



Basic hypothesis



- Rafale C and Typhoon share the same aerodynamic configuration, means same CL (lift) and CD (drag) coefficients law $[C_x(\text{Mach}, \text{AoA})]$. This is known as not realistic, but I do not have reliable data to differentiate them.
 - Subjective position may give less Drag at high Mach number to the Typhoon and better Lift at high AoA (>20) for the Rafale.
- M88-2 and EJ-200 share same Thrust Profile (coefficient between static thrust and actual thrust at a given altitude and Mach number configuration) under $M=1.8$, even mounted behind 2 very different air intake, EJ-200 thrust is assumed to decrease only after $M=2.2$. This is known as not realistic, but I do not have reliable data to differentiate them.
- Rafale C and Typhoon share Fly Control limits (AoA limitation versus G factor). This is known as not realistic, but I do not have reliable data to differentiate them.
 - Non confirmed information indicated higher AoA values allowed for the Rafale (Flight envelop of the Typhoon is still not fully open)

Basic Data

DASSAULT Rafale C (M88-2)

| Mass Control | lbs | kg |
|-------------------|--------|-------|
| Empty Weight (lb) | 19,974 | 9,048 |
| Internal Fuel | 10,486 | 4,750 |

| Area Control | sqr. Ft | m2 |
|--------------------|---------|-------|
| Area (Square feet) | 497.99 | 45.72 |

| G | CAT - I AoA Limit | CAT - III AoA Limit |
|-------|----------------------|------------------------|
| 1.00 | 35.00 | 20.00 |
| 7.00 | 30.00 | 14.00 |
| 10.00 | 14.00 | 14.00 |

| Thrust | lbs | kN |
|---------|--------|-----|
| Full AB | 33,754 | 150 |
| MIL | 22,503 | 100 |

| | lbs | kg |
|-----------------------------|--------|--------|
| Combat Weight (50% Fuel) | 25,216 | 11,423 |

| | lbs/lbs.h | kg/daN.h |
|--------------------------|-----------|----------|
| Specic Conso (MIL Power) | 0.78 | 0.80 |
| Specic Conso (AB) | 1.67 | 1.70 |

EADS Typhoon (EJ-200)

| Mass Control | lbs | kg |
|-------------------|--------|--------|
| Empty Weight (lb) | 24,283 | 11,000 |
| Internal Fuel | 8,830 | 4,000 |

| Area Control | sqr. Ft | m2 |
|--------------------|---------|-------|
| Area (Square feet) | 538.07 | 49.40 |

| G | CAT - I AoA Limit | CAT - III AoA Limit |
|-------|----------------------|------------------------|
| 1.00 | 35.00 | 20.00 |
| 7.00 | 30.00 | 14.00 |
| 10.00 | 14.00 | 14.00 |

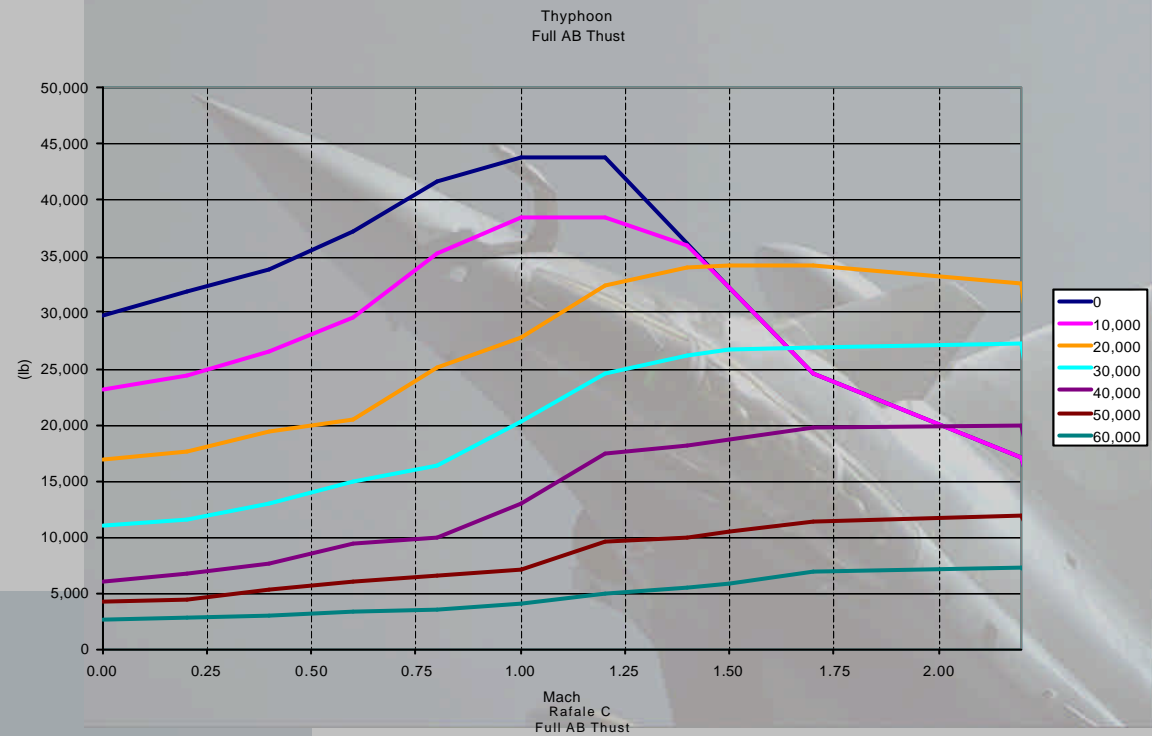
| Thrust | lbs | kN |
|---------|--------|-----|
| Full AB | 40,505 | 180 |
| MIL | 27,003 | 120 |

