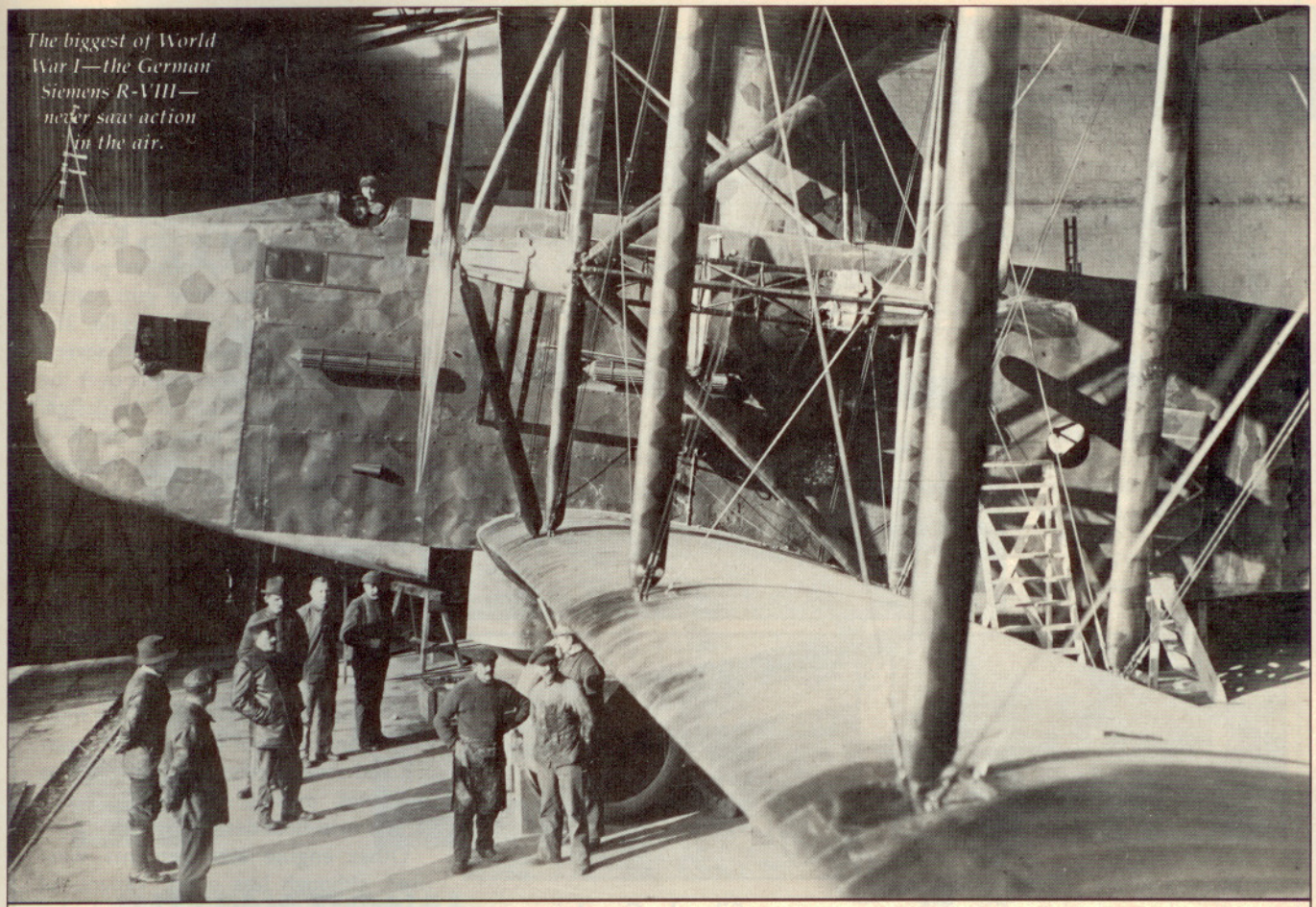


The biggest of World War I—the German Siemens R-VIII—never saw action in the air.

