

F-22



By: Jiten Patel
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Eurofighter



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Rafale



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AIRLINERS.NET

COMPETITION

MIG-27



Gripen



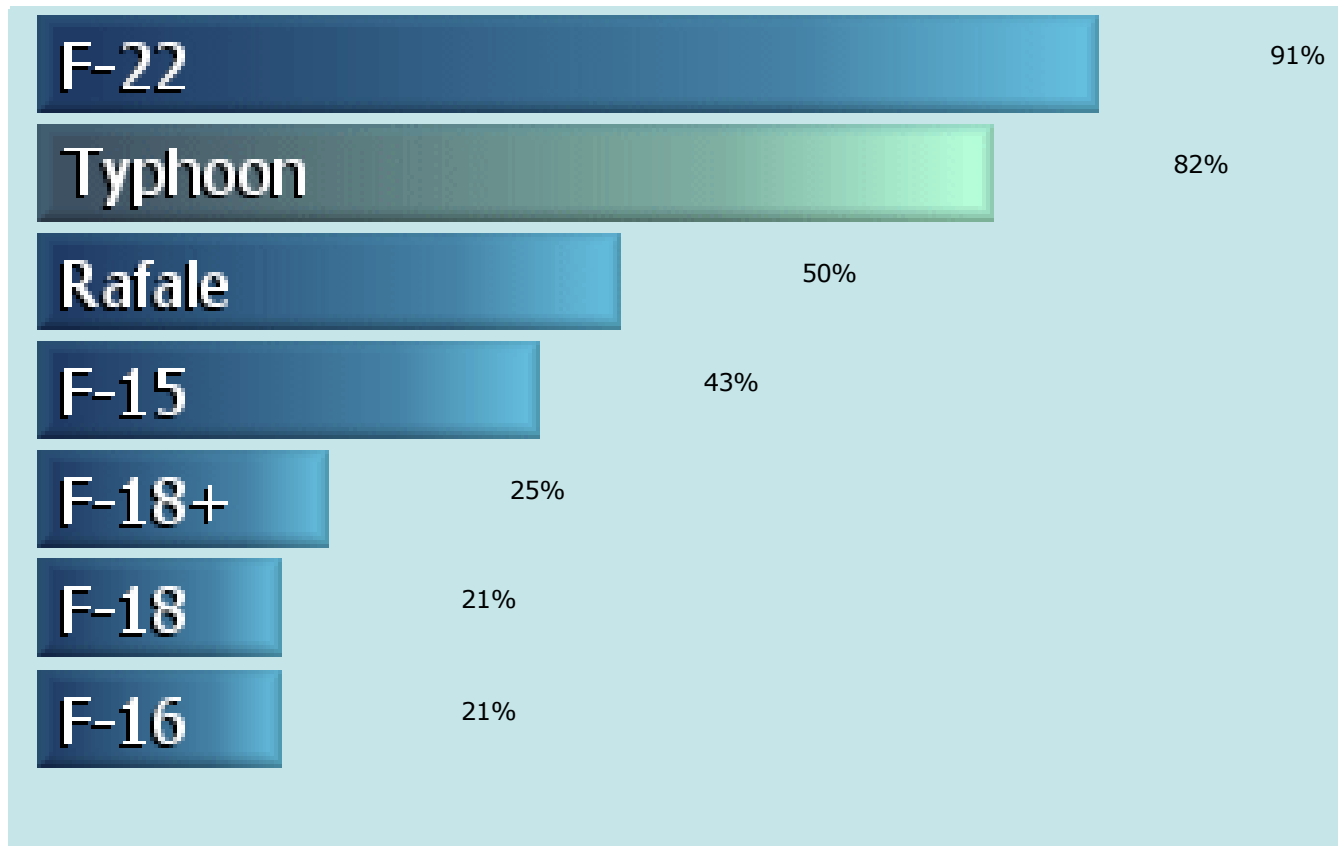
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COMPARATOR AIRCRAFT

	f22	f18c	f15c	Eurofighter	Rafale	Gripen
MAX TOGW	60000LB	51,550LB	68,000LB	46,300LB	54,000LB	31,000LB
WING AREA	840 ft ²	400 ft ²	608 ft ²	540 ft ²	492 ft ²	275 ft ²
WING LOADING	71.43 lb/ft ²	129 lb/ft ²	112 lb/ft ²	86 lb/ft ²	110 lb/ft ²	113 lb/ft ²
WING SPAN	44ft 6in	40ft	42ft 10in	35ft 11in	35ft 5in	27ft 7in
THRUST TO WIEGHT	1.4 (50% fuel)	~1.2:1 (50% fuel)	1.3:1 (50% fuel)	1.42:1 (50% fuel)	1.3:1 (50% fuel)	.98:1 (50% fuel)
MAX SPEED	Mach 2.42+	Mach 1.8	Mach 2.5	Mach 2.0+	Mach 2.0	Mach 2
CLIMB RATE		50,000 ft/sec	50,000ft/sec	50,000ft/sec	65,550 ft/sec	
TURN RATE	20+ deg/sec	19.2 deg/sec (at SL)	16 deg/sec	20+ deg/sec	~20 deg/sec	20 deg/sec
INSTANTENOUS TURN RATE	30+ deg/sec		26 deg/sec	30+ deg/sec	30 deg/sec	30 deg/sec
COST	~\$300mill	\$60mill	\$50mill	\$85 mill	\$70mill	\$25mill

Resources : <http://www.eurofighter-typhoon.co.uk/Eurofighter/tech.php>
<http://en.wikipedia.org>

