CONVAIR
Consolidated Vultee Aircraft Corporation - San Diego 12 California

Address Reply To
Commercial Sales Dept.

October 29, 1952

Mr. Amon G. Carter, Publisher
American Airlines, Incorporated
c/o Fort Worth Star-Telegram
Fort Worth, Texas

Dear Mr. Carter:

Just in case you missed it when originally published in THE AIR LINE PILOT, we are sending you the attached reprint of the pilots' analysis of our Convair-Liner Model 340.

As you know, these people take a pretty cold, objective look at any new airplane, and the fact that the 340 shows up so well in their analysis gives us, of course, a great deal of satisfaction. I am sure it is worth some study by all who are in the air transport field.

Sincerely yours,

Mark Miller

Mark R. Miller
Assistant to Vice President

Enclosure

# The Air Line Pilot

## Comparison of the Convair 340 and 240

## Airworthiness Review


Convair 340
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# Comparison of Convair 340 and 240

**By L. Homer Mouden**

**A member of the ALPA Committee which inspected the Convair 340 evaluates the plane for fellow pilots.**

Recently, at Convair's invitation, nine Airline pilots from eight domestic airlines who have ordered 340s and a representative from ALPA's Engineering Department spent an interesting week at the Convair factory at San Diego. We were given the opportunity to inspect, fly, and attempt to evaluate the Convair 340, which is now coming off the production lines for delivery to United Air Lines and Braniff Airlines. During that week, an attempt was made to absorb as much information as possible concerning the design, engineering, construction and flight characteristics of the new Convair 340 airplane. While the amount of information assimilated was considerable, it is recognized and acknowledged that some of the opinions formed by the writer will necessarily be subject to change at future dates, as operational experience is accumulated. There has never been a better method of finding and eliminating any "bugs" in an airplane than through scheduled operations. The opinions expressed in this article are those of the writer and not necessarily those of the entire Evaluation Committee, nor of ALPA. They are based, however, on opinions formulated in some fourteen years of flying, and from experiences gained in two years of flying the Convair 240.

**General Characteristics** of the 340 are basically similar to the 240. The fuselage of the 340 is 4′ 6″ longer than the 240, and the wing-span is 13′ 11″ greater. The overall height to the top of the vertical fin has been increased by 10″. The increase in overall height and in propeller clearance is due to a longer main landing gear strut and larger main gear tires. The added length of the fuselage of the 340, with an additional window on each side, gives the appearance of longer, cleaner lines than even those of the 240, while the additional 1½° dihedral in the longer wing makes the airplane appear closer to the ground than the 240. Actually, the prop clearance is greater for the same prop diameter than the older model.

The larger tires carrying a lower air pressure are an improvement over the smaller high-pressure tire of its predecessor. These should be more forgiving of poor landings or bad braking technique. They also should give the airplane better handling characteristics on unimproved runways, or on ice and in deep snow. The heavier gear, together with the softer tire, should result in less maintenance on the gear.

The airplane is powered by two Pratt-Whitney R-2800-CB16 engines. This engine is capable of developing the full 2400 horsepower for takeoff at 59½ inches manifold pressure with a reserve of throttle left. This will permit maximum allowable power for takeoffs on hot summer days, or at higher field elevations. This has been found to be a weakness of the R-2800-CA18 installations in the 240s.

**Engines** drive Hamilton Standard, solid dural, flat tipped propellers of 13′ 6″ diameter through a reduction gear ratio of .45 to 1. The propellers are full-feathering and reversing and are identical in design and installation with the latest propeller installations recently made on the CV-240s by several of the airlines.

A preliminary inspection of the airplane indicates that it was designed and engineered so as to require the minimum of auxiliary equipment at a station. The external power source and CB connections are conveniently combined in one unit, located in the belly near the nosewheel. The airplane can be re-fueled without the need of ladders for getting on the wing. Both the fore and aft cargo doors have built-in flood lights for illumination of the shadow side of the airplane when parked under ramp flood lights.

The airplane is boarded by means of build-in steps, which unfold outward from the left side of the fuselage just aft of the cockpit. The passenger entrance door is hinged at the top and opens upward to form a canopy over the entrance steps. These steps can be raised or lowered either from within the entranceway, or from the outside. This feature permits rapid boarding or deplaning of passengers, and is a very satisfactory means of emergency evacuation from the airplane when the landing gear is extended.