BIG WINGS

The world record-holding jumbos

BY PETER M. BOWERS

Much attention has been given, from time to time, to certain airplanes, each ballyhooed upon its appearance as "the biggest airplane in the world." Some, of course, have deserved the name. Others have been big but were not actually the biggest by any of several applicable criteria.

The most obvious standard, of course, is pure size—the longest dimension of the airplane, its wingspan. It would not be wrong to call the airplane with longest wing at the time "the biggest." However, there are other factors that should be taken into consideration as well—such factors as gross weight, wing area, number of engines, total horsepower and payload in either pounds or available seats. Some airplanes that didn't qualify as "the biggest" in terms of wingspan took the lead in one or more of the other areas. One criterion—gross weight—existed for some designs only as a potential. A few of the recognized but short-lived giants never got to fly at their designed gross weights.

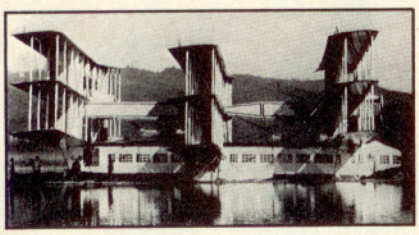
Between 1913 and the present, only 14 designs truly have qualified in their day as "The World's Biggest Airplane." There was no head-to-head competition in the giant airplane field. The biggies were designed to do a job—carry payloads over distances—and as fuel and load requirements were revised, bigger airframes were required to handle them. The "gee whiz" superlatives of the mechanical and aviation press are usually directed at size, weight, power and payload as marks of progress but not necessarily of superiority.

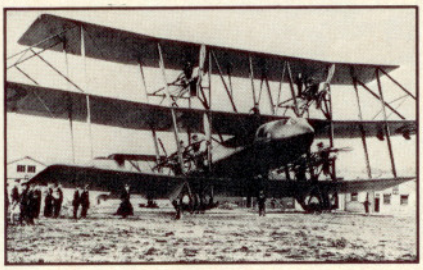
Economics enter the picture, too. It is easy to rationalize that one airplane can carry a given tonnage or number of passengers at less cost than can two airplanes capable of carrying only half that load each. However, the logic is not totally valid. The unit cost of the bigger airplane, built in lesser quantity, is apt to be more than double that of the smaller airplane, while the maintenance and servicing costs may be more than merely twice that of the smaller unit. When the giant is well-suited to quantity production, however, bringing the cost-per-pound-of-airframe down, the economics of bigness get very profitable—that important airline economic criterion, the cost-per-seat-mile (or cost-per-ton-mile), goes down as the number of seats or cubage on the airplane goes up.

While increasing the wingspan and area in order to carry a bigger load is the easy solution to the problem, sheer size is a very significant handicap from

PHOTOGRAPHY FROM THE COLLECTION OF THE AUTHOR

Clockwise from top: Sikorsky "Grand"; first four-engine airplane. Zeppelin (Staaken) biplane bomber, R-VI four-engine version. Tarrant Tabor: Everything went fine until he opened up the top engines. Caproni CA-60—broke up on second landing.





the manufacturing, maintenance and operational standpoints. Even now, there are few hangars that can house real giants, and existing airline terminals are unable to handle anything with greater wingspan than the 195 feet of the Boeing 747. In recent years, bigger loads have been carried by more efficient wings, not larger ones.

Some of the giants described here held their titles by default. They were the biggest by one or more of several criteria, because other larger designs that preceded them no longer existed.

Comparative statistics for the 14 giants described in this article are presented in a single table that is color-coded and marked to identify the features that made a particular airplane the biggest of its time (p. 64). It also shows the all-time tops in number of engines, maximum wingspan, etc. It should be noted that some giants with long production lives have had significant increases in power and gross weight, but these have not altered their relative standings. Gross weights given are for either the first production model or a specified later model.

