The Golden Age of Propliners

By Gary L. Killion

Pacific Southwest Airlines Douglas DC-4 at the old LAX terminal in May 1959. PSA was the most successful California intrastate airline. It survived into the deregulation era. (From the author's collection)

The end of WWII marked the beginning of the golden age for reciprocating-powered American airliners. After four years of restrictions on travel for non-essential purposes and the return of servicemen to civilian life, many Americans were eager to enjoy the freedom to travel once again. Trains were still the mode of choice for travel of any significant distance, but the airlines were ready to take on the challenge. Some industry leaders correctly predicted that airliners would completely replace trains for passenger travel. Others erroneously predicted that aircraft would also replace trains for transportation of freight. Although it was common during the Berlin Airlift crisis, it is hard to imagine an all-cargo airline routinely hauling coal!

Most people were pleased to just be able to travel domestically during the immediate recovery period, but many would soon experience the thrills of visiting foreign lands.

Airliners of this period were much slower and had somewhat higher cabin noise levels than the jets of today, but their cabins were spacious and comfortable. There was no incentive to pack more and more passengers into crowded cabins because the airplanes were generally weight-limited. Passenger seats were spacious and comfortable as well. The typical passenger was well-dressed in a business suit and tie, or the ladies' equivalent.

Infrequent travelers could work with a travel agent to get airline reservations; but those more familiar with the airlines that served a particular destination could consult the airlines' own published schedules, that were always freely available on their counters, or the *Official Airline Guide*. Instead of having to deal with a faceless computer, the traveler could then call the airline and work directly with a live reservation clerk. The fares were set, so one didn't have to search to see which airline or which day of the week would yield the best fare. Flights typically operated at lower load factors, so seats were generally available. Subject to seat availability, one could switch flights at the last minute without penalty. Even switching to a flight on another airline was no problem because the airlines accepted each other's tickets.

Passengers were not subjected to the inconvenience of long security lines then. There were no seat reservations, so the experienced traveler would try to board as early as possible to get a preferred seat. Passengers sometimes had to board through inclement weather, but they could actually see the airplane they were about to board! Contrary to the jets of today in which the most desirable seats are toward the front of the cabin, the best seats then were in the rear away from the noise and vibration of the propellers.

Meals were served on all but the shortest flights. The cost was included in the fare, and even on coach flights they were luxurious compared to those served today (if there is a meal today). In lieu of having a tray that folds down from the seat ahead, a passenger was given a pillow on which to place the meal tray. The flight attendants that served the meals were referred to then as 'stewardesses'. Passengers sometimes had to endure smoke-filled cabins — the airlines even provided small complimentary packages of cigarettes. Most people found the flight itself entertaining, so there was no pressing need for inflight entertainment systems.

Passengers were not the only persons that could enjoy air travel. Unlike today's security minded terminals, spectators could actually see airplanes from observation decks. At many terminals, they could just watch over a 4-foot chain link fence next to the waiting airplane. Photography was sometimes impaired because the photographer couldn't get

back far enough from the airplane! Discrete photographers could sometimes gain access to the apron through the general aviation area.

When the war began, more than three fourths of the airplanes in U.S. airline service were Douglas DC-3s. They would be used for almost all postwar flights as well while the airlines awaited converted military surplus Douglas C-54s and equivalent Navy R5Ds. More than 400 were converted to civil airplanes, primarily by Douglas, Martin, Republic, Temco and Matson Navigation Co. Douglas also assembled 79 new DC-4s from components made for the C-54s cancelled at the end of the war. The Civil Aeronautics Administration (CAA) issued Type Certificate 762 (the redundant "Approved" was no longer used in the document title) on June 6, 1946, for the newly-assembled DC-4s and converted C-54s, which were also referred to generically as DC-4s. They quickly replaced DC-3s on the longer flights; but they would, in turn, be replaced on many of those flights as newer pressurized airplanes became available.

Although Douglas aircraft predominated initially, Lockheed products were coming on the scene as well. Except for eight added to the Lodestar fleet of National Airlines, most of the converted Lockheed C-60s were destined for company executive travel (the precursor of the later 'bizjet' fleet). None of the 15 C-69s were released immediately, but Lockheed completed a few cancelled aircraft as new civil 049 Constellations. Type Certificate 763 was issued October 10, 1946. Production of additional 049s continued at a rapid pace, most going to TWA (Transcontinental & Western Air, later Trans World Airlines).

Those were the airplanes that would serve the airlines until postwar models were available.

Turbine Power?

As WWII drew to a close, turbine engines promised to revolutionize almost everything with wings from the highest-performance military aircraft to small general aviation airplanes. Turbojet engines did replace reciprocating engines as the powerplants of fighters almost immediately, and all new bomber designs also used this new form of propulsion within a short time. With the promise of major breakthroughs in performance and passenger comfort, the airlines and manufacturers of their airplanes also looked forward to this new form of propulsion. Because of their superior takeoff performance, turbo-propeller engines appeared more promising for airliners than turbojet engines. Unfortunately, neither would be suitable for airline service for several years. Excessive fuel consumption and extremely short service lives made them prohibitive for airline use —advancement in turbine metallurgy was needed to permit the higher turbine temperatures needed for sustained economical operation. Other areas needed improvement as well. British engine manufacturers were much farther ahead in turbine technology than their American counterparts. Unfortunately for the British aircraft industry, British airframe manufacturers were as far behind as the engine manufacturers were ahead. Development costs of entirely new aircraft to best utilize this new form of propulsion would also place them beyond the reach of the airlines for some time. Although later turbine-powered aircraft are beyond the scope of this article, it should be noted that Vickers Viscounts, Fairchild F-27s and Lockheed Electras did go into U.S. airline service before the piston-powered airliners gave way completely to the jet age.

