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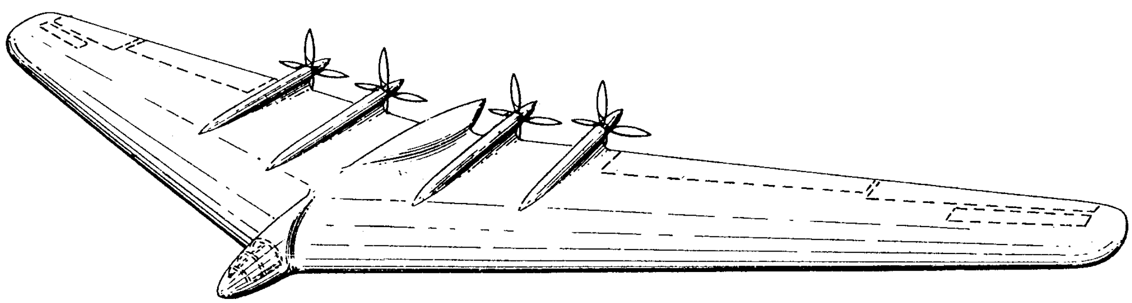
Prototype Issue

Northrop Flying Wings Design Concepts - 1950

Northrop Aircraft, Inc. was always interested in the flying wing concept. Jack Northrop's dream was realized in 1946 when the first XB-35 took to the air. However, the piston engined B-35 and its jet-engined sibling B-49 were destined to not achieve production status. There were a number of factors standing in the way of success for the flying wings. They were unconventional configurations, and were going up against the giant but relatively conventional Consolidated B-36… prejudice against unconventional aircraft was firmly entrenched, and the Northrop corporation did not have the political clout of their competition. But perhaps most telling, the flying wings had their bomb loads distributed through several smaller bomb bays, rather than one central, large by. While this would have proven an irrelevancy in World War II with a load of conventional bombs, in the late 1940's the USAF was looking at fielding the latest generation of hydrogen bombs. These weapons were giant devices that simply would not fit within the confines of the B-35's small bomb bays.

In 1950, several designs were unveiled for new flying wing bombers. These aircraft were advancements upon existing B-35 and B-49 flying wing bomber designs, using somewhat different planforms (including cockpits that projected well ahead of the wing leading edge) and taking advantage of new, powerful turboprop engine designs. But perhaps the greatest advance over the previous flying wings was the use of something that more closely approximated a fuselage… providing the volume to carry a single multi-megaton citybuster. The design chosen was an update of an earlier Northrop concept, dating from 1941.