Aside from their distinctive size, many of these giants have unique features that make the individual aircraft interesting.

Sikorsky Grand

First of the giants, a true pioneer, was the Sikorsky "Russian Knight" of 1913. It was the first four-engine airplane and one of the first to enclose crew and passengers in a cabin. It was not a one-time freak, either. More than 70 were built in the four-year period before the Russian Revolution of 1917, at which time designer Igor Sikorsky left the country. Although some of the big Sikorskys had individual names, they were collectively named "Grand" because of their great size relative to their contemporaries.

The Grands were marginal airplanes in their day—an early example of aircraft potential held back by inadequate powerplants. Other four-engine models soon followed the Sikorsky but for many years it was almost alone in its engine arrangement—all four strung out in a line along the leading edge of the lower wing. A major disadvantage of this system, due largely to the low airspeeds and barely effective control systems of the day, was the inability to overcome asymmetric trim if an outboard engine lost power in flight.

The Zeppelin Giants

Germany was the next builder of giants and quickly exceeded the Russian output. The leader was the airplane subsidiary of the Zeppelin airship firm. Since the plant was at Staaken, near Berlin, the airplanes sometimes are identified as "Staakens."

The first, flown in April 1915, was a trimotor with 245-hp airship engines, one in the nose and two in between-wing nacelles driving pusher propellers. A manned machine gun station was in the nose of each nacelle. The same airframe was adapted to several different engine arrangements over the four-year production life of the design. The most common, used on the R-VI bomber, involved four 245-hp engines, two in each nacelle; one drove a pusher propeller and one a tractor.

The purpose of this was to reduce the turning moment or asymmetric trim that resulted from loss of one engine by grouping all engines as close to the center of the airplane as possible so that directional trim could be maintained with the twin rudders. The four-engine arrangement was quite successful, and several even were operated as seaplanes, making them the all-time largest twin-float designs.

Other engine arrangements were used, although less often. Variants of the R-VI, the R-XIV and R-XV had a fifth engine in the nose. The six-engine versions had two engines side-by-side in the nose geared to a single propeller and two engines mounted in tandem in the nacelles driving single pusher propellers. Again, gunners rode in the front of the nacelles.

Siemens R-VIII

Several other German firms got on the giant-aircraft bandwagon during World War I. The largest design of that period was the R-VIII built by the airplane division of the Siemens electrical firm. The R-VIII was a six-engine design but didn't look it; the engines were all inside the fuselage. One was connected to each of two two-blade propellers between the wings by shaft and gears. The others were paired, each pair driving a four-blade pusher propeller.

The R-VIII topped the field in wingspan, area and total horsepower but never achieved its calculated gross weight of 34,980 pounds. It was not completed until after the armistice was signed and then was scrapped on orders of the Allied Control Commission.

Tarrant Tabor

The title of "World's Biggest" passed to Britain in 1919 with the Tarrant Tabor triplane. While its center wingspan did

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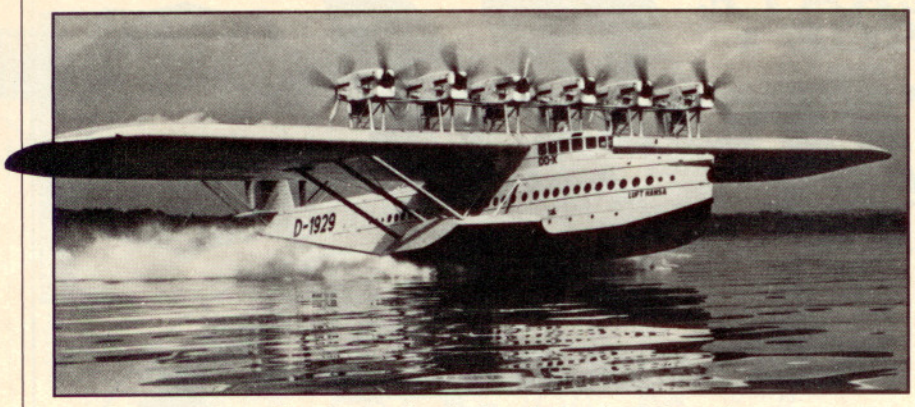


The world's only 12-engine airplane, the Dornier DoX, set a long-standing record by carrying 169 people aloft in 1927.

not match that of the R-VIII, it was tops in wing area, total horsepower and, potentially, in gross weight.

