B-58
HUSTLER

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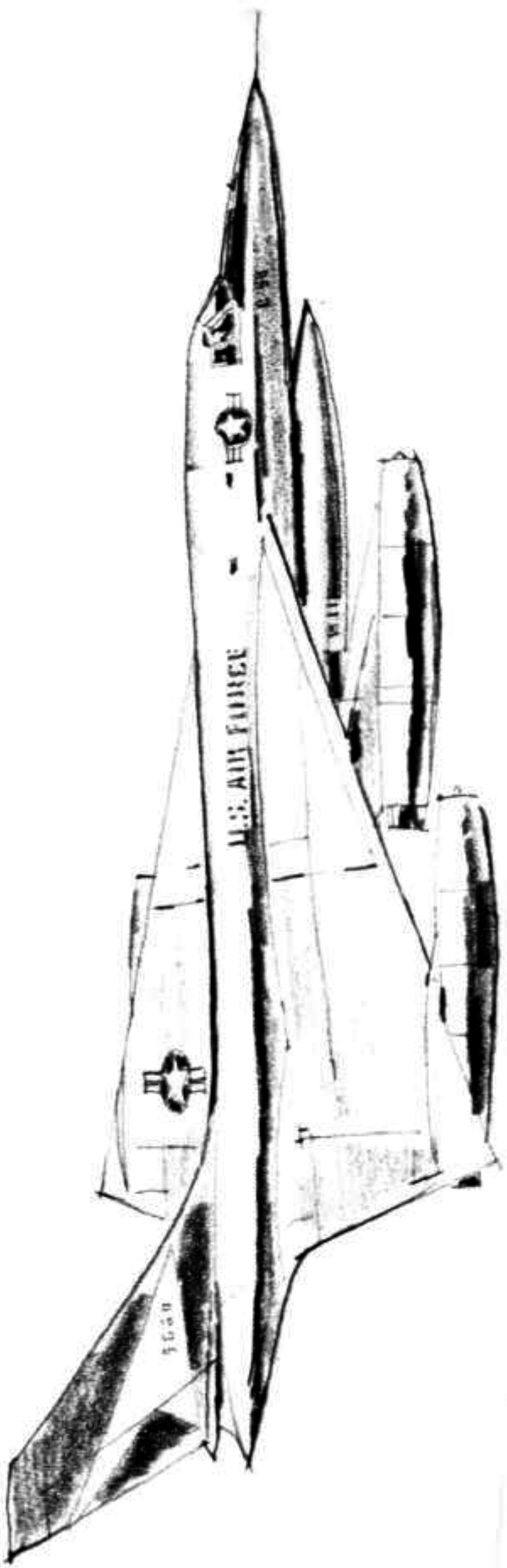


The Aircraft—The U. S. Air Force B-58 is the free world's newest, swiftest and most versatile long-range bomber, built to deliver nuclear bombs at intercontinental distances with pinpoint precision.

The needle-nosed fuselage is 97 feet long; the sharply swept delta wing, 57 feet across. Four jets power the bomber. It requires a crew of only three.

The Mission—Since the late 1940's the U. S. Strategic Air Command has been the defensive right arm of the West—cocked to strike a massive counterblow if the free world were attacked.

To keep the peace by deterring aggression, SAC maintains a force of mixed weapons. At present the principal elements of SAC's operational inventory are two manned bombers (the B-47 and B-52) and three ballistic missiles (the medium-range Jupiter and Thor, and intercontinental Atlas).