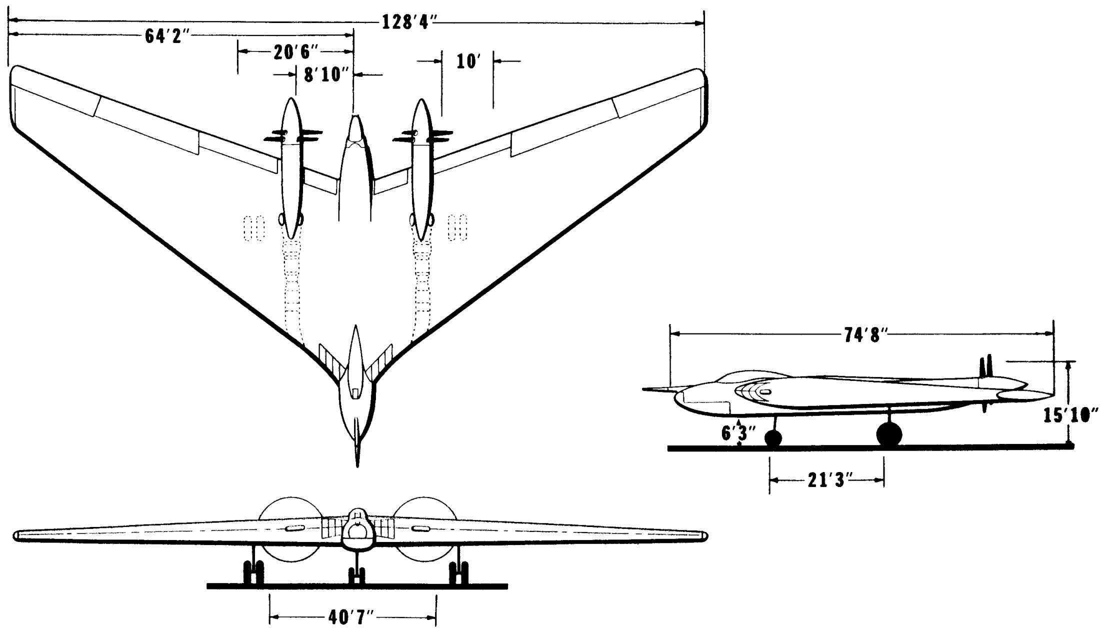


Northrop drawing of a flying wing design patent filed for in 1941

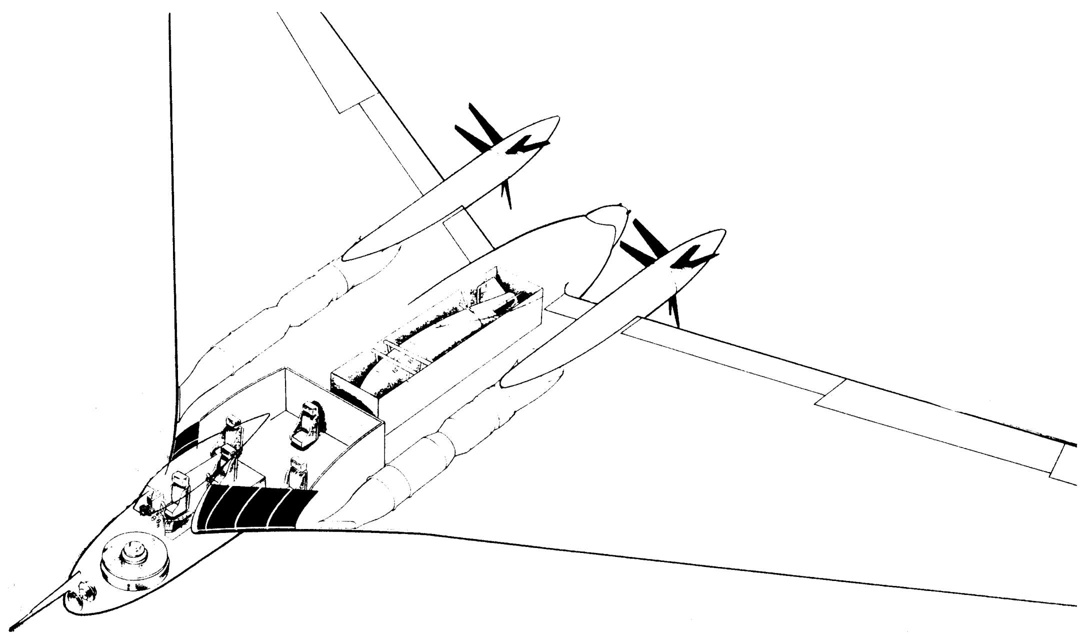
A crew of five was contemplated for these designs, with two crewmembers in a tandem cockpit (similar to the Boeing B-47). Two other seats were located in the leading edges of the wing roots, and were provided with large windows for forward visibility. A tail stinger was provided with a remote gun turret containing two or four machineguns (probably .50 caliber). Inflight refueling was planned for long range bomb runs; speed and maneuverability were expected to be such that fighter interception would be extremely difficult.

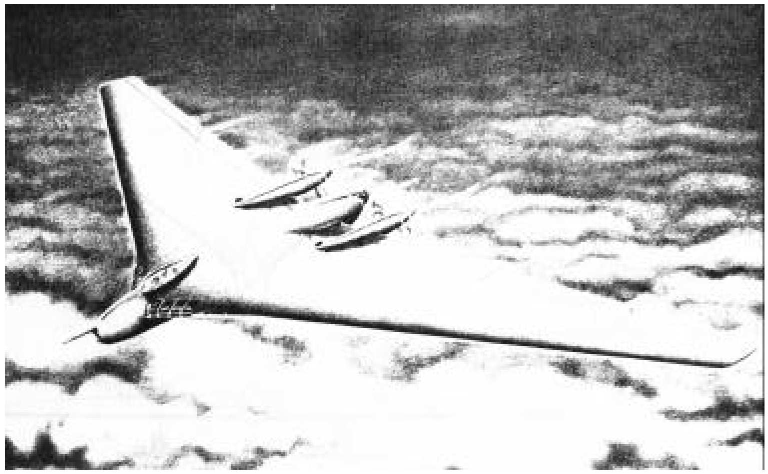
The primary version was equipped with two Turbodyne V turboprop engines, each driving a six-bladed counter-rotating propeller. The Turbodyne was a large turboprop engine developed in-house at Northrop; each engine could put out 10,000 horsepower.

Span: 128.33 feet/ 39.12 meters
Length: 74.67 feet/ 22.76 meters
Maximum ground weight: 161,540 lbs./73,427 kg
Maximum flight weight (after inflight refueling): 222,710 lbs./101,232 kg
Cruising speed: 450 knots
Bombing altitude: 43,000 feet
Combat radius - unrefueled: 2,400 n. mi.
Combat radius - refueled at cruising altitude: 4,500 n. mi.
Combat radius - refueled 1000 n. mi. from base: 4,850 n. mi.