The Civil Aeronautics Board

The Civil Aeronautics Board (CAB), comprised of five presidentially-appointed members, completely controlled almost every aspect of U.S. airline operation. First, an airline had to have a certificate of public convenience and necessity showing that it was fit, willing and able, and that the proposed transportation was, in fact, needed for public convenience and necessity.

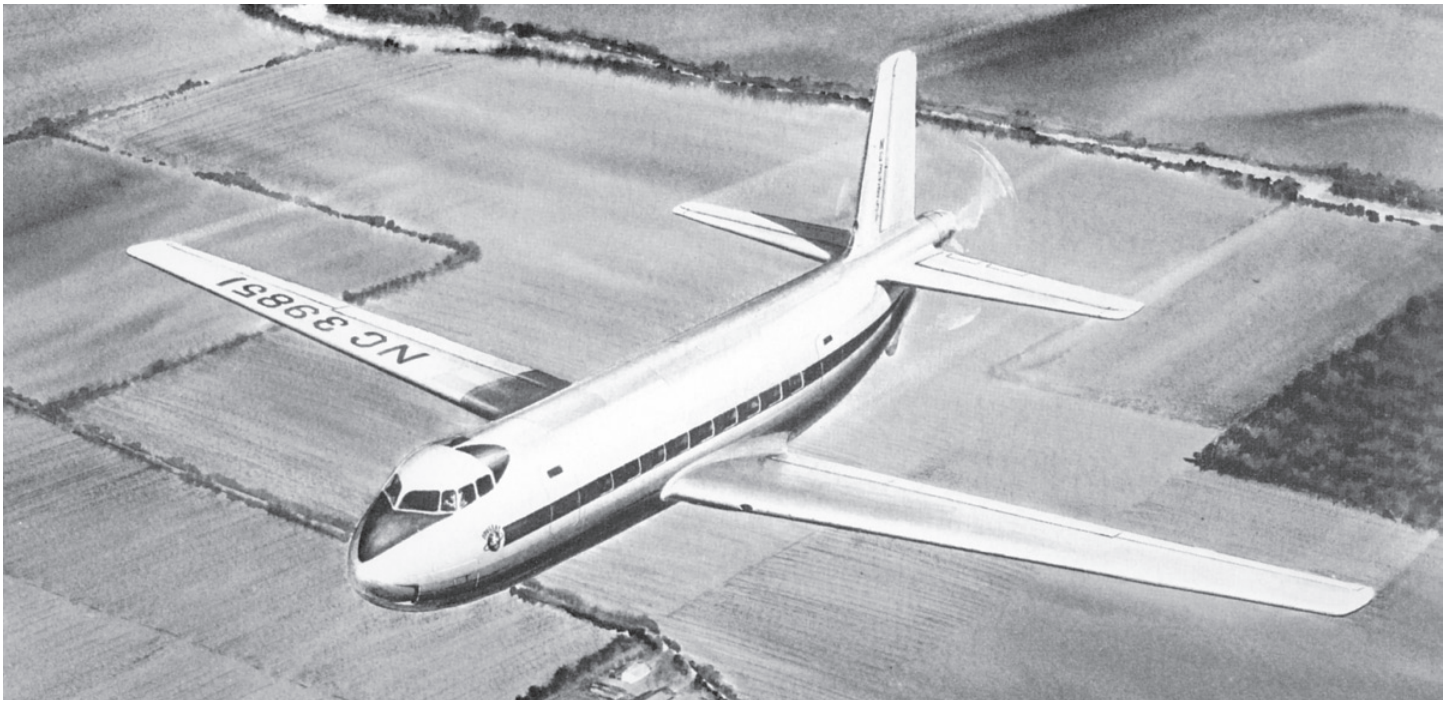
Which routes and destinations an airline could serve, the frequency of service, and the fares it could charge were based primarily on three considerations — limited competition, the needs of the traveling public and the overall financial health of the airline industry. Due to those sometimes conflicting considerations, the CAB was frequently accused of being biased and inconsistent. Sometimes the criticism was justified.

> The typical passenger was well-dressed in a business suit and tie, or the ladies' equivalent.

There was one area over which the CAB had no jurisdiction — intrastate airline service, provided there was no carriage of mail. Generally, that was academic because most states lacked widely-separated population centers large enough to make intrastate service profitable. The one major exception was California, where such airline service was under the cognizance of the California Public Utilities Commission. In another area — service to foreign destinations — the CAB's decisions were subject to presidential approval or disapproval. The CAB was reportedly instrumental in the presidential denial of Pan American Airway's quest to be the sole U.S. international airline — a so-called 'chosen instrument'.

Sometimes overlooked were two other important functions of the CAB — aircraft accident investigation and aviation safety rulemaking — that were transferred to the National Transportation Safety Board and the Federal Aviation Agency, respectively, in 1967.

Despite the almost complete control the CAB had over U.S. airlines, Congress had the authority to pass legislation to restrain it when needed — the ultimate in that regard being the Airline Deregulation Act of 1978 that eliminated the CAB altogether.



