

# F-22 RAPTOR



Presented by:

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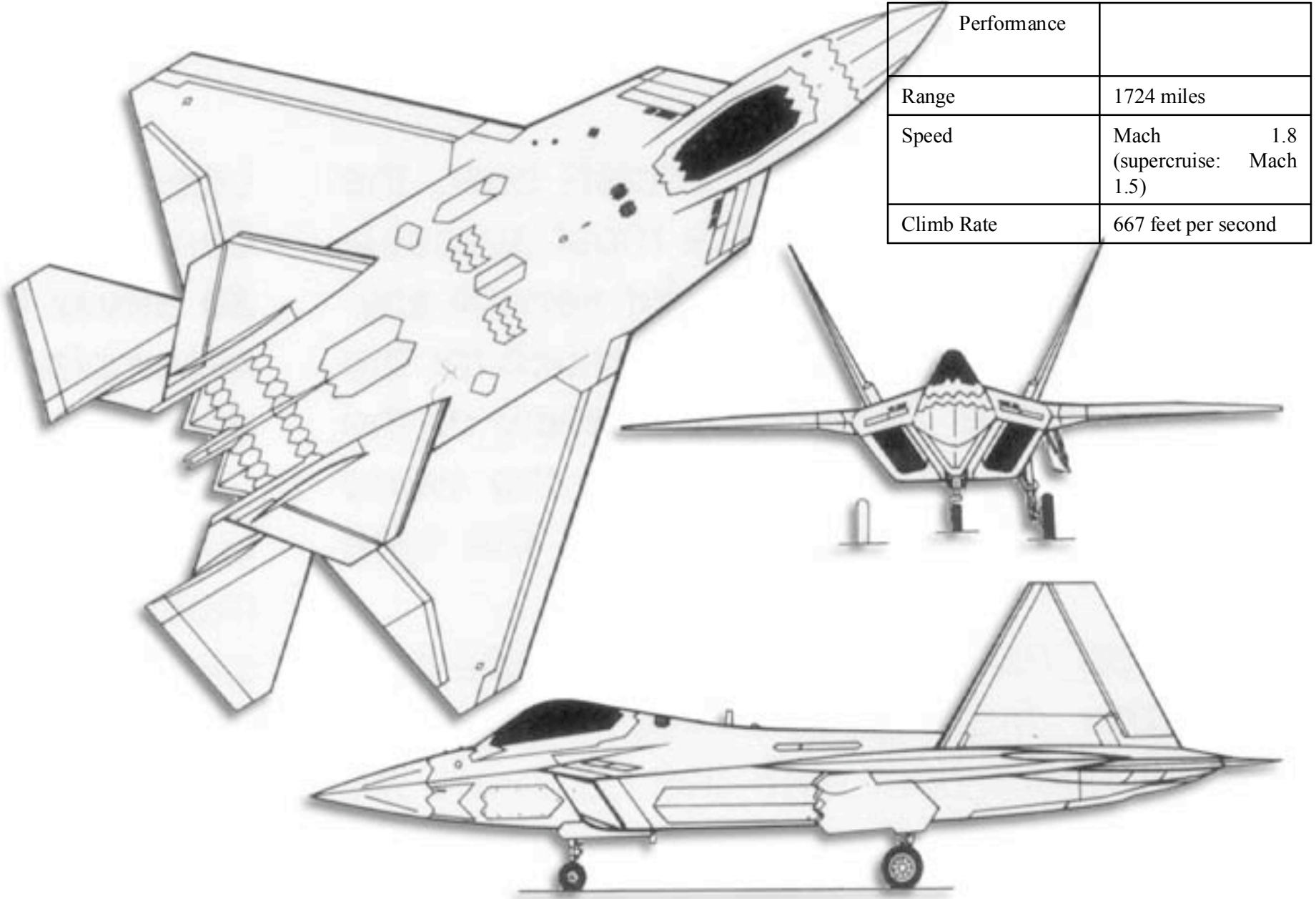
Doug Morton