The carry on luggage racks immediately to one's right as they enter the airplane give baggage storage capacity of 85 cubic feet. In addition, there are 152 cubic feet in the forward cargo compartment, 200 cubic feet in the rear cargo compartment, and 78 cubic feet in the belly compartment. The airplane seems to have adequate space for baggage and a sizeable amount of cargo.

*A clever innovation for coat storage was accomplished by slanting the forward cargo wall inward slightly at the top* and installing rows of tandem coat-hanger hooks on this wall. They are hidden from sight and protected from dust by means of a curtain on a traverse rod. The coats are easily stored by the cabin attendants, and can be conveniently and quickly distributed while the passengers are deplaning.

**Cabin** is basically the same as the 240, with the addition of one extra row of seats—making a total seating capacity in the cabin of 44 passengers. The bulkhead arrangements, galley and lavatory are essentially the same as those 240s with integral forward loading doors.

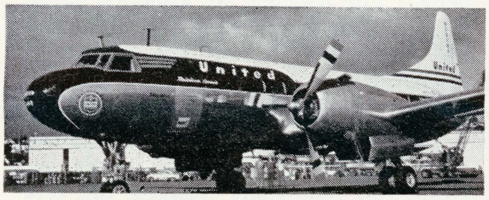
Upon entering the cockpit, those pilots who had not previously been flying CV-240s were immediately impressed with the wonderful visibility from the cockpit. After having been flying the 240-2 with indirect instrument lighting and without the larger glare shield such as is used in some models of the 240, it seemed as though the visibility had been reduced some

## About the Author

**Captain Mouden flys for Mid-Continent Airlines, and has been a member of the Safety Committee since its inception. He served as Chairman of the Safety and Engineering Committee of Council 45 for 4 years, and is currently Chairman of the Regional Air Safety and Engineering Committee at Kansas City. Captain Mouden has BS and MA degrees in Science, and was on the staff of Iowa State College for 4 years previous to taking up commercial flying. He has been flying since 1938, and has been with Mid-Continent since 1941.**

