef&Lef, AoA=7.5 (CL/CD=8.5)

GW=22,045 lbs, 10,000 ft => 255 Kts (IAS)

GW=22,045 lbs, 30,000 ft => 265 Kts (IAS)

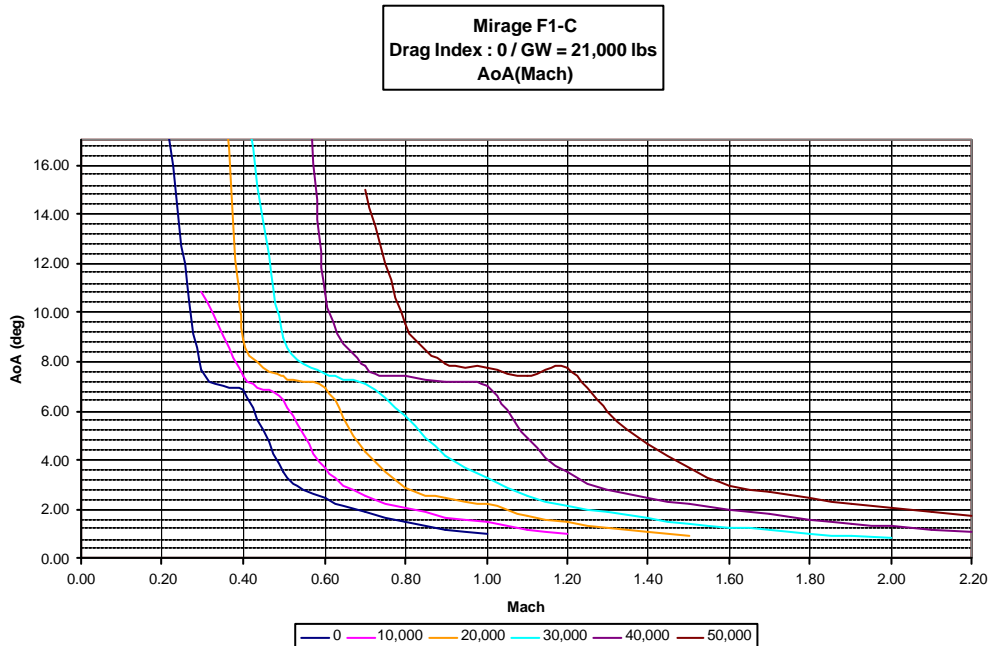
GW=19,840 lbs, 10,000 ft => 245 Kts (IAS)