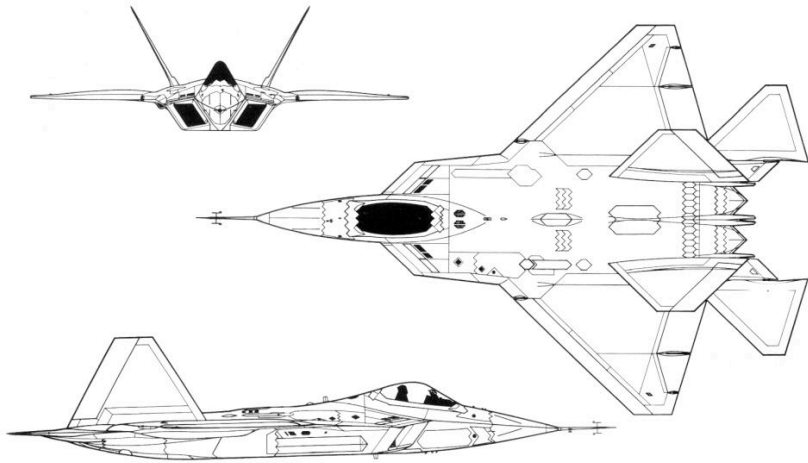
<http://www.fas.org/> <http://www.fighter-planes.com>
www.globalsecurity.org



Beyond Visual Range Combat

Study performed by Britain's **DERA**, or the **Defense Evaluation and Research Agency**. The percentage is the theoretical win percentage against a Su-35 Super Flanker. The most imperative data is the comparison between the US current air superiority fighter in the F-15 and the F-22. There is some debate in the Typhoon (Eurofighter) and Rafale numbers, due to the fact that the typhoon was chosen over the Rafale by the British.

HISTORY



Lockheed-Martin YF-22



Northrop-Grumman YF-23

RFP:

Air superiority

Supersonic cruise

Stealth

Increase combat radius

Reasonable price

Takeoff and Landing in 2000 ft

Evolution from YF-22 to F-22

Wing

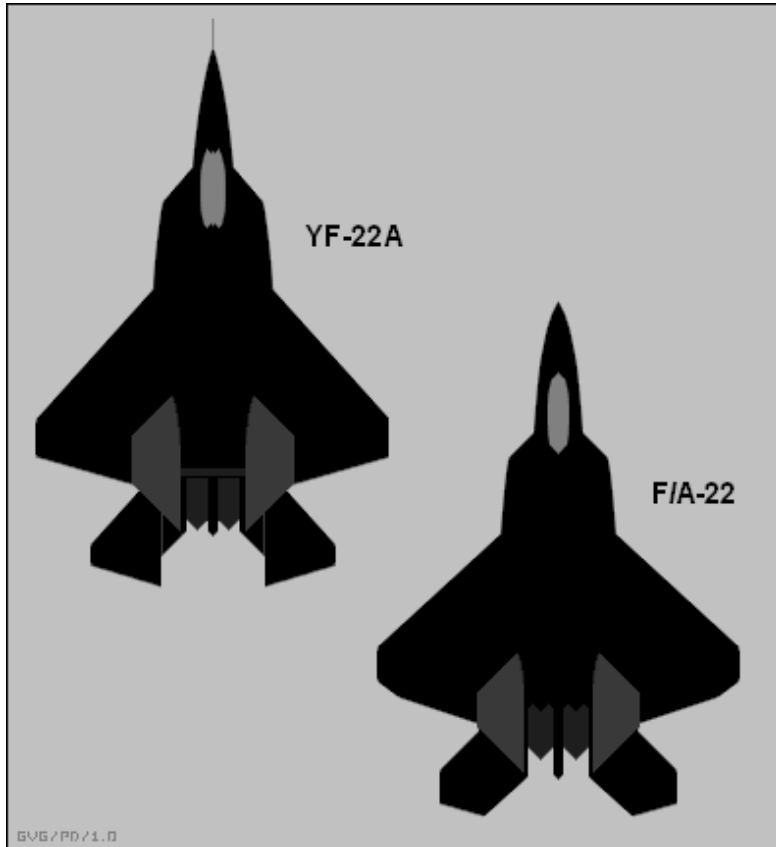
- LE sweep from 48 on the prototype to 42 degrees on the F-22
- Wingspan increased from
- TE changes for lower operability

Fuselage

- Canopy moved forward and intake moved rearward for increased visibility, structural strength and better performance
- Removal of airbrake

Tail

- Vertical tail size reduced 20%
 - Initial tail volume due to concerns over spin problems
 - Spin problems never materialized and the volume was reduced



Thrust Vectoring



X-31 program looked into thrust vectoring that produce high pitch rate.

Thrust Vectoring Cont...

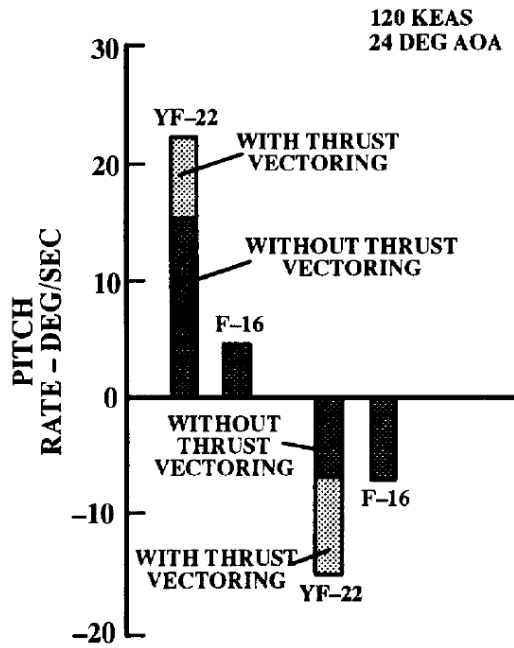


Figure 14. YF-22 Pitch Rate Comparison with the F-16 at Low Speed

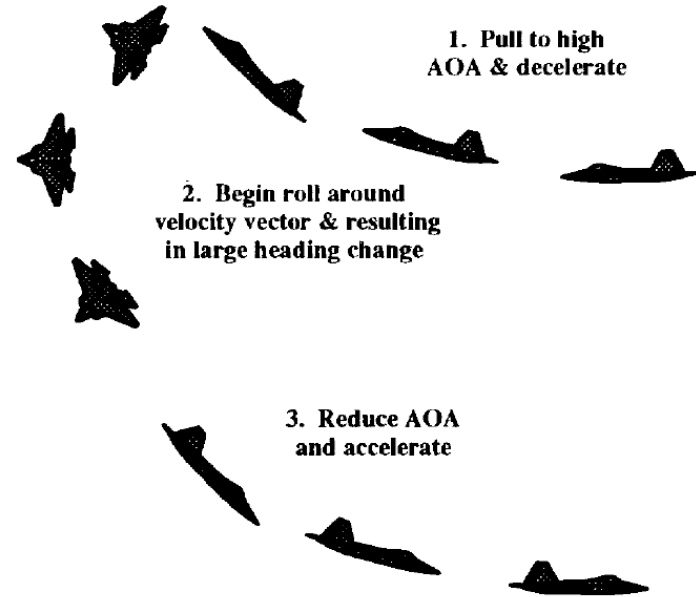


Figure 15. High Angle of Attack Heading Reversal Maneuver

Thrust Vectoring cont..