Three-view of Turbodyne V version

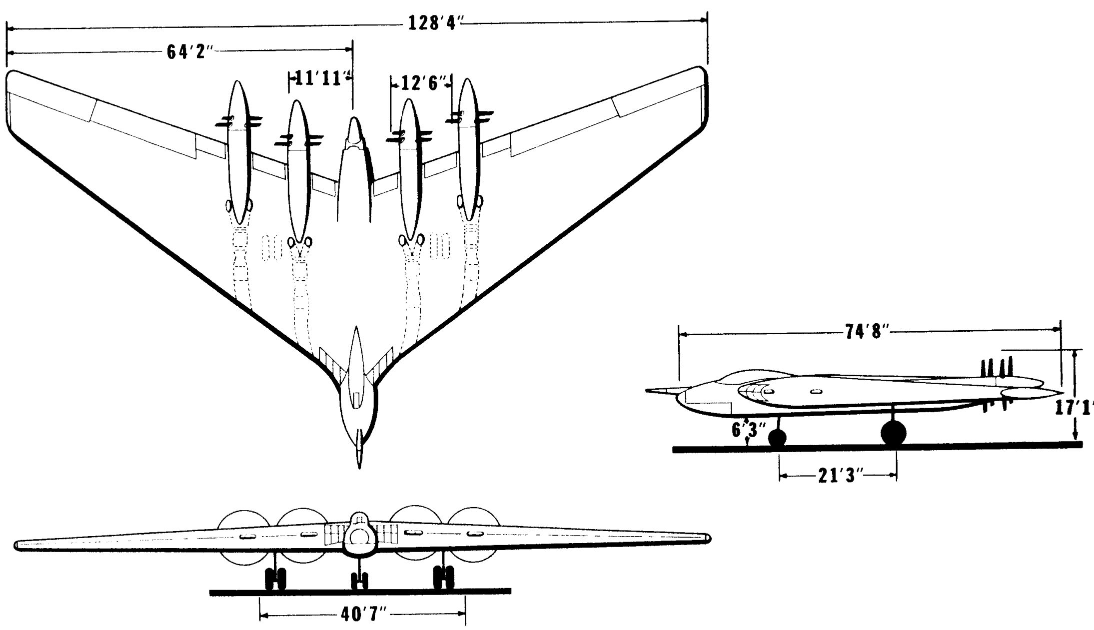

Cutaway view of Turbodyne V version



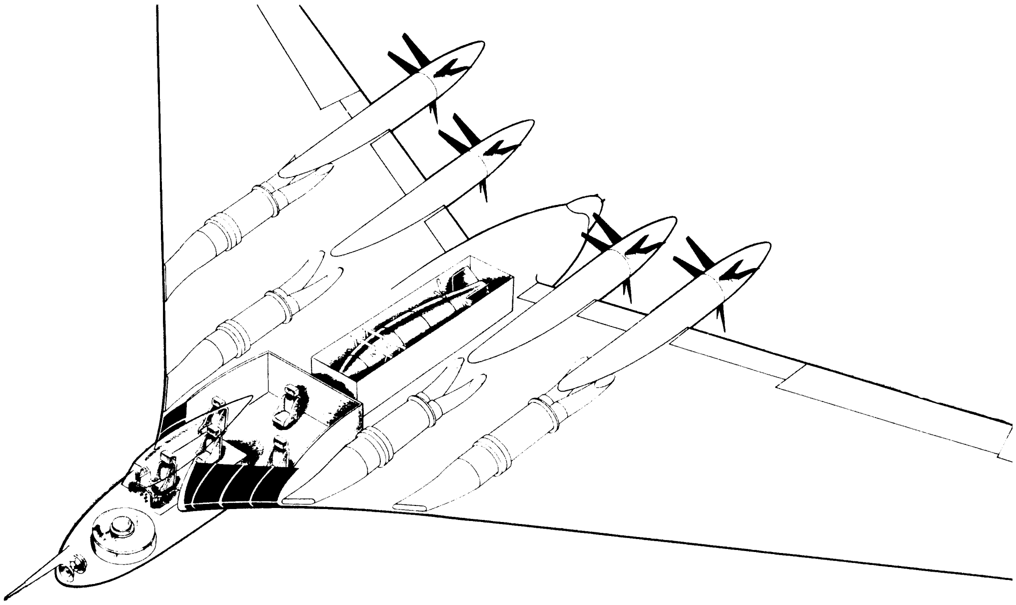
Artists impression of Turbodyne V version

The alternate version was equipped with four Allison XT 40 turboprops, providing a total of 30,000 shaft horsepower. The propeller arrangement was divided into four six-bladed counter-rotating props. Otherwise the design was essentially identical to the Turbodyne V variant. Performance was lower than that of the Turbodyne V version.

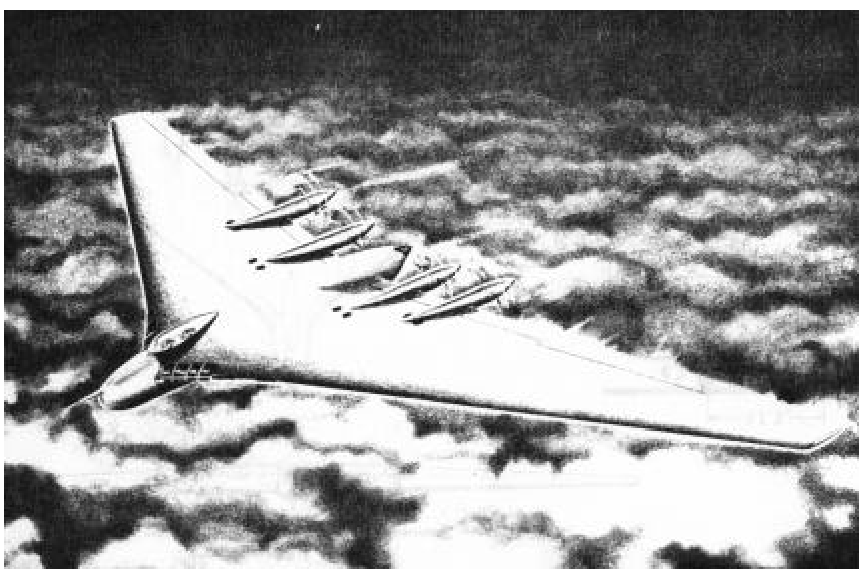
Span: 128.33 feet/ 39.12 meters
Length: 74.67 feet/ 22.76 meters
Maximum ground weight: 175,400 lbs./79,727 kg
Maximum flight weight (after inflight refueling): 212,100 lbs./96,409 kg
Cruising speed: 440 knots
Bombing altitude: 37,000 feet
Combat radius - unrefueled: 2,400 n. mi.
Combat radius - refueled at cruising altitude: 3,500 n. mi.



