Northrop YB-49
Flying Wing Bomber

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Mission / Purpose

- Jet Powered Variant of the XB-35
- Northrop XB-35 was the 13th flying wing flown by the company
- Designed as a long range, heavy bomber meant to compete with the Convair B-36

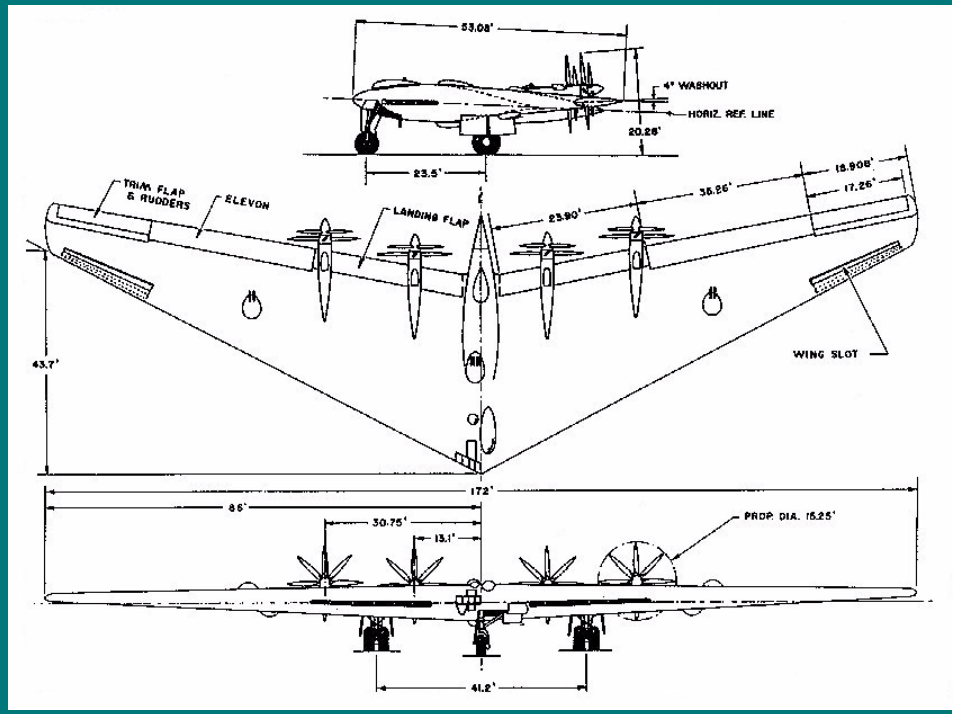
http://www.nurflugel.com/Nurflugel/Northrop/yb-49/body_yb-49.html

pages.nyu.edu/~jh15/ images/b36-1.jpg

Mission / Purpose

- XB-35 design was commissioned during WWII to have a range of 10,000 miles carrying 10,000lbs of bombs.
- Original mission called for a bomber that could operate from the western hemisphere and bomb Europe without refueling.