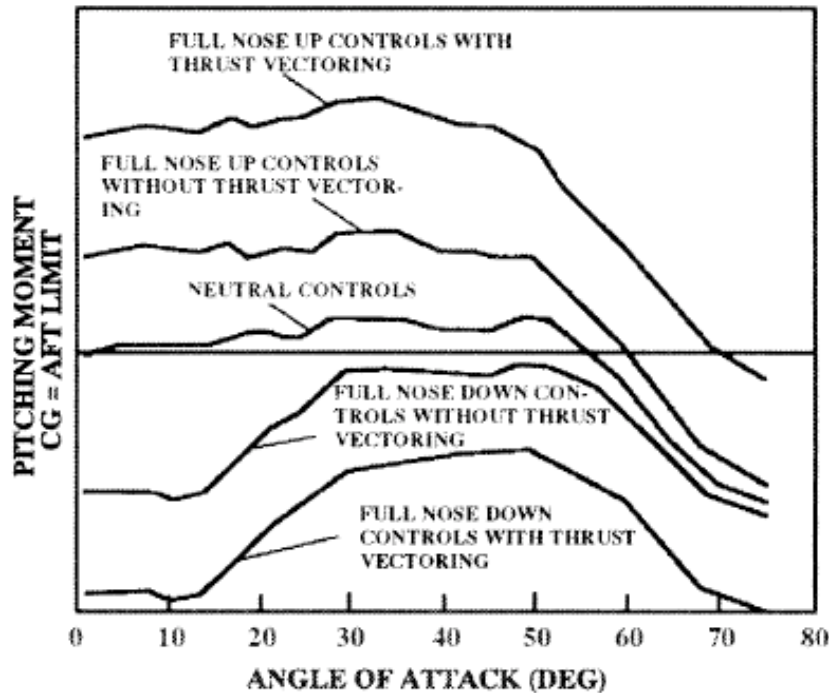


Figure 8. Pitching Moment vs. Angle of Attack

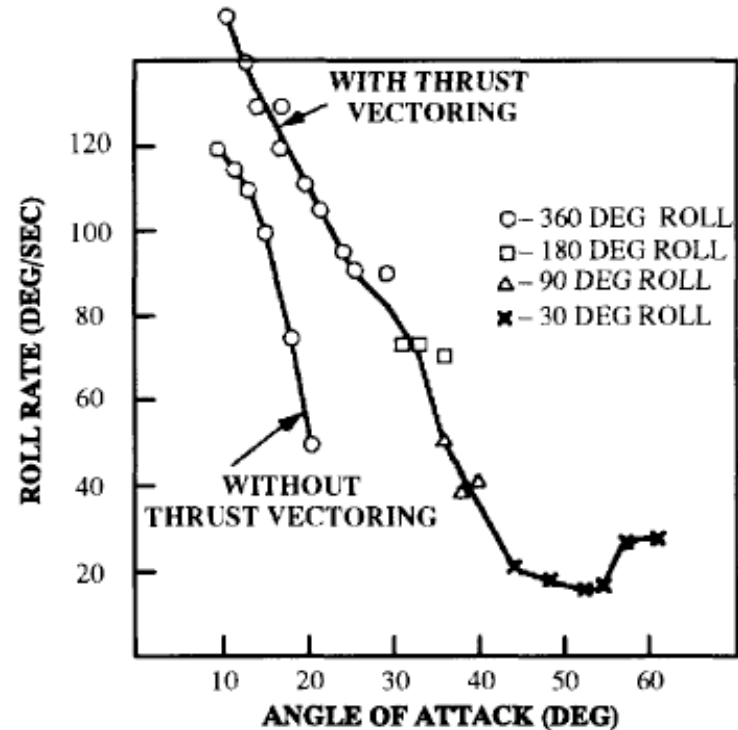


Figure 12. YF-22 Roll Rate vs. Angle of Attack

Three View Drawings



→ www.aerospaceweb.org

Dimensions

Geometric Characteristics	AR	Cr (ft)	Ct (ft)	S (ft^2)	Λ LE (deg)	Λ 1/4 (deg)	Λ	b (ft)
Wing	2.4	32.32	3.74	824.36	42	62.02	0.116	44.5
Horizontal Tail	6.18	9.35	3.74	136	42	47.94	0.4	29
Vertical Tail	1.94	17.53	4.2075	178	22.9	53.88	0.24	9.59