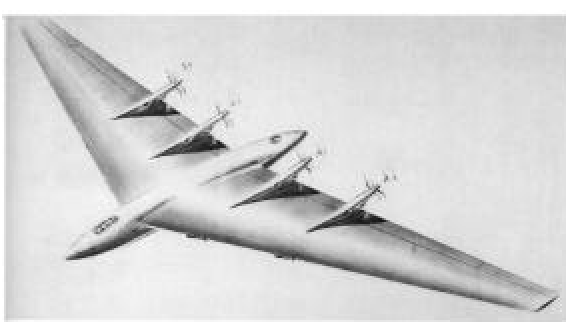
Three-view of alternate version

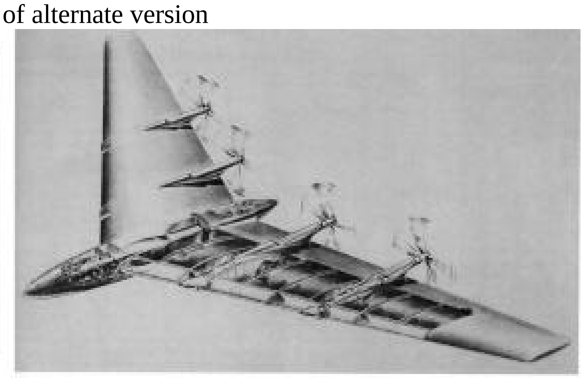


Cutaway view of alternate version



Artists impression of alternate version





Artists impressions of slightly different versions of the turboprop flying wing.

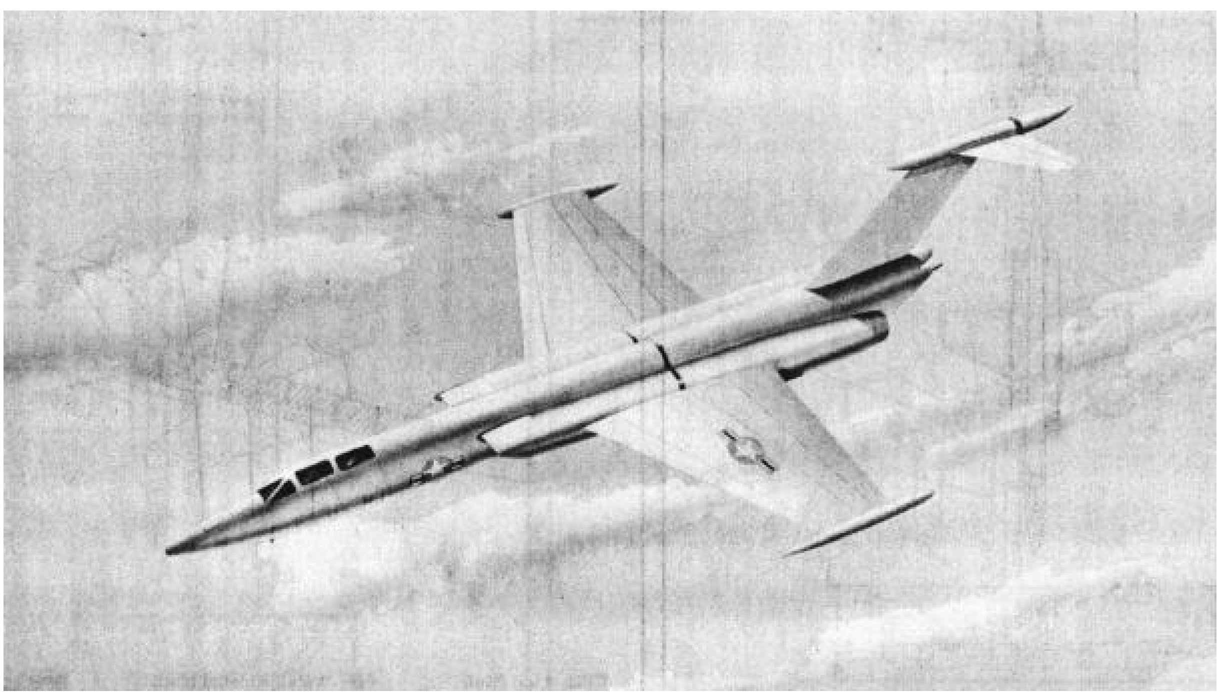
Martin XB-68

One bomber that received the B-number but not the production go-ahead was the Martin XB-68. This mid-1950's tactical bomber has been previously described as a three-engined delta winged aircraft similar in design to the Convair B-58 "Hustler" (see Lloyd Jones, “U.S. Bombers, 1928 to 1980’s,” Aero Publishers, Inc., 1980). However, information has been found that shows a completely different design. This confusion is likely due to different designs being studied to perform the same role.

