

KELLY AIR FORCE BASE,
XC-99 AIRPLANE
(Kelly Air Force Base, Consolidated Vultee Model 137)
San Antonio
Bexar County
Texas

HAER NO. TX-23-A

WRITTEN HISTORICAL AND DESCRIPTIVE DATA
FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
Intermountain Support Office - Denver
National Park Service
P.O. Box 25287
Denver, Colorado 80225-0287

HISTORIC AMERICAN ENGINEERING RECORD

KELLY AIR FORCE BASE,
XC-99 AIRPLANE
(KELLY AIR FORCE BASE, CONSOLIDATED VULTEE MODEL 37)

HAER No. TX-23-A

For information about other structures at Kelly Air Force Base, San Antonio, Texas, see:

HABS No. TX-3396-A through TX-3396-AC (various buildings).

this documentation was never sent to HABS and is not part of the HABS collection

Location: Kelly Air Force Base, San Antonio, Texas. The XC-99 is undergoing restoration at the time of this writing and will be moved to a site near the main gate on Duncan Drive, immediately across from the Bungalow Colony. U.S.G.S. 7.5 Minute Maps: San Antonio West and Terrell Wells.

UTM 14.542480.3250000

Date of Construction:

Construction Contract dated 11 December 1942.
Maiden flight 23 November 1947.

Constructor: Consolidated Vultee Aircraft Corporation, San Diego Division. Roberts R. Hoover, Project Engineer.

Present Owner: U.S. Air Force.

Original Use: Long range cargo and troop transport aircraft.

Present Use: Undergoing restoration for future static display at Kelly Air Force Base.

Significance: The XC-99 airplane pioneered the development of large cargo transport aircraft in the period immediately after World War II. It was the largest airplane in active service at this time. During its service life, the XC-99 flew over 7,434 hours, traveled about 1,486,000 miles, and carried over 60 million lbs. of cargo. In fact, the XC-99 broke

the record for cargo carrying capacity; it could carry 101,000 lbs of cargo. From 1947 to 1957, the XC-99 made a significant contribution to aviation development by offering valuable lessons to both military and commercial aircraft manufacturers on the optimum design configuration and operating costs of large transport aircraft. The redesigned landing gear and use of rollers to improve the method of loading cargo contributed to the development of large military and commercial transports, including the C-5 transport aircraft. However, the XC-99 was a one of a kind aircraft making it difficult to keep operational as new technologies became available.

Project Information:

As part of an effort to document historic properties located at Kelly Air Force Base, San Antonio, Texas, the U.S. Army Corps of Engineers, Fort Worth District, contracted with Geo-Marine, Inc. Of Plano, Texas, to produce HAER documentation for the XC-99 airplane. This project was awarded under Contract No. DACA63-93-D-0014, Delivery Order No. 0105.

During 1995, the report was researched and prepared by Joe Freeman, Architect, Historical Architect, and consultant to Komatsu\Rangel, Inc. Mr. Freeman also took the photographs.

History:

Brief History of the U.S. Air Force:

Military aviation in the United States began in 1907 with the creation of the Aeronautical Division, Army Signal Corps. The Aeronautical Division was originally composed of three individuals (an officer and two enlisted men) and no flying equipment. The following year the Army received its first aircraft, a Wright Model A, and its first airship. The Aeronautical Division grew

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slowly and at the beginning of World War I mustered only 20 aircraft. In July 1914, the Aeronautical Division was renamed the Aeronautical Section, Army Signal Corps. The only military duties undertaken by Army aviation during this period occurred in 1916, when Army aircraft were used to support the U.S. intervention against Pancho Villa in Mexico.

Provoked by the German unrestricted submarine warfare campaign, the United States entered World War I on the side of the Allied powers on April 6, 1917. At that time, the Aeronautical Section had a strength of 55 aircraft divided into seven squadrons: four in the United States and one each in the Philippines, Panama, and Hawaii. These aircraft were essentially for training purposes and incapable of flying missions across the Western Front. In order to contribute to the war effort, the United States began to recruit and train troops for an American Expeditionary Force (AEF), to be deployed to France. To support the AEF, the Airplane Division, Army Signal Corps (as the Aviation Section was renamed in July 1917) had to increase the number of pilots and aircraft, as well as expand the aircraft's capabilities. The United States was able to provide an adequate number of pilots and training aircraft, but could only furnish a few of the necessary combat aircraft. This shortage was alleviated by the British and French. In May 1918, control of aviation services was removed from the Signal Corps and placed under the Bureau of Aircraft Production and the Division of Military Aeronautics, which were soon combined into the Air Service (USAAS). By the time of the Armistice in November 1918, the Air Service had grown to a peak strength of 8,403 aircraft.