The designers recognized the problem of engine-out trim and bunched the engines as close to the center as possible, using both the tandem-engine arrangement of the Zeppelin R-VI plus the stacking of single engines. This latter detail was to be its undoing.

With its six 450-hp engines, the Tabor was ready for its first flight on May 26, 1919. The pilot opened the four lower engines to full power for his takeoff roll on turf, then added power to the upper engines. The thrust of this pair, located 28 feet above the ground, coupled with the drag of the wheels on the turf created a nose-down couple that the elevators could not overcome. The Tabor crashed with fatal results on its first takeoff roll. This proved that large airplanes are much more trim-sensitive in pitch than they are in yaw.

Caproni CA-60

The first airplane to draw raves because of its size was the Italian Caproni CA-60 of 1920. Called "Capronissimo," it was tops in several areas. While its wingspan was less than several preceding giants, it had the most area thanks to *nine* wings in a unique triple-tandem triplane arrangement. It had eight 400-hp engines and was planned to carry 100 passengers, but such was not to be. The flying houseboat made two short, straight-ahead flights and broke up on its second landing. (With the exception of one French glider in 1922, it should be noted that no tandem design, double or triple, has been notably successful.)

Dornier DoX

Germany was out of the giant airplane business for nearly 10 years as a result of treaty limitations but came back in a big way with the Dornier DoX of 1929. (It actually was built in Dornier's Swiss plant because a suitably sized building was not available at the factory in Germany.) This was the first giant to get all-out publicity as the "World's Biggest Airplane" and is still tops 55 years later in one aspect—it had 12 engines.