The XB-68 described here, Martin Model 316, was a twin-engine design of relatively conventional layout, looking as much like a contemporary fighter as a bomber (however, the resemblance to the stillborn Boeing B-59 is remarkable). A slender fuselage was flanked by the long engine nacelles, each equipped with inlets that would have looked at home on the MiG 25 or the F-15. Relatively low aspect ratio, moderately swept wings were mid-mounted to the nacelles. A swept T-tail provided stability at the rear, mounted above the radar-controlled tail gun.

Landing gear was similar to the Boeing B-47 in having two sets of main gear in tandem, with outriggers in wingtip pods. The fuselage was packed with fuel tanks, even though the range was rather limited (it is unknown if in-flight refueling was considered). Cruise to the target was to be subsonic and at high altitude, but the bomb run dash was to be conducted at supersonic speed and at even higher altitude. The bombs were to be stored in a rotary bomb bay (used on the Martin B-57 Canberra). Two deceleration parachutes were included for braking.

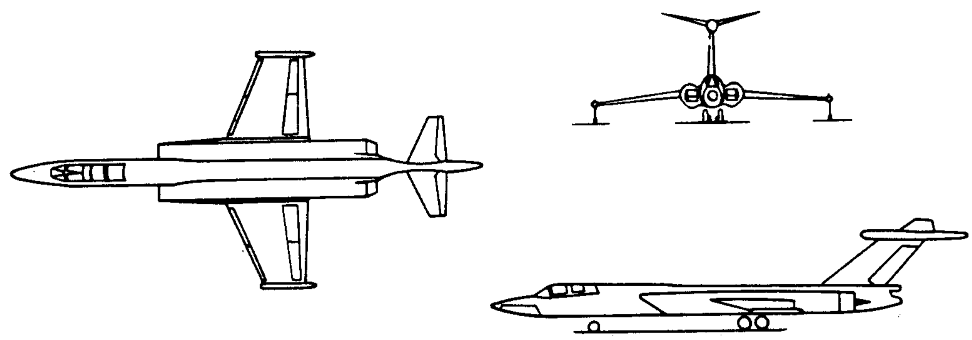
A crew of two were used on this aircraft: a pilot-radio operator and a navigator-bombardier-defense systems operator. The tandem cockpit was pressurized and cooled by a refrigeration unit while at high Mach numbers. The aircraft was built mainly of steel and rated to a skin temperature of 350 degrees Fahrenheit.



Artwork of the Martin B-68

Characteristics Summary

BOMBER . . . . (SUPERSONIC) XB-68



Wing Area	875 sq ft	Length	109.8 ft
Span	53.0 ft	Height	25.5 ft

AVAILABILITY			PROCUREMENT			
Number available			Number to be delivered in fiscal years			
ACTIVE	RESERVE	TOTAL				

STATUS

SEE DATA UNDER "STATUS" BLOCK OF XB-68 (Subsonic) SUMMARY

POWER PLANT

(2) J75 (JT4B-21)

Pratt & Whitney

ENGINE RATINGS

S.L.S.	LB	S.F.C.
Max:	27,500	2.864
Mil:	18,150	0.864
Nor:	16,350	0.820

FEATURES

Crew 2
Induction System Evaporative
Cooling of Engine Air by Water Injection.
Windshield Defogging
Pressurization and Compartment
Cooling System with Prov. for Evaporative Cooling at High Mach Numbers
Ejection Seats
All-Weather Aircraft
Electronic Bomb-Navig & T/C System
Provisions for A F.R.
Single-Point Refueling
Radar Controlled Turret
Integral Fuel Tanks
(2) Deceleration Chutes
Max Fuel Cap: . . . *7140 gal
*Includes 909 gal bomb bay tank.

ARMAMENT

Turret 1
Guns..1 x 20mm(T-171E-2)
Ammunition (tot)...1100 rds
Bombs:

Class (lb)	Load
D	1 x 3500
C	1 x 8500

Data for XB-68

Loading and Performance—Typical Mission

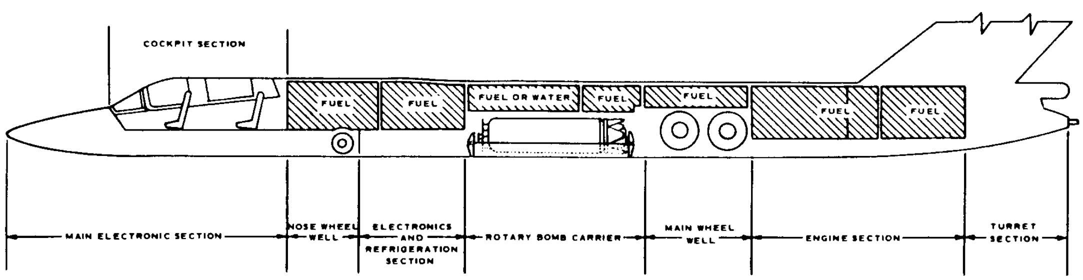
CONDITIONS			BASIC MISSION (SUBSONIC)	BASIC MISSION (SUPERSONIC)	ALTERNATE SUPERSONIC	SUPERSONIC WITH ISEC	LOW ALTITUDE	ALTERNATE LOW ALT.	FERRY RANGE
TAKE-OFF WEIGHT		(lb)	I 100,000	II 100,000	100,000 III	100,269 (6) IV	V 100,000	100,000 VI	VII 102,720
Fuel at 6.5 lb/gal (grade JP-4)		(lb)	40,500	40;500	40,500	37,951	40,500	40,500	46,400
Payload (Bombs)		(lb)	3500	3500	3500	3500	3500	3500	None
Payload (Chaff)		(lb)	200	200	200	200	200	200	200
Wing loading		(lb/sq ft)	114	114	114	114	114	114	117
Stall speed (power off)		(kn)	148	148	148	148	148	148	150
Take-off ground run at SL	(2)	(ft)	3035	3035	3035	3050	3035	3035	3230
Take-off to clear 50 ft	(2)	(ft)	4572	4572	4572	4600	4572	4572	4810
Rate of climb at SL	(3)	(fpm)	11,100	11,100	11,100	11,050	11,100	11,100	10,680
Rate of climb at SL(one engine out)	(3)	(fpm)	2620	2620	2620	2600	2620	2620	2500
Time: SL to 20,000 ft	(3)	(min)	2.2	2.2	2.2	2.2	2.2	2.2	2.3
Time: SL to 30,000 ft	(3)	(min)	4.0	4.0	4.0	4.0	4.0	4.0	4.2
Service ceiling (100 fpm)	(3)	(ft)	40,950	40,950	40,950	40,900	40,950	40,950	40,700
Service ceiling (one engine out)	(3)	(ft)	27,300	27,300	27,300	27,250	27,300	27,300	26,600
COMBAT RANGE	(5)	(n. mi)	—	—	—	—	—	—	2642
COMBAT RADIUS	(5)	(n. mi)	1086	598	662	553	580	732	—
Average cruise speed		(kn)	526	527	527	528	478	526	531
Initial cruising altitude		(ft)	30,300	30,300	30,300	30,200	S.L.	30,300	29,600
Target speed		(kn)	536	1150	1150	1380	641 (4)	641 (4)	
Target altitude		(ft)	42,200	55,500	57,250	61,800 (1)	S.L.	S.L.	
Final cruising altitude		(ft)	38,900	38,900	38,900	38,900	38,900	38,900	38,700
Total mission time		(hr)	4.15	1.79	2.02	1.68	2.36	2.78	4.98
COMBAT WEIGHT		(lb)	74,180	72,118	71,625	71,943	75,436	74,353	62,217
Combat altitude		(ft)	42,200	55,500	57,250	61,800	S.L.	S.L.	38,700
Combat speed	(2)	(kn)	1333 (7)	1357 (8)	1357 (8)	1380 (1)	821 (8)	821 (8)	1380 (8)
Combat climb	(2)	(fpm)	1800 (3)	4100 (9)	2000 (9)(10)	7900	46,700 (11)	47,250 (11)	4800 (3)
Combat ceiling (500 fpm)	(2)	(ft)	44,800 (3)	58,150 (9)	58,250 (9)(10)	66,950	57,400 (9)	57,650 (9)	48,200 (3)
Service ceiling (100 fpm)	(2)	(ft)	45,400 (3)	58,450 (9)	58,550 (9)(10)	67,250	57,650 (9)	57,900 (9)	48,850 (3)
Service ceiling (one engine out)	(3)	(ft)	34,700	35,300	35,500	35,400	34,250	34,500	39,100
Max rate of climb at SL	(2)	(fpm)	15,370 (3)	48,600 (11)	49,000 (11)	48,800 (11)	46,700 (11)	47,250 (11)	18,300 (3)
Max Speed at 54,700 ft	(8) (2) (7)	(kn)	1380	1380	1380	1380	1380	1380	1380
Basic speed at 35,000 ft	(2)(7)	(kn/ft)	1212	1212	1212	1212	1212	1212	1212
LANDING WEIGHT		(lb)	61,368	61,368	61,368	61,242	61,368	61,368	62,217
Ground roll at SL		(ft)	(12)	(12)	(12)	(12)	(12)	(12)	(12)
Ground roll (auxiliary brake)	(13)	(ft)	1710	1710	1710	1700	1710	1710	1730
Total from 50 ft		(ft)	(12)	(12)	(12)	(12)	(12)	(12)	(12)
Total from 50 ft (auxiliary brake)	(13)	(ft)	2680	2680	2680	2670	2680	2680	2720