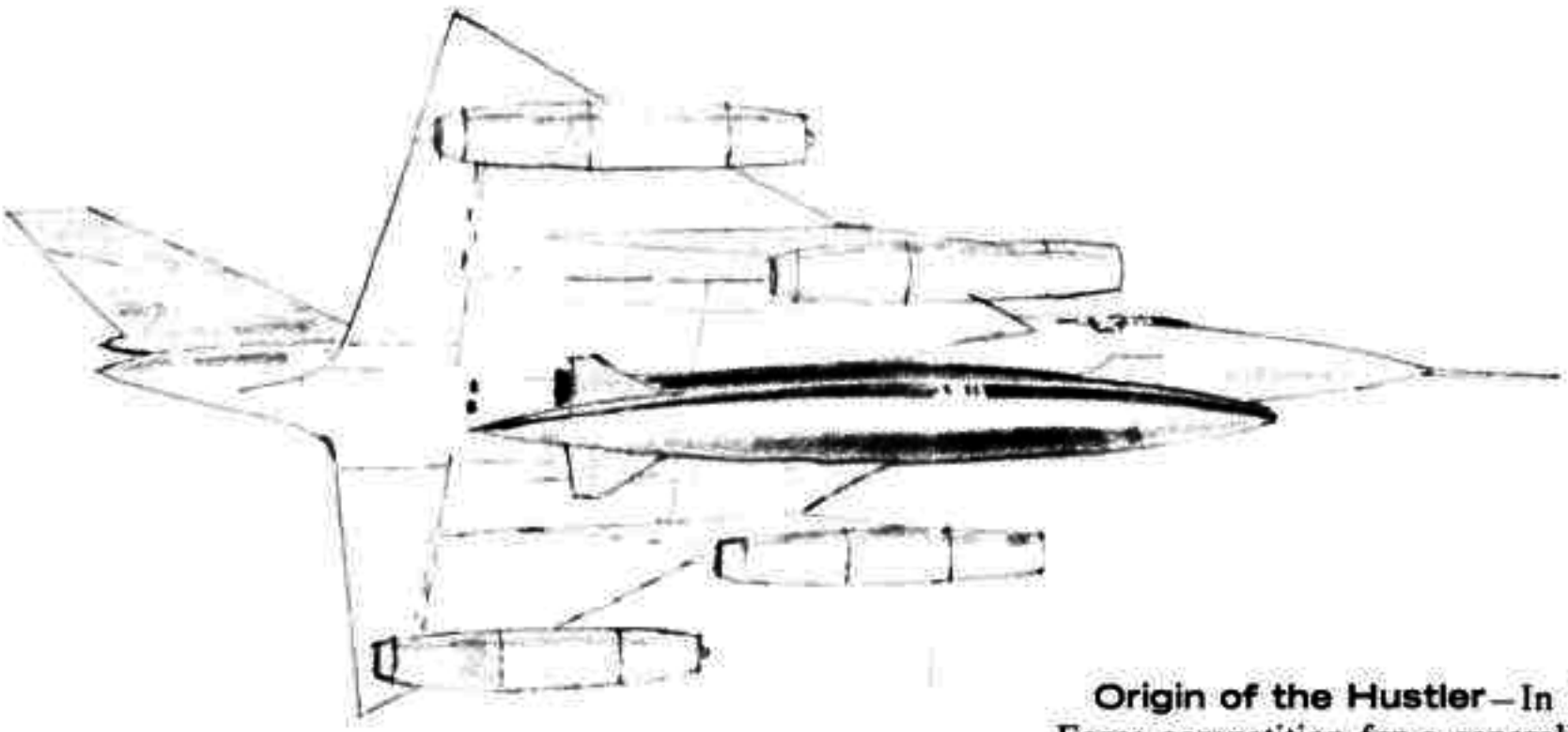
The most advanced SAC aircraft, now entering the ready force, is the world's first supersonic bomber, the Convair B-58.

This plane is unconventional in many ways —in size (small for the mission); in structure (honeycomb sandwich); in location of the bomb bay (outside the fuselage); and in accuracy of the bombing and navigation equipment (a tenfold improvement).

But the B-58's great distinction is this:

The bomber can penetrate to targets in the enemy heartland while flying at great altitude at more than twice the speed of sound.

This means above 60,000 feet at more than 1,300 miles an hour—twice as fast as any other bomber in the western world.