| | lbs | kg |
|-----------------------------|--------|--------|
| Combat Weight (50% Fuel) | 28,698 | 13,000 |

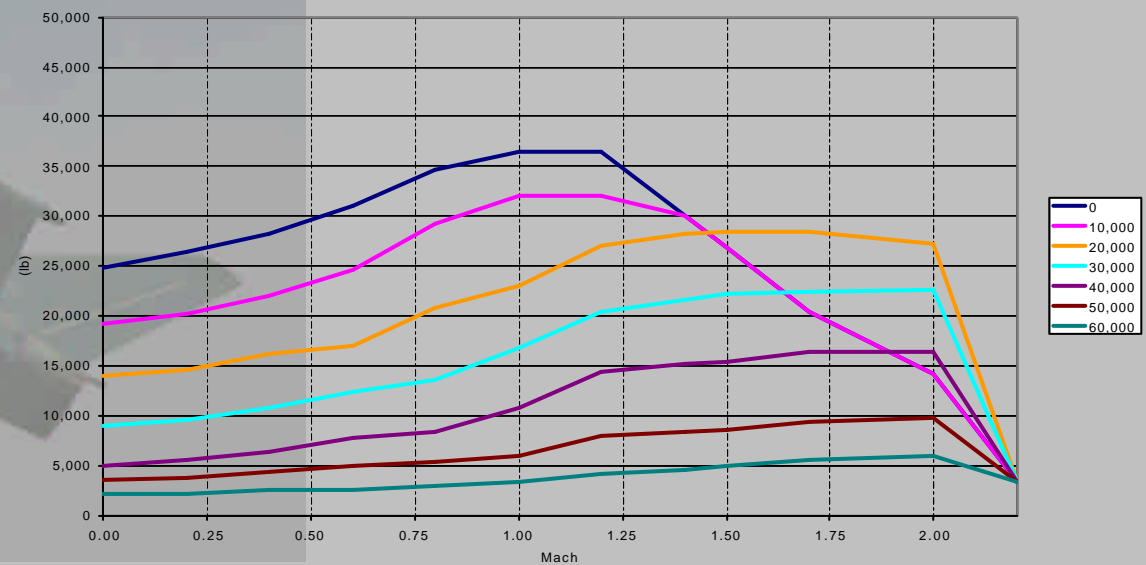
| | lbs/lbs.h | kg/daN.h |
|--------------------------|-----------|----------|
| Specic Conso (MIL Power) | 0.81 | 0.83 |
| Specic Conso (AB) | 1.73 | 1.76 |

Full AB Thrust (lbs)

EADS Typhoon (EJ-200)