The German word for flying boat is *Flugboot*. The DoX wasn't just another

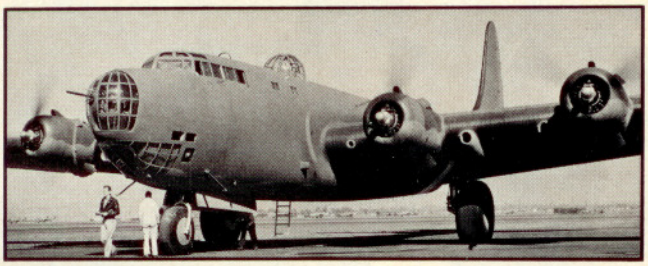
CHARTBUSTERS

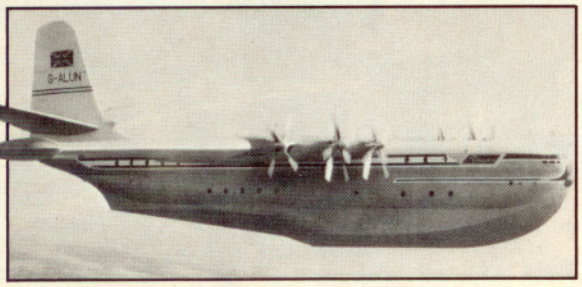
Make/Model	Year	Number of Engines	Hp Each	Total Hp	Wingspan (ft in)	Wing Area (sq ft)	Gross Weight (lbs)	Seats (crew and passengers)	Remarks
Sikorsky Grand	1913/17	4	100	400	91 11	1,292	9,000	8	70+ built
Zeppelin-Staaken R-VI	1915/18	4	260	1,040	138 6	3,586	26,066	7	18 R-VIs; 22 variants
Siemens R-VIII	1919	6	300	1,800	157 6	4,752	34,980 (potential)	10	Five started; one completed. Not flown at gross weight
Tarrant Tabor	1919	6	500	3,000	131 3	4,950	44,672 (potential)	5	One only; crashed on first takeoff
Caproni CA-60	1920	8	400	3,200	98 5	9,000	57,200 (potential)	100+ (potential)	One only; crashed before flight at gross weight
Dornier DoX	1929	12	450 600	5,400 7,200	157 5	4,885	123,200	159	Three built; world's only 12-engine airplanes
ANT-20 Maxim Gorky	1934	8	750	6,000	206 7	5,228	92,400	63	Eight-engine prototype; six-engine production
Douglas XB-19A	1941/43	4	2,600	10,400	212 0	4,492	164,000	16	One built; became XB-19A in 1943
Convair B-36J	1946/54	6 piston 4 jets	3,800 5,200	22,800 20,800	230 0	4,772	410,000	15	321 production models
Hughes H-4	1947	8	3,000	24,000	320 0	11,432	360,000	710 (potential)	One built; one short flight
SARO Princess	1952	10	3,780	37,800	219 6	5,250	330,000	230	One flown; two scrapped unfinished
Boeing B-52	1954/62	8	11,200 (lbs)	89,600 (lbs)	185 0	4,000	488,000	5	444 built
Lockheed C-5A	1968	4	41,000 (lbs)	164,000 (lbs)	222 8	6,200	769,000	364	81 built; back in production 10 years later
Boeing 747B	1969	4	53,000 (lbs)	212,000 (lbs)	195 8	5,500	836,000	553	More than 600 built; one flown at 844,000 lbs

All-time maximum Prevailing maximum Unattained maximum

The ANT-20 Maxim Gorky—pride of Stalinist Russia. Destroyed in a midair collision in 1935 but followed by 16 production models.

Douglas XB-19: Purely a research airplane, the XB-19 helped establish the use of tricycle gear on heavy aircraft.





Above left: Convair B-36—former backbone of the Strategic Air Command. Above right: Howard Hughes's obsession—the Spruce Goose. Left: SARO "Princess"—last of the great flying boats.

Flugboot—it was a *Flugschiffe*, a flying ship. It followed the design trend of earlier four-engine Dornier flying boats with tandem engines in above-wing nacelles. Starting with 450-hp British Bristol Jupiter air-cooled radial engines, the Dornier DoX was woefully underpowered and had a service ceiling of only 1,377 feet. A change to 600-hp American Curtiss Conqueror engines improved the performance, but not much.

On October 21, 1927, the DoX set a long-standing airlift record by carrying 169 people aloft—150 passengers, 10 crew and nine stowaways.

After retirement, the DoX was set up outside the Berlin Air Museum, where it was destroyed by World War II bombing. Two production models were built for Italy and were powered by more-powerful Italian engines.

Tupolev ANT-20 Maxim Gorky

Russia regained the "Biggest Airplane" title in 1934 with the uncontested ANT-20, designed and built by A.N. Tupolev. This airplane led the field in span and area, but it weighed less and had less total horsepower than the DoX. It proved to be underpowered with its six original engines, so two more were added in a tandem-engine nacelle above the fuselage. The first ANT-20, named *Maxim Gorky* for the famous Russian writer, was publicized widely and was used for propaganda purposes but was destroyed in a midair collision on May 18, 1935. There were approximately 16 six-engine production versions used as civil transports and, later, as troop and cargo transports in World War II.

Douglas XB-19

The giant-aircraft lead passed to the United States for the first time with the appearance of the Douglas XB-19 in mid-1941. This was never intended to be a production model; it strictly was a research and development project. One of its most significant contributions was the first use of tricycle landing gear on large aircraft. This statement would seem to be in error because of the earlier appearance of such a design on the Consolidated B-24, but this was a smaller design initiated two years after the XB-19 was started in 1937, which was completed and flown 18 months before the Douglas.