General dimensions

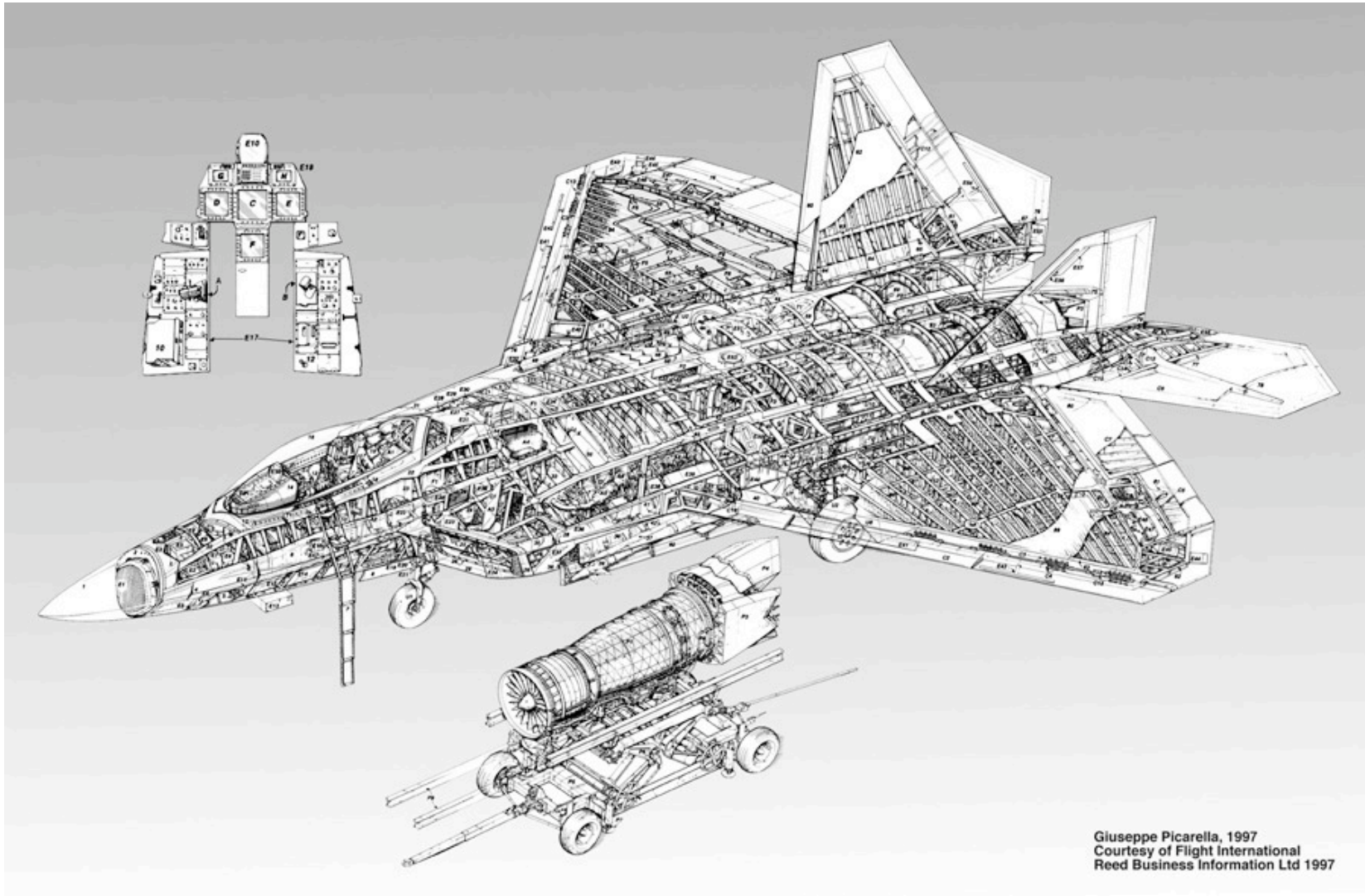
WING

wing span	AR	Wing Root chord	Wing tip chord	_LE	_TE	taper ratio	Anhedral	root twist	tip twist	t/c tip	t/c root
13.56m	2.4	9.85m	1.14m	42°	-17°	0.169	3.25°	5°	-3.1°	5.92%	4.29%

OVERALL

length	height	wheelbase	weapons bay ground Clearance	weight (empty)	max T/O weight	W/S	T/W
18.92m	5.08m	6.04m	.94m	14365 kg	27216 kg	348.7 kg/m^2	1.4

Cutaway Drawing



Giuseppe Picarella, 1997
Courtesy of Flight International
Reed Business Information Ltd 1997