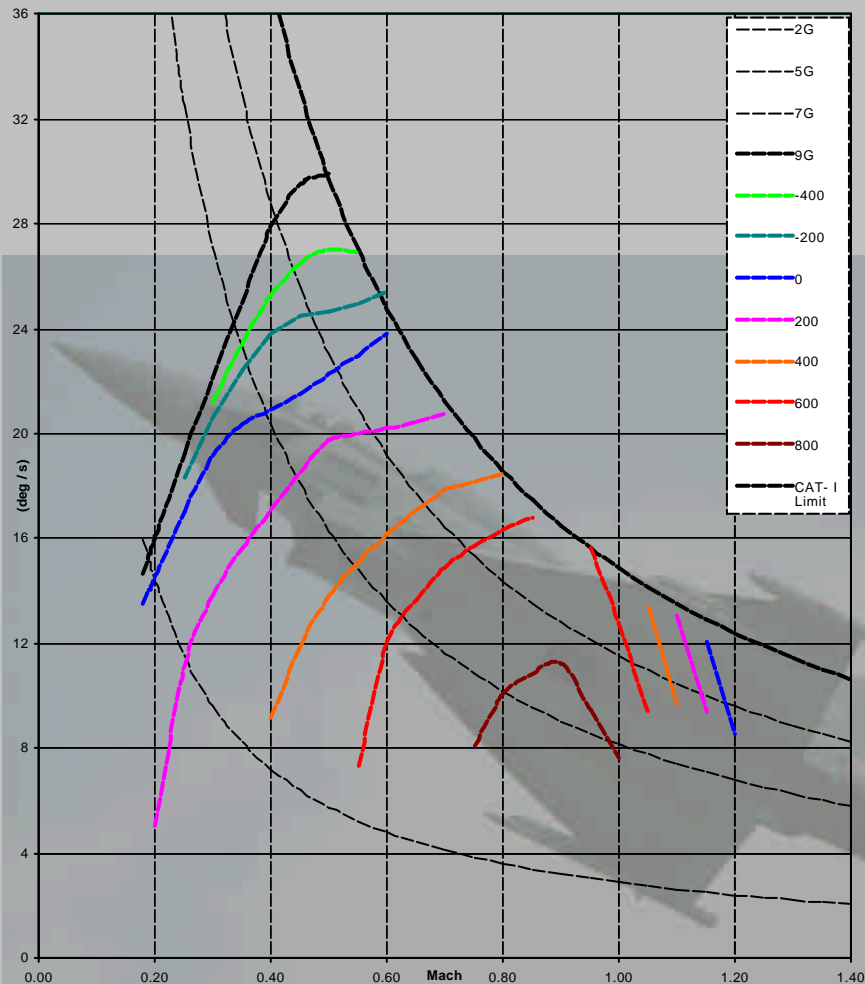


DASSAULT Rafale C (M88-2)

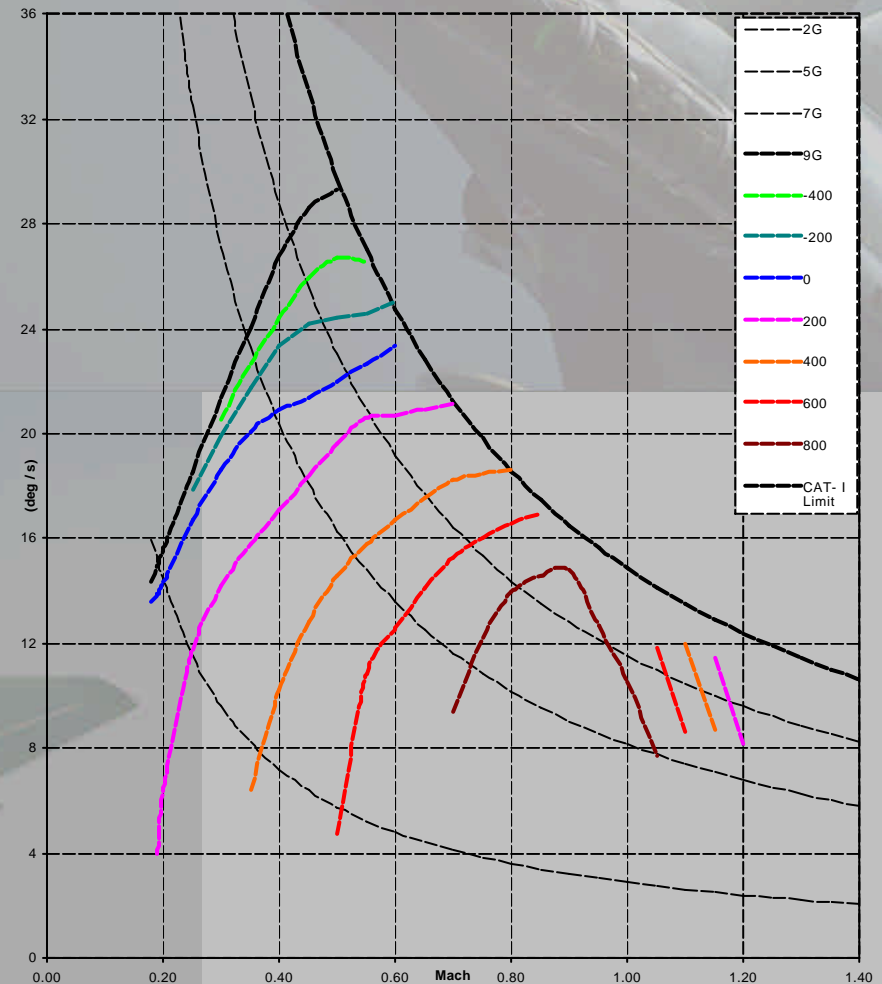


Turn Rate Diagram at Sea level with 50% internal fuel (1/2)