Planes vs. Missiles—It used to be said that the intercontinental missile would become the "ultimate weapon," making the manned bomber obsolete. Today, SAC's doctrine is generally accepted—that a mix of bombers and missiles will be needed indefinitely. Some of the reasons are:

1. Bombers can be dispersed and rotated from base to base, minimizing loss in a surprise attack; or be kept on airborne alert, impervious to enemy missiles.

2. A missile cannot be recalled, once it is launched. Bombers can be launched at the first report of danger, and called back if the report proves false, avoiding war by accident.

3. There will always be missions aircraft can perform best. "For the foreseeable future," says Gen. Thomas S. Power, commander of SAC, "manned bombers will have to be used for missions which entail reconnaissance and on-the-spot decisions, for attacks against well-protected and concentrated targets, especially if their location is not accurately known."

Thus, the high-performance manned bomber is expected to be needed as long as strategic forces are needed. In addition, the supersonic bomber has two potential civilian roles of importance—to break trail for the supersonic transport, and to serve as a recoverable booster for space vehicles.

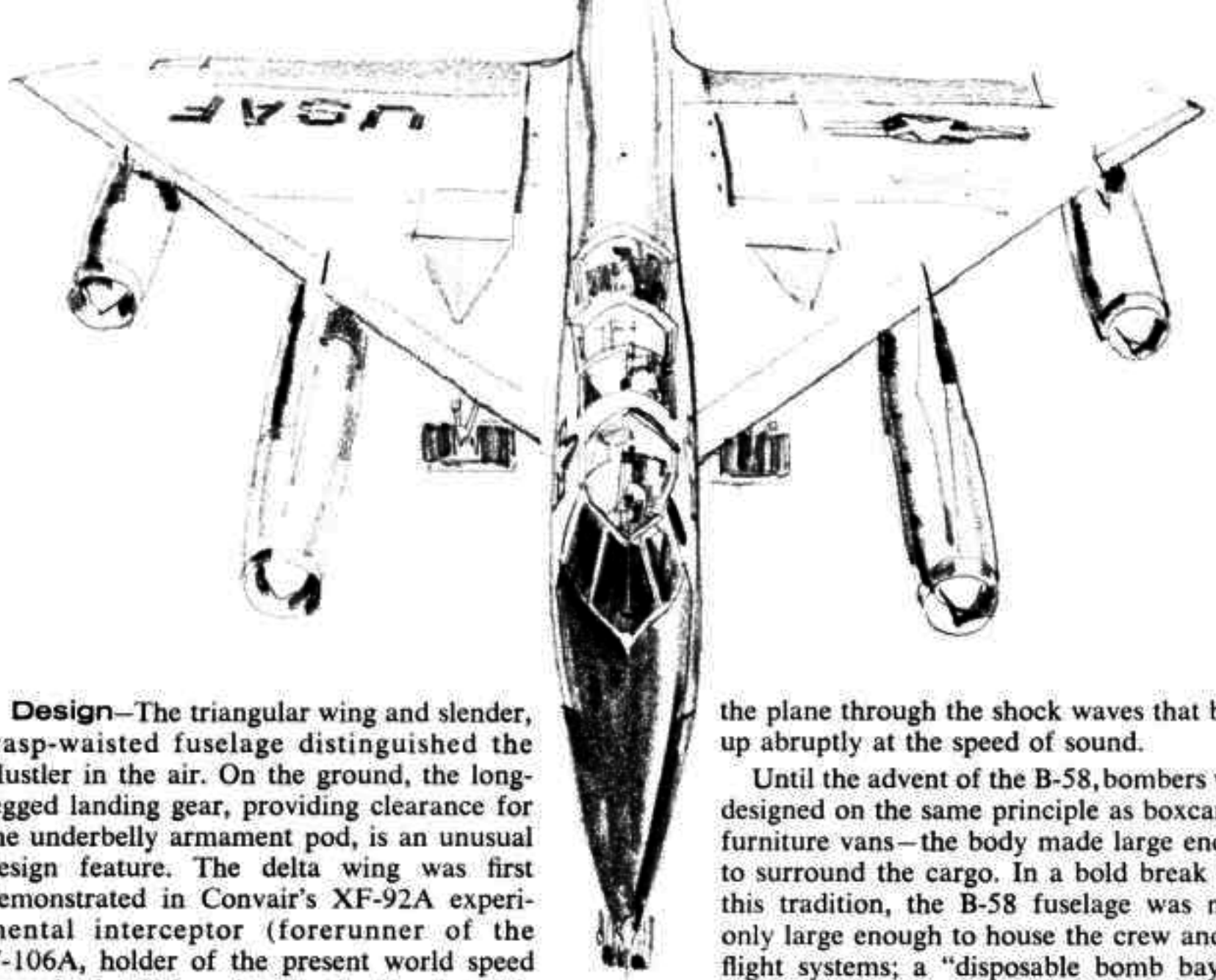
Origin of the Hustler—In 1949 an Air Force competition for a generalized bomber study, to examine the feasibility of a supersonic system, was won by Convair (Fort Worth) Division of General Dynamics Corporation.