XB-35



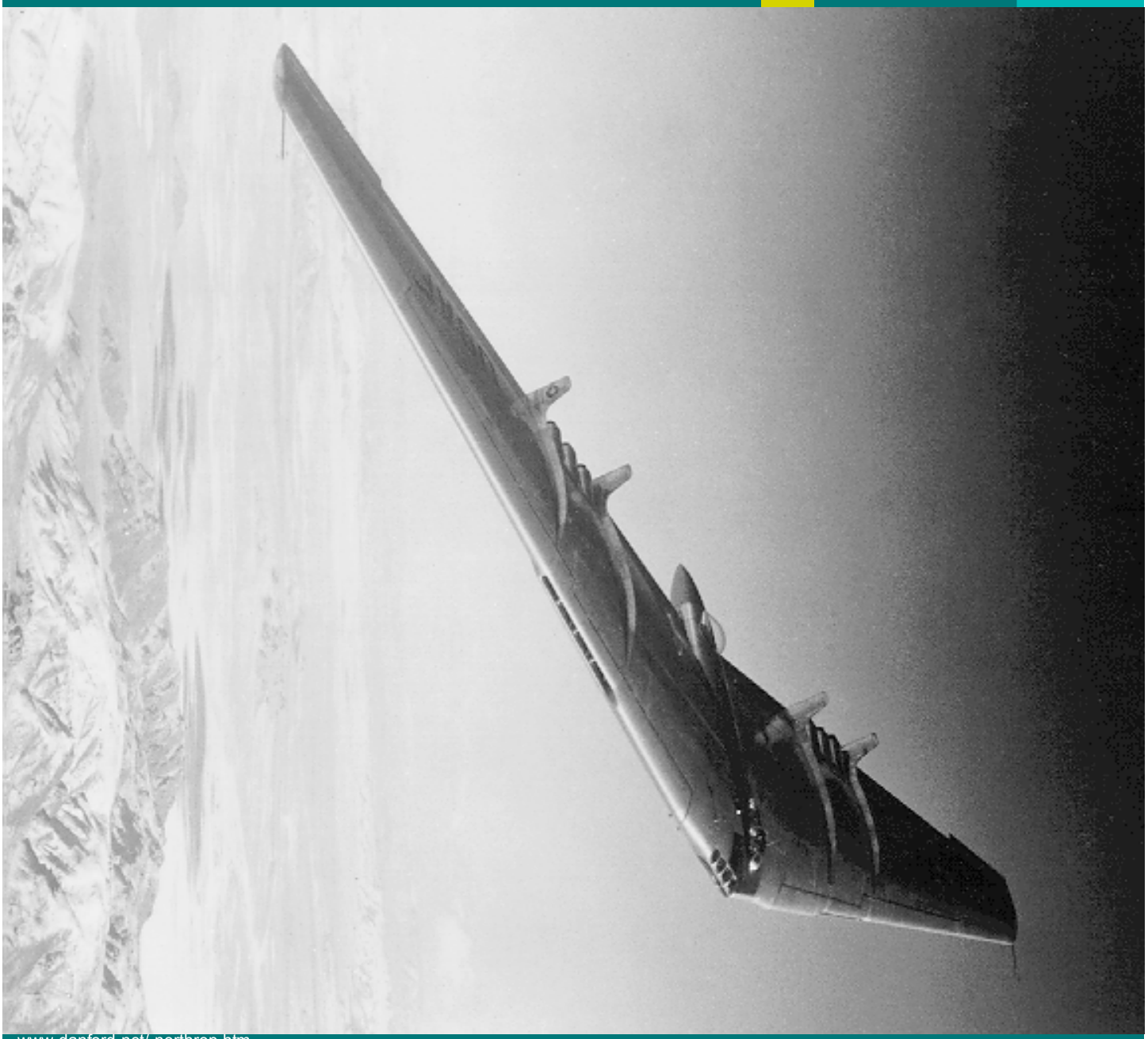
www.volny.cz/kletectvi/ northrop.htm

Mission / Purpose

- Why a Flying Wing?
  - Jack Northrop was a HUGE believer in the idea for years
  - Large internal volume (fuel and payload)
  - Simplified Structures
  - Extremely low drag possible!
  - Earlier stability and control studies showed concept was viable
  - Subsonic mission

Mission / Purpose

- XB-35 was classified as a heavy bomber
- YB-49 promised greatly improved performance over it's piston driven predecessor in terms of speed
- Sacrifice in range was deemed acceptable
- YB-49 was eventually classified as a medium bomber



www.danford.net/ northrop.htm

avions.legendaires.free.fr/ Images/imagemai02.jpg

Mission / Purpose

- Alterations from XB-35
  - Piston/prop propulsion replaced with 8 Allison J35-A-5 turbojet engines
  - Slot intakes cut into leading edge of wing
  - Four vertical surfaces added; two inboard of engines and two outboard
  - Wing fences Added
  - All guns removed except for those in tail stinger