Turn Performance at Sea level
Rafale C
Drag Index : 0 / GW = 25,200 lbs
Full AB



Turn Performance at Sea level
Typhoon
Drag Index : 0 GW = 28,700 lbs
Full AB



Turn Rate Diagram at Sea level with 50% internal fuel (2/2)

- Rafale C main data for Turn performance at sea level are:
 - Maximum Turn Rate (CAT-I AoA limit) 30.00 deg/s at M=0.50
 - Maximum sustained Turn Rate ($P_s=0$) 23.9 deg/s at M=0.60
- Typhoon main data for Turn performance at sea level are:
 - Maximum Turn Rate (CAT-I AoA limit) 29.33 deg/s at M=0.50
 - Maximum sustained Turn Rate ($P_s=0$) 23.4 deg/s at M=0.60
- Very small, quite un-significant, advantage to the Rafale in turn performance in such configuration.

Horizontal evolution capabilities of the two planes are very similar.



Rafale

Typhoon

Maximum Excess Specific Power with 50% internal fuel

DASSAULT Rafale C (M88-2)

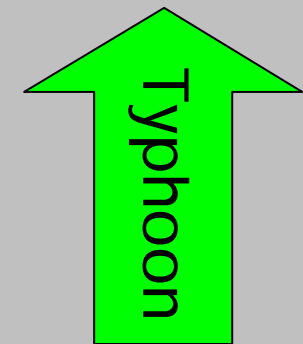
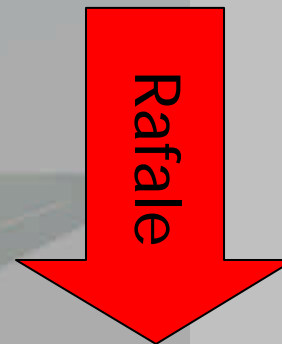
| Alt (ft) | Maximum Ps | | |
|----------|------------|------|-----------|
| | CAS | Mach | Ps (ft/s) |
| 0 | 592 | 0.90 | 918 |
| 5,000 | 540 | 0.90 | 889 |
| 10,000 | 519 | 0.95 | 855 |
| 15,000 | 483 | 0.98 | 738 |
| 20,000 | 466 | 1.05 | 619 |
| 25,000 | 440 | 1.10 | 557 |
| 30,000 | 414 | 1.16 | 492 |
| 35,000 | 383 | 1.20 | 438 |
| 40,000 | 339 | 1.20 | 377 |
| 45,000 | 372 | 1.48 | 217 |
| 50,000 | 324 | 1.46 | 86 |
| 55,000 | 319 | 1.62 | 29 |

- This tables show best Excess Specific Power (Ps) at 1G, it indicates mainly the initial climb rate
- Typhoon demonstrate higher Excess Specific Power than the Rafale at all altitude (around 10% higher at sea level) in this configuration (no external loads, 50% internal fuel).