NOTES

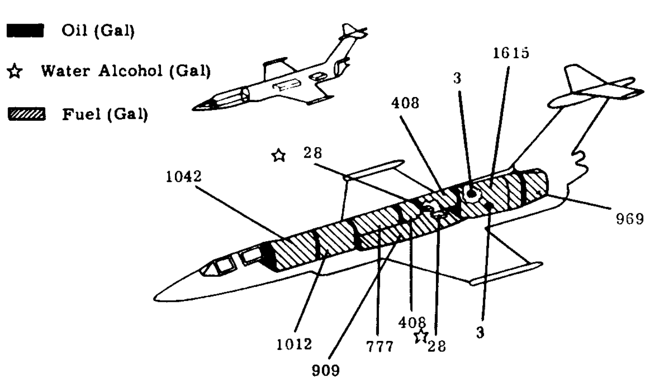
(1) Max power with ISEC (minimum saturation Mach 2.4)
(2) Maximum power
(3) Military power
(4) Normal power
(5) Detailed descriptions of RADIUS and RANGE missions given on page 6
(6) Includes 2818 lb of water used for evaporative cooling
(7) Design structural limit
(8) Maximum power at reduced throttle (rpm)
(9) At Mach 2.0
(10) At Mach 2.4 (with ISEC-40% saturation)
(11) At Mach 0.925
(12) Data not available
(13) With (2) 24 foot diameter chutes

PERFORMANCE BASIS:
(a) Data source: Contractor estimates (not substantiated by WADC)
(b) Performance is based on powers shown on page 3

Martin XB-68 Data



Cutaway view of Martin XB-68



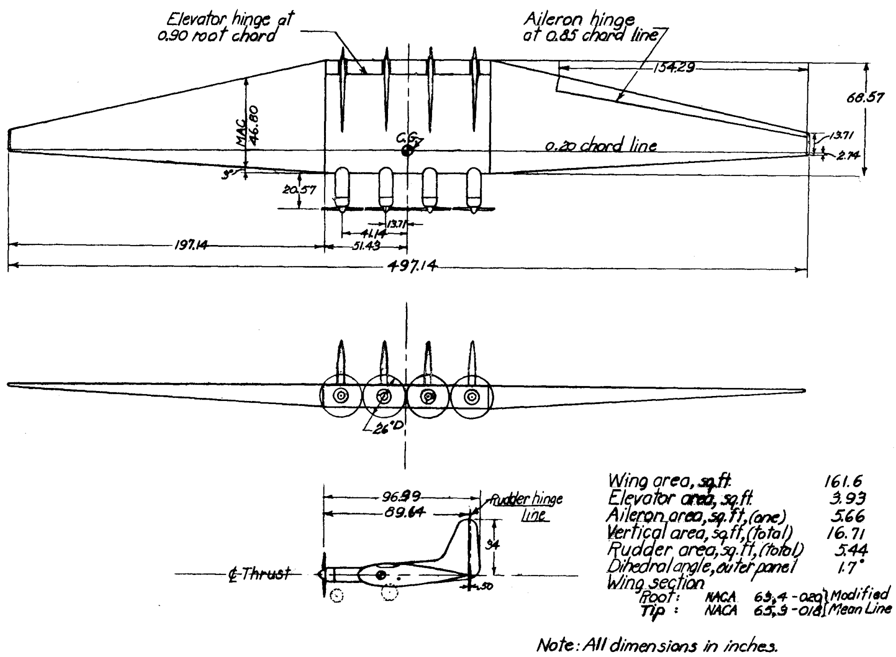
Locations of fuel, oil and water/alcohol tanks

Kaiser Tailless Airplane

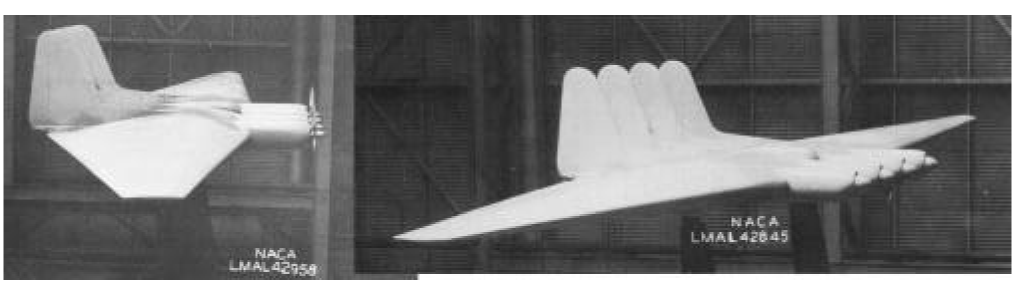
One little known and poorly documented aircraft was known as the “Kaiser Tailless Airplane.” While information available to the author is extremely limited, it appears that the Kaiser Tailless Airplane was designed for Henry Kaiser, the American industrialist who produced the Liberty Ships during World War II. In 1942, Kaiser proposed using very large flying boats to ferry troops and supplies from the US to Britain, bypassing the dreaded German U-Boat wolfpacks. Kaiser formed a partnership with howard Hughes to produce the HK-1 Hercules (the “Spruce Goose”), but it appears that Kaiser had at least one other design studied.