This study recommended a delta-wing configuration for the first faster-than-sound bomber, and use of a disposable under-fuselage pod to carry the payload. The Air Force awarded Convair a follow-on study contract in 1951, when the B-58 designation was assigned.

A third competition resulted in the MX-1964 contract of August 1952. This called for production of a flyable bomber, under the first weapon system management plan. The Fort Worth plant was chosen not only to design, build and assemble the new airframe, but to act as over-all manager of the program for the Air Force. Convair assumed responsibility for everything but the government-supplied jet engines.

This plan in no way limited use of the nation's broad industrial base. Convair subcontracted the major subsystems to 16 companies, purchased raw materials and equipment from 3,600 vendors, and procured components and services from some 15,000 firms in nearly 50 states.

As a result, the B-58 and its major subsystems were developed and produced fast. The first B-58 flew on November 11, 1956, just two years and two months from the day the engineering drawings were released to the manufacturing department.



Design—The triangular wing and slender, wasp-waisted fuselage distinguished the Hustler in the air. On the ground, the long-legged landing gear, providing clearance for the underbelly armament pod, is an unusual design feature. The delta wing was first demonstrated in Convair's XF-92A experimental interceptor (forerunner of the F-106A, holder of the present world speed record of 1,525 mph). In the Hustler, this plan-form provides optimum lift-drag ratio for speeds and altitudes far beyond those of any other bomber in existence. The triangular shape has great strength and provides large fuel-storage capacity, even when the wing is made thin enough for Mach 2 flight. The exceptional rigidity of the wing is of particular importance in on-the-deck bombing missions (page 9).

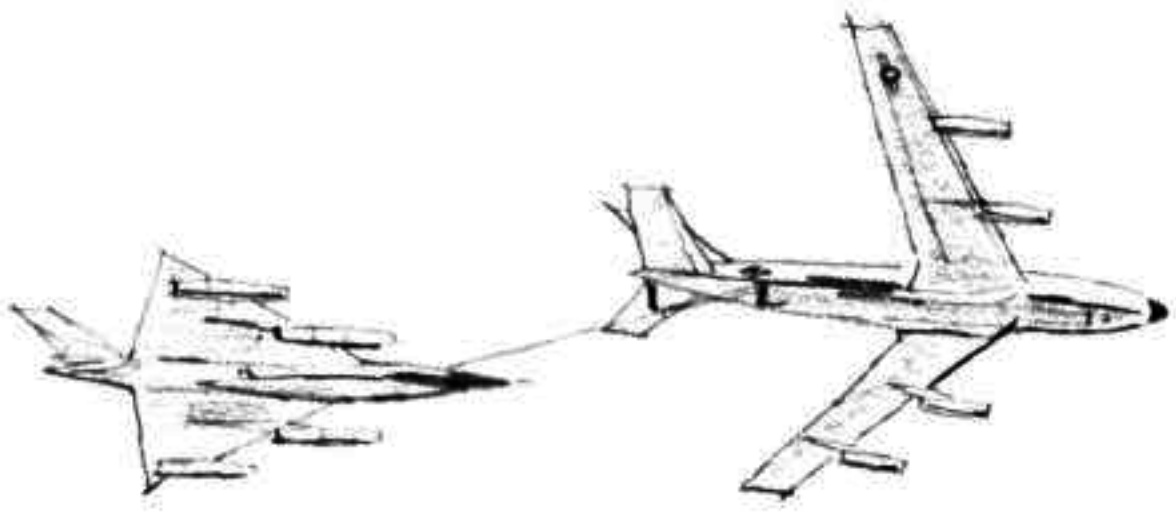
No flaps or other high-lift devices are needed for taking off and landing. The straight forward stability of the delta (which is virtually stall-proof) gives the pilot unmatched control over his plane, even at very low speeds. As in all Convair deltas, the B-58 has no horizontal tail surfaces; elevators are combined with ailerons in members called "elevons," situated along the trailing edge of the wing.