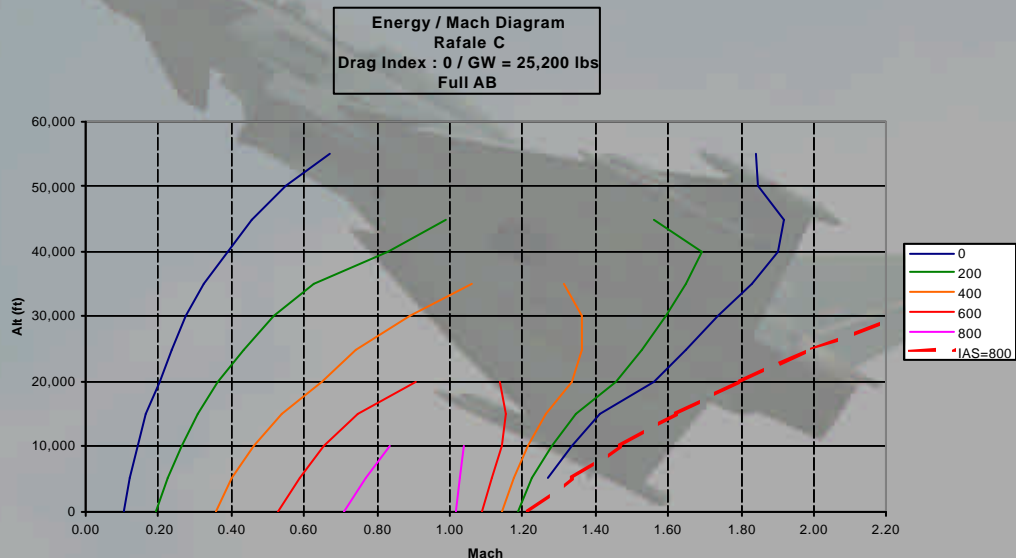
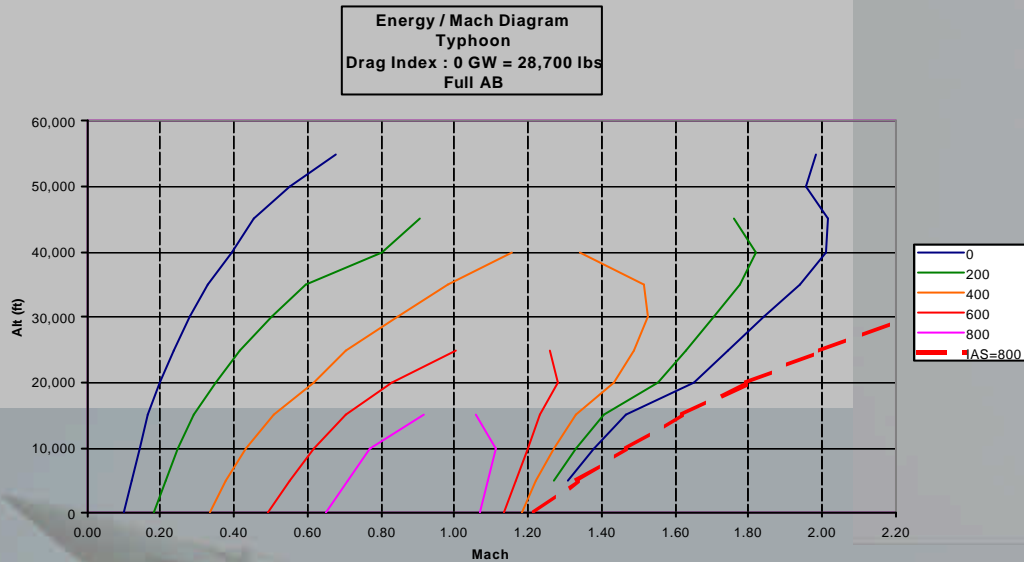
Vertical evolution capabilities of the Typhoon are better (10%).

EADS Typhoon (EJ-200)

| Alt (ft) | Vz Maximale | | |
|----------|-------------|------|-----------|
| | CAS | Mach | Vz (ft/s) |
| 0 | 592 | 0.90 | 1020 |
| 5,000 | 553 | 0.92 | 981 |
| 10,000 | 541 | 0.99 | 950 |
| 15,000 | 494 | 1.00 | 821 |
| 20,000 | 487 | 1.09 | 701 |
| 25,000 | 460 | 1.15 | 635 |
| 30,000 | 430 | 1.20 | 566 |
| 35,000 | 383 | 1.20 | 500 |
| 40,000 | 339 | 1.20 | 424 |
| 45,000 | 382 | 1.52 | 273 |
| 50,000 | 377 | 1.69 | 130 |
| 55,000 | 335 | 1.70 | 70 |