Following World War I, the Air Service rapidly shrank, as did the entire Army. The number of officers and men fell from 215,731 at the Armistice

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to 9,050 by 1920. Many of the aircraft used in Europe were burned, for the Air Service considered them obsolete and not worth the expense of shipping them back to the United States. The remaining aircraft were retained until a replacement program was initiated in the mid-1920s. Indeed, the last model of World War I-designed aircraft to remain in U.S. service, the de Havilland DH-4, was not retired until 1932.

During the early 1920s, several Army aviators, the most influential being General Billy Mitchell, agitated for an air force arm that was completely independent of the Army. At this time, Congress, the Navy, and the Army General Staff were either indifferent or hostile to the idea of an independent air force. Mitchell was courtmartialed in 1925, following impolitic remarks concerning the crash of the Navy airship *Shenendoah* and was found guilty of "conduct prejudicial to good order and discipline." He was sentenced to five years suspension from active duty and resigned from the Army soon after. Mitchell was a popular figure, however, and his court-martial provided him a platform from which to push for an independent air force. The furor created by his court-martial resulted in the creation of the Army Air Corps (USAAC) on July 2, 1926, which granted aviation more prestige within the Army and signaled the beginning of a more aggressive aircraft procurement policy.

Throughout the 1930s, Air Corps officers continued to lobby for an independent air force. During this same time period, several types of aircraft, including the Martin B-10/B-12, Seversky P-35, and

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Boeing B-17, were acquired¹. These aircraft were on or near the cutting edge of aviation technology, but only limited numbers were procured, in part, because of the country's economic depression. For example, 152 B-10/B-12s and 137 P-35s were manufactured for the United States between 1934-1939. In 1939, the American aviation industry began a period of rapid expansion, funded not by the U.S. government, but by the British and French. In 1940, however, the United States began to fund a massive military expansion as it became apparent that the nation could be drawn into the war. This included an expansion of the Air Corps. In 1941, the Army was radically reorganized into three new major groups: Army Ground Forces, Army Service Forces, and Army Air Forces (USAAF). The USAAF was conceived as a semi-autonomous branch of the Army, responsible for air warfare. Once the importance of air combat was realized during World War II, Congress and the public could finally appreciate and justify the ASAAFs efforts to establish an independent branch. However, during the war, a major reorganization would have been detrimental to the war effort. Thus, it was not until September 18, 1947, that the United States Air Force (USAF) was created from the USAAF as an independent service.

¹ In the aircraft designation system used by the USAF during the service life of the XC-99, each aircraft was given a designation consisting of an initial letter indicating the type of aircraft, a number assigned in order as aircraft designs were added to that aircraft type, and sometimes a final letter was appended to the designation, in alphabetical order, indicating model changes. Some of the designations relevant to this discussion are: 'C' for cargo aircraft; 'B' for bomber aircraft; 'P' for pursuit aircraft, and the prefix 'X' indicating a prototype. Thus, the B-36B was the second model of the 36th design in the bomber category and the XC-99 was the prototype aircraft of the 99th cargo design.

Brief History of General Dynamics:

The modern General Dynamics Corporation has four major components: submarine and tank construction, aerospace, and building supplies. The predecessor of the aerospace section was Consolidated Aircraft Corporation (Consolidated) which was formed by Rueben Fleet in 1923. The following year Consolidated received orders from the USAAS for a new primary trainer, the PT-1, which was followed in 1928 by orders for the PT-3, similar to the PT-1 but with a more powerful engine. The PT-1/PT-3 series were fixed gear, open cockpit, wire-braced biplanes. The USAAC received a total of 469 PT-1/PT-3s, and 32 O-17s, an observation plane derived from the PT-3. In the early 1930s, Consolidated was able to win another Air Corps contract for a more advanced plane, the P-30 fighter (later redesignated PB-2) and an attack derivative, the YA-11. The P-30 was a two-seat, low-wing monoplane fighter with retractable landing gear. In all, 54 P-30s and five YA-11s were completed. Also, in 1936, Consolidated began delivery of the PBX Catalina flying boat to the U.S. Navy, which was one of the more successful Consolidated designs of the period. The PBX remained in production until the end of World War II; a total of 2,398 was built by Consolidated. In 1941, deliveries began for the B-24 Liberator heavy bomber which, with the B-17 Flying Fortress heavy bomber, provided the backbone of the USAAF strategic bomber force during World War II. A total of 18,188 examples of the B-24 and its derivatives, the C-87 and C-109 cargo aircraft, the F-7 photography plane, and the AT-22, a training aircraft for flight engineers, was delivered. In 1943, Consolidated merged with Vultee, a relatively new aircraft manufacturer (established in 1939) to form Consolidated Vultee.

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During World War II, Consolidated developed two new heavy bombers, the B-32 Dominator and the B-36 Peacemaker. The design specifications for the B-32 were similar to those for the Boeing B-29 Superfortress, for the B-32 served as a back-up in case the B-29 program failed. Since B-29s were already in combat when the B-32 made its first flight, procurement was limited to 115. During this period, Consolidated began work on the B-36, which had a low priority and did not fly until 1946, a year after the war ended.

After World War II, Consolidated Vultee realized some success in the civilian airliner market. One of its aircraft, the Model CV-240, was procured by the USAF as the C-131 Samaritan. In 1954, Consolidated Vultee was purchased by General Dynamics and renamed the Convair division. During the 1950s, Convair had several new aircraft types adopted by the USAF, such as the B-58 Hustler strategic bomber (116 built) and the F-102 Delta Dagger and F-106 Delta Dart interceptors (1,100 and 320 built, respectively). In 1961, the company became known as General Dynamics-Convair and in 1965, simply as General Dynamics. Under General Dynamics, two aircraft have been procured in quantity by the USAF, the F-111 and the F-16 Falcon, both of which are still in service.

History of the XC-99:

The XC-99 was designed as a long-range cargo and troop transport aircraft. The evacuation of 345,000 troops from Dunkirk, France in 1940 had indicated to some military personnel the need for an aircraft capable of moving large numbers of troops and equipment over great distances. The cargo haulers at the time, the C-47 and C-54, could carry 6,000-10,000 lbs. of cargo or 33 passengers and 14,000-32,000 lbs. of cargo or 26 passengers,

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respectively. The XC-99 was designed to carry 101,000 lbs. of cargo or 400 passengers. Built for the Strategic Air Command (SAC), Army Air Force, the XC-99 was a sister ship to the B-36 bomber, the Air Force's primary post-World War II intercontinental bomber. Although the B-36 was ordered in 1941 when it appeared likely that the United States would require a bomber capable of reaching Europe and Japan from bases within the United States, the bombers which were already in existence, such as the Boeing B-17 and Consolidated B-24, and those whose development was already advanced, such as the Boeing B-29, proved adequate for the needs of the USAAF throughout World War II. Thus, the B-36 program was given a low priority and development languished. The first flight occurred in August 1946, a year after World War II ended.

Since the XC-99 was intended to support the operation of the B-36, the wings, landing gear, and tail of the B-36 were joined to a new fuselage to produce the XC-99. The fuselage consisted of two B-36s welded together to produce more cargo space. Built under Contract No. W535-AC-34454 (December 11, 1942), for \$10,916,235.79, it originated as the Consolidated Vultee Model 37. Roberts Hoover was project engineer. The XC-99 was initially designed at the Fort Worth plant, but production was moved to the San Diego facility--with the exception of the wings which were built in Fort Worth (where the B-36 bomber was manufactured) and sent to San Diego.

On November 24, 1947, the XC-99 flew from Lindbergh Field in San Diego, California; the pilot was Russell R. Rogers and the co-pilot, Beryl A. Erikson. Consolidated Vultee conducted flight testing at its San Diego and Fort Worth plants until May 26, 1949, when the XC-99 was accepted by the USAF as an experimental aircraft and assigned

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to the Eighth Air Force (SAC) in Fort Worth, Texas. After acceptance, the plane was grounded for a year to implement structural modifications that would increase the permissible gross weight.