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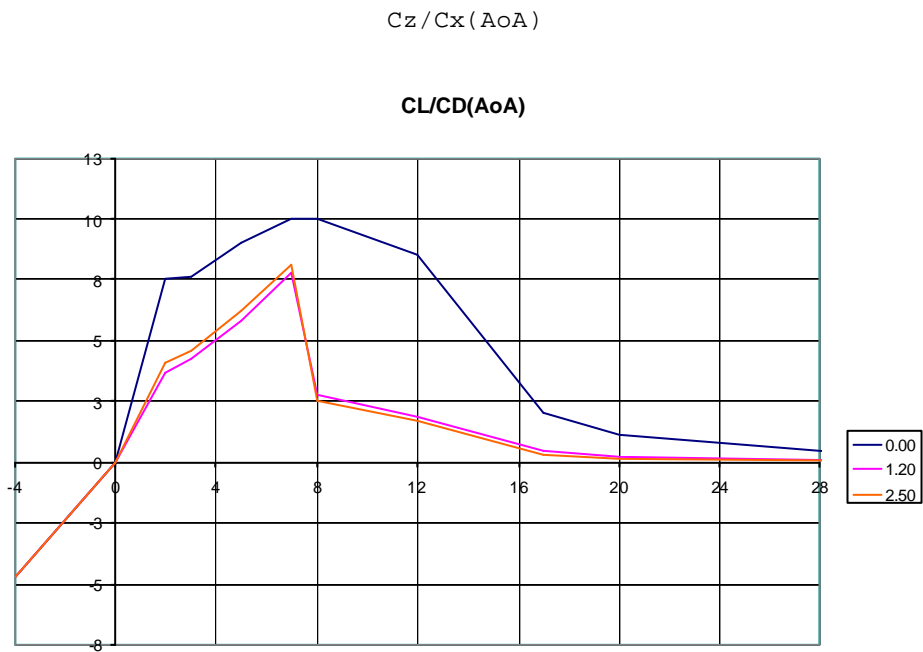
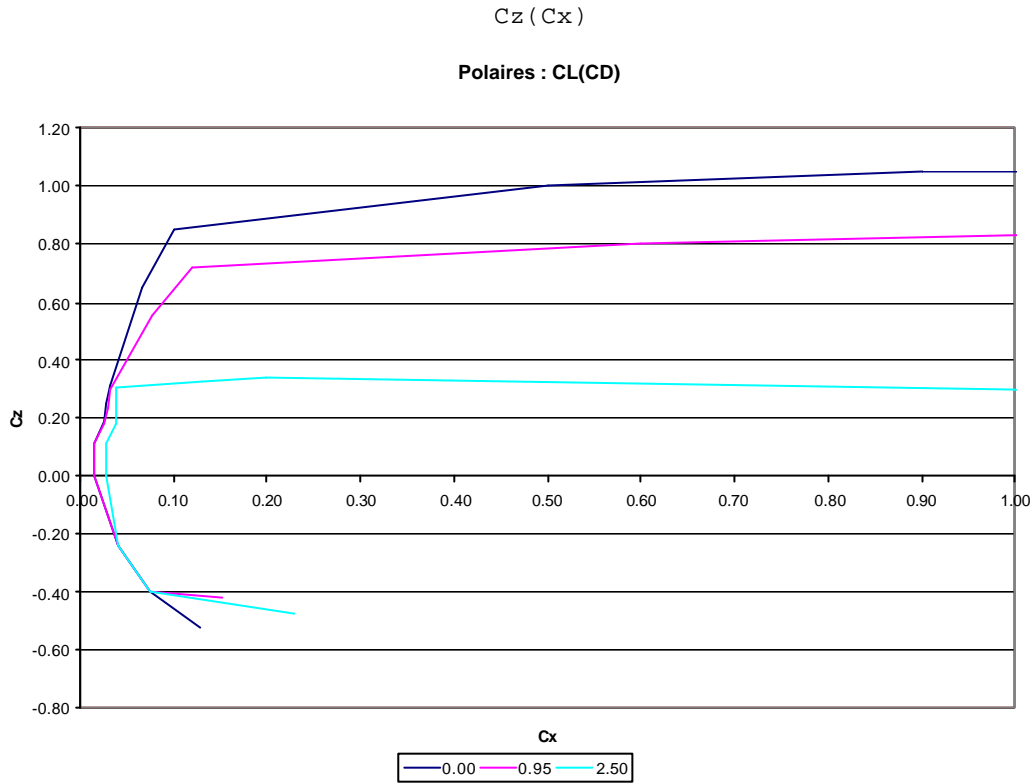
All Down GW=19,290 lbs, AoA=9.5 (CL/CD=4.5) 150Kts(IAS) at 1,500 ft,

Set of curves giving Mach number versus Angle Of Attack, at stabilized flight level (1G), 50% internal fuel, no external load, for a given altitude (from 0 to 50,000 ft, step 10,000 ft)

a) Clean Configuration (50% Internal Fuel)



## Aerodynamics coefficients



## **Acceleration and Angle of Attack Limitations**

Max values of AoA (in degrees) recommended is 17 degree in subsonic configuration (15 if Mach > 1.00), providing best turn rate.

Lift is no more increasing when AoA get higher than 20 degrees and automatic Pitch limiter keep incidence lower than 23 degree. Stall is quite impossible to reach in symmetrical condition.

Maximum Acceleration (G) in subsonic domain is 7.2G for light configurations (CAT-I), this limit is decreased to 6 when Mach number goes higher than 1.0.

A technical review of the airframe is required if G-load exceed 11G, but structural limit seems to be around 14G. Maximum reported G-Load in real life is 17G !

## **Flaps and Slats management**

Flaps (Tef) are managed manually for the Mirage F1, the Flacon FM's provide 4 Flaps positions:

- Full Up 0°
- Combat 9°
- Take Off 18°
- Land On 27°

Increase Flaps angle of one step is done by using Crlt+F12, decrease of one step by Ctrl+F11, set directly to full up is done key in by Ctrl+F9 and to full Down by Ctrl+F10.

