B-52, The “StratoFortress”

Aerodynamics and Performance
Build-up

- Latest Model
  - B-52H
  - Last B-52H delivered in 1962
- Transonic Bomber
  - Nuclear Payload capable
  - 20 Cruise Missiles
    - AGM-86C
    - AGM-12 Have Nap
    - AGM-84 Harpoon
  - Up to 50,000 lb ordnance payload
  - 51 bombs of 750-lb class

Service

- Crew
  - Upper Deck
    - 2 Pilots
    - Electronic Warfare Officer
  - Lower Deck
    - Bombardier
    - Radar Navigator
- Deployment
  - 102 B-52H's
  - 192 B-52G's
  - All in Service of USAF as far as we can tell
  - $53.4 million each [1998$]

Additional Payload

- In addition to attack ordnance, B-52H carries:
  - Norden APQ-156 Multi-mode targeting radar
  - Terrain Avoidance Radar
  - Electro-Optical Viewing System (EVS)
    - Infra-red and low light display used in conjunction with terrain avoidance sensors to navigate in bad weather at low altitudes, or with the nuclear windscreen shielding in place
  - ECM
    - ALT-28 jammer
    - ALQ-117, -115, -172 deception jammers
  - Optional Stinger Air to Air missiles in aft gun-turret

Weight Breakdown

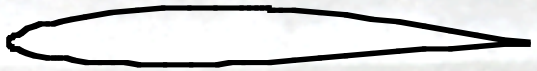
- Max TOGW
  - 505,000 lb
- Fuel Weight
  - 299,434 lb internal
  - 9,114 lb on non-jettisonable under-wing pylons
- Ordnance Weight
  - 50,000 lb
- Airframe operational empty
  - 146452 lb

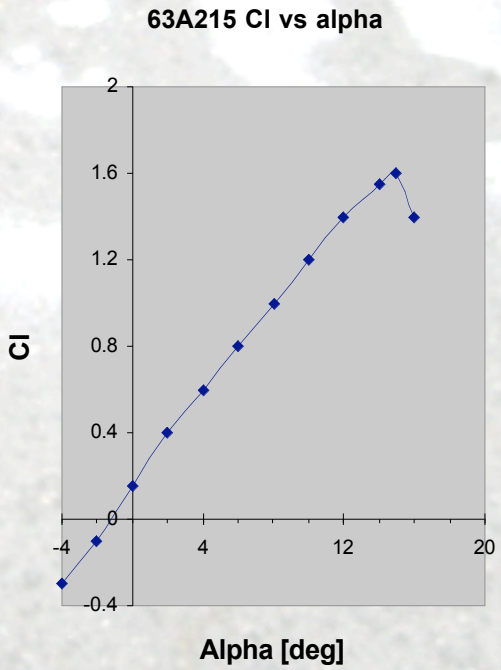
Basic Geometry

- Length: 160.9 ft
- Wing
  - Span: 185 ft
  - Area: 4000 ft^2
  - Root Chord: ~34.5 ft
  - Mean Chord: 21.62 ft
  - Taper Ratio: 0.37
  - Leading Edge Sweep: 35°
  - AR: 8.56
- Tail Plane
  - Horizontal Tail Span: 55.625 ft
  - Horizontal Tail Plan Area: ~1004 ft^2
  - Vertical Tail Height: 24.339 ft
  - Vertical Tail Plan Area: ~451 ft^2

