

Functional Requirements  
Design Ideas

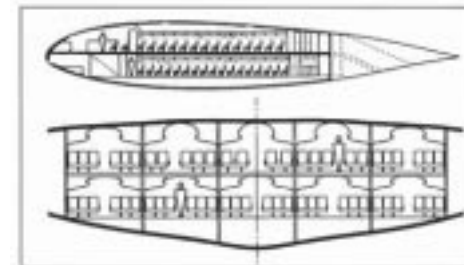
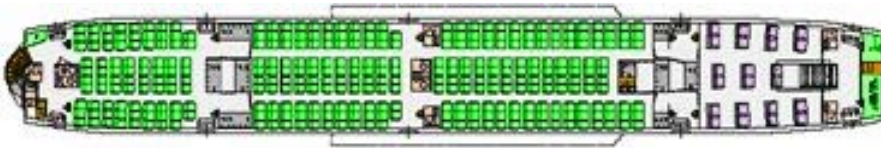
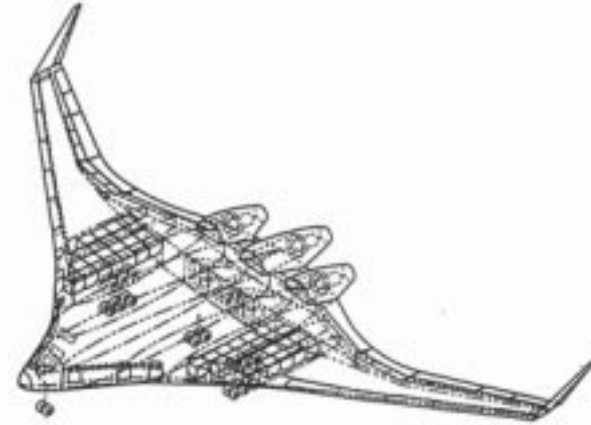
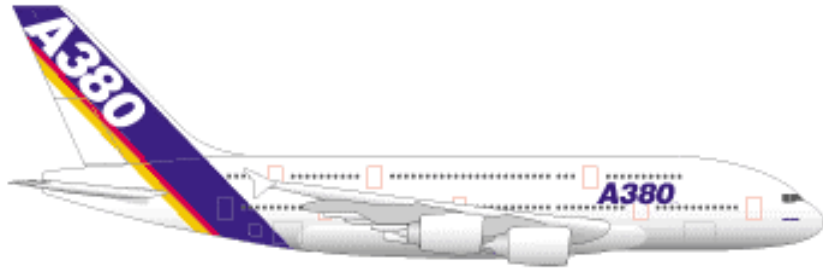
**Functional Requirements**

What not How

**Design Ideas**

How

# Functional Requirements - **What** Design Ideas - **How**



# Designs



*Constraints? Functional Requirements?*

# Functional Criteria

<u>Criteria</u>	<u>Weight</u>	<u>Scale</u>
Altitude	50%	1-5
Cost	20%	1-5
Turn Around Time	10%	1-5
Durability	10%	1-5

*Constraints? Functional Requirements?*

# Design Selection Matrix

	Design 1	Design 2	Design 3
Altitude			
Cost			
Turn Around Time			
Durability			
TOTAL			

*Constraints? Functional Requirements?*

# Documentation

## *Explain*

- How to make it
- How to operate it
- How to repair and service it
- How it works
- (Bonus) Why it may not work

What can go wrong

*Constraints? Functional Requirements?*

# Functional Requirements



What

...

not How

# Functional Requirements

## - What not How -

### Functional Requirements





- Available now
- Reasonable cost
- Sea-based, deep-interdiction
  - Carry heavy bomb loads for long distances
  - Precision strike
  - Carrier operation
- Highly maneuverable fighter
- Low radar signature

“Dash in, drop a lot of bombs,



# Functional Requirements

## Design Ideas

Functional Requirements	Design Ideas	
<ul style="list-style-type: none"> <li>• Available now</li> <li>• Reasonable cost</li> <li>• Sea-based, deep-interdiction               <ul style="list-style-type: none"> <li>– Carry heavy bomb loads for long distances</li> <li>– Precision strike</li> <li>– Carrier operation</li> </ul> </li> <li>• Highly maneuverable fighter</li> <li>• Low radar signature</li> </ul> <p>“Dash in, drop a lot of bombs,</p>		F-14D
		F/A-18 + USAF
		Su-27
		JSF

# Design Selection

<b>TABLE 1</b>	<b>F-18A</b>	<b>F-18E</b>	<b>F-14D</b>	<b>A-6E</b>	<b>Su-27</b>
<b>Weight empty (lb.)</b>	23,832	30,564	43,879	27,888	38,580
Pilot and ammo (lb.)	535	535	838	500	500
Mm/no. of rounds	20/570	20/570	20/675	0	30/150
Internal fuel (lb.)	10,860	14,400	16,200	15,939	20,723
External fuel (lb.)	7,431	7,206	3,854	0	0
AAM (2); Sidewinders	472	472	472	0	472
No. of tanks/capacity	3/330	2/480	2/280	0	0
<b>Bomb weight</b> in lb.	4,000	<b>4,000</b>	<b>8,000</b>	8,000	<b>8,000</b>
Bombs: no. and type	(2) Mk 84*	(4) Mk 83	(4) Mk 84	(4) Mk 84	(4) Mk 84
Takeoff gross weight (lb.)	47,130	57,177	73,253	52,327	68,275
Takeoff fuel weight as % of gross takeoff weight	37.5	36.8	27.4	30.5	30.4
* Two 1,000-lb. Mk 83s used in Desert Fox, not 2,000 lb. Mk 84.					