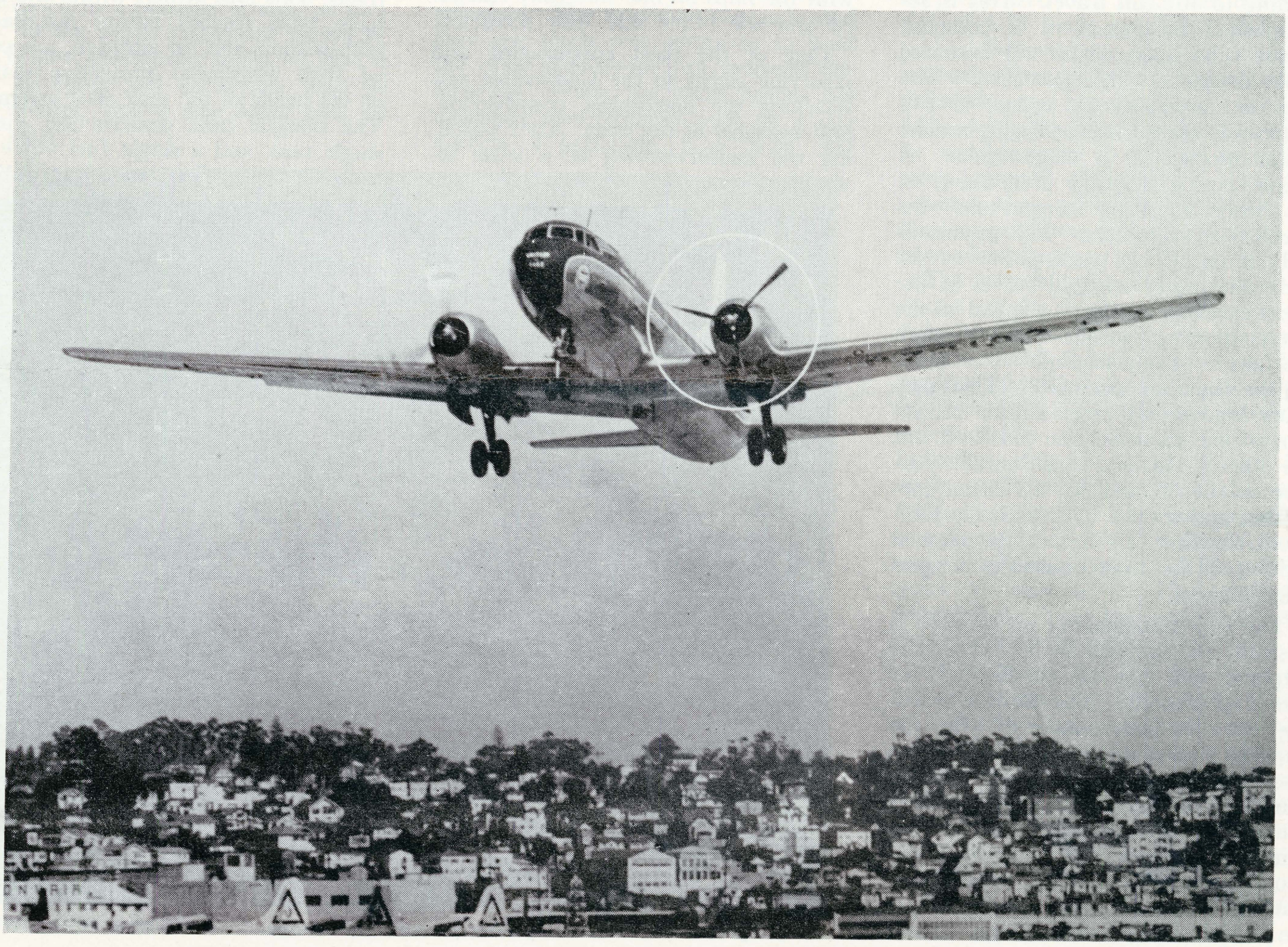
# Camera

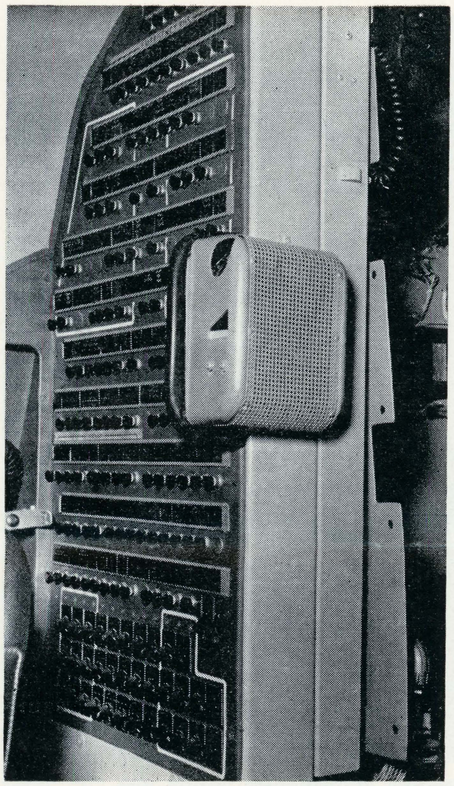
Interior.




Convair 340 on the line (see page 2).

One engine inoperative take-off demonstration.





Circuit breaker panel.

by the direct lighting glare shield. However, pilots familiar with this glare shield installation, as used in the AAL 240s, are well pleased with it, and thought the visibility in the 340 was equally good. *It has the best visibility, in my opnion, of any airplane in airline use today.* This may be due in part to the ALPA Committee's suggested changes to the original cockpit mock-up of the 240 during design stages. This amplifies the importance of pilot participation in airline transport design.