Spanload distribution

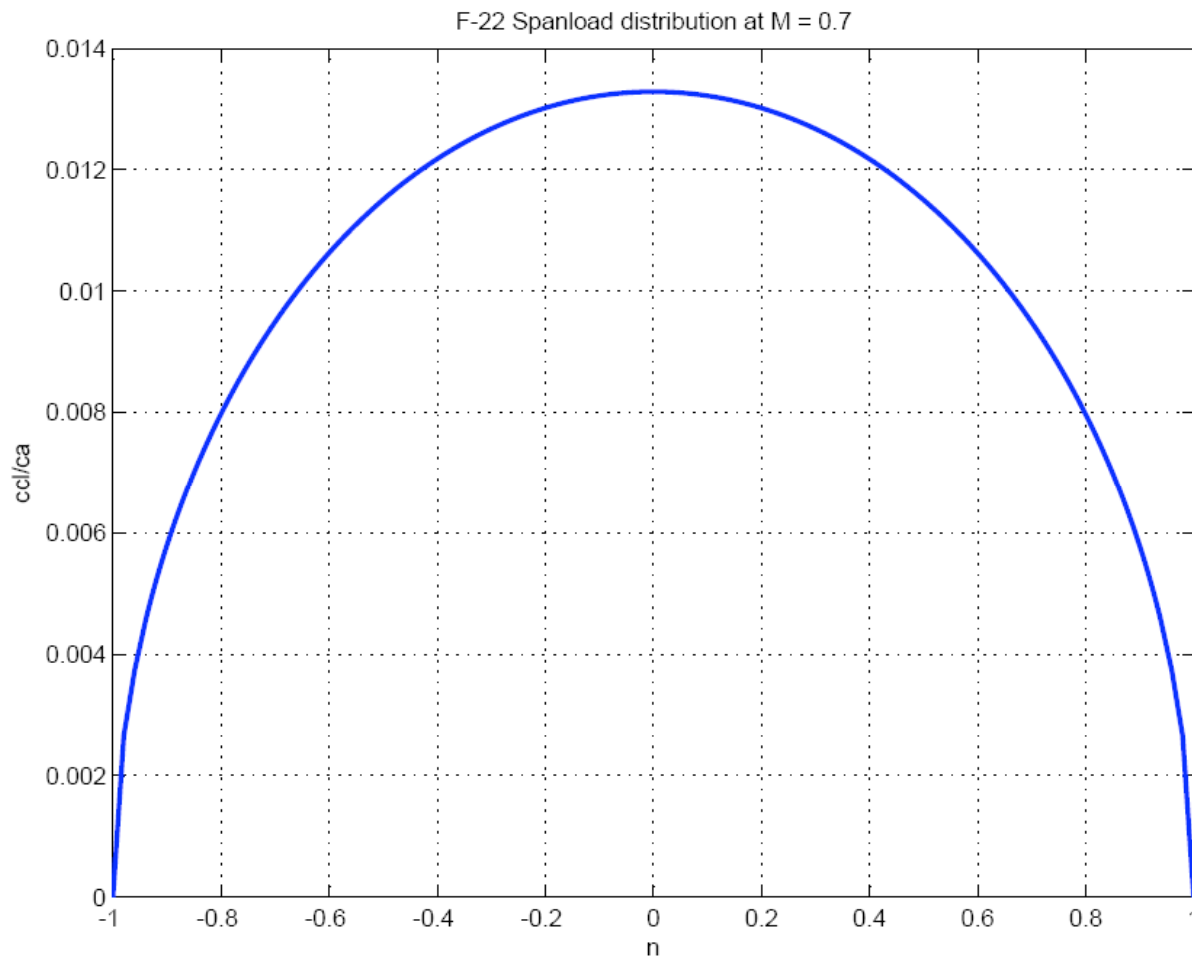


Figure shows the spanload distribution at M = 0.7, CL = 0.010433 [note by instructor: clearly a wrong number]