www.globalaircraft.org/planes/ yb-49_flying_wing.p

History

- June 1, 1945 – First two XB-35 to YB-49 conversions commissioned.
- Maiden flight of first YB-49: October 21, 1947 Maiden flight of second: January 13, 1948
- Both based at Muroc AFB for testing
- 20 month test flight program conducted with both AF and Northrop pilots
  - 144 flights flown by Northrop pilots
  - 25 flights flown by Air Force pilots
- April 26, 1948, the first YB-49 achieved a milestone of sorts, the aircraft staying up in the air for 9 hours, 6 hours of which were above 40,000 feet. (unofficial record for the time)
- June 5, 1948, 2nd YB-49 crashes killing all aboard including Capt. Glenn Edwards. Investigation suggested Edwards surpassed the V_{ne}. Muroc AFT renamed Edwards AFB.

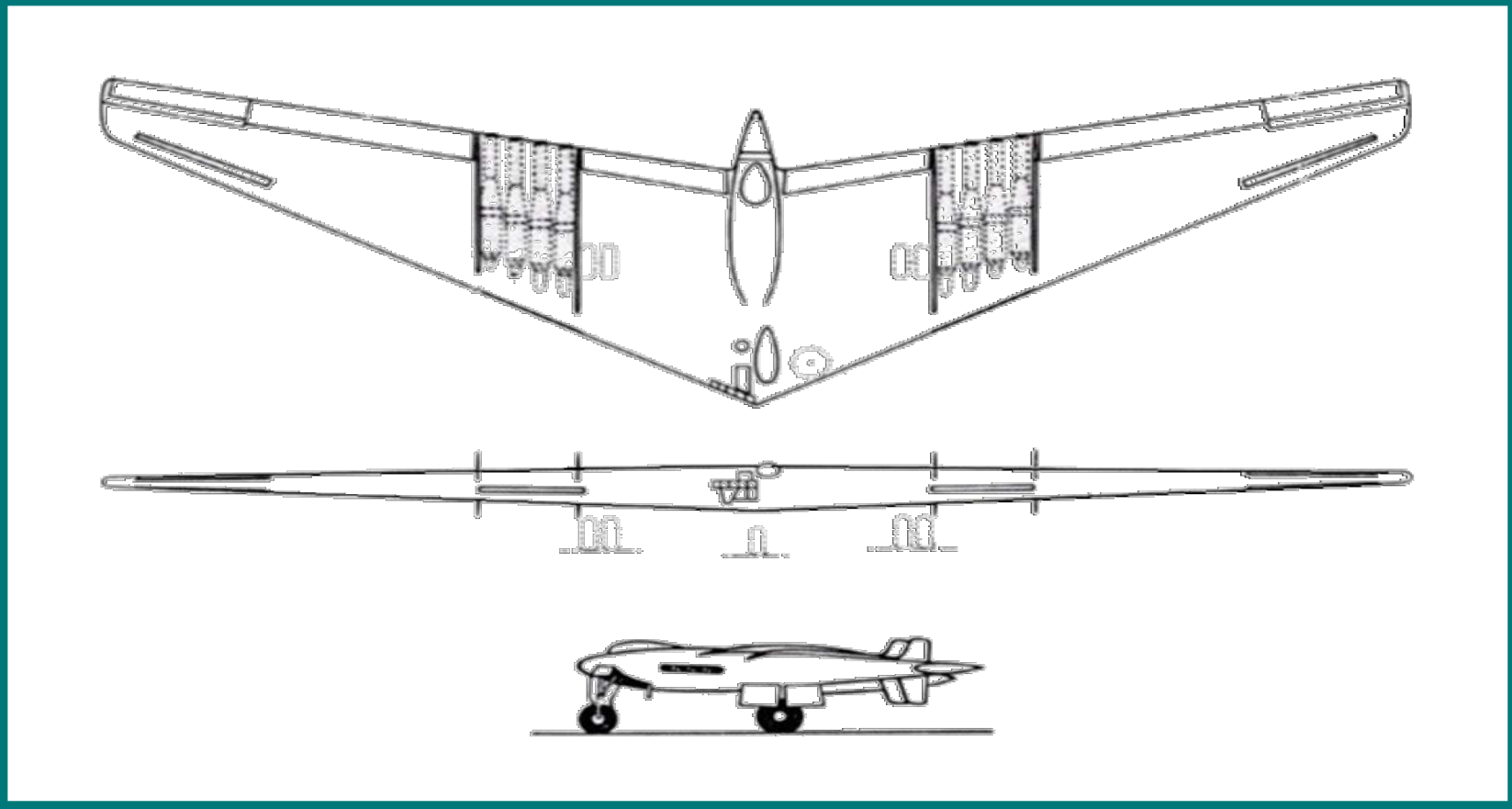
History

- Air Force decided to continue program
- Bombing tests show accuracy worse than older B-29. Instability issues frustrate pilots and crews.
- 1948, YB-49 down-graded to medium bomber. Now competes with XB-46, XB-47, and XB-48 projects instead of B-36.
- 1949, YB-49 ordered on publicity tour.
  - Possible sabotage during trip
  - Engine fire during flight caused by oil drain from engines. Appeared to be intentional.
- March 15, 1950, program officially cancelled.
- March 15, 1950, same day program is cancelled, first YB-49 suffers a failure during taxiing and is destroyed

YB-49 Specifications

Area, S	4000 ft^2
Span, b	172 ft
Max payload	15,000 lb
Max takeoff weight	213,500 lb
8 Allison J35-A-5 turbojet engines	32,000 lb (total)
Cruise speed / Max speed	420 mph / 495 mph (520 mph record speed)
Range	4000 mi with bombs