R.G. Mitchell rendering of of the "DC-8" Skybus. Its two Allison engines, buried in the lower fuselage, would have driven the contra-rotating propellers with very long shafts. (Courtesy of the Boeing Company)

New Postwar Airliners: The Losers That Never Went into Production

As it became apparent that WWII was ending, aircraft manufacturers were desperate to find new products to replace the massive cutbacks of military aircraft. The prewar manufacturers of light airplanes, e.g. Piper, Aeronca, Taylorcraft, etc., could simply resume production of their prewar products immediately for the anticipated boom in personal flying. For those producing combat or other large military airplanes, the future did not look so promising. Many considered building aircraft for the airline industry as a means of staying in business. As the four-engine Douglas and Lockheed aircraft were expected to fill the need for longer range aircraft and nothing but the venerable Douglas DC-3 was in sight for shorter route segments, most of the industry attention was focused on the so-called 'DC-3 replacement' market with anticipated traffic growth taken into account. Ultimately, only the models proposed by Consolidated Vultee (later Convair) and Martin for this market would reach production.

Eastern Air Lines and National ordered the CW-20E, a 36-passenger postwar development of the Curtiss C-46. Both orders were cancelled — newly proposed postwar airplanes appeared much more promising. One of those was Curtiss-Wright's own CW-28, a 32-passenger design with a new wing of higher aspect ratio, slimmer fuselage, redesigned tail surfaces and tricycle landing gear. Curtiss-Wright had high hopes of selling the new model to American Airlines, but the September 1945 announcement that the airline had purchased 100 Convair 240s (later reduced to 75) sounded the death knell for the CW-28 and probably for Curtiss-Wright as an aircraft manufacturer as well. On top of that blow, Curtiss-Wright's enthusiasm for building airline aircraft was reportedly dampened by other manufacturers' threats to boycott Wright engines.

Boeing offered its 30-passenger, high-wing 431-16. After concluding that it had little potential, the design studies were sold to Fokker. The F.27 is reputed to have evolved from them; but it's doubtful that, as eventually built, it owed much more to the Boeing model than its basic high-wing configuration.

Ludicrous as it may seem today, Fairchild released sketches of its Model F-78, a proposed 45-passenger version of the C-82 Packet! About the only positive thing in its favor was a lounge in the extended nose from which passengers would have had a panoramic forward view. In another configuration, passengers could have viewed the area just passed over from an aft-mounted lounge. Needless to say, there is no record that any airline even considered it.

Douglas offered a model identified as the "DC-8" that was based on its XB-42 Mixmaster bomber. It incorporated two liquid-cooled Allison V-1710 engines buried in the fuselage and driving contra-rotating propellers at the aft end. It was expected to have performance equal to conventional 40 to 50-passenger aircraft despite having much less power due to the absence of drag from wing-mounted engines and propellers. Its promised performance notwithstanding, airlines were reluctant to order that "DC-8" because of perceived maintenance and safety problems with the novel propulsion installation.

Several manufacturers offered smaller models in the mistaken belief that new aircraft meeting then current airworthiness standards would be required in lieu of DC-3s. Unfortunately, they learned the hard way that any investment based on proposed government action is very risky. This was long before regulators were required to perform cost-benefit

A new TWA Lockheed 749 (AAHS photo archives, William Steenbeck collection, AAHS-477)

analyses for proposed rulemaking, but the service history of DC-3s simply did not warrant such costly action. With some needed improvements required by airworthiness directives, DC-3s are still flying safely more than 70 years later!

Although most of the attention was focused on the DC-3 replacement market, three models intended for long-haul routes failed to reach production — at least as civil aircraft. Pan American ordered 26 Douglas Model 415As (dubbed "DC-7s," by Douglas), 108-passenger civil variants of the military C-74 Globemaster, in 1944. By the time of its first flight in September 1945, the order for C-74s had been cut from 50 to 14 airplanes; and the cost of the "DC-7s" had risen accordingly. After reassessing its postwar needs, Pan American cancelled its "DC-7" order and chose Boeing Stratocruisers instead. Its slower cruising speed might also have been a factor. This "DC-7" was unrelated to the much later DC-7s with turbo-compound engines.

Republic hoped to become a manufacturer of airline aircraft by developing the RC-2 Rainbow, a very streamlined 46-passenger version of its military XF-12 reconnaissance airplane. The company had orders for about two dozen airplanes from American Airlines and Pan American, but further development became unfeasible when Republic failed to receive a production contract for F-12s.

Martin advertised as late as the end of 1946 for engineers to develop a civil version of the large Mars flying boat. That effort would have been completely in vain as there was no postwar airline interest whatsoever in flying boats. Although totally undesirable for postwar airline service, the equivalent military JRM aircraft were extremely valuable during the Korean War and were reportedly the most cost-effective means of shipping Navy supplies to Hawaii from the West Coast.

With very few exceptions, Douglas, Lockheed, Convair, Boeing and Martin dominated airline service worldwide during the years between WWII and the jet age. Douglas and Lockheed produced steadily improved successors to their DC-4 and 049 Constellation — both of which were begun before WWII. Convair and Martin introduced new postwar designs for the DC-3 replacement market, and Boeing developed its B-29 bomber into the double-deck Stratocruiser.

The Lockheed Constellation Series

Lockheed was in the best position to produce modern postwar aircraft because it had already begun producing the world's most advanced airliner for military service.