# Brief History

<b>First Flight</b>	September 7, 1997
<b>Date Deployed</b>	deliveries beginning in 2002 operational by December 2005
<b>Testing:</b>	9 total test aircraft between 1997 and 2001 First 3 structurally tested, most recent 6 tested avionics 4337 test hours in 2409 sorties
<b>- Boeing 757 Flying Test Bed</b>	Radar in the nosecone tested basic radar operations such as search-and-track modes
	Wing section above forward fuselage
<b>- Other aircraft</b>	T-39 Sabreliner used as a target aircraft T-33 used for calibrated airborne trials

# History Cont.

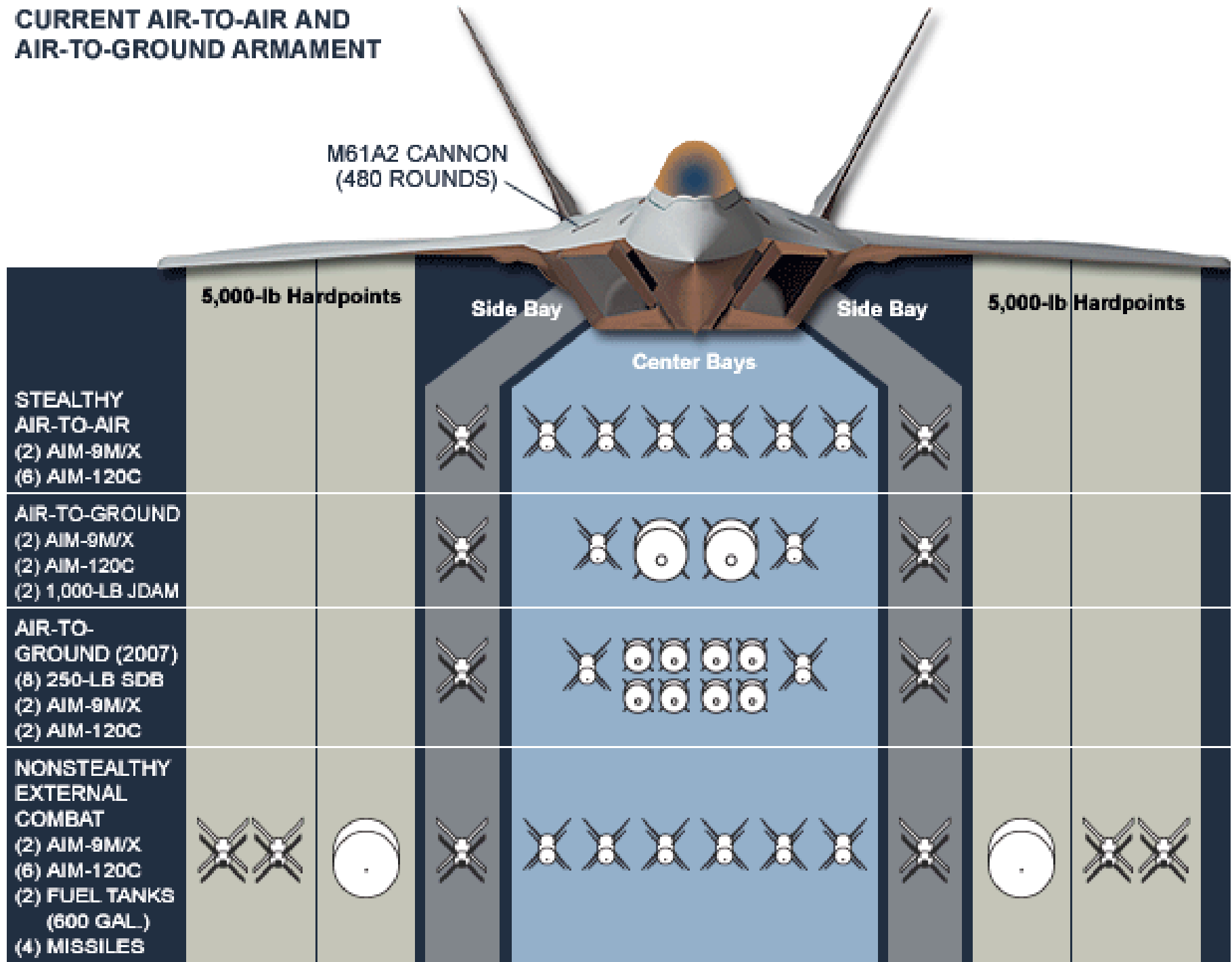
<b>- Problems</b>	Hairline cracks in canopies of first two prototype
	The two-seater F-22B was never built and was completed as the F-22A
	Horizontal Stabilizer replaced in 1999 after 'disbonding' between core and skin materials due to different thermal coefficients of expansion
<b>- Design Goals</b>	Stealth/ Agility Trade off
	Remarkable T/W ratio
	Integrated avionics for single pilot operations
	Supersonic cruise without afterburners
	1.75 million lines of software code
	AOA greater than 85 degrees
	Throttle and stick contain 20 controls and 63 functions