Lift Distribution Across Span

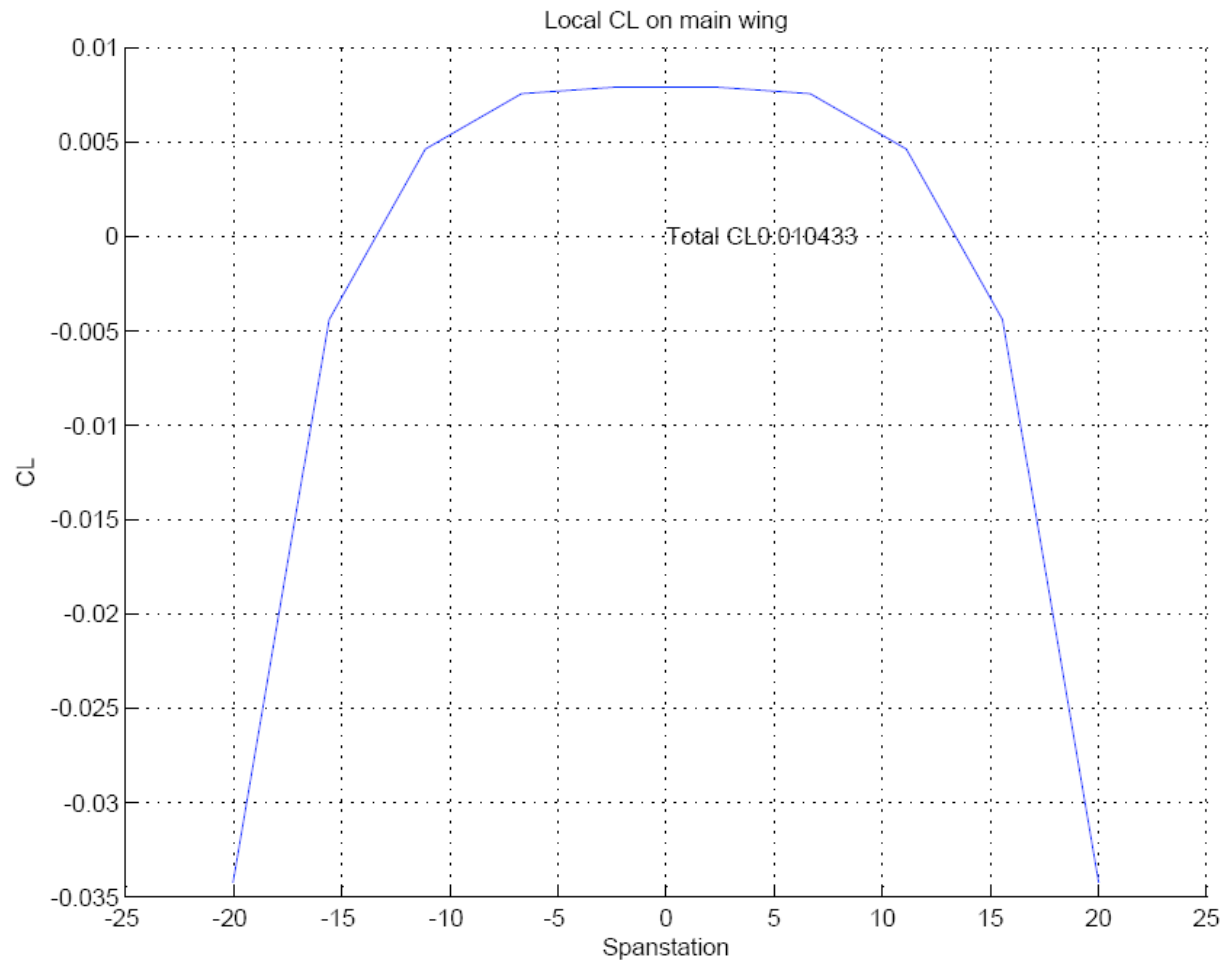


Figure shows the local lift distribution across span at $M = 0.7$

Twist Distribution

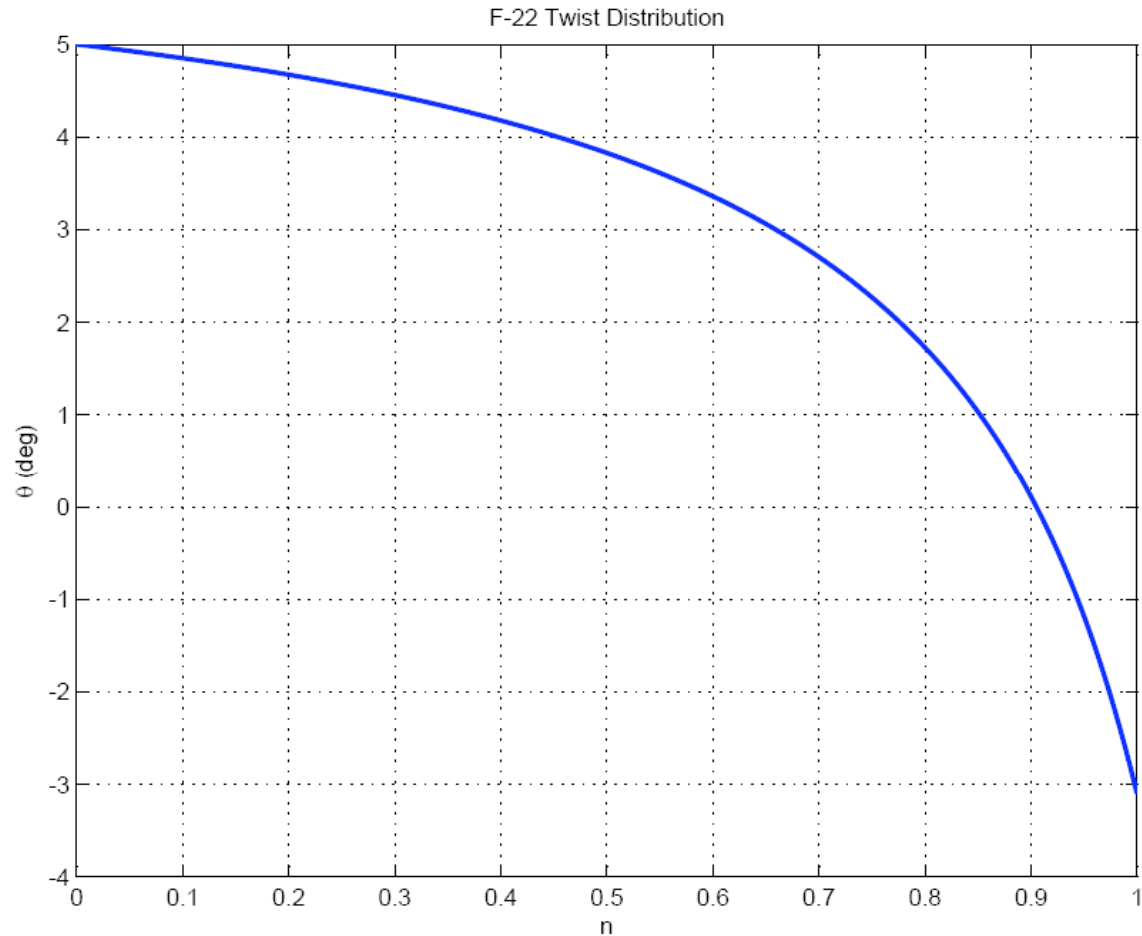


Figure shows the twist distribution across span with $_root = 5^\circ$ & $_tip = -3.1^\circ$

Section Lift Coefficient

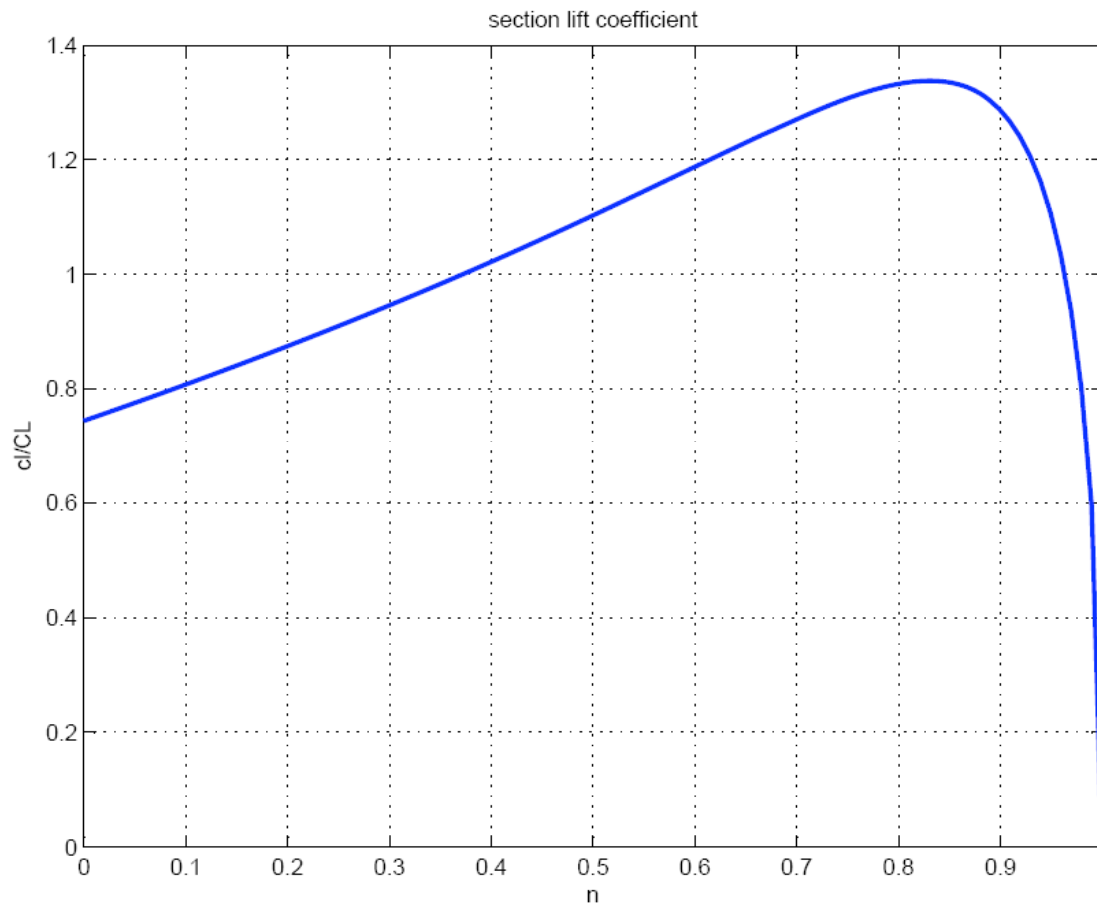
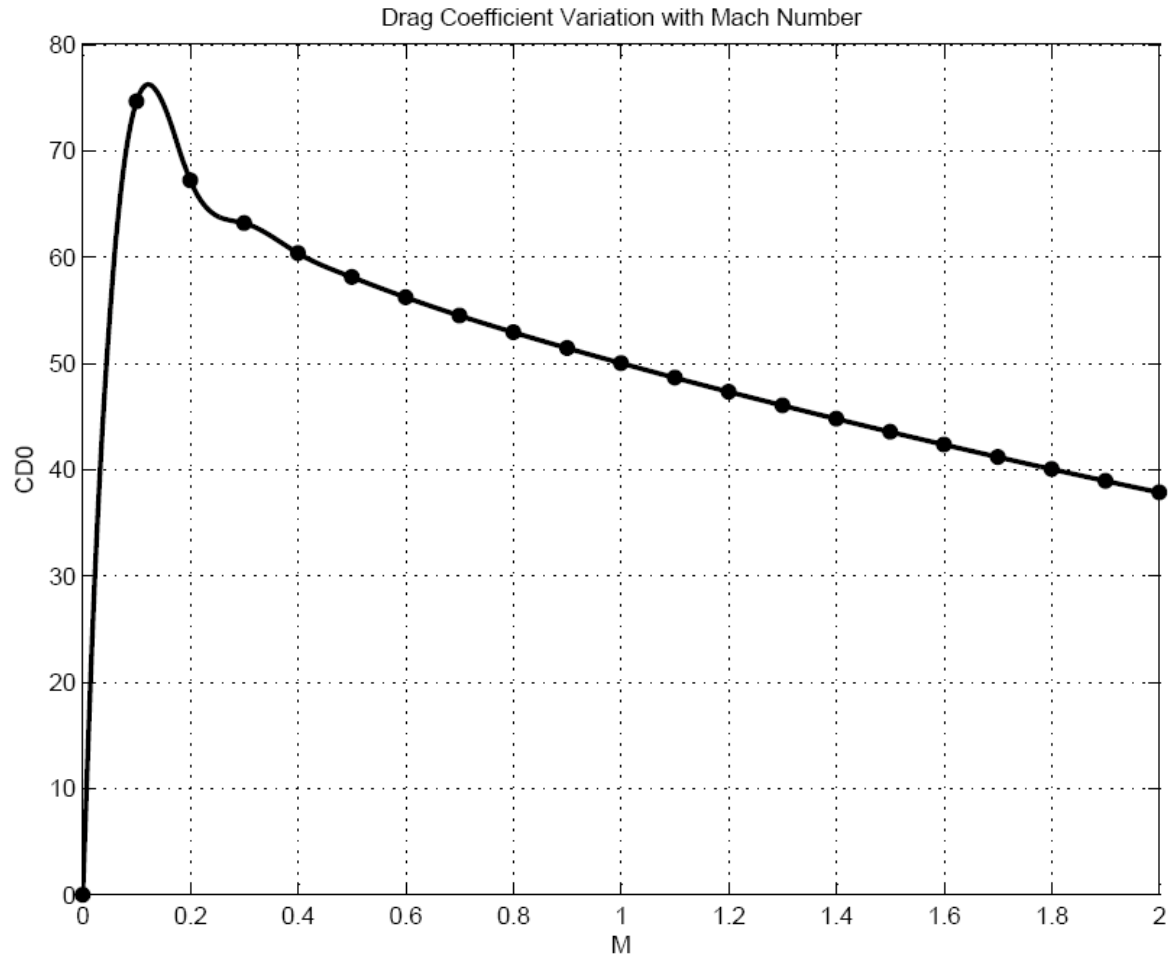