The XC-99 remained with the Eighth Air Force in Fort Worth until September 8, 1950, when it was transferred to Kelly Air Force Base (AFB) since it was the main B-36 supply center. Once the aircraft arrived at Kelly the testing program resumed. The original Project Officer appears to have been Col. Theodore W. Tucker, an experienced B-36 pilot, who was later replaced as Project Officer by Captain James M. Pittard, Jr. During the Korean War the XC-99 began making twice-weekly trips from Kelly AFB to McClellan AFB in California. McClellan AFB was a major supply center for the Korean war. Although the XC-99 was always considered an experimental aircraft, the experimental 'X' designation was informally removed in August 1953 during a trip between San Antonio and Rhein Main, West Germany. Government regulations restricted experimental aircraft from travelling overseas. By July 1954, the XC-99 was no longer considered a project aircraft and was maintained and scheduled as a regular aircraft. As a one-of-a-kind aircraft, the XC-99 was dependent on its sister design, the B-36, for a supply of spare parts. As the USAF B-36 inventory began to dwindle in the mid-1950s, the XC-99 became more difficult to maintain. In March 1957, XC-99 flights were canceled. In need of repairs, it was estimated that 144,734 hours of labor and over one million dollars would be required to replace structural sections which were no longer repairable. Faced with the high cost, the USAF declared the XC-99 surplus on July 11, 1957, after only three years of service.

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After having been declared surplus, the XC-99 was offered for sale on July 25, 1957. When no purchaser was found, it was donated to the Disabled American Veterans, Department of Texas, San Antonio Chapter, on November 6, 1957. Under the terms of the donation, the aircraft was to be removed from Kelly at no cost to the government; used only for display, ceremonial, or historical purposes; and could not be used for profit. Classified equipment was removed from the aircraft, which then sat at the north end of the runway until July 1959, when it was moved to private property about 4,400 ft west of the runway's north end. In 1976, control of the XC-99 was transferred from the Disabled American Veterans to the San Antonio Memorial Air Museum. In 1981, the Museum of American Aviation, which was formed by the American Aviation Research Association, inherited the XC-99 and other assets of the San Antonio Air Museum when that organization dissolved. Finally, the Kelly Field Heritage Foundation purchased the XC-99 for \$50,000 and returned it to Kelly AFB for restoration.

During its lifespan as a carrier, major modifications to the aircraft appear to have been minimal. Early in the testing program the single wheel landing gear was replaced by four-wheel bogies. In 1950, the 3,000 hp R-4360-25 engines were replaced by 3,500 hp R-4360-41 engines, bringing the aircraft up to B-36 standards. At the same time, a self traversing system for the upper deck hoists for ease in cargo loading was installed and the fire extinguishing system was altered from 72 bottles of carbon dioxide to only four bottles of methyl bromide, saving 2,380 lbs. A warning system, indicating when engine oil reserves dropped below 26 gallons, was also installed at Kelly. In 1953, a new nose section was fitted which incorporated a radome for an AN-APS-42 on-board radar, to allow for better all-weather flight

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capability. Although not a modification, changes to the USAFs method of loading cargo were required to improve efficiency. In order to reduce the time needed to load small, high density packages, Kelly built cargo bins capable of holding 4,000 lbs., an early application of containerized cargo. These bins were intended for use on the upper cargo deck, which could hold a maximum of 13 such bins, while the lower cargo deck was to be used for bulkier items, such as engines. Each preloaded bin could be loaded into the aircraft in about four minutes.