Wing Geometry

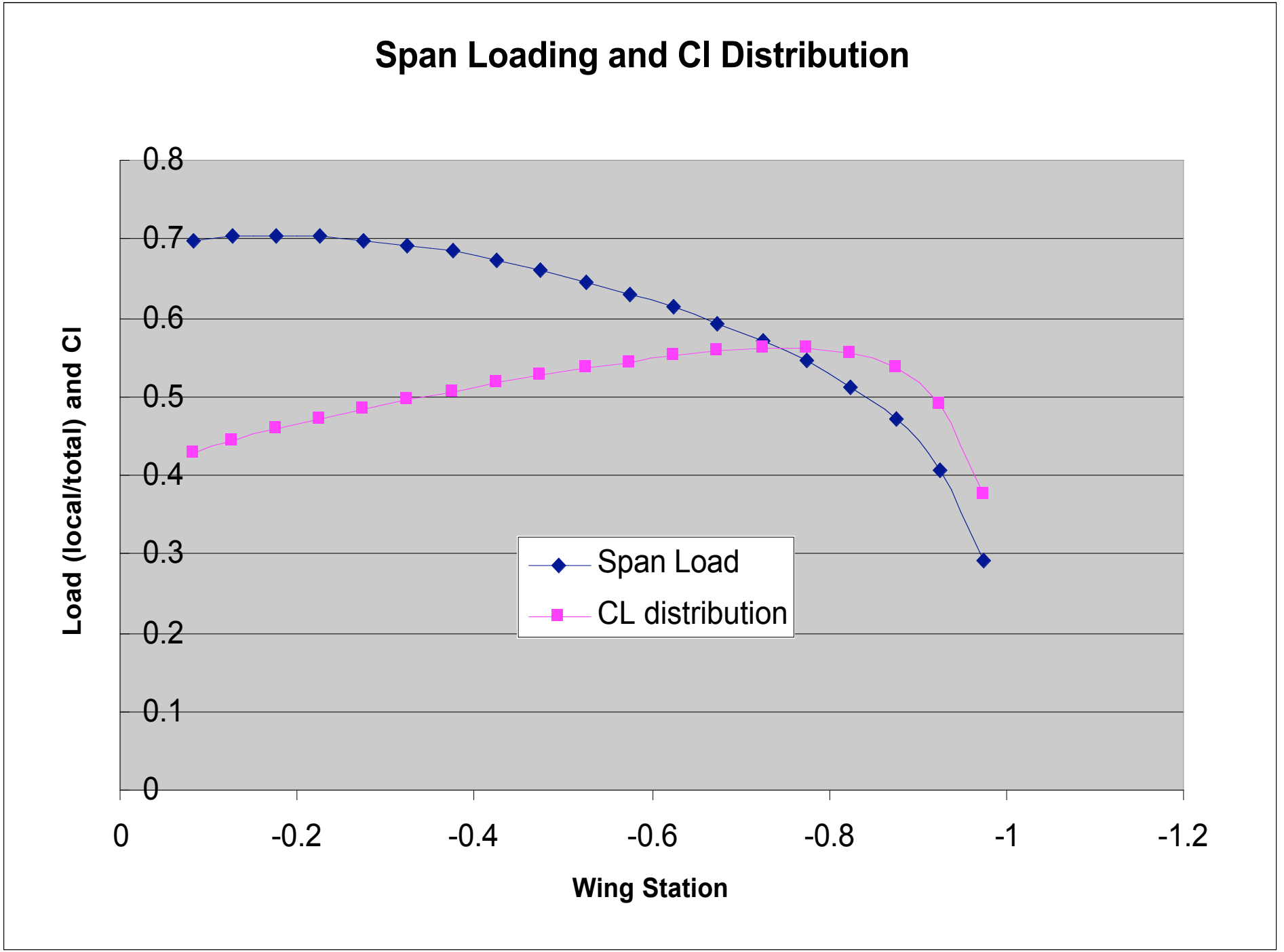
- Wing Root: 14% thick NACA 63A219.3 mod
- Wing Tip: 8% thick NACA 65A209.5 mod
  - Paneling is unavailable for these specific airfoils,
  - To the left is a NACA 63A210, and the lift data for a 63A215