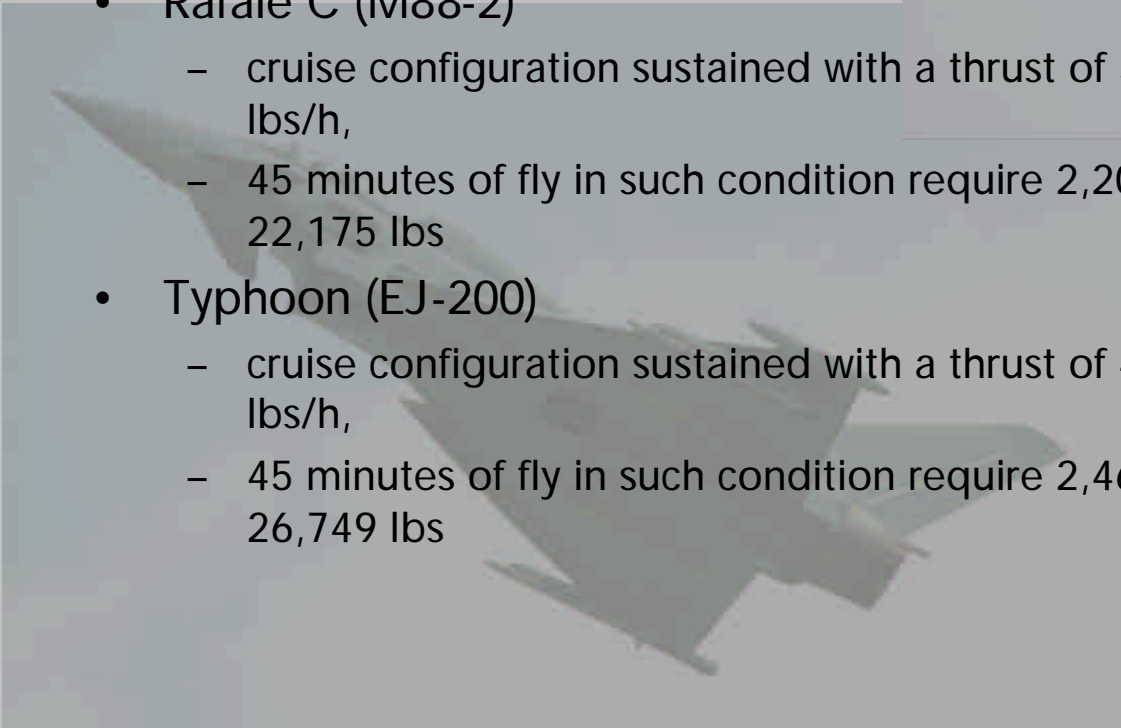
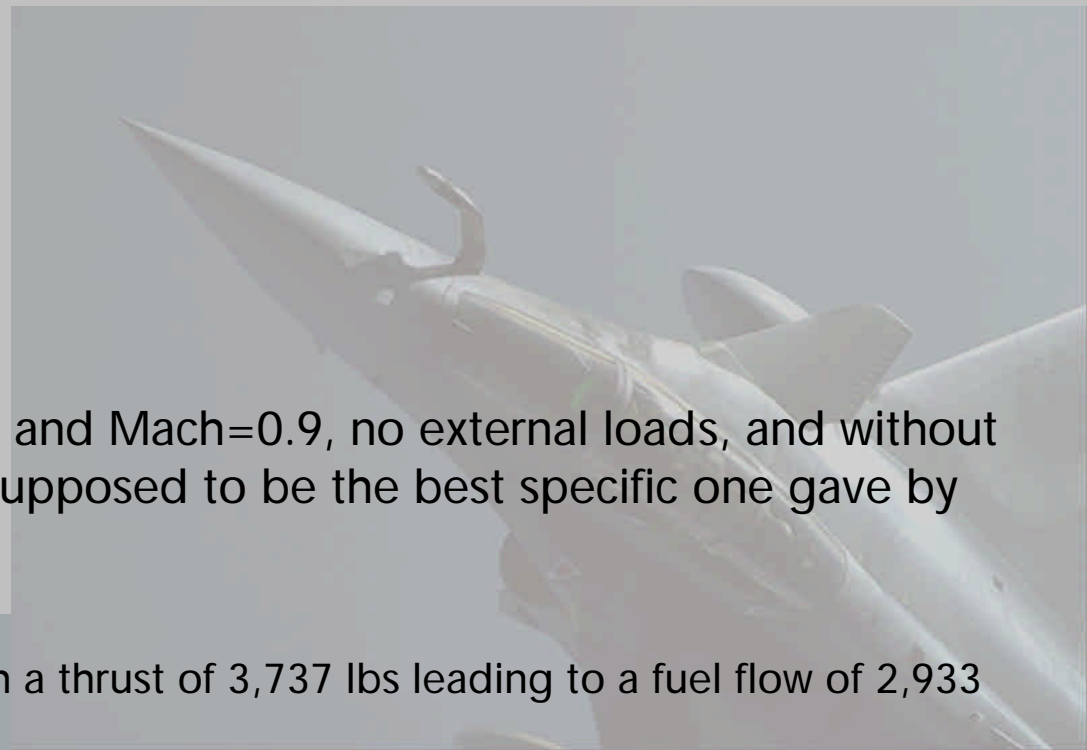
Energy (Ps) / Mach Diagram with 50% internal fuel



- Rafale C gross weight is less (25,200lbs) but due to extra thrust, Typhoon demonstrate superior Energy (Ps) at quite all altitude and Mach giving him advantage in climb and acceleration
- Maximum Mach number of Rafale is 1.8 compared to Mach 2.0 for Typhoon, mainly due to stealth characteristics of Rafale Air Intake and lack of mobile devices leading to loss of thrust for higher mach number