In 1949, the year the USAF accepted the XC-99, Convair submitted a proposal to the USAF for an improved version of the XC-99, to be designated the C-99. The design team was led by J.W. Larson, chief engineer of the Convair Fort Worth plant. Part of the design criteria for the C-99 was the ability to carry 101,000-lb. cargos across the Atlantic or 116,000-lb. cargos for shorter distances. Changes from the XC-99 would have included: increased range; a new model R-4360 engine which would deliver 4,000 hp; pressurization for the flight cabin and upper cargo deck; a new fuselage design with 57 percent more cargo volume than the XC-99; adoption of the then standard B-36B bubble canopy and three-level flight deck; installation of a new nose wheel which would not protrude into the lower cargo deck; and the provision of clamshell doors in the nose and tail of the aircraft, which would be provided with integral ramps. The new cargo doors would allow the aircraft to deliver most of the largest equipment the Army possessed, including the M-46 tank, as well as the personnel necessary to operate and maintain the equipment. It was estimated that these capabilities would allow 44 C-99s to carry an entire Airborne division across the Atlantic. The major competitors of the C-99 were the Douglas C-124A and Boeing C-97, which were already being

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procured by the USAF. Both were smaller aircraft than the C-99, but Convair felt that the C-99 would be price-competitive with the other aircraft since it utilized about 70 percent of the parts and tooling of the B-36. Convair was also hoping to sell a commercial version of the aircraft with seating for 400 passengers.

The XC-99 did not prove to be as successful as Consolidated Vultee had envisioned, and neither the military nor commercial versions of the C-99 were produced for several reasons. As an airliner, the C-99 could have carried up to 400 people, but airlines were doubtful that enough passengers would book each flight to make it profitable. In order to fill each plane with a sufficient number of passengers, airlines would have to cut the frequency of their trips by two-thirds. The 747, which was later used successfully as a passenger plane, holds up to 452 people. However, a plane of this size would not have been commercially viable in the early 1950s.

The USAF had a similar dilemma in finding enough cargo to make each trip with the XC-99 cost efficient. While there were times when the ability to haul large, heavy equipment to a particular destination was critical, to be financially successful, there had to be a large, heavy load waiting at a destination for the return trip. The USAF did not have sufficient loads requiring the XC-99s capabilities. Furthermore, there were a limited number of landing fields that could accommodate an aircraft the size of the XC-99. During the 1950s, the advantage that the XC-99 offered in transporting heavy equipment or troops was diminished as shifts in military strategy leaned toward massive retaliation with nuclear strikes. In addition, aviation technology was changing rapidly in the late 1940s due to the

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introduction of jet engines in the latter part of World War II. Although still primitive, jet engines had already changed the design of fighter and bomber aircraft, and the USAF may have assumed that by waiting until the technology matured, an even better aircraft would become available. Finally, though the XC-99 proved able to transport heavy cargo when necessary, the flights had to be carefully planned and were potentially unreliable. Cool air was an advantage; it gave the aircraft more lift. On several occasions flights from Texas had to be postponed due to the summer heat.

While the USAF and commercial airlines considered the financial drawbacks associated with operating a large cargo carrier, the public was fascinated with the XC-99. The arrival of the XC-99 was an event. In Rhein Main, West Germany, thousands of people brought picnics and spread blankets near the runway to watch it land. The XC-99 had a distinctive look; it was the biggest airplane and the first double decker ever built. MGM studios hired the XC-99 to transport numerous biplanes from Florida for a movie. A large crowd greeted its landing, though the crew was to realize later that many had thought the movie actor, John Wayne, was aboard. Not everyone was enthralled with the XC-99, however. One farmer sued because the noise of the aircraft flying overhead had scared his prize cattle.

Although the XC-99 never reached production status, it did achieve many milestones and made several important contributions to cargo transport. On April 15, 1949, the XC-99 lifted a 100,000-lb. payload, breaking the previous record of 84,000 lbs. set by a B-36 bomber on January 29, 1949. The cargo consisted of zinc alloy bars, which due to their density did not fill the spacious cargo bays. On its first flight from Kelly AFB in July 1950,

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before the official evaluation commenced, the XC-99 flew on a trip which included Geiger AFB, Spokane, Washington; McChord AFB, Tacoma, Washington; and McClellan AFB, Sacramento, California. During this flight the XC-99 carried a 101,266 lb. cargo, primarily 42 2,300-lb. engines, from Convair San Diego to Kelly AFB. Later, the XC-99 was to lift a 104,000 lb. load from an airfield at an elevation of over 5,000 ft. In November 1950, the XC-99 carried an 85,000 lb. cargo from McClellan AFB, Sacramento, California, to Turner AFB, Albany, Georgia, setting a new record. In August 1953, the XC-99 flew its first intercontinental trip from Kelly AFB to Rhein Main, West Germany, carrying a 61,000 lb. payload. The route included stops in Bermuda and the Azores, although the same trip could have been flown directly with a smaller cargo. Another record was set on July 12, 1955, when the XC-99 carried 212 passengers, which was a record for a land plane, from Kelly to the Convair Fort Worth plant. Finally, the XC-99 helped to support Project DEW (Distant Early Warning) Line by flying 360,000 lbs. of cargo from Dover AFB, Delaware, to Keflavik, Iceland, in only six trips. The DEW Line was a series of radar stations established in the Arctic to warn against Russian nuclear attacks. During its career, the XC-99 amassed a total of 7,425.5 hours of flight, covered a distance of 1,486,000 miles and carried 60 million lbs. of cargo.