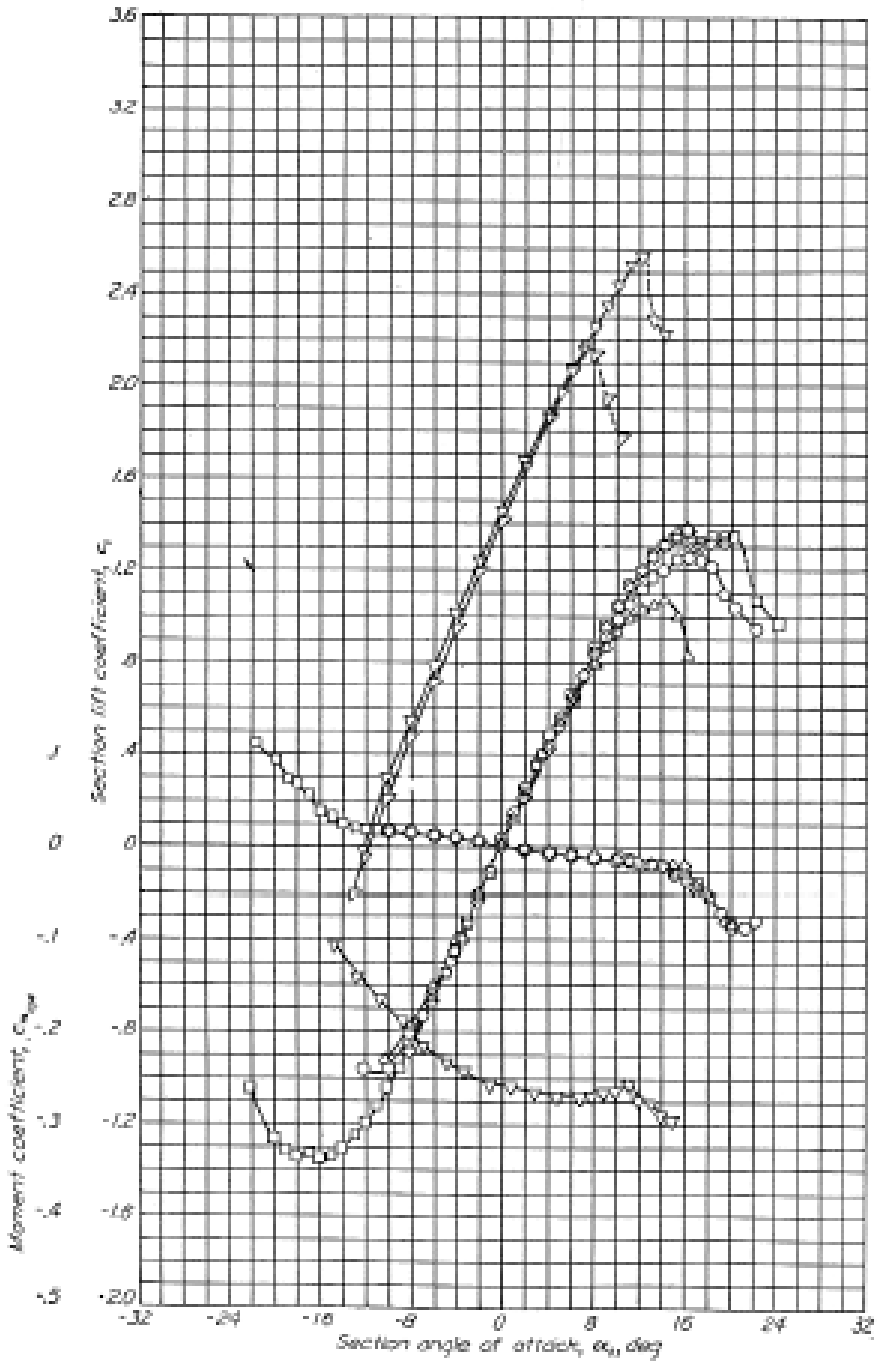
YB-49 Final Configuration