The Constellation was begun in 1938 with design studies for a very advanced 32-passenger aircraft known at the time as the Model 44 Excalibur. Pan American showed some interest, but Howard Hughes became the real driving force the following year on behalf of his TWA. By early 1940, when orders were placed for 40 airplanes each by TWA and Pan American, it had been enlarged and was to be a much faster

The Lockheed VC-121A that had been Dwight Eisenhower's first presidential aircraft, the Columbine II*, at Los Angeles International. (AAHS photo archives, R. Hufford collection, AAHS-30351)*

Braniff Douglas DC-6 at Kansas City in March 1964 ((AAHS photo archives, R. Hufford collection, AAHS-32903)

design with much greater range. Cabin pressurization was to be provided for the comfort of 40-50 passengers. Specific details of the TWA contract are uncertain, but Lockheed was precluded from delivering Constellations to any other domestic airline until TWA could enjoy having theirs in service for a while. Hughes did not anticipate then that TWA would later become an international airline as sales to such airlines were apparently allowed. WWII precluded further development for airline use, but it did continue for the military C-69 transport and XB-30 bomber. The latter was later dropped in favor of Boeing's more promising B-29. The first flight of a C-69 took place in January 1943.

After completing seven of the cancelled C-69s as 049s, Lockheed was able to continue production of truly postwar 049s. Recipients consisted of American Overseas Airlines (AOA), KLM (Koninklijke Luchtvaart Maatschappij) and Air France, in addition to TWA and Pan American.

As with most new designs, the 049s and their Wright Cyclone 18 BA engines suffered from a number of introductory problems. A low point in the Constellation's early days was the crash of a TWA 049 during a November 1947 training flight. The crash was attributed to a fire caused by an electrical failure. The problems were quickly corrected, and Constellations went on to achieve an excellent reputation for reliability.

After producing 88 049 Constellations, including those delivered as C-69s, Lockheed introduced the improved 649 and 749 models with more powerful Cyclone 18 BD engines. Those engines and appropriate structural improvements enabled much greater range. There were, of course, numerous detail improvements. They differed in appearance from the 049s primarily by having revised ejector-type exhaust systems (sometimes promoted as "jet exhausts"). Production of those aircraft included ten military C-121A series delivered to the U.S. Air Force and two PO-1W early-warning feasibility-study airplanes for the U.S. Navy. Altogether, 154 civil and military 649 and 749 aircraft were produced before they were succeeded in production by Super Constellations.

The Douglas DC-6

Any DC-4s newly-manufactured postwar in the absence of a later design would have been hopelessly outclassed by the Constellations, but fortuitously for Douglas — or perhaps by design — a recently placed contract was amended in 1945 to substitute XC-112, XC-114 and XC-116 prototypes in lieu of the last three of 400 C-54Gs. Each was to have a stretched, pressurized fuselage and a thermal anti-ice system for the wing and empennage. They were to be powered by Pratt & Whitney R-2800 Double Wasp, Allison V-1710 and General Electric TG-100 engines, respectively. The XC-116 was cancelled very early when development of the turbo-propeller TG-100 engines was discontinued, and the XC-114 later met the same fate. The XC-112 was completed and first flown February 15, 1946, with Benny Howard at the controls. Although not identical, it was similar enough to serve as the preproduction prototype of the new DC-6s ordered by American Airlines and United Air Lines. (The XC-112 airframe probably had older 24ST aluminum alloy in lieu of the new 75ST alloy.) The flight test program went smoothly, and Type Certificate 781 was issued June 23, 1947. A tentative type certificate had been issued earlier, allowing American and United to begin service concurrently on April 27, 1947.

Like the Constellations, DC-6s experienced a low point in their early days when a United airplane crashed with 52 fatalities in Bryce Canyon, Utah. An American DC-6 narrowly missed the same fate two weeks later by making a safe emergency landing at Gallup, New Mexico. In both instances it was found that a tank was inadvertently overfilled inflight during transfer; and fuel discharged from the vent was ingested into the combustion heater inlet, causing an uncontrollable fire. The hazard was corrected by further separating the fuel tank vent and the heater intake. Although Constellations had gone into service much earlier, DC-6s eventually proved to be worthy competitors.

One special DC-6, the military VC-118, served as the U.S. presidential airplane during the Truman Administration. It should be noted that a DC-6 variant produced under license by Canadair also served as Canada's head-of-state airplane. Due to licensing provisions, the fuselage was the same length as that of a DC-4. It was preceded 46 similar airline aircraft with Rolls Royce Merlin engines.

After the DC-6s had been in production for some time, Douglas introduced the DC-6A and DC-6B with the fuselage extended five feet forward of the wing. DC-6As were all-

Douglas C-118A flying over the Southern California coastline, probably on its first flight. (Douglas photo from Chuck Stewart collection, aahs-32903)

cargo airplanes, while DC-6Bs were passenger-configured with seating for eight additional passengers. Douglas also offered a convertible 'combi' configuration with a movable bulkhead to separate passengers and cargo. The bulkhead could be installed in one of four different positions to vary the ratio of cargo and passengers. Douglas originally promoted the convertible airplanes as DC-6Cs, but decided instead to certificate the convertible interior as just an optional configuration of the DC-6A. Unfortunately, this early promotion sometimes led to the erroneous identification of so-configured airplanes as DC-6Cs. In anticipation of the coming jet age, some customers ordered passenger-configured DC-6As in lieu of DC-6Bs because they could easily be converted for cargo service after they had lost their appeal for passenger service.