The XC-99 contributed to the development of large cargo transport in several ways. First, and perhaps foremost, it showed that substantial cargos could be transported economically by large aircraft. In 1952, the XC-99 had an average cost of 13.12 cents per mile, as compared to the 26 cents per mile achieved by other cargo aircraft during the same period. Second, from the experience gained during operation of the XC-99,

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the USAF developed more efficient means of handling cargo. The XC-99 relied on elevators and ceiling hoists to lift cargo to the first or second deck. This time-consuming process prompted the development of rollers found on today's cargo planes. Finally, the XC-99 contributed to a redesigned landing gear. Originally, it was designed with two tires, 16 ft in diameter, under the wings. Upon landing, the force of the weight carried by each wheel punched through the runway pavement. Thus, it was necessary to replace them with multiple wheels to reduce the load carried by each and lessen the impact upon landing.

Description:

The Consolidated Vultee XC-99 was designed as a transport version of the company's B-36 heavy bomber. It was capable of carrying a 101,000-lb. cargo, 400 troops, or 300 stretcher cases with attendants. Designed to support the B-36, the wings, tail, and landing gear of the B-36 were joined to a new, double-decked fuselage (see Glossary), 20 ft longer and 10 ft taller than that of the B-36. The XC-99 is an extremely large aircraft, with a length of 182.6 ft, a wingspan of 230 ft, a height of 57.1 ft, and an empty weight of 135,232 lbs. It weighed 4.2 times more than the C-46 and 3.7 times more than the C-54. The XC-99 proved that aircraft were no longer limited by weight or size. A weight breakdown for the aircraft shows that the fuselage weighs 25,164 lbs., the wings 37,100 lbs., the tail 4,659 lbs., the landing gear 18,738 lbs., the equipment 7,226 lbs., and the power plant and nacelles 42,345 lbs. The useful load of the aircraft was 128,768 lbs. The XC-99 had a maximum speed of 300 mph, a stall speed of 93 mph, a service ceiling of 30,000 ft, a range of 8,100 miles, and required a takeoff distance of 5,000 ft.

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A crew of eight was required to fly the XC-99. Crew members included: a pilot and copilot; two flight engineers; a navigator; a radio man; and two scanners, whose job was to observe the operation of flaps, landing gear, and engines, which were not visible to the pilot. On longer trips relief crew members accompanied the flight. The crew had spacious room and was accommodated with 11 bunks, two hot plates, an electric oven, an ice box, a dining table and chairs, a food storage compartment, and room for the commander to relax in. It was also equipped with two 8-channel VHF radio sets, two radio compasses, one low-frequency receiver, one 20-channel UHF set, one R-541/ARN14D Omni receiver, and one APS/42. Radar, an addition to the original airplane, was a Goodyear AN-APS-42 nose-mounted unit.

The XC-99 has an aluminum structure and magnesium alloy skin, with the airframe (exclusive of engines, tires, and equipment) containing about 75,000 lbs of aluminum and magnesium alloy, 18,000 lbs of steel, and 2,000 lbs of plastic and glass. The XC-99 was the first cargo plane to have a double decked fuselage, with about 16,000 cubic ft of stowage space and vertical clearance of 9.5 ft for the lower deck and 7.5 ft for the upper deck. The lower front deck was designed for loads of 100 lbs per sq ft and the lower rear deck for 150 lbs per sq ft, while the upper front and rear decks were designed for 75 and 100 lbs per sq ft, respectively. However, selected areas of the upper deck received local reinforcement to provide for concentrated loads in excess of these limits. Access to the cargo decks was provided by four cargo hatches: two large hatches were placed in the belly of the aircraft, one near the leading edge of the wing and the other immediately forward of the tail, which gave access to the lower cargo deck; two smaller hatches were located in the upper deck,