Slats are managed automatically in flight (like the real F1 with "AUTO SLAT ON" engaged), they are activated when incidence is more than 7.5 degrees, all performance curves are computed with Flaps full up and "AUTO SLATS ON". WARNING, Lef status displayed on top left of the screen does not reflect aerodynamic Slats effect, ignore it.

## **Take Off Configuration**

### Real Life data:

*Clean configuration (DI=0), Tef and Lef Full Down, 100% internal fuel, Full AB Thrust:*

- *From 0 to 130Kts, acceleration is around 0.5G, i.e. speed increase of 7.5 Kts per sec.*
- *Time to reach 100Kts : 11s*
- *Time to reach 150Kts : 15s*
- *Stabilized speed at 200Kts, AoA=4.5 degrees, climb angle of 14 degrees (gear up)*
- Set Flaps to 18 degrees (should be done automatically),
- Set slats to 20 degrees ((should be done automatically),
- Increase thrust to Minimum After Burner with brakes locked,

- Release brakes and increase thrust to Maximum After Burner
- When speed reach 120-140 Kts (depending on weight), rotate
- Plane is airborne between 150 and 170Kts,
- Retract under carriage and keep slats and flaps down, increase speed to 200Kts and keep it constant
- Retract flaps and slats (Ctrl+F9 and Alt+F9).

## **Landing Configuration**

### Real Life data:

Clean configuration (DI=0), 50% internal fuel, all down:

- 7,400 rd/min 185Kts AoA=8

All Down GW=19,290 lbs, AoA=9.5 (CL/CD=4.5)

- 150Kts(IAS) at 1,500 ft,
- Set Flaps to 27 degrees (Ctrl+F10).
- Reduce speed to 190-200Kts (RPM 85%)
- Set gear down, keep alignment and speed
- Reduce speed down to 150Kts just before touch down

## **Climb Rate**

### Real Life data:

Subsonic climb schedule:

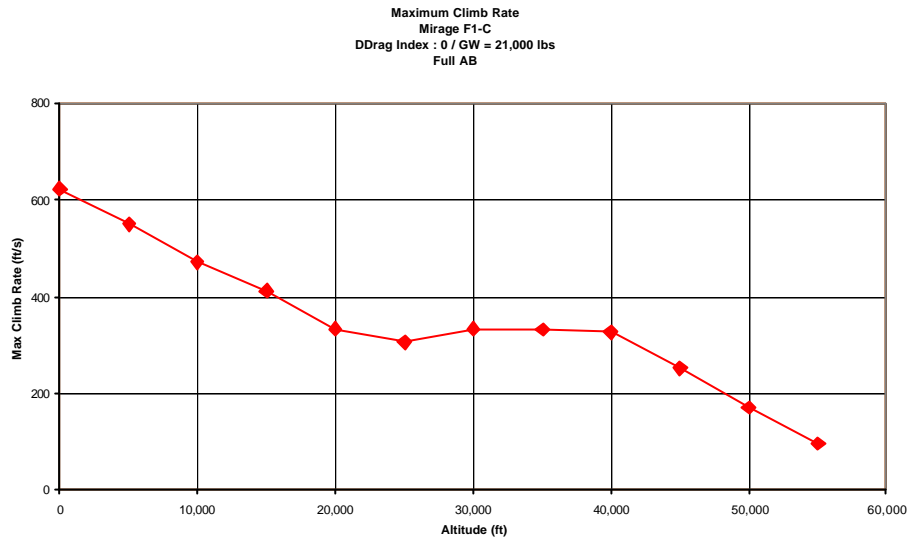
- Clean (or 2xR550) MIL Thrust: 470Kts (M=0.92).
- Clean (or 2xR550) AB Thrust: 500Kts (M=0.95).
- With two RP35 Pylon Tank MIL Thrust: 422Kts (M=0.84).
- With two RP35 Pylon Tank AB Thrust: 470Kts (M=0.92).