The fuselage is shaped like a slender hourglass. This is an application of the "area rule," a design concept that permits easy passage of the plane through the shock waves that build up abruptly at the speed of sound.

Until the advent of the B-58, bombers were designed on the same principle as boxcars or furniture vans—the body made large enough to surround the cargo. In a bold break with this tradition, the B-58 fuselage was made only large enough to house the crew and the flight systems; a "disposable bomb bay" in the form of a streamlined pod was designed as an external attachment to be dropped over the target, letting the Hustler fly home lean and fast.

The pod concept permitted great mission flexibility. In addition to the free-fall bomb pod, the basic B-58 could be fitted with a rocket-powered pod, for launching far from the target; or with pods filled with reconnaissance gear or electronic counter-measures equipment.

The original pod contained fuel as well as bomb space. In a further refinement of the "use and discard" philosophy, B-58s are being fitted with dual or two-component pods, nested together to have the appearance of a single under-fuselage attachment. The large lower cell holds fuel for consumption on the outbound leg of a mission; when emptied it is jettisoned and the Hustler races on toward the target, carrying only the small weapon pod.

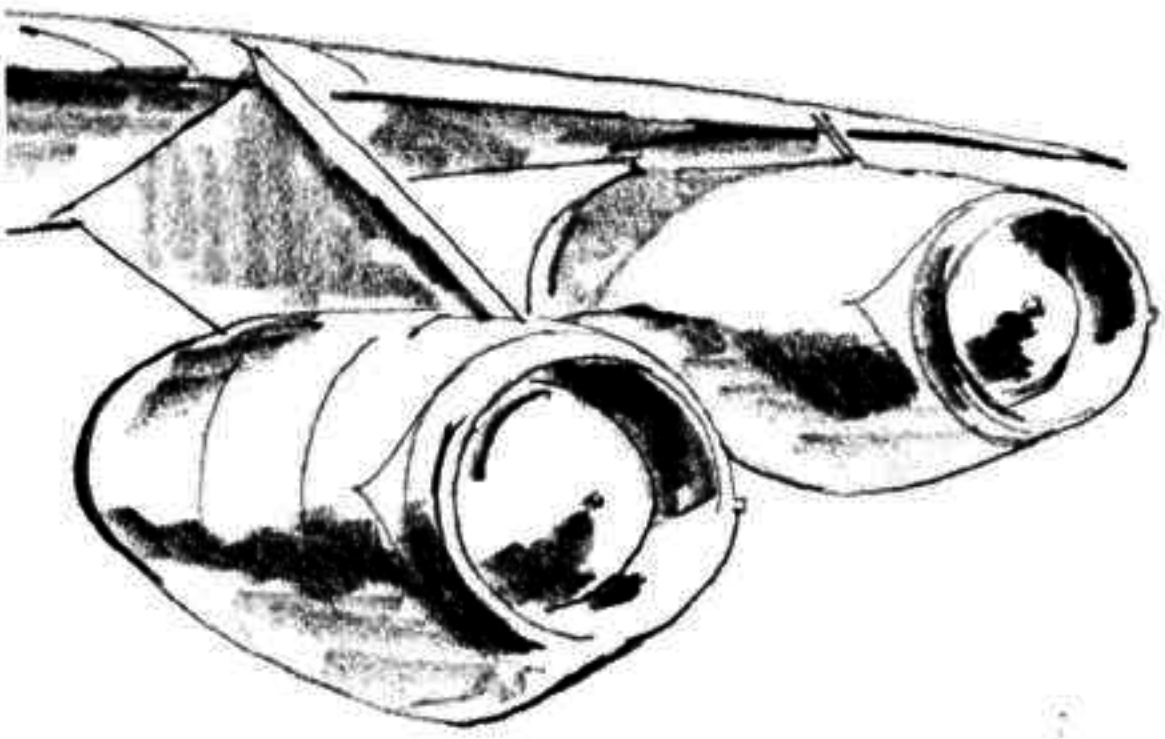


Propulsion – As a result of Convair studies defining the power plant characteristics desired in the new bomber, General Electric designed the J-79 jet engine specifically for the B-58.

The J-79 achieved substantial improvements in the ratio of thrust to engine weight, frontal area and fuel consumption. Credit was given to three basic design innovations—variable stators, modulated afterburner, and a variable convergent-divergent ejector nozzle. (A civilian version of this engine, the CJ-805, gives the Convair jet airliners their great speed.)

The Hustler carries four J-79s on forward-slung pylons. Each engine has a "spike" or variable air inlet duct, for optimum performance throughout the broad speed spectrum.

Subsystems – Operational characteristics of the B-58 required radically new electronic subsystems, largely designed and built by subcontractors to Convair specifications. Supersonic speeds at 12-mile altitudes ruled out conventional navigation and bombing methods; the need for satisfactory flying qualities at both sub- and supersonic speeds presented unusual problems for the flight control system.