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directly above the lower deck hatches, to give access to these areas. The upper hatches could be fitted with hatch covers when troops or stretchers were being carried. The aircraft was equipped with ramps to enable mobile equipment to be loaded into the aircraft; these ramps were adjustable in width, to accommodate vehicles of varying tread widths, i.e., the space between the points of contact (with the ground) of a pair of wheels. In addition, the aircraft was fitted with four electric hoists and a monorail system to handle other types of cargo. The wings taper from 33.3 ft wide at the wing root to only 6.3 ft at the wing tips. The wings are a maximum of 7.5 ft thick, which allowed a catwalk within the wings, providing access to the engines during flight. Two doors, on the upper cargo deck, lead into the wings. The wings are fitted with 12 compartments in the wing center section, which carried a total of 21,116 gallons of gasoline and 1,200 gallons of oil. These storage compartments were fitted so that the inboard fuel tank was located 10 ft from the fuselage, with a bulkhead between the tank and the fuselage so that spilled fuel could not reach the fuselage. The leading edge of the wing was built with double-skinned construction to allow heated air to circulate from the engines to prevent the wings from icing.

The aircraft was originally powered by six Pratt and Whitney R-4360-25 radial engines,² each with an output of 3,000 hp. These were later replaced by

² Piston engine designations in the period started with an initial letter indicating the type of engine, a middle number showing the displacement of the engine in cubic inches, and a terminal number differentiating models of the engines. In the case of the engines mounted in the XC-99, 'R' stands for radial and 4360 indicates a 4,360-cubic inch engine, while the -25 and -41 indicate different models of the same engine.

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R-4360-41 engines, capable of 3,500 hp. The engines are buried in the aircraft's wing and arranged in a pusher configuration, a design oddity for the period. The term pusher refers to aircraft which have the propellers mounted behind the wing, rather than in front as in the more common tractor design. Air for the engines was obtained through ducts from the leading edge of the wing. The engines were fitted with cooling fans and automatically controlled air cooling plugs. These plugs were ring-shaped devices, which moved back and forth between the engine nacelle and propeller spinner to control the amount of air flow over the engine, which was required to cool the radial engines. Each engine was equipped with two turbo-superchargers, which compressed the air fed to the engines to allow for efficient operation at altitude. Exhaust collectors on each engine fed two overboard exhausts; each overboard exhaust was fitted with a heat exchanger to provide warm air for deicing the leading edges of the wings and tail surfaces, and to provide cabin heat.

The airplane is fitted with hydraulic-powered landing gear, nose wheel steering, and main gear brakes. The plane is also fitted with an emergency hydraulic system, consisting of a hand-operated pump connected to a separate hydraulic fluid reservoir. The landing gear originally consisted of dual-wheel nose gear, single-wheel main gear using 110-in diameter tires, and a tail bumper. Later, the single-wheel main gears were replaced by four-wheel, bogie-type main gear. The aircraft control surfaces were manually powered through control cables, with trim tabs on ailerons, rudder, and elevators. Three pairs of slotted flaps were also fitted to the aircraft. The electrical power was provided primarily by the 208-volt, 400-cycle, three-phase, alternating current system powered by two main engine-driven alternators and a backup

power plant-driven alternator. Direct-current power was provided by motor-generator converters or by the aircraft battery.

Glossary: Aileron: A movable hinged section of an airplane wing, for banking in turns.

Elevator: A movable airfoil like a horizontal rudder, for making an aircraft go up or down.

Fuselage: Body of an aircraft excluding tail and wings.

Flaps: A hinged section on an aircraft wing, used in landing and takeoff.

Nacelle: An enclosed part in an aircraft, for housing the engines, cargo, etc., when it is not part of the fuselage proper.

Radial Engine: A radial engine is an air-cooled engine whose cylinders were arranged around the crankshaft like the spokes of a wheel. Seven or nine cylinders proved to be the maximum practical number of cylinders that could be arranged thus; larger radial engines had to resort to more than one row of cylinders, although this caused problems in cooling.