Figure shows the section lift coefficient variation with span.

$n_{max} = 0.831$ and $cl/CL|_{max} = 1.338$.

Drag Coefficient



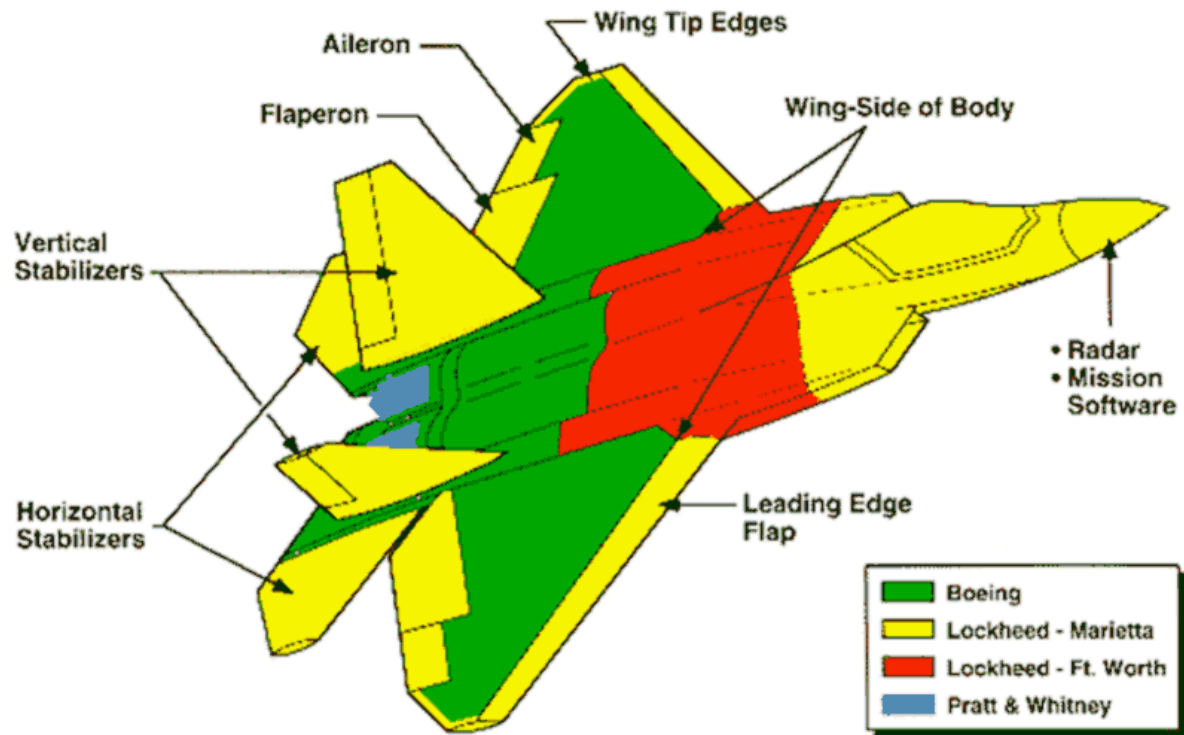
[note by instructor: clearly a wrong results]