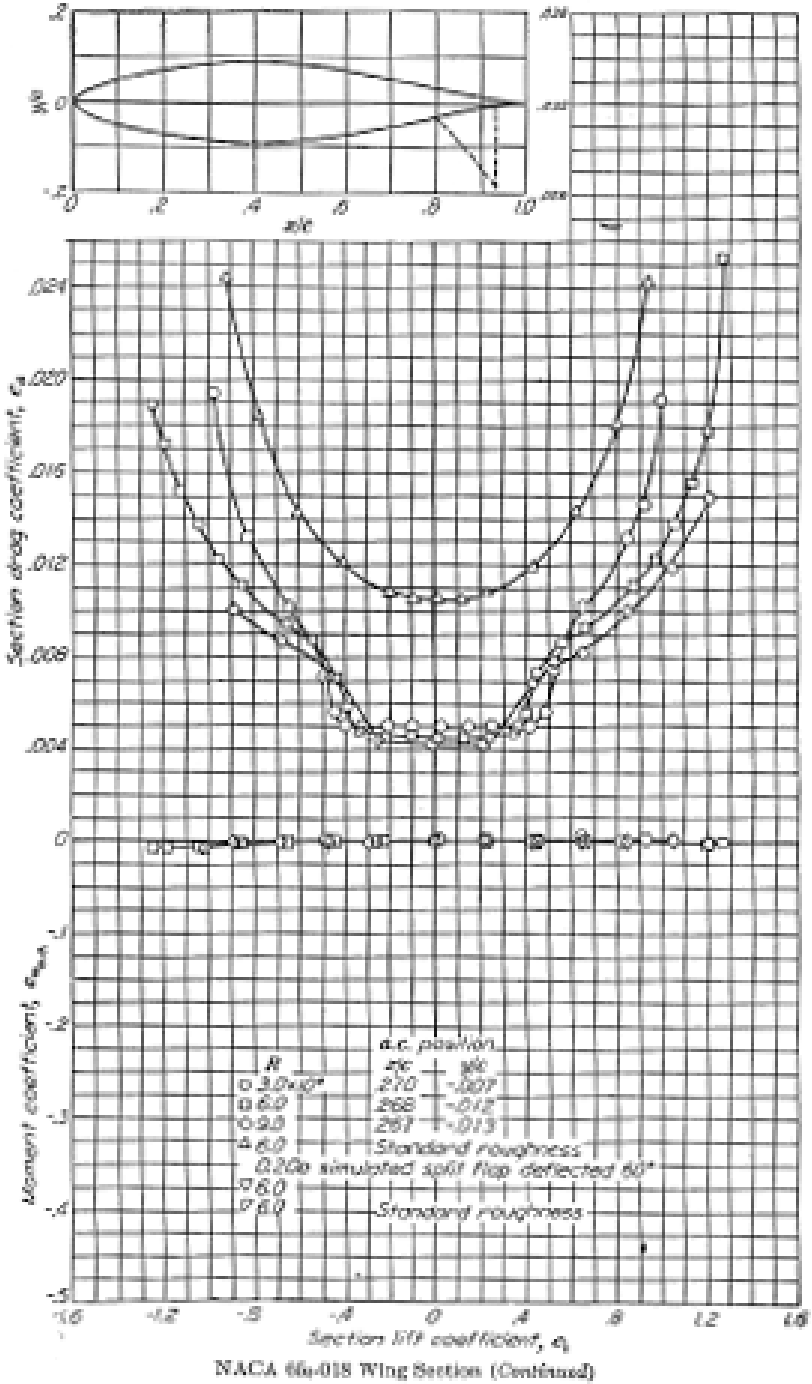
www.globalaircraft.org/planes/ yb-49_flying_wing.p