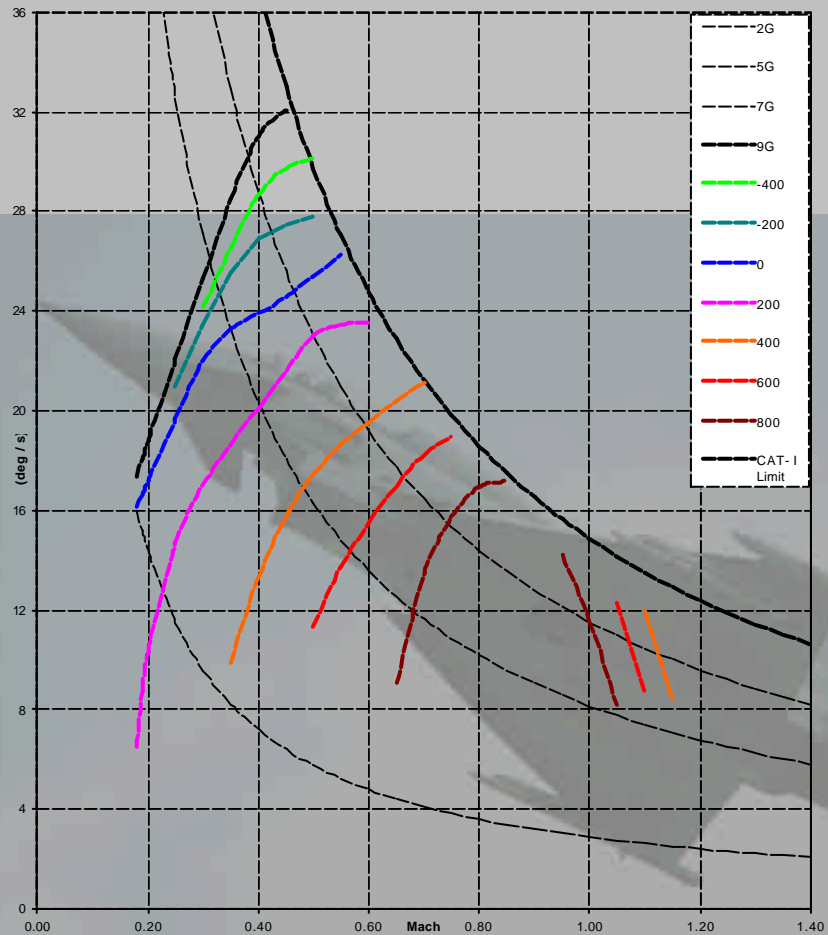
Configuration for 45' Cruise

- Cruise is supposed to be at FL300 and Mach=0.9, no external loads, and without after burner (fuel consumption is supposed to be the best specific one gave by engine manufacturer)
- Rafale C (M88-2)
 - cruise configuration sustained with a thrust of 3,737 lbs leading to a fuel flow of 2,933 lbs/h,
 - 45 minutes of fly in such condition require 2,200 lbs of fuel, given a gross weight of 22,175 lbs
- Typhoon (EJ-200)
 - cruise configuration sustained with a thrust of 4,040 lbs leading to a fuel flow of 3,289 lbs/h,
 - 45 minutes of fly in such condition require 2,467 lbs of fuel, given a gross weight of 26,749 lbs