Supersonic climb schedule:

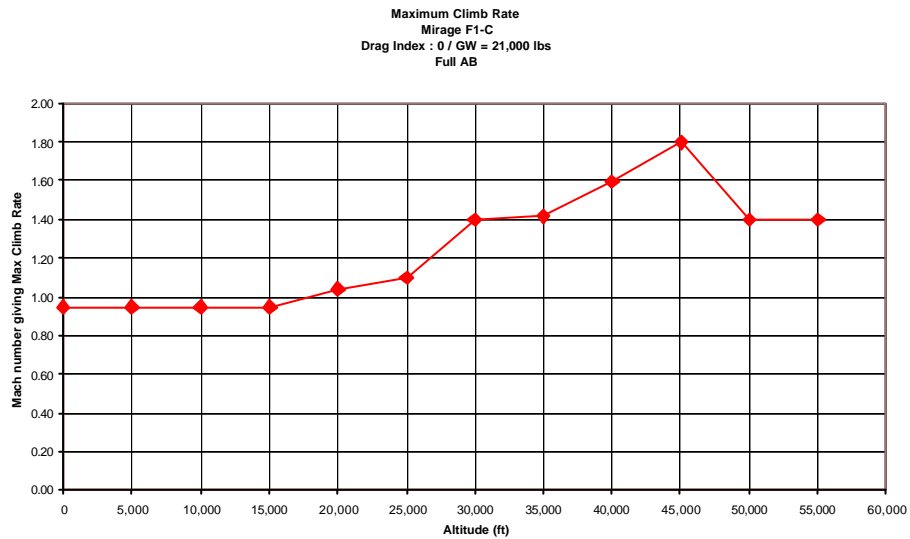
- Use subsonic climb schedule up to 30,000 ft
- At 30,000 ft increase speed up to 650Kts (M=1.65)
- Keep 650Kts and increase altitude until reach M=1.8.
- Keep M=1.8 and increase altitude.

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a) Maximum climb rate in ft/s along altitude, clean configuration, GW=21,000 lbs, full AB.