Because of high approach speed and long bomb-pod trajectories, a special-purpose search radar was designed to provide adequate sighting range and sighting resolution. An astro-compass, good by day or night, was developed to yield accurate heading information. A completely integrated computing system tied together the various airborne elements of the weapon complex.

Compared with the contemporary K-3A navigation - bombing system, the Hustler's system weighs only half as much, occupies one-third less space, and is improved in navigation accuracy by a factor of approximately 10 to 1.

The first time the bombing system was used under combat conditions—in the 1960 SAC Combat Competition—the B-58 won the award for the most accurate bombing runs of the meet, although it bombed at more than twice the speed of sound and competed against B-47 and B-52 units with years of practice behind them. No aircraft had ever before won a top award in a SAC Combat Competition its first time out.

Features of the B-58 flight control system include three-axis damping, constant stick forces at all speeds, continuous protection from "G" forces, and coupling provisions for station keeping, approach control, landing and flareout.

The fire-control and electronic-counter measures systems also were tailored to the peculiar requirements of B-58 missions.

Construction—Design of the B-58 structure was a real challenge, one that caused Convair-Fort Worth to revolutionize its manufacturing concepts, machinery and techniques. The leading edges of the wing, for example, heat to a sizzling 260°F at supersonic speeds; conventional aluminum wing skins would weaken quickly.

The use of large sandwich panels was the primary solution. The "sandwich" consists of a cellular honeycomb core, bonded between two thin, tough skins. The core may be fiber glass or metal; the skins, aluminum or stainless steel. The bonding process may employ either organic adhesives or brazing.

Sandwich material is structurally efficient, has a high strength-to-weight ratio, provides aerodynamic smoothness, and is resistant to sonic fatigue failure. Its use helped hold the B-58's structural weight to only 13.8 per cent of maximum gross weight (compared with a low of 19.8 per cent among previous operational bombers).