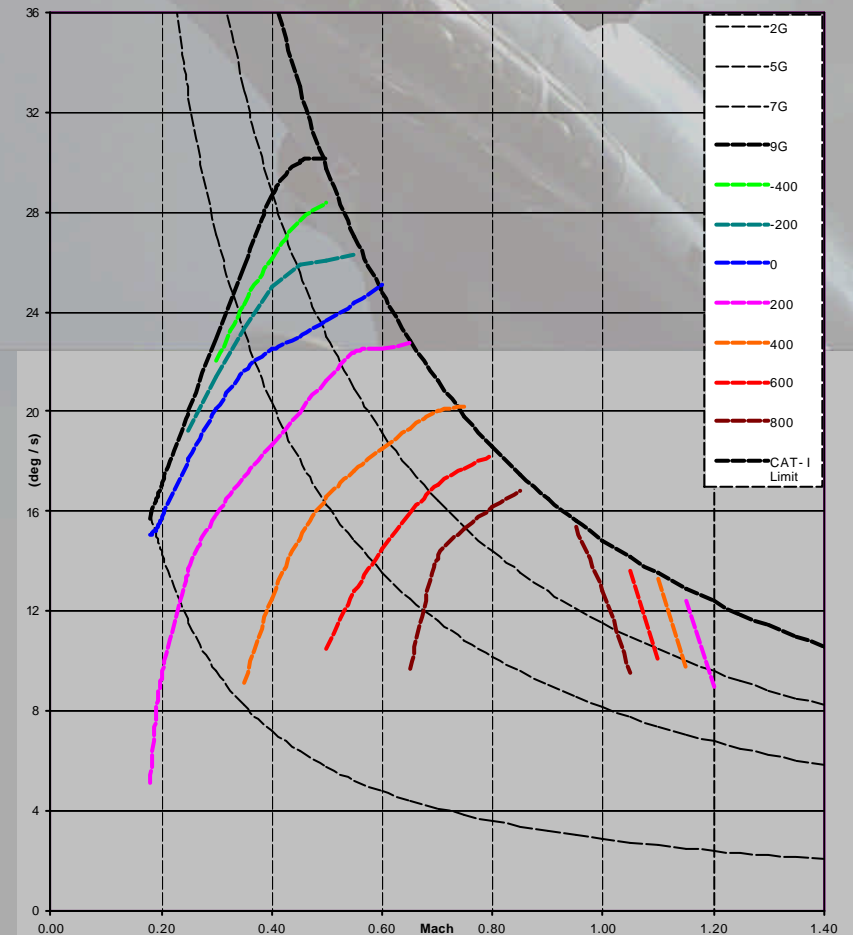


Turn Rate Diagram at Sea level with 45' cruise (1/2)

Turn Performance at Sea level
Rafale C
Drag Index : 0 / GW = 22,175 lbs
Full AB



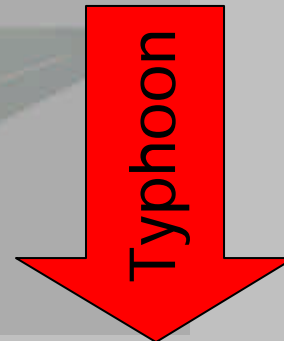
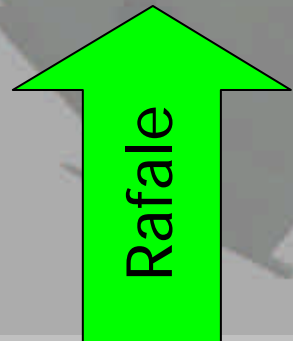
Turn Performance at Sea level
Typhoon
Drag Index : 0 GW = 26,750 lbs
Full AB



Turn Rate Diagram at Sea level with with 45' cruise (2/2)

- Rafale C main data for Turn performance at sea level are:
 - Maximum Turn Rate (CAT-I AoA limit) 32.10 deg/s at M=0.45 (R= 895 ft)
 - Maximum sustained Turn Rate (Ps=0) 26.25 deg/s at M=0.55 (R=1,340 ft)
- Typhoon main data for Turn performance at sea level are:
 - Maximum Turn Rate (CAT-I AoA limit) 30.2 deg/s at M=0.50 (R=1,060 ft)
 - Maximum sustained Turn Rate (Ps=0) 25.1 deg/s at M=0.60 (R=1,529 ft)
- Better Turn rate (Maximum and sustained) at lower speed (so with lower Turn radius), give to the Rafale a significant advantage in horizontal evolution in such configuration.

Horizontal evolution capabilities of the Rafale are better.



Maximum Excess Specific Power with 45' cruise fuel

DASSAULT Rafale C (M88-2)

| Alt (ft) | Vz Maximale | | |
|----------|-------------|------|-----------|
| | CAS | Mach | Vz (ft/s) |
| 0 | 592 | 0.90 | 1044 |
| 5,000 | 540 | 0.90 | 1011 |
| 10,000 | 519 | 0.95 | 972 |
| 15,000 | 483 | 0.98 | 839 |
| 20,000 | 466 | 1.05 | 704 |
| 25,000 | 440 | 1.10 | 634 |
| 30,000 | 414 | 1.16 | 560 |
| 35,000 | 383 | 1.20 | 498 |
| 40,000 | 339 | 1.20 | 429 |
| 45,000 | 301 | 1.20 | 317 |
| 50,000 | 335 | 1.50 | 122 |
| 55,000 | 334 | 1.69 | 59 |

EADS Typhoon (EJ-200)

| Alt (ft) | Vz Maximale | | |
|----------|-------------|------|-----------|
| | CAS | Mach | Vz (ft/s) |
| 0 | 592 | 0.90 | 1095 |
| 5,000 | 553 | 0.92 | 1053 |
| 10,000 | 541 | 0.99 | 1019 |
| 15,000 | 494 | 1.00 | 881 |
| 20,000 | 487 | 1.09 | 752 |
| 25,000 | 460 | 1.15 | 681 |
| 30,000 | 430 | 1.20 | 607 |
| 35,000 | 383 | 1.20 | 537 |
| 40,000 | 339 | 1.20 | 459 |
| 45,000 | 368 | 1.47 | 301 |
| 50,000 | 370 | 1.66 | 153 |
| 55,000 | 335 | 1.70 | 89 |

- This tables show best Excess Specific Power (Ps) at 1G, it indicates mainly the initial climb rate and vertical evolution capability in dogfight.
- Typhoon still demonstrate higher Excess Specific Power than the Rafale at all altitude (around 5% higher at sea level) but advantage is lower in this configuration.

Vertical evolution capabilities of the Typhoon are better (5%).