Geometric Parameters

<i>Wing Geometric Properties</i>	
Mean Aerodynamic Chord	21.75 ft
XlocMAC	7.369 ft
YlocMAC	8.184 ft
Quarter Chord Sweep	62.12°
Wing Area	824.36 ft ²

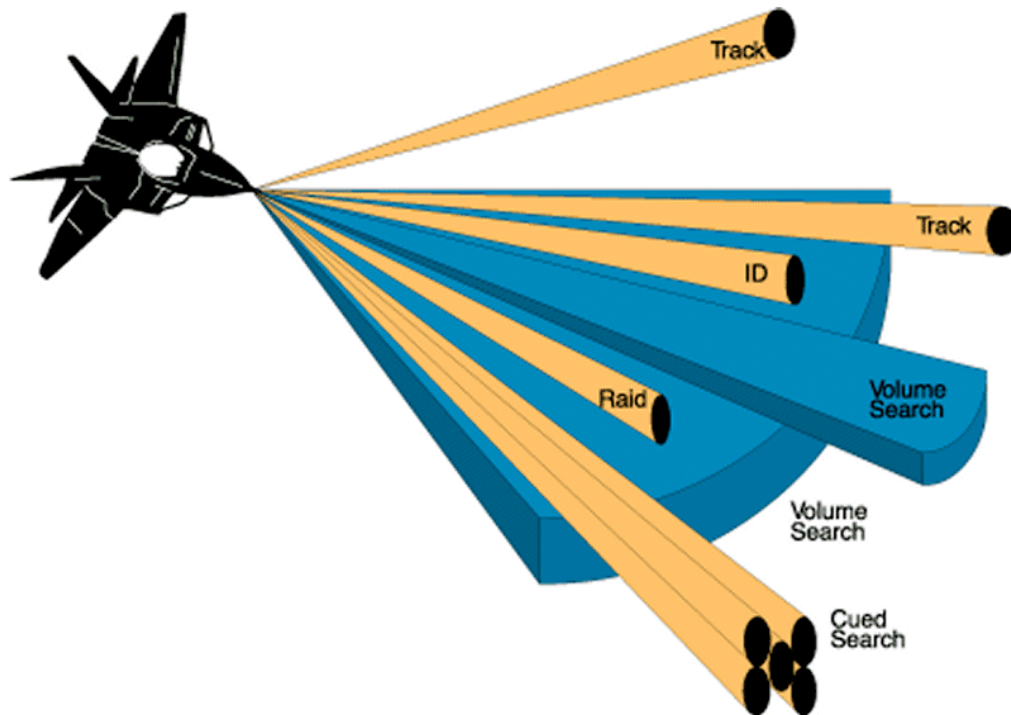
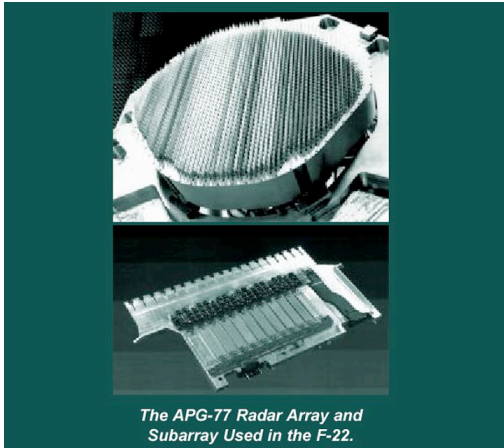
<i>Aerodynamics Characteristics</i>	
CL α	2.46/rad
Cm α	3.66/rad
CD0	0.0082131
Cdi	0.00001521
Neutral Point	28.1

Manufacturing



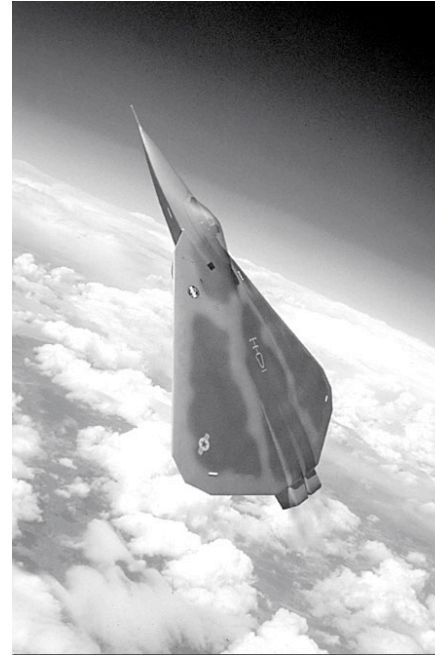
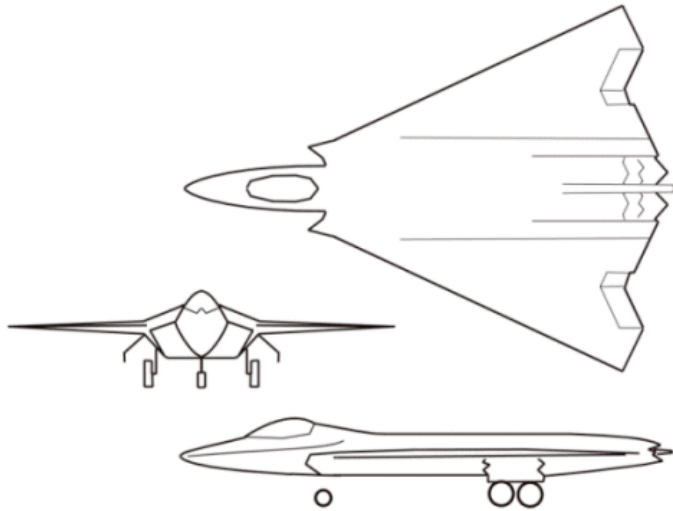
→ www.globalsecurity.org

Radar



→ www.globalsecurity.org

Aircraft based on F-22 design



FB-22 bomber concept

References

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