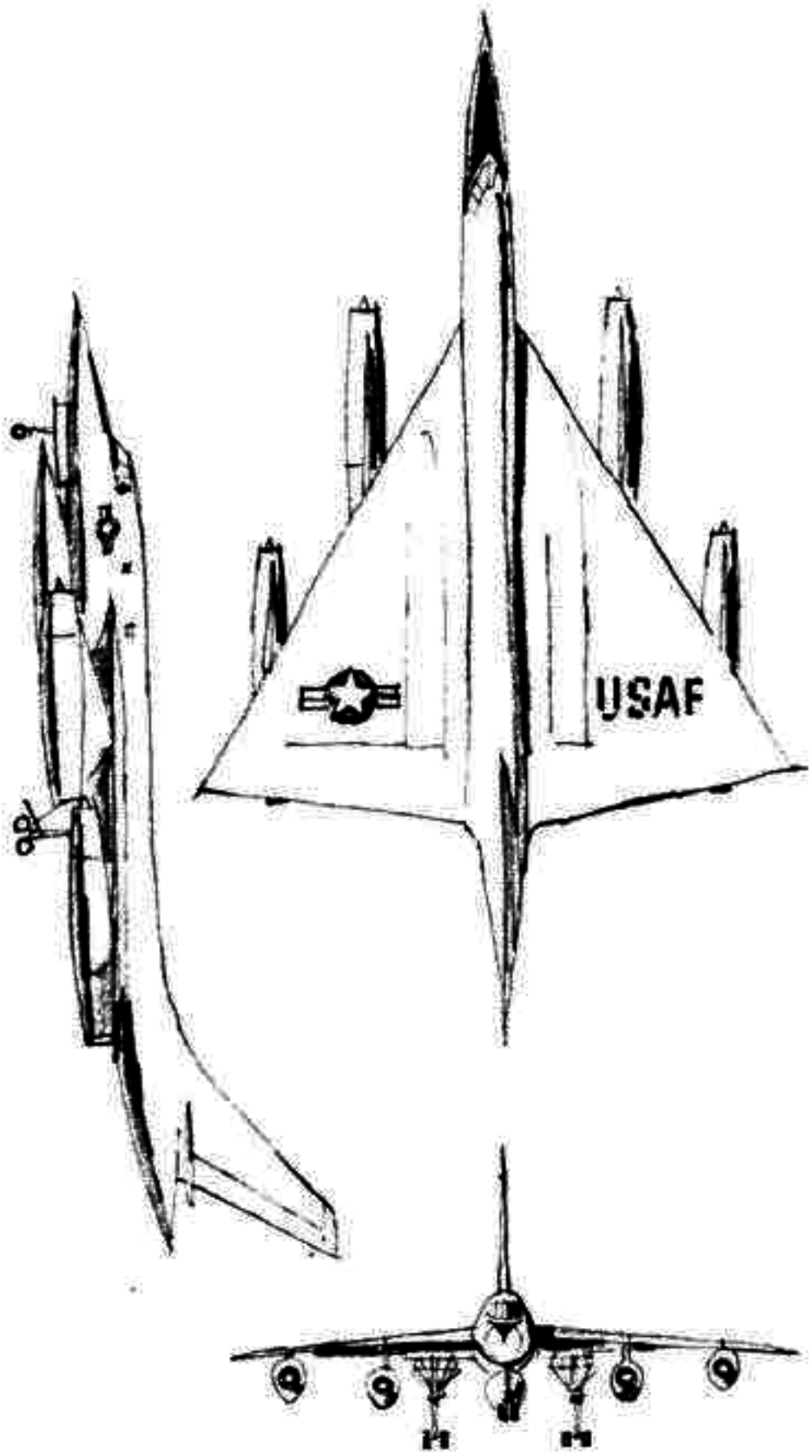
Sandwich panels comprise some 90 per cent of the Hustler's wing surface. Stainless steel is used in areas subject to severe loading and heating (such as the elevons). Since the entire wing is used as a fuel tank, fiber glass honeycomb is the core material used most extensively; being a poor thermal conductor, it insulates the fuel from external heat.