DC-6A production included 64 delivered to the U.S. Navy as R6D-1s and 101 delivered to the U.S. Air Force as C-118As. One DC-6B was also delivered to the Navy as the R6D-1Z.

Even after the DC-7 series with power-recovery turbines on their R-2250 piston engines went into production, the demand for new DC-6As and DC-6Bs continued. The penultimate Douglas piston-powered airliner was a DC-6B delivered November 17, 1958, to Jugoslovenski Aerotransport (JAT). Altogether, 704 DC-6 variants, including the military models, were produced.

Only the Martin and Convair models designed for the DC-3 replacement market reached production. Both were entirely new designs. It was anticipated that the vast technological advances of WWII could be combined with the operational experience of the airlines to produced airplanes far in advanced of any existing airline type. While basically sound thinking, it resulted in gross overconfidence at Martin and to a lesser degree at Convair.

The Martin 202 and 404

Martin considered both high and low-wing designs before choosing a 40-passenger, low-wing design for development as its Model 202. Although it undoubtedly made extensive use of the same technology and would also have two Pratt & Whitney R-2800 Double Wasp engines, it bore little resemblance to Martin's famous B-26 Marauder bomber.

Due no doubt to overconfidence, Martin made several basic errors in its development. The first was to use production aircraft for testing, a gamble that Martin lost. Despite early enthusiasm about flight characteristics, it was soon found that extensive redesign was required before it could be certificated. Apart from the resulting delays, it was reported that nearly $1.3 million worth of no longer usable parts and components had to be scrapped.

The most serious error, which plagued the 202 throughout its development and operational history, was failing to design it with adequate lateral stability. Based on seeing the early sketches, CAA flight test personnel advised Martin that they seriously doubted the 202 would have sufficient lateral stability for certification. Using data from Martin's earlier wind tunnel tests, the NACA (National Advisory Committee for Aeronautics, the forerunner of NASA) also reached the same conclusion. Martin had rationalized otherwise, but the flight test program confirmed the CAA and NACA suspicions. As a result, Martin had to redesign the wing to increase the dihedral of the outer panels. It was also found necessary to greatly increase the vertical fin area to provide satisfactory directional stability.

A structural defect of the spar fittings used to increase the dihedral was later responsible for the fatal crash of a Northwest Airlines 202 in August 1948. The airplane had been in service for just five months and had logged only 1,321 hours flight time. The remaining 202s had to be returned to the factory for costly modifications. Although the hazard was corrected, the 202s' reputation was irreparably harmed.

One error, not hazardous but nevertheless costly, was failing to provide enough galley space for flight attendants to prepare inflight meals. Northwest had to remove a row of seats to provide adequate galley space — four fewer seats than

TWA Martin 404 at Kansas City August1958. Note the ventral stairs and increased dihedral outboard of the engines, both common to all 202s and 404s. (From the author's collection)

Convair's competing 240 and a ten percent loss in revenue.

Martin's biggest mistake of all, from a program viability standpoint, was writing contracts that reportedly gave customers the option of canceling their orders altogether with full refund of their down payments. Due to the delays and decaying market conditions, Martin saw an early backlog of about 270 202s shrink to 31 airplanes for Northwest, Línea Aerea Nacional de Chile (LAN) and Línea Aeropostal Venezolana (LAV). Also lost were more than 100 firm orders and options for the 303, a companion pressurized model that was canceled altogether. Twelve partially completed 202 airframes were placed in storage in hopes that buyers could be found after market conditions improved.

After Northwest retired its fleet prematurely, the 202s went on to enjoy relatively trouble-free service with Southwest Airways (later Pacific Airlines) and Allegheny Airlines. LAN and LAV both enjoyed several years of trouble-free service with their 202s as well.

After market conditions improved, Martin proposed pressurized 404s to TWA and Eastern as replacements for their DC-3s and TWA's aging Boeing Stratoliners. The 404 was a development of the 202 with its shortcomings corrected and the fuselage lengthened to accommodate as many passengers as the 240. After being rebuffed by Convair, both airlines placed orders for large fleets of Martin's 404s. Martin also completed the stored 202s as 202As. They were intended to be just interim airplanes pending delivery of the 404s, but TWA elected to retain them. In the meantime, Convair had recognized that significant changes would have to be made to the 240 in order to sell any additional aircraft. The result was that the 404 had the misfortune to be an excellent design competing with one that was outstanding! Martin's only additional 404 sales were two delivered to the U.S. Coast Guard as military RM-1Z aircraft.

After their service with Eastern and TWA, the 404s were quickly picked up by Pacific, Mohawk Airlines, Piedmont Airlines and Southern Airways. A significant number were converted for executive use; and, in contrast, some found their way into the low, slow world of aerial application.

The Convair 240, 340 and 440

Convair also made some marketing mistakes, but its Convair-Liner series ultimately proved to be an outstanding winner. Unlike Martin, Convair built the 110 for developmental flying before committing a new model to production. As noted earlier, the production 240 (two engines, 40 passengers) was launched with a large order from American. Although it differed in many respects, it benefitted significantly from the testing completed with the 110.

The 240 and 202 were similar in appearance. Primary distinguishing features were the 240 nose gear with dual wheels, the horizontal stabilizer of the 202 with pronounced dihedral, and the increased wing dihedral outboard of the nacelles of the 202. Both the 240 and 202 were powered with Pratt & Whitney Double Wasp engines.