Performance	
Range	1724 miles
Speed	Mach 1.8 (supercruise: Mach 1.5)
Climb Rate	667 feet per second

# CURRENT AIR-TO-AIR AND AIR-TO-GROUND ARMAMENT

M61A2 CANNON  
(480 ROUNDS)



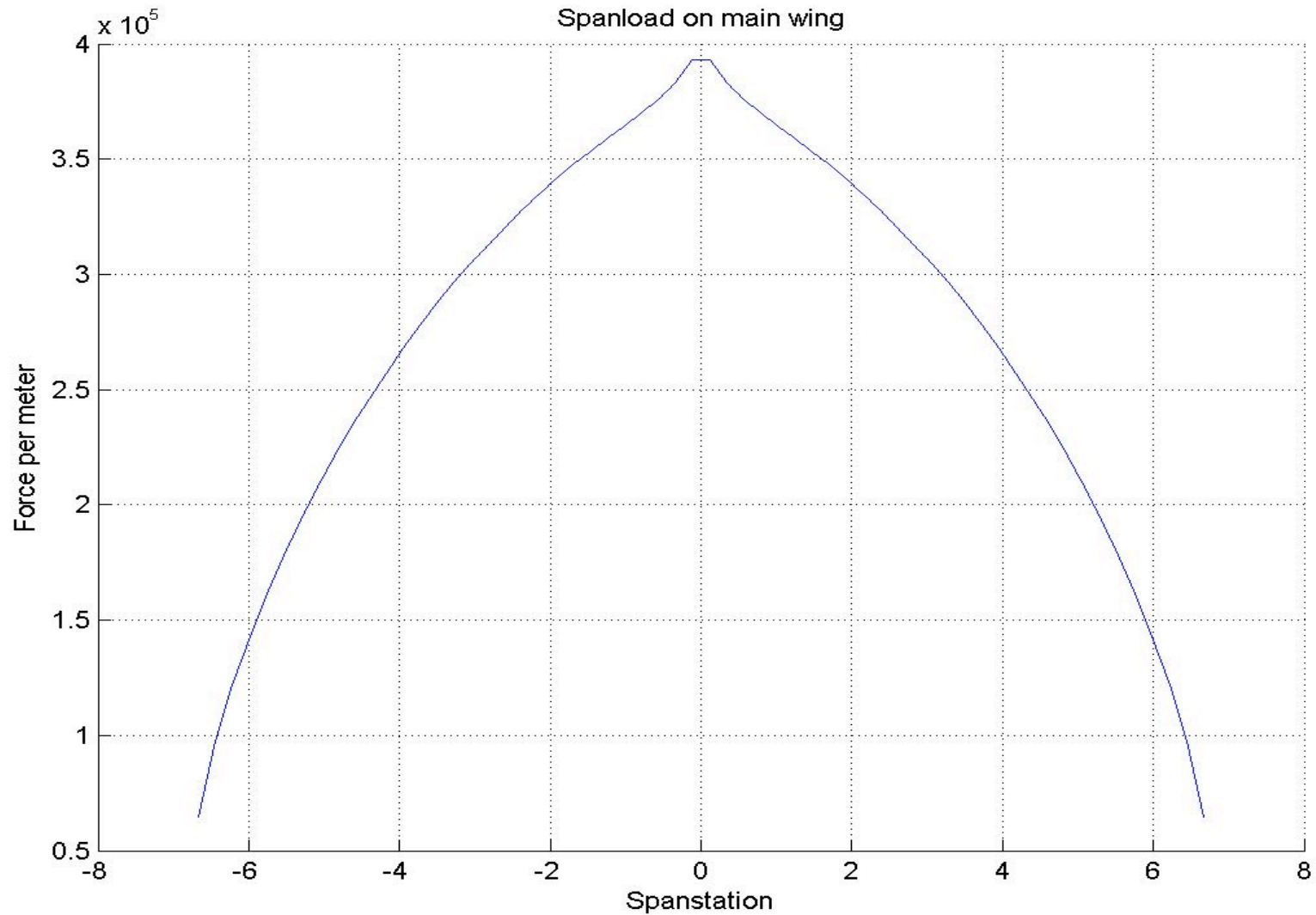
# Basic Geometry

Swing, Sref	840 square feet
b	44.5 feet, 13.56 meters
AR	2.357
Taper ratio	0.1685
Sweep	42 deg LE, -17 deg TE, 30.9 deg c/4 sweep
Stail	Horizontal – 136 square feet Vertical – 178 square feet
b tail	29 feet, 8.84 meters
Wetted Area	3400 square feet
Tail Scrape Angle	15.95 degrees