Stall: To lose the amount of forward speed necessary to maintain altitude and be controlled.

Sources:

Angelucci, Enzo
1985 The American Fighter. Peter M. Bowers, consultant. New York: Orion Books.

Aviation Week

- 1949 Convair Redesigns Big Transport: Modification of XC-99, Competitor of C-97 and C-124, Would Haul 100,000 lb. over trans-Atlantic Distance. 5 December.
- 1952 XC-99 Sets Air Cargo Records. 2 June:18.

Consolidated Vultee

- ca. 1949 C-99 Troop and Cargo Long Range Aircraft. Design proposal submitted by the Consolidated Vultee Fort Worth Division.

Convairiety

- 1949 XC-99 on First Test Hop in Months Tries Out New Landing Gear. 2 February.
- 1949 XC-99 Quits SD to Finish Tests at FW. 16 February.
- 1949 XC-99 Racks Up new Record: 100,000 Lb. Load Taken Up In Test. 27 April.
- 1949 AF Accepts XC-99 Climaxing 6 ½ Years Planning, Building. 8 June.
- 1949 Air Force Studies New Cargo Ship. 23 November.
- 1950 AF Fits XC-99 With Engines Like B-36. 15 February.
- 1950 Convair Gives Counsel in XC-99 Test Project. 8 November.
- 1952 [year uncertain] Pre-Loaded Cargo Bins Help Speed up Transfer of Freight From XC-99. 16 July.
- 1953 Convair's XC-99 Passes 2,000th Hour in Air. 8 April.
- 1953 An 'X' no Longer, Convair's C-99 Spans Atlantic. 26 August.
- 1955 XC-99 Sets Another Record With 212 Passengers on Trip to FW. 27 July.

Franklin, R.

1986 *The Defender: The Story of General Dynamics.* Harper & Row, Publishers, New York.

General Dynamics

n.d. Model 37 (XC-99). Publication providing basic data on XC-99. pp. 97-98.

Goldberg, Alfred, ed.

1974 *A History of the United States Air Force.* D. Van Nostrand Company, Inc, Princeton.

Grenville, J.A.S.

1994 *A History of the World in the Twentieth Century.* The Belknap Press of Harvard University Press, Cambridge.

Kelly AFB, Texas, Office of History

ca. 1993 XC-99: Queen of the Skies. Summary of the history of the XC-99 prepared by Sgt. Obert, Kelly Air Force Base, History Office.

Maxwell AFB, Alabama, Air Force Historical Research Agency

n.d. Vertical files on XC-99.

Paris, Roy

1959 *Aviation's Amazon: Experiment in Air Logistics. The Airman.* July:10-12. Office of History, McClellan Air Force Base, California.

Perret, Geoffrey

1993 *Winged Victory: The Army Air Forces in World War II.* Random House, New York.

Public Information Office, San Antonio Material Area, Kelly Air Force Base, Texas

1950 XC-99 Breaking Records During Evaluation Program at Kelly Air Force Base, Texas. Press release issued 26 October.

1950 Press release issued 10 November.

ca. 1953 Undated Press release.

Poindexter, G.W.

1994 Restoring the Queen/Big Piece of Airlift History is Getting New Lease on Life. *Air Force Times*. 19 December. Retrieved from America Online:GeoArch1 information service March 13, 1995.

San Diego Union

1955 212 Ride S.D.-Built Plane. 13 July.

Swanborough, G., and P.M. Bowers

1968 *United States Navy Aircraft Since 1911*. Funk & Wagnalls, New York.

Texas Historical Commission

1990 Metal Dinosaur: One of a Kind Aircraft was World's Largest. *The Medallion: Preservation News in Texas* 27(4). Texas Historical Commission, Austin.

Unknown (possibly San Antonio newspaper)

1959 XC-99, Aerial Goliath, Moved to Last Resting Place at Kelly. 7 January.

United States Air Force (USAF)

1949 Flight Operating Instructions: XC-99 Airplane. USAF handbook issued 31 March 1949, marked "Restricted."

Waters, A.W.

1983 *All the U.S. Air Force Airplanes, 1907-1983*. Hippocrene Books, New York.

Western Flying

ca. 1948 Design Details of the XC-99. pp. 10, and 20.