Unlike Martin, which mistakenly believed that the airlines didn't want the expense and complexity of cabin pressurization, Convair designed the 240 with pressurization. Also, it had a four-passenger advantage after seat rows had to be removed from 202s to provide adequate galley space. The 240 did have higher cabin noise levels due to its exhaust-augmented engine cooling system, which discharged at the trailing edge of the wings.

Although Convair certainly fared much better than Martin, Convair found after about 160 240s had been produced that additional sales were almost impossible due to the prevailing economic conditions. Most of the trunk airlines found financing new airplanes difficult, and priorities had to be given to DC-6s and Constellations. Because of short-sighted CAB restrictions, local service airlines found such financing impossible. In late 1948, Convair formed a leasing subsidiary known as Air Fleets.

United Convair 340 at Omaha September 1957. Unrestricted access to the boarding area! (From the author's collection)

An early Air Transport Command Boeing YC-97 passing over the Golden Gate Bridge. (E. Stoltz collection, aahs-p000049)

It was expected to own as many as 100 airplanes of the basic American Airlines configuration that could be rotated from one airline to another as market conditions demanded. At least 16 were produced for Air Fleets, but the program proved to be ahead of its time, and Convair was forced to find other buyers.

Fortunately, Convair won a competition over Martin to sell a large number to the U.S. Air Force as T-29s and C-131As. Altogether, 566 240s were sold for airline, business and military use.

One disadvantage of the 240s was that they lacked sufficient wing area to be operated economically on the routes of many airlines. United, in particular, found that generally the 240s couldn't be operated with full passenger loads through the Rocky Mountain area. Convair mistakenly believed that Martin was out of the airliner business forever, and that the airlines would have no choice but to buy 240s 'as is' to replace their obsolete DC-3s. Martin, on the other hand, mistakenly believed that the airlines would find its new 404s superior just by stretching their fuselages to restore them to accommodate 40 passengers like the 240s and adding pressurization. Convair finally recognized they would have to make changes or risk losing out altogether to Martin. The resulting 340s would have more wing area to enable them to operate economically under more challenging conditions and stretched fuselages to maintain a four-passenger advantage. There were, of course, other improvements based on 240 service experience. One distinguishing feature was that passenger boarding was on the opposite side of the 340's forward fuselage to be more compatible with most airlines' operating procedures. Convair later supplied kits to convert 340s to a configuration identical to the 440s described below.

Even though the Martin 404 had fallen by the wayside as a competitor, a new threat arose in the form of the British Vickers Viscount. Its excellent Rolls Royce Dart turbo-propeller engines more than compensated for a rather mediocre airframe. (Any airline airplane designed after WWII with a single spar, fatigue life-limited wing can only be considered mediocre at best!) Viscounts placed in service with Capital Airlines on July 26, 1955, provided a preview of the coming jet age. To counter this new threat, Convair redesigned the exhaust system and improved soundproofing to lower the cabin noise significantly. Other changes were made to improve performance. After 311 340s had been produced, they were replaced in production by 440s incorporating those new improvements. Although not as quiet and vibration-free as Viscounts, the 440s enabled Convair to remain competitive. Even the cabin noise issue was completely eliminated when many were converted later to turbo-propeller 580s and 640s. It is interesting to note that the 1,086 240s, 340s and 440s produced for airline, executive and military operators was considerably greater than the total of both their Martin and Vickers competitors. Unlike the Viscounts, many are still flying after more than 60 years!

The Boeing 377 Stratocruiser

The last of the piston-powered U.S. airliners to go into service after WWII was the Boeing 377 Stratocruiser. The company's B-29 Superfortress was an outstanding bomber that literally brought the war to a sudden end. Before the first flight, Boeing began to look at ways to develop it into a military transport and postwar airline aircraft. An order for three XC-97s was placed in January of 1942, but progress moved very slowly due to the pressing need for bombers. The military transports were known as Stratofreighters, while the civil aircraft would be called Stratocruisers.

The B-29 fuselage was the basis of what would become the lower of two cabin decks. A larger circular structure was

Former AOA Boeing Stratocruiser at Los Angeles International, nearing its last days in the Pan American fleet July 1959. (From the author's collection)

joined to create the upper deck with the intersection of the two circles forming the floor of the upper deck. This 'figure 8' cross section provided a lighter fuselage than an elliptical single-deck design. The wings, empennage, landing gear and powerplant remained essentially unchanged.

Due to much higher wartime priorities, XC-97s did not fly until November 9, 1944. Another order was placed the following July for six YC-97s, three YC-97As and one YC-97B. In the meantime, Boeing had made an improved variant of the B-29 known later as the B-50. The airframe was made of the new lighter and stronger 75ST aluminum alloy in lieu of the original 24ST. The Wright R-3350 engines were replaced with 3,500 hp Pratt & Whitney R-4360 'corncob' engines, and the fin was much taller to accommodate the additional power. A thermal anti-ice system was used for the wing and empennage. Those same changes were incorporated in the YC-97As and all later military and civilian variants as well. The sole YC-97B was a passenger-configured airplane very similar to the Stratocruisers delivered later to Pan American. Although the YC-97s did go into service almost immediately, it would be some time before the later aircraft would join them.

Pan American placed the first order for 377 Stratocruisers in November 1945, and subsequent orders from AOA, Northwest, United, Svensk Interkontinental Lufttrafic (SILA) and British Overseas Airways Corp. (BOAC) followed. The four SILA airplanes were ordered on behalf of the SAS (Scandinavian Airlines System) consortium being formed. Typically, the Stratocruisers would have provisions for about 60 seated passengers, or fewer in a sleeper configuration. Each would have an unbooked lounge in the aft lower deck.