Other Missions—The B-58 has demonstrated remarkable capability as a penetration aircraft, traveling at high speed at treetop elevations where enemy search radar is blind. In 1959, one of the bombers hedgehopped 1,400 miles across four states at 700 mph, never more than 500 feet off the deck. "We were traveling a little faster than a .45-caliber pistol bullet," Convair pilot B. A. Erickson reported afterward. "No wonder people on the ground had trouble recognizing us."

The Hustler also has demonstrated usefulness as a rocket-launching platform; it achieved the first supersonic air launch of a strategic ballistic missile. In a related undertaking, Convair showed the feasibility of launching a satellite-inspection vehicle from the Hustler.

Other Versions—The B-58 is designed to cruise subsonically (to conserve fuel) during most of an intercontinental mission; then step up its speed to Mach 2 over enemy territory. A heavier all-supersonic version employing the J-58 engine, has been proposed. A two-engine, all-supersonic model has been proposed as a long-range interceptor. This would have the J-58 or J-93 engines, be fitted with a Hughes fire-control system, and carry GAR-9 missiles. The aircraft also is adaptable to a two- or four-engine tactical bomber configuration.

Still another outgrowth of the B-58 program could be the world's first supersonic transport. Equipped with J-58 engines, a transport fuselage and a conventional horizontal tail, the modified B-58 would be not only a valuable symbol of national prestige, but an important interim plane leading toward the development of the ultimate supersonic airliner. The B-58 supersonic transport would be available for service within three to five years, long before any other supersonic airliner could be put into operation.



B-58 Specifications

Type	Delta wing, strategic jet bomber
Maximum speed	More than 1,300 mph (Mach 2)
Range	Intercontinental (with in-flight refueling)
Service ceiling	Above 60,000 feet
Length	96 feet, 9 inches
Wing span	56 feet, 10 inches
Wing area	1,542 square feet
Height over tail	31 feet, 5 inches
Maximum takeoff weight	Over 160,000 mm lbs.
Fuel capacity	Over 15,000 gals.
Landing gear	2-wheel nose gear, two 8-wheel truck main gears
Crew	Pilot, bombardier-navigator, defensive systems operator (3)
Engines	4 General Electric J-79 turbojet, pod-mounted; 15,600 takeoff thrust each with afterburner

CONVAIR AND GENERAL DYNAMICS

Convair-Fort Worth is one of five operating divisions of Convair, which in turn is a division of General Dynamics Corporation.

The Fort Worth plant was built by the Air Force during World War II for production of the B-24 Liberator bomber and C-87 Liberator Express transport. After the war, the plant produced nearly 400 B-36 intercontinental bombers for the Strategic Air Command. The plant now is not only the production facility for the B-58 bomber, but also the development center for the Air Force's first nuclear powered bomber.

Other divisions of Convair are:

San Diego, which builds the F-106 all-weather jet interceptor and the 880/990 jet transports; Astronautics, also located in San Diego, which produces the Air Force Atlas intercontinental ballistic missile and associated space vehicles; Pomona, which produces the Navy Tartar and Terrier and other surface-to-air guided missiles; and Daingerfield, Tex., which operates a ramjet test facility for the Navy.

Other divisions of General Dynamics are:

Electric Boat, Groton, Conn., pioneer producer of atomic-powered submarines.

Electro Dynamic, Bayonne, N. J., electric motors and generators.

General Atomic, San Diego, Calif., nuclear reactors and related research.

Liquid Carbonic, Chicago, Ill., medical and industrial gases.

Stromberg-Carlson, Rochester, N. Y., electronic and communication devices.

Material Service, Chicago, Ill., construction materials, coal and limestone.

Canadair Limited, Montreal, the largest airframe builder in Canada, is a subsidiary of General Dynamics.