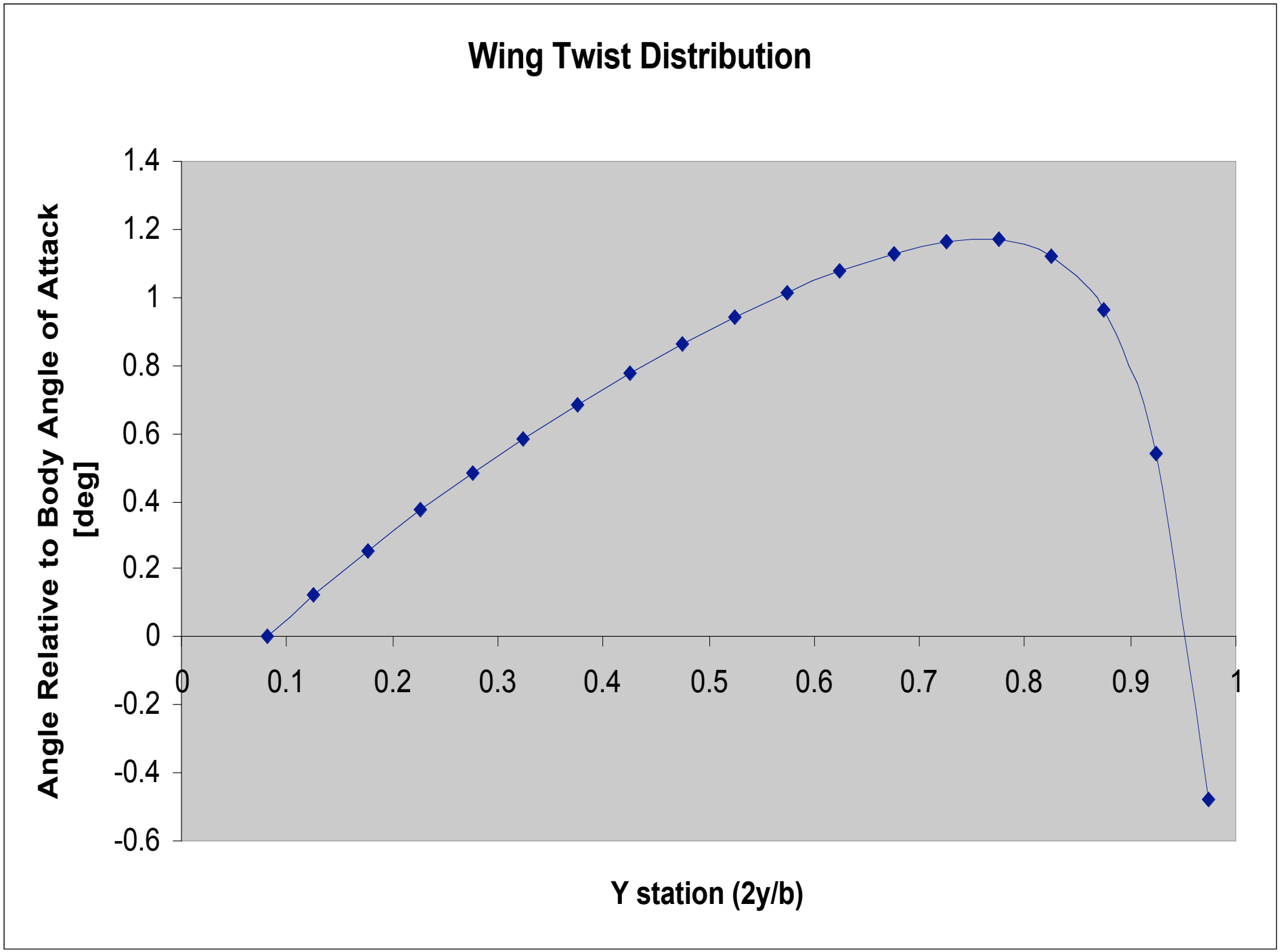




Wing Loading

- Cl for trimmed cruise at altitude ~0.37
  - X_{CP} wing = -68.296 ft
  - X_{CP} tail = -130 ft (tail average quarter chord)
  - Main wing carries 85.3% of Load
  - Tail carries remaining 14.7%


Span Loading and Cl Distribution
Load (local/total) and Cl
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
Wing Station
Span Load
CL distribution


Wing Twist Distribution
Angle Relative to Body Angle of Attack [deg]
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Y station (2y/b)

Propulsion

- 8 Pratt & Whitney TF33-P-3 Turbofans
  - Static Thrust: 17,000 each
  - TSFC: 0.52 (lb/hr)/lbf
  - Throughput: 450 lb air / sec each
  - Weight: 3,900 lb each

Performance

- Take-off/Landing
  - Ground Roll: 9500 ft at Max TOGW
  - Rotation:
    - None, hence the long ground roll
  - Bicycle Landing Gear
    - 4 carriages with 8 wheels each
    - Outriggers to support wings when fully fueled

- Cruise
  - Ceiling 55,000 ft
  - Wetted Area: 23701 ft^2
    - C_L min drag ~0.3
    - $Cd_{friction}$ ~ 0.01429
    - L/D max ~19
      - cannot fly here
      - Cruise at L/D ~ 11
      - Due to wave drag from Mach 0.75+ flight
  - Range: 10,000 mi
  - Cruise Speed 442 kt
  - Max Speed 516 kt
  - Low altitude penetration speed 360 kt

High Lift Devices

- The B-52 incorporates fowler flaps along the inboard 62% of the wing, terminating at the start of the exhaust from the outboard engines. It incorporates a gap for the exhaust of the inboard engines
- When extended, they have ~30-35% local chord length, for a total area of ~1100 square feet.
- They are deflectable to ~40°
- Spoilers also used in high lift flight

Dynamics and Control

- Neutral point at x = -76.2 ft, just aft of the wing root
- Balanced slightly stable
  - CG x = -78.5
  - NP x = -76.2
  - Yields static margin of 2.3 feet

B-52 Control Surfaces

- The B-52H uses 7 spoilers above each wing for roll control
- A fixed horizontal tail with trailing edge deflections for pitch control.
- Vertical tail with trailing edge deflections for yaw control.

Changes with Model

- Use of ailerons and 6 spoilers for roll control in the A-F models,

- G&H models use 7 spoilers and no ailerons