Planform / Airfoil Issues and Analysis

Wing Area (total)	4000 ft2 (371.6 m2)
Span	172 ft (52.4 m)
Length	53.08 ft (16.2 m)
Aspect Ratio	7.4:1
Taper Ratio	4:1
Incidence	0 deg at root chord -4 deg at tip chord
Dihedral	0° 53' at Leading Edge
Wing Thickness	85.5 inches at root chord
Sweep	26º57'48" LE 10º15'22" TE
M.A.C	315" (210" Aft Sta 0) (CG @ 35.4% MAC)
Root Airfoil	R.C. NACA 65,3-019
Tip Airfoil	T.C. NACA 65,3-018
Chords	R.C. 37.5 ft (11.4 m) T.C. 9.33 ft (2.8 m)



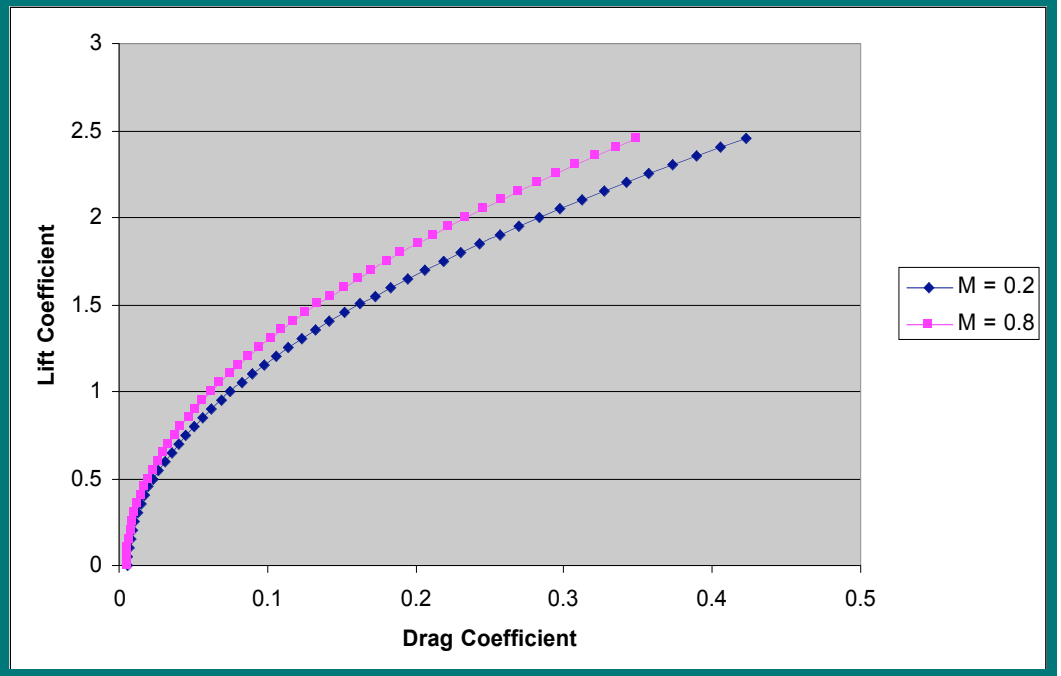
NACA 66-018 Wing Section



NACA 66-018 Wing Section (Continued)