After a protracted development period, Type Certificate 812 was issued on September 3, 1948, for the 377; however, Pan American was still unable to place the Stratocruiser in service for several months. Finally, it began service from San Francisco to Honolulu on April 1, 1949 — almost three years later than expected! As additional airplanes became available, Stratocruisers were used for service to London, Tokyo and South America.

AOA placed its order for Stratocruisers on April 1, 1946, and began service to London in competition with Pan American on August 17, 1949. Its airplanes were similarly configured, except that they had Curtiss propellers in lieu of the troublesome Hamilton Standard propellers. After AOA began experiencing financial losses, parent American Airlines sold it to Pan American on September 25, 1950.

Northwest Airlines introduced its Stratocruisers August 1, 1949, from Minneapolis-St. Paul to Chicago. It would later operate them briefly on its routes to the Far East; but, with that exception, they were used exclusively on its domestic service. Eastern Air Lines also flew them on the Chicago to Miami portions of interchange flights with Northwest from circa 1956 to 1958.

Unlike the other operators' Stratocruisers, those of United were used only on domestic flights. Faced with the prospect of competing with Pan American on its routes to Honolulu, United reluctantly ordered seven of its own. The first was placed in service on January 13, 1950. Although previously flown exclusively to Hawaii, Stratocruisers were also used from Los Angeles to Seattle via San Francisco toward the end of their time with United.

SAS decided to forego taking delivery of its four airplanes. BOAC also had six on order, but it was anxious to begin Stratocruiser service before those were scheduled for delivery. In order to begin service about six months earlier, it elected to obtain the SILA airplanes as well. After its early Comets were grounded in 1954, BOAC was desperate to find enough

Continental Vickers Viscount at Tucson September 1963. (From the author's collection)

airplanes to serve its route network, so it acquired one additional Stratocruiser from Pan American and the entire six remaining airplanes of United.

The Stratocruisers proved to be a mixed blessing for their operators. Although they were expensive to operate and suffered from a higher rate of accidents than many other airline airplanes of that era, they were considered the ultimate in luxury by their passengers. They were spacious, unusually free from vibration and quiet for their day. They are especially remembered for their lounges in the aft lower deck. Alone, 56 Stratocruisers would have been a tremendous financial loss for Boeing, but it was more than compensated by 888 C-97s!

The British Challenge—Maybe

As previously noted, the British engine manufacturers were at the forefront of turbine technology in the immediate postwar period. The British aircraft manufacturers hoped to utilize this new form of propulsion to become competitive in world airliner design, and Vickers did succeed in doing so with its turbopropeller-powered Viscount. De Havilland attempted to do so as well using turbojet engines. The early Comet 1 and 2 aircraft could cruise close to 500mph, but they lacked sufficient range to be considered by the scheduled U.S. airlines. Overseas National Airways, a supplemental airline, did show some interest in obtaining a few in 1951. The Comet 3 was expected to have transatlantic range, so Pan American placed an order for three a year later.

British interests asserted that American sales failed because the CAA would not accept certification to British airworthiness standards, and that it did so to protect the U.S. aircraft industry. That assertion is totally false. The CAA had (and the FAA still has) a statutory obligation to find compliance with then current U.S. certification standards — Part 4b of the Civil Air Regulations — not those of a foreign country. At best, de Havilland would have had to petition for exemptions from any relevant U.S. standards with which the Comet failed to comply. In order for them to be granted, de Havilland would have had to show somehow that granting the needed exemptions would be in the U.S. public interest. De Havilland would have been hard pressed to find any reasons it would be in the public interest of this country. With the benefit of hindsight, the subsequent tragic Comet crashes showed that the British standards were grossly inadequate in those days for such aircraft. Despite the acclaim, all the early Comets had to be removed from airline service while the causes were investigated and appropriate changes developed. The British aviation industry was devastated. The unsafe conditions of the early Comets were eventually corrected in the Comet 4s, but they were no match for the Boeing 707s and Douglas DC-8s ready to go into service.

Bristol failed in its attempts to sell Britannias to Capital and Northeast Airlines. In addition to the large Capital fleet, Vickers managed to sell a few Viscounts to Northeast and Continental Air Lines; but the British manufacturers failed to exploit their early advantage in turbine technology.

Across the Country Nonstop

The Lockheed Constellations and Douglas DC-6s were big steps forward for airlines worldwide, but there was still one more hurdle to be overcome for domestic service — sufficient range for nonstop transcontinental flights and speeds great enough to complete such flights without exceeding crew duty-time limits. Otherwise, double crews would have been required.

Wright added turbo-compounding to the earlier Cyclone

Eastern 1049 Super Constellation at DCA Oct.1960. ((AAHS photo archives, R. Hufford collection, AAHS-34529)

18 BD engines used in Constellations to greatly increase their power ratings. The change basically involved capturing energy that would otherwise be lost in the exhaust by passing it through power recovery turbines, or PRTs, geared directly to the crankshafts. The engines installed in Constellations were rated at 2,500 hp for takeoff, but with the PRTs and related changes it was increased to 3,250 hp.