# Design Selection

<b>TABLE 2</b>	<b>F-18A</b>	<b>F-18E</b>	<b>F-14D</b>	<b>A-6E</b>	<b>Su-27</b>
<b>Store stations</b>	(2) 2,500	Same as F-18A	(4) 2,000	(5) 3,600	(7) 2,000
	(2) 2,350	Same as F-18A	(2) 2,200	—	—
	(1) 2,400	Same as F-18A	(2) 1,800	—	—
Wing area (sq. ft.)	400	500	565	484	667
Wingspan	37.5	44.7	64.1/38.2	53	48.2
Sea level static afterburner thrust (lb.)	32,000	44,000	55,600	18,600 (*1)	55,100
Attack wing loading (bombs on board) (lb./sq. ft.) @ 60% fuel	100	98	115	94.9	90
Wing loading (bombs dropped) (lb./lb.) @ 60% fuel	90	90	101	NA	78
Attack thrust/weight (lb./lb.) @ 60% fuel	.80	.90	.85	NA	.92
Thrust/weight (bombs dropped; lb./lb.) @ 60% fuel	.89	.98	.97	NA	1.06
Turning drag/lift factor	28.5	24.4	15.9	16.4	25.8
<b>Attack-mission radius</b> in n.m.	290 (*2)	<b>390</b> (*2)	<b>402</b> (*2)	500 (*2)	<b>420</b> (*2, *3)
<b>Radius x bomb load</b> (R x B); n.m. x lb./10 <sup>6</sup> or 1,000,000	1.16	<b>1.56</b>	<b>3.22</b>	4.00	<b>3.36</b>
*1 No afterburner, *2 "Hi-lo-lo-hi" mission, *3 Probably low, NA=not available					


















# Functional Criteria

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Available Now	50%	1-5
Reasonable Cost	20%	1-5
Sea-based Deep Interdiction	10%	1-5
Low Radar Signature	20%	1-5

# Design Selection Matrix

<u>Functional Criteria</u>	Design 1	Design 2	Design 3
Available Now			
Reasonable Cost			
Sea-based Deep Interdiction			
Low Radar Signature			
TOTAL			

# Design Selection

				
Available Now				
Reasonable Cost				
Sea-based Deep Interdiction				
TOTAL				

# Functional Requirements

## - What not How -

### Functional Requirements

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### Design Ideas





# Platforms

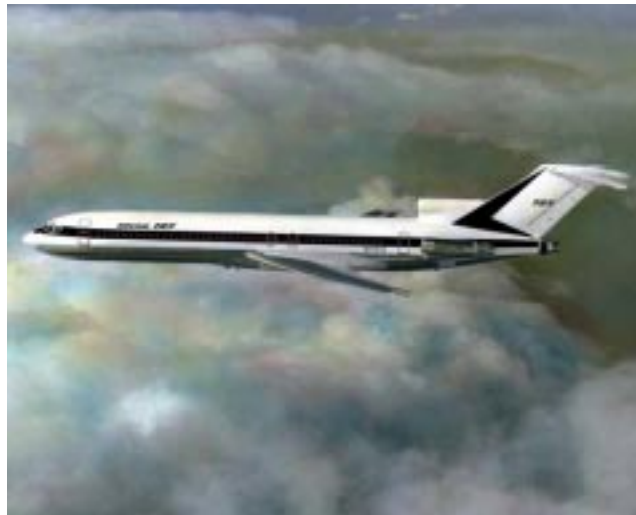
**707**

- 4 engines



**727**

- 3 engines



**737**

- 2 engines



*Constraints? Functional Requirements?*

# Platforms

## **Airforce**

- CTOL



F-16

## **Navy**

- Carrier based



F-18

## **Marine**

- STOVL



Harrier

*Constraints? Functional Requirements?*

# Platforms

**737 NG**  
• 2 engines

**737-600**



**737-700**



**737-800**



**737-900**



*Constraints? Functional Requirements?*

# Platforms

## Joint Strike Fighter



### Airforce

- CTOL



### Navy

- Carrier based



### Marine

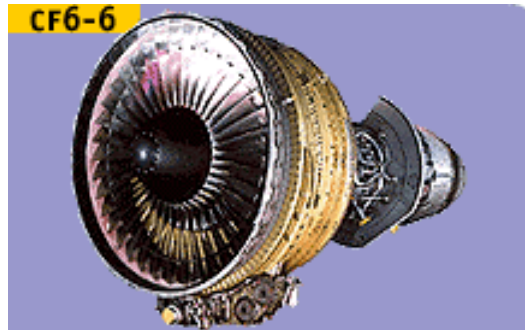
- STOVL



*Constraints? Functional Requirements?*

# Platforms

**CF-6**



*Constraints? Functional Requirements?*

# Platforms

## Oracle8i Database Family

- Oracle8i Enterprise Edition
- Oracle8i Standard Edition
- Oracle 8i Personal Edition
- Oracle8i Lite
- Oracle8i Appliance (h/w and s/w)