In 1943, the XB-19 became the XB-19A when fitted with larger liquid-cooled Allison V-3420 engines in place of its original air-cooled Wright R-3550 radials. This was not an attempt to improve the airplane but to serve as a test bed for the new engine.

The XB-19A was used for various research work, including hurricane hunting, until 1947. It then was flown to Tucson, Arizona, to be stored for display in the National Air Museum. It was eventually scrapped.

Convair B-36

Consolidated merged with Vultee during World War II to become Consolidated-Vultee, or Convair. The six-engine B-36 was designed in response to a U.S. Army Air Corps requirement for a long-range heavy bomber issued in 1941, but its size and complexity were such that the prototype XB-36 was not flown until August 8, 1946. The XB-36 was followed by 381 production models, the last built in August 1954.

A unique feature of the B-36 was its powerplant arrangement; six 3,500-hp air-cooled radial engines buried in the thick wing, driving pusher propellers through extension shafts. In an effort to improve performance in the dawning jet age, most B-36s were converted to 10-engine models by adding a pair of power pods from the Boeing B-47 jet bomber, each of which contained two 5,200-pounds-thrust jet engines.

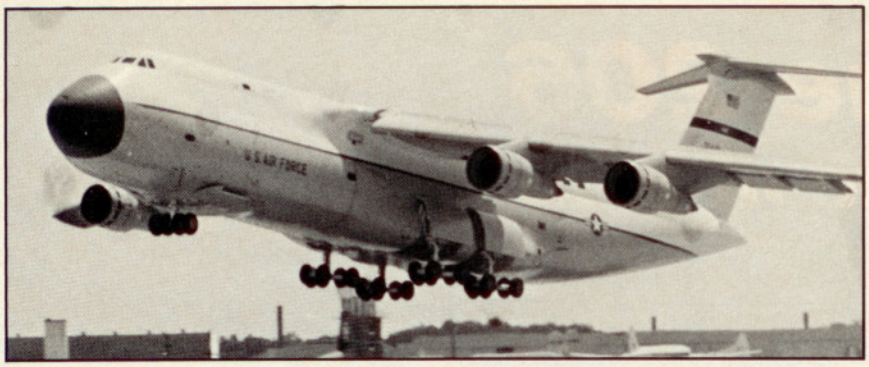
A special midget fighter, the McDonnell XF-85, was built to be carried by the B-36 for defensive purposes, but no B-36 ever carried it. However, a number of reconnaissance versions were adapted to carry camera-equipped Republic RF-84K single-seat jets that could extend the search area of the mother ship.

The last Convair B-36 was retired in February 1959.

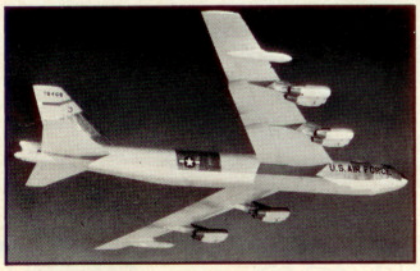
Hughes H-4 Spruce Goose

The world's all-time biggest airplane in terms of wingspan and area is Howard Hughes' popularly but inaccurately named *Spruce Goose*. There is little spruce in the all-wood giant flying boat.

The idea for a huge transport, built of non-strategic materials, originated with shipbuilder Henry J. Kaiser during



A trio of jumbos: above, Lockheed C-5A "Galaxy"; right, Boeing 747 (wait until People Express learns you can pack 1,000 passengers into one); below, Boeing B-52.



the height of the German U-boat successes early in World War II. To oversimplify the story, he teamed up with Howard Hughes to build a fleet of giant transports that could overcome the U-boat hazard by flying over it. However, Kaiser soon dropped out, and Hughes carried on alone.