Lockheed was in the process of replacing the earlier Wright engines with turbo-compound engines in its P2V Neptunes, so it was quite straightforward to make the same change in its Constellations. To take full advantage of the additional power, the fuselage was stretched more than 18 ft. Optional wingtip fuel tanks were used to obtain the needed range. With those changes, the aircraft were identified as 1049 Super Constellations. TWA, Eastern and Northwest were the primary U.S. customers for passenger-configured models. Others, including The Flying Tiger Line, Slick Airways and Seaboard and Western Airlines, purchased all-cargo models. Many foreign airlines also purchased Super Constellations.

Military sales accounted for many additional sales of Super Constellation variants. Apart from transports, there were 222 'Warning Star' early-warning aircraft. The VC-118 was replaced first by a VC-121A and later by a VC-121E as the presidential aircraft for the Eisenhower Administration.

Altogether, domestic and foreign airlines, and U.S. military services received 685 Super Constellations.

It was easy to rationalize replacing the earlier Wright engines with the turbo-compound engines in Constellations, but the wisdom of replacing the extremely reliable Pratt & Whitney Double Wasp engines in DC-6s was worthy of very careful consideration. Some, including Donald Douglas himself, were initially skeptical of producing a turbo-compound model because turbine-powered airliners appeared to be just over the horizon. Nevertheless, he agreed to begin development of a new model, tentatively identified as the DC-6C but later identified as the DC-7. In an obvious oversimplification, Douglas engineers were purportedly given just one goal — make it fly faster than any other piston airliner in service. As the forward fuselage had already been stretched for the DC-6B, the DC-7 fuselage was only stretched minimally enough for one additional seat row aft of the wing. Douglas was able to achieve transcontinental range without using tip tanks. American was the first to begin transcontinental service with its new DC-7s, followed by TWA with its Super Constellations. United was initially reluctant to

Early shot of a United Douglas DC-7 before spinners and inner cowl liners were added to aid cooling. United pioneered fleetwide radar installations shortly afterward. (AAHS photo archives, R. Hufford collection, AAHS-40102)

View showing TWA Lockheed 1649A's high-aspect ratio wing. (AAHS photo archives, Eric Miller collection, AAHS-1633)

Braniff Douglas DC-7C on a very murky Oklahoma City day in December 1962. (From the author's collection)

order DC-7s, but later did so and joined the transcontinental race. In the meantime, National and Delta had also become DC-7 customers.

Douglas later developed a follow-on model, the DC-7B, with increased operating weights and optional 'saddle' fuel tanks in the upper afterbody of each nacelle. (Contrary to popular belief, only the DC-7Bs of Pan American and South African Airways had the saddle tanks.) In a breach of its previous loyalty to Lockheed, Eastern added DC-7Bs to its Super Constellation fleet. Pan American actually wanted more range, but ordered a few as interim aircraft for its Latin American services. Continental, Panagra (Pan American-Grace Airways) also became DC-7B customers. Lockheed was more successful in gaining foreign sales as South African Airways would be the only foreign airline to order DC-7s or DC-7Bs. Also, unlike Lockheed, Douglas would not receive any military sales.

And Now, Across the Atlantic Nonstop

The Sujper Constellations and DC-7s enabled nonstop transcontinental service, but they still lacked enough fuel to enable nonstop transatlantic flights under typical wind conditions, particularly in the westbound direction. Pan American first addressed the need by adding 450 gallons of fuel capacity to a few of its Boeing Stratocruisers. Improved turbo-compound engines would enable greater payloads, but both Douglas and Lockheed had already used almost all space available for fuel in their models.

Lockheed addressed the need for more fuel capacity by designing a new high aspect-ratio wing with greater space for fuel in its otherwise similar 1649 Starliner. Douglas took a simpler approach to provide additional space. For its DC-7C, Douglas simply increased the wingspan by inserting a ten-foot section between the two wing halves. Because the design and certification tasks were less complicated, it was ready to fly 10 months earlier than the Starliner. Pan American, Northwest, Braniff and numerous foreign airlines all chose DC-7Cs, leaving just TWA, Air France and Lufthansa to choose Starliners.

Regardless of whether they were installed in a Lockheed or Douglas product, the turbo-compound engines were not noted for reliability. Many of the problems were due to the high cruise power settings airlines were using for competitive reasons. An FAA maintenance inspector assigned to United once commented that one could almost tell to the day when its DC-8s went into

service by the improved reliability of its DC-7 engines!

After being replaced in passenger service by the new Boeing 707s and Douglas DC-8s, many of the DC-7s and Super Constellations were scrapped or converted for all-cargo service. The DC-7Cs and Starliners were especially desirable for such use because of their uniquely long-range.

The golden age of reciprocating-powered airlines ended, and the jet age began October 26, 1958, when a Pan American 707 first departed New York for Paris. Granted, that flight was preceded several years earlier by the failed attempt to pioneer jet travel with de Havilland Comet 1 aircraft. Also, BOAC introduced the improved Comet 4s on transatlantic service about three weeks before the Pan American flight, but they were outclassed by the 707s and DC-8s. The jet age — together with hijacking, suicide bombings, deregulation and the computer age — changed air travel forever! ✈

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One of a number of DC-7s converted for all-cargo use after their appeal for passenger service had ended. This cargo area was adjacent to the old LAX terminal. They had actually become DC-7Bs even though United promoted its cargo aircraft as 'DC-7As.' (From the author's collection)

The end of one era and the beginning of another! A Pan American 707 taxiing out at Idlewild May 16, 1959. (AAHS photo archives, R. Hufford collection, AAHS-36830)