# Lifting Properties

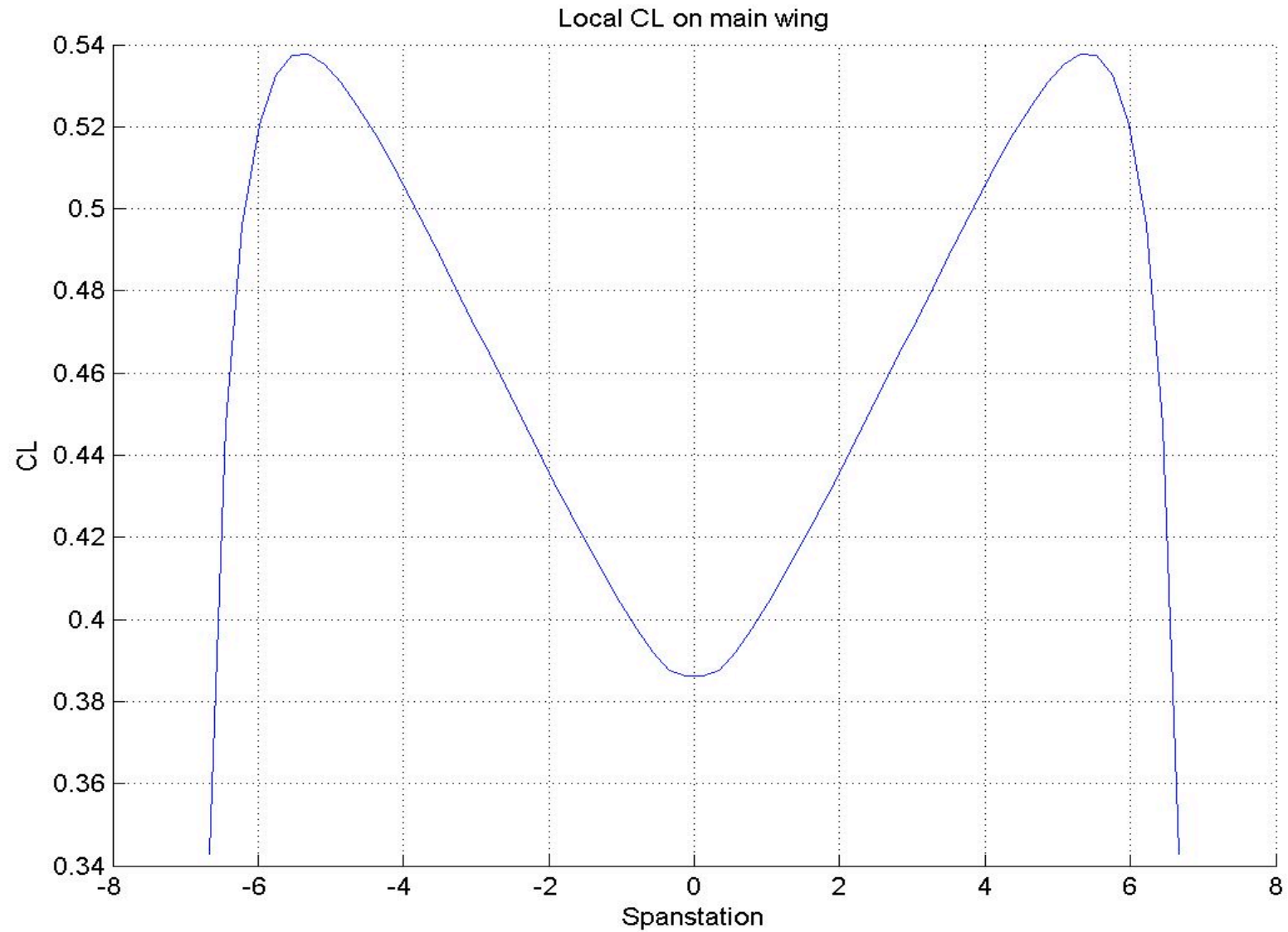
Wing Loading (W/S)	71.43
-t/c versus x/c	Root – 5.92 % Tip – 4.29 %
Twist	Root – 0.5 deg Tip – -3.1 deg
Anhedral	LE at 3.25 deg
CL_cruise	0.186 for M=1.5
CL_max	2.6 at sea level
L/D max	8.4
Flat wing span loading	Next slide
CL distribution	Second slide
CLa(lift curve slope)	3.27 per radian

# Flat Wing Span Loading





# CL Distribution



# High Lift Devices and Control Surfaces

<b>Leading Edge Flaps</b>	
B_device/b	0.445
S_device/Sref	0.061
<b>Ailerons</b>	
B_device/b	0.223
S_device/Sref	0.025
<b>Flaperons</b>	
B_device/b	0.111
S_device/Sref	0.065
<b>Rudder</b>	
B_device/b	0.223
S_device/Sref	0.065
<b>Stabilator</b>	
B_device/b	0.260
S_device/Sref	0.162

# Propulsion and Weight Fractions

Propulsion System	two Pratt & Whitney F119-PW-100 engines 35,000 lbs (st) each
T/W	1.4, 1.2 for TO
TOGW	60,000 lbs
$W_{\text{payload}}/\text{TOGW}$	0.20
$W_{\text{fuel}}/\text{TOGW}$	0.47

# Stability

Neutral Point	Subsonic 34.8 feet
CG location	37.14 feet
dCm/dCL (static margin)	Subsonic -2.34 feet
Load split for wing/tail for trimmed cruise	L <sub>wing</sub> = 68055 lbs L <sub>tail</sub> = -8055 lbs Wing/tail = 8.45
-CL at tailsrape -1 degree	0.855