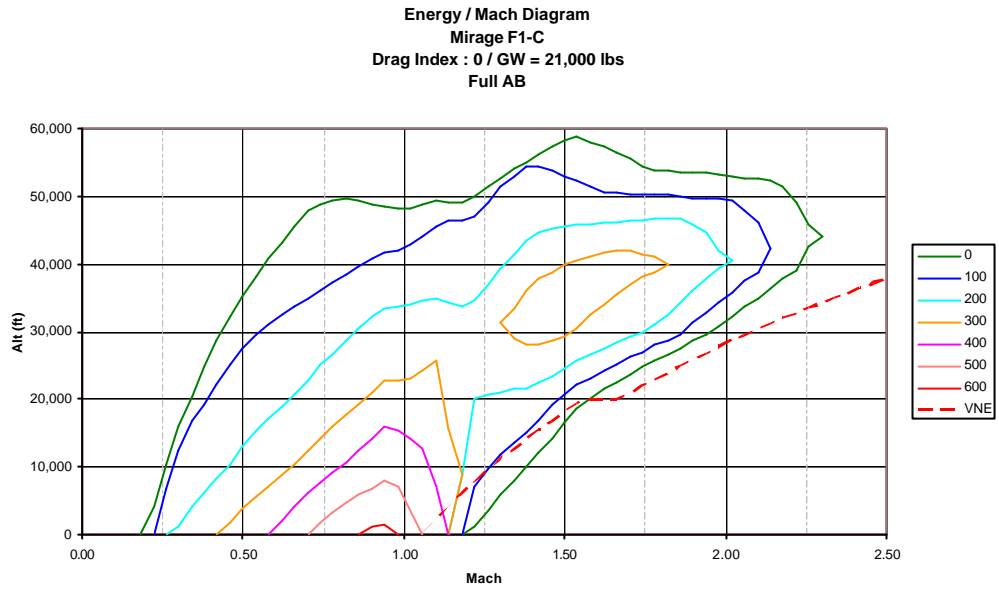
b) Mach number corresponding



## Energy / Mach Diagram

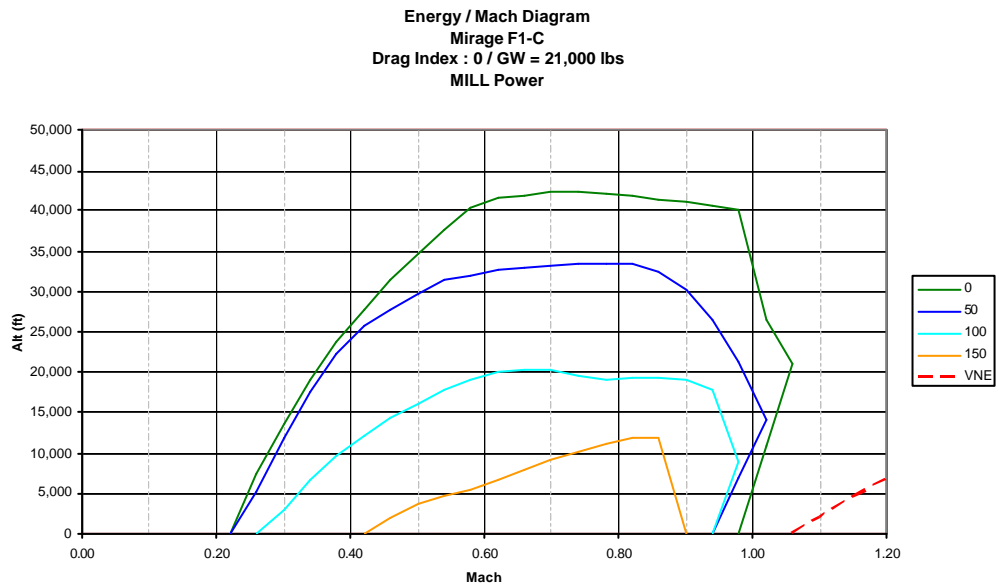
Set Of curves giving minimum and maximum mach number for a given altitude and excessive specific power (Ps)

a) Clean Configuration (50% Internal Fuel, no load, Full AB)



Maximum speed at low altitude is limited by VNE (700Kts), but actual maximum reachable speed (Ps=0) at sea level in such configuration is 800 Kts

b) Clean Configuration (50% Internal Fuel, no load, MIL power)





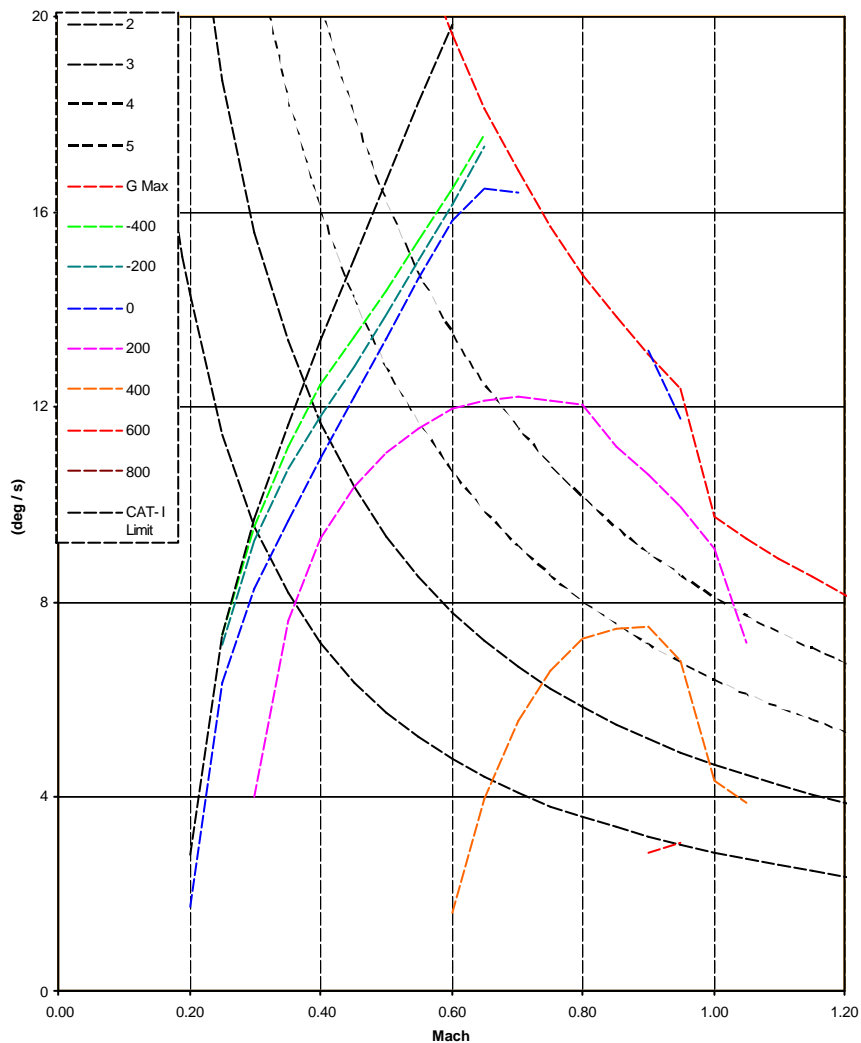
## Turn Rate versus Mach number Diagram

### Real Life data:

Clean configuration (DI=0), 50% internal fuel, sea level:

- 7,700 rd/min (80% MIL) 450 Kts, AoA=1.0, 2G (60 degrees bank) => Ps=0 (speed sustained)
- 8,400 rd/min (100% MIL) 450 Kts, 4G => Ps=0 (speed sustained)
- Full AB, 450 Kts, 7G, AoA in [7.0;9.0] => Ps=0 (speed sustained)

### Turn Performance at Sea level Mirage F1-C Drag Index : 0 / GW = 21,000 lbs Full AB



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Version 2005.035

**Measured** in flight (F4) versus **Computed**, Sustained G-load, speed and altitude constant (more or less), Altitude 1,400ft, clean:

6,400 lbs fuel, M=0.85 (550Kts), G=6.6, AoA=8.3  
6,400 lbs fuel, M=0.85 (550Kts), G=6.8, AoA=7.8  
4,700 lbs fuel, M=0.68 (450Kts), G=6.9, AoA=11.0  
4,700 lbs fuel, M=0.68 (450Kts), G=6.4, AoA=9.3

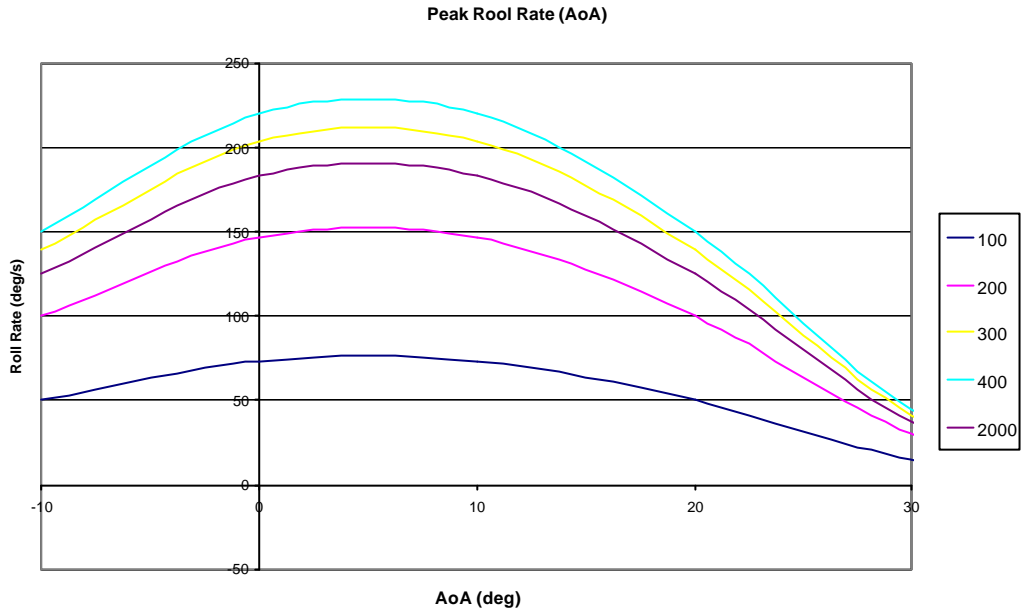
Corner Speed is between M=0.55 and M=0.7 with a sustained turn rate around 16 degree per second.

Maximum turn rate is reached with M=0.60, 6.9G, at 18.8 degrees per second

## Roll Rate versus AoA

Set of curves giving Maximum roll rate (deg/seg) and time to roll 90deg at constant speed versus Angle of Attack

Peak Roll rate function of Angle of attack (for a given Dynamic pressure in Qbar), Clean configuration, 50% internal fuel



## Thrust tables

Static Thrust of SNECMA ATAR 9K50 are 68kN (15,369 lbs) with After Burner and 48kN (10,750 lbs)