The Kaiser Tailless Airplane was a flying wing of somewhat unconventional layout. The wing was given minimal dihedral; the trailing edge swept forward more steeply than the leading edge swept back, giving the vehicle almost the appearance of forward sweep. Four piston engines were mounted well forward of the wing centerbody, with a large dorsal fin directly aft of each engine. A cockpit bubble appears above the wing centerline. The full scale vehicle was to have a span of 290 feet/ 88.4 meters, a wing area of 7920 square feet/ 736 sqaure meters, and a gross weight of 175,000 pounds/ 79,545 kilograms.

A 1/7 scale wind tunnel model, built by Kaiser Cargo, Inc. was supplied to Langley Field, Virginia, for wind tunnel testing. The results were reported in March of 1946.

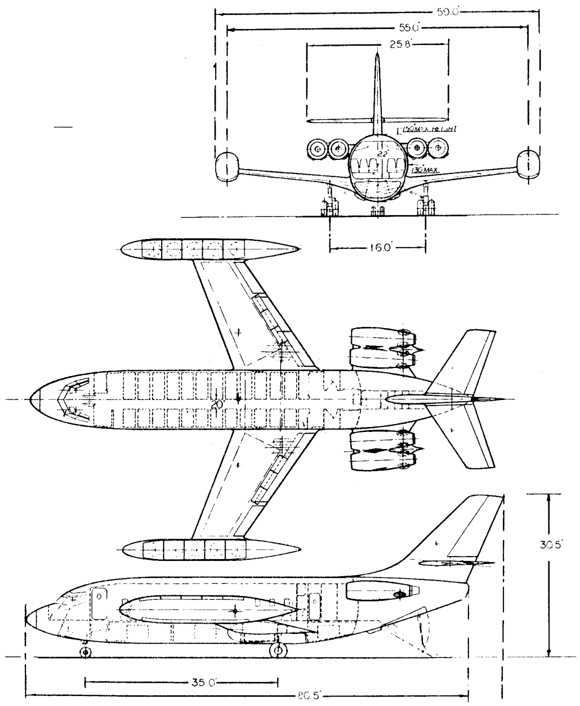


General Arrangement of the Wind Tunnel Model



Photos of the Wind Tunnel Model (Note Canopy)

Reference: C. Brewer, E. Rickey, “Tests of the 1/7-Scale Powered Model of the Kaiser Tailless Airplane in the Langley Full-Scale Tunnel,” NACA Langley Memorial Aeronautical Laboratory, Memorandum Report L6C13, March, 1946

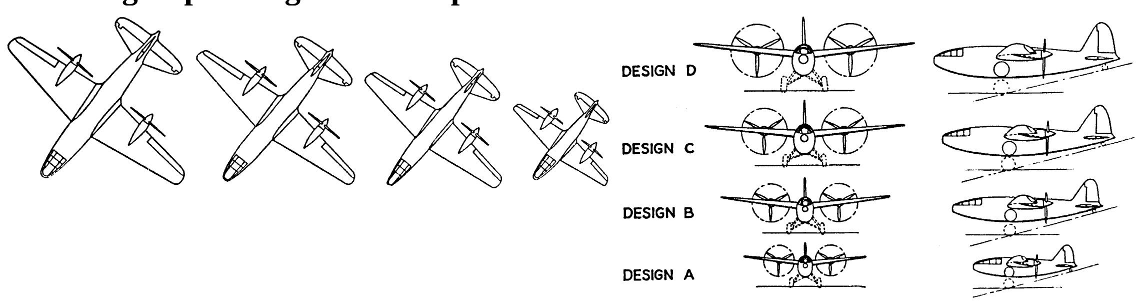


Boeing VTOL Intercity Transport

For a NASA study on short-haul commercial transport, Boeing designed a number of short and vertical take-off aircraft. One of these was a pure jet lift design, using small lift jets contained within wingtip pods to provide vertical lift.
Data:
Empty Weight: 54,098 lbs/
Gross Weight:80,758 lbs/
Length: 80.0 ft/
Span (overall): 59.0 ft/
Wing Area: 712 sq. ft/
Cruise Speed: 466 knots/
Cruise Altitude: 20,000 ft/
Cruise Engines: 4 X 6950 lbs T/
Lift Jets: 10 X 9970 lbs/

Reference:
"Conference on V/STOL and STOL Aircraft," NASA SP-116

Curtis High-Speed Fighter Concepts



In 1940, Curtis released data on a series of hypothetical fighters designed for maximum speed. In Curtis' study, they had focused on a single configuration but greatly varied dimensions, weights and powerplants. All were assumed to have a liquid cooled engine (based upon then-available American engines), with a single air intake located in the nose. As the study was merely a hypothetical exercise in high-speed flight, no armament data was given.

Data:

	A	B	C	D
Gross Weight (lbs):	6000	11,200	15,800	20,600
Power (hp):	1,150	2,300	3,450	4,600
Wing Area (sq. ft):	110	207	293	382
Span (ft):	28.3	38.75	46.2	52.7
Length (ft):	22.5	33.75	39.3	43.3
Stall Speed (mph):	84	84	84	84
Maximum Speed (mph):	482	496	510	520