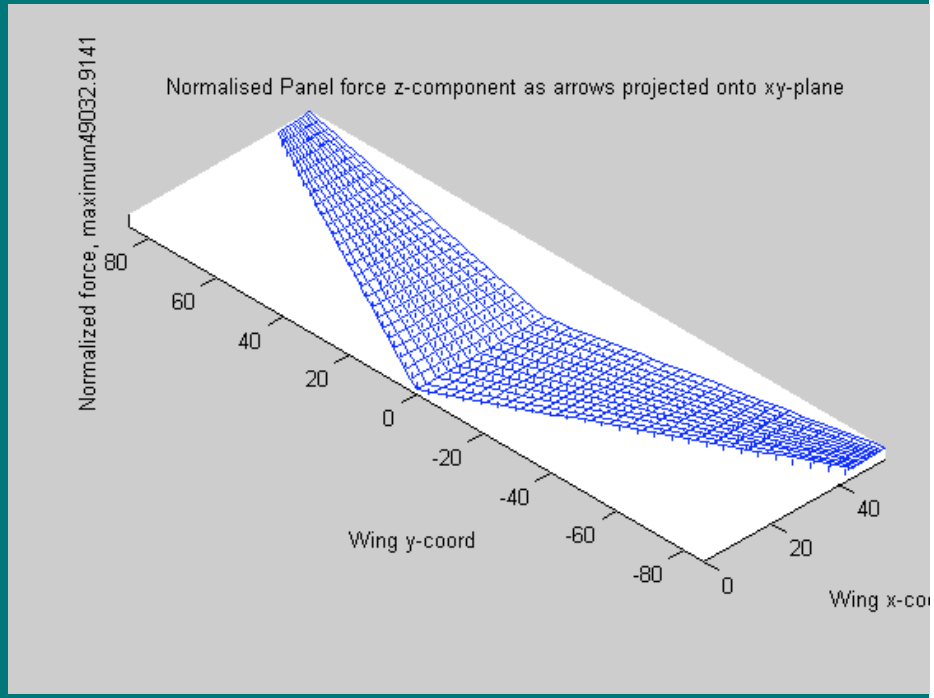
Planform / Airfoil Issues and Analysis

- C_L Cruise = 0.118
- C_L Max = 1.2 (clean)
- C_{d_0} = 0.00608
  for Mach = 0.2
- C_{d_0}= 0.00601
  for M = 0.5