The H-4 was not completed by war's end. The government lost interest, so Hughes completed it at his own expense, finally completing it in 1947. It made only one short, straight-ahead flight in Long Beach Harbor on November 2, 1947, and then was retired to an air-conditioned hangar on shore for the next 35 years. It never achieved its gross weight of 360,000 pounds or its potential of 700 fully armed troops.

A political hot potato all those years, it was evicted from its hangar on leased city land, but the *Spruce Goose* was saved from scrapping and now occupies a huge museum hangar alongside another gigantic Long Beach landmark, the *Queen Mary*.

SARO Princess

One giant that held its title briefly in the areas of total horsepower and potential revenue seats was the 10-engine "Princess" flying boat built by the British firm of Saunders and Roe (hence SARO). Three were started in 1947, but only one was completed. Its first flight was on August 22, 1952.

The Princess, the final holdover from the era of transoceanic flying-boat transport, had less space and area than several predecessors but had the maximum power and seating (220) of its day. It came nowhere near the potential of the *Spruce Goose* (700), but it did fly at its designed gross weight.

It was unique on several counts, one being the fact that it was the world's only 10-engine airplane designed and built as such. Further, the powerplant installation was unique. All 10 engines were contained within the wing. The eight inboards were paired to drive four individual co-axial propellers, while the two outboards drove one single-rotation propeller each.

Boeing B-52

Preeminence in giants returned to the United States when the Boeing B-52 eight-jet bomber appeared in 1954 to supplement and, eventually, replace the dimensionally larger B-36. However, in total power, payload and gross weight, the B-52 beat the B-36. Direct comparison on the basis of jet vs. propeller power is difficult, but one pound of jet thrust is equivalent to one horsepower at 375 mph—less at lower speeds and greater at higher speeds.

The B-52 was built to serve as a high-altitude nuclear bomber but has since been structurally modified to perform many other bombing and reconnaissance missions, including the delivery of long-range stand-off weapons. B-52s are still the backbone of the Air Force heavy bomber fleet 30 years after the first one flew and are expected to serve in this capacity almost to the twenty-first century.

Lockheed C-5A Galaxy

Another giant, the Lockheed C-5A "Galaxy," led the pack dimensionally by default and legitimately by power and gross weight. With its wingspan of 222 feet and length of 247 feet, it is the largest airplane flying today. Following its appearance in 1968, it had passenger capacity exceeded only by the potential of the *Spruce Goose* and, at 164,000 pounds of thrust in four jet engines and a gross weight of 769,000 pounds, was the champ in those departments.

Production of the C-5A ended in 1973 after 81 were built, but, in an unprecedented move, the Air Force had Lockheed reestablish the production line for the C-5B version.

Boeing 747

Looking simply like an enlarged 707, the Boeing 747 was nicknamed the "Jumbo Jet" long before it flew on February 9, 1969. Each of its four 53,000-pounds-thrust engines produces more than double the power of all eight engines in the *Spruce Goose*. The 747's wingspan was smaller than many preceding giants but was longer than the *Spruce Goose* by nearly 13 feet. Thanks to its power and to latter-day wing and flap design that greatly increased the lift coefficient, a test 747 was able to fly at a record 844,000 pounds. Normal gross is 836,000 pounds for the 747B.

Initial seating was for 350 to 400 passengers plus cabin attendants and three essential crew members. In an emergency evacuation operation in Australia, a 747 carried more than 600 passengers. At first, the upper deck of the 747 was not used for additional revenue passengers. Soon, however, seats were added, requiring additional escape facilities. In the latest -300 variant, the upper deck has been stretched to accommodate a maximum of 81 revenue passengers. The high-density version can carry up to 550 pasengers and crew. It is possible that a 747, of which there have now been more than 600 built with more to come, could carry as many as 1,000 people in another emergency situation. □

Intrigued by airplanes long before his first ride in a Travel Air at age 10, Peter Bowers, AOPA 54408, has since logged more than 5,000 hours.