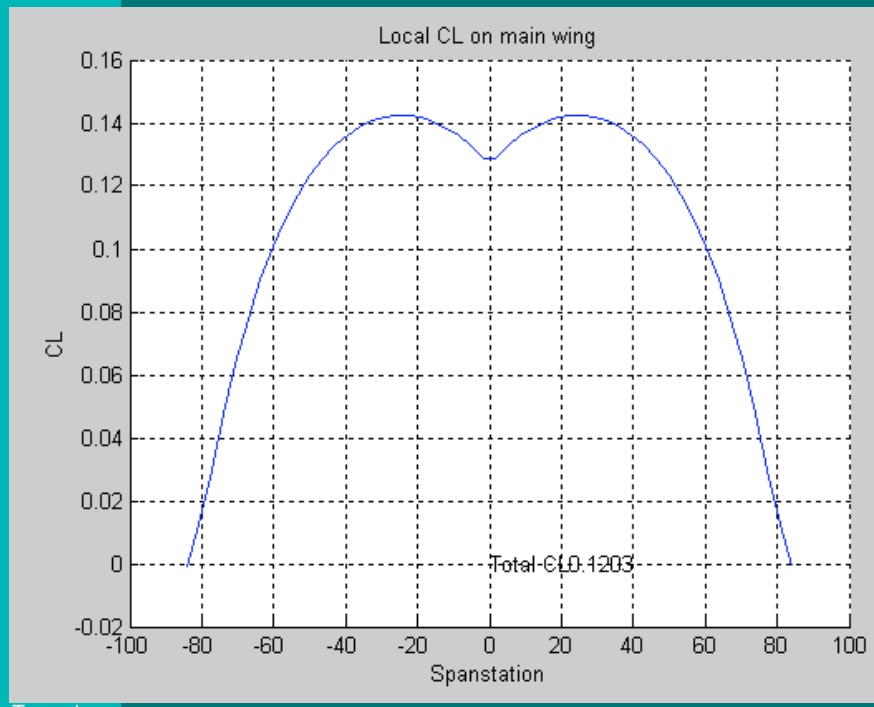
Planform / Airfoil Issues and Analysis

- Tornado Analysis
- 624 Panels
  - 12 chord-wise divisions
  - 26 divisions across half-span

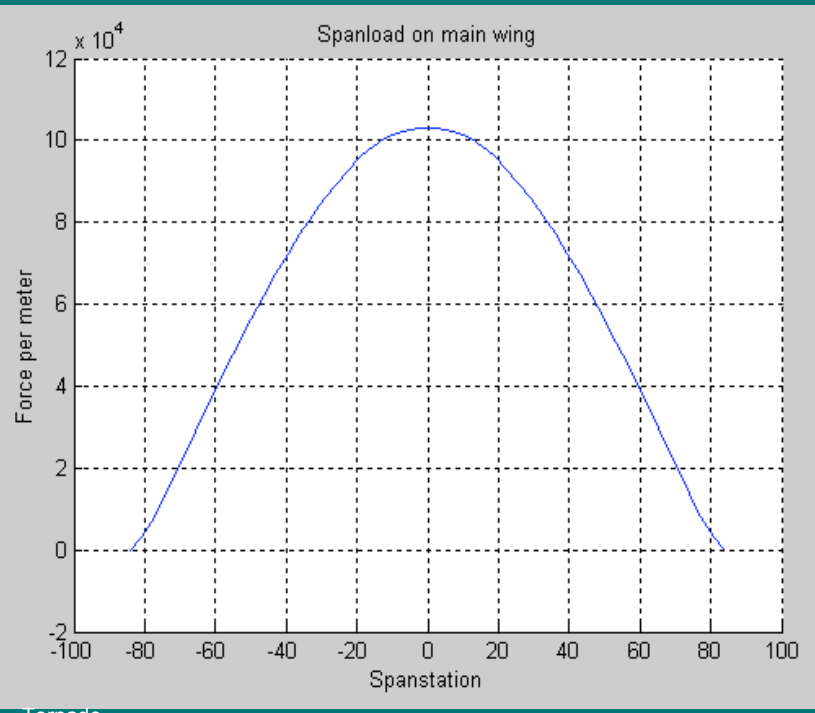


Tornado

Planform / Airfoil Issues and Analysis



Tornado



Tornado

Planform / Airfoil Issues and Analysis

- 10 % Static Margin Instability
- Elevons/Trim Flaps to trim
  - Small moment arm (no tail)
- Split Drag Rudders
- Vertical surfaces still did not provide enough yaw stability (first aircraft to incorporate an artificial stability system as a result)
- Flow field with bomb bays open turbulent
  - Decreased bomb accuracy

Overall Assessment

- Poor fuel efficiency reduced range and payload capabilities
- Increased max speed by 100 mph over XB-35
- Eliminated vibration due to piston engines (fixed gearbox problems)
- Long range and high cruising altitude goals required by Air Force were not fully met
- Test pilots complained that it could not hold a steady course or a constant airspeed and altitude
- “It was the wrong airplane at the wrong time…”

Concluding Thoughts…

- Good Idea at the wrong time
- Stability issues were likely unsolvable with the technology available
- Provided valuable data on radar cross-section reduction associated with flying wings
- Amazing resemblance to later B-2
- Even if stability problems had been solved, it is questionable whether or not it would have been adopted by the Air Force given Convair's involvement.

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