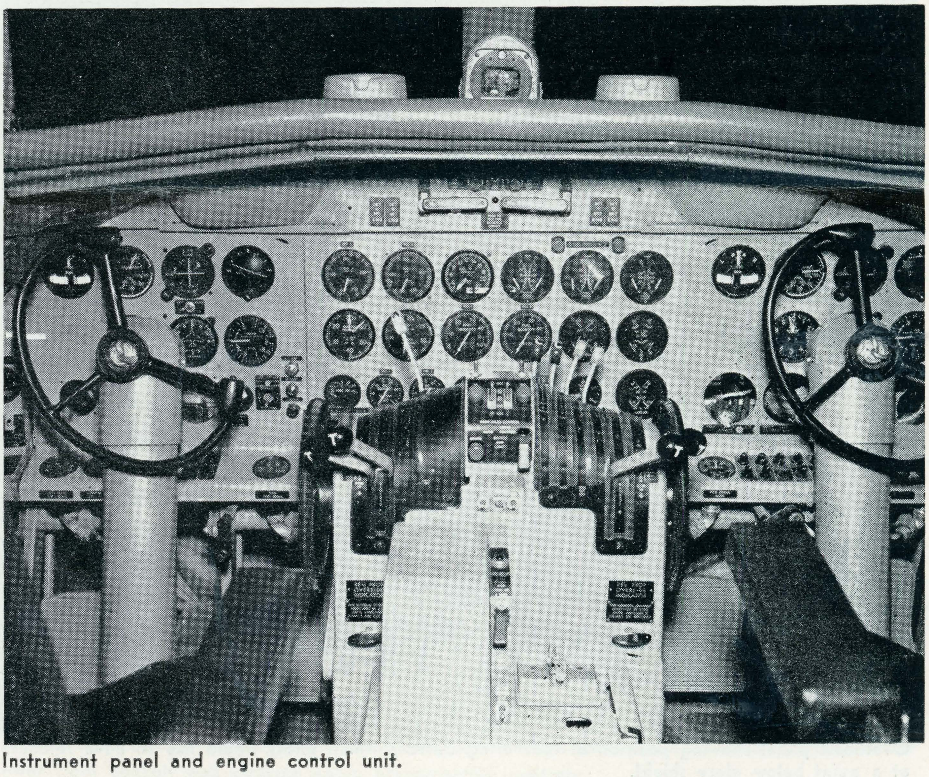
It is difficult to evaluate a new cockpit with only a cursory inspection, as the use of various items in relation to other items within the cockpit is best determined by on-the-line experience. *The basic cockpit arrangement is good.* The cockpit seats in the 340 are comfortable, and have adequate adjustments. It appeared to have greater fore and aft limits in seat adjustment than does the 240, which is an improvement; but I was of the opinion that another additional inch forward adjustment would have been desirable to give maximum accommodation to pilots of all sizes.

*The cockpit noise level is even lower than the 240.* The cockpit speakers that were installed in the UAL model were very readable, and conversation between pilots was conducted at near normal voice level. Convair is to be commended for this feature. It seemed as though they had been more successful in further lowering the noise level in the cockpit than they had been in the cabin. The cabin did not get a fair test, however, as most of the seats were removed to accommodate ballast, which necessarily changed the acoustics considerably.

The airplane has been electrified even more so than the 240, which has resulted in additional "control panels" within the cockpit. The crossreed valve is now electric, thus making the fuel system completely electrified, with all the controls installed on an overhead fuel panel. This produces the usual pilot concern over "non-manual" controls of such vital operations of the airplane. However, it is recognized that cables have been known to operate valves and controls due to deformation of the airplane structure during a crash landing.

The installation of additional electric equipment has brought the location of the feathering buttons overhead a little farther aft in relation to the pilot's position. This has placed them in an even less desirable location than in the 240s. In the pilots' opinions, the logical location for the feathering buttons is on the fire-control panel located immediately above the center instrument panel, and just under the glare shield. There they would be conveniently available without danger of being tripped accidentally. The pilots are bringing this item to the attention of their respective companies, with good prospects of effecting a change to the proposed location. This would make the "lights out" check of the buttons on takeoff much easier, and would permit the co-pilot to keep his vision forward instead of looking toward the top of the cockpit at the start of the takeoff roll. They would be under observation at all times, and would be accessible by a simple reach of the hand rather than to require a full-arm sweep to reach them, as is common with the feathering button installations in most airline airplanes. The original idea of installing feathering buttons in as inaccessible a spot as possible, to prevent them from being activated inadvertently, has long been known to be outmoded and absurd. Prop feathering is definitely a part of fire control in an engine, and the feathering controls should be treated accordingly.

The airplane fire extinguishing system utilizes chlorobromo-methane (or CB, as it is commonly known) instead of the $CO_2$ system used in the Convair 240. Tests have indicated that, pound for pound, this is much more efficient, and that the corrosive effect is nil if the lines are purged within a reasonable time after discharge. The toxic effect is supposed to be less than that of the $CO_2$, but there are no indications that pilot protection by means of oxygen masks in the event of a discharge in flight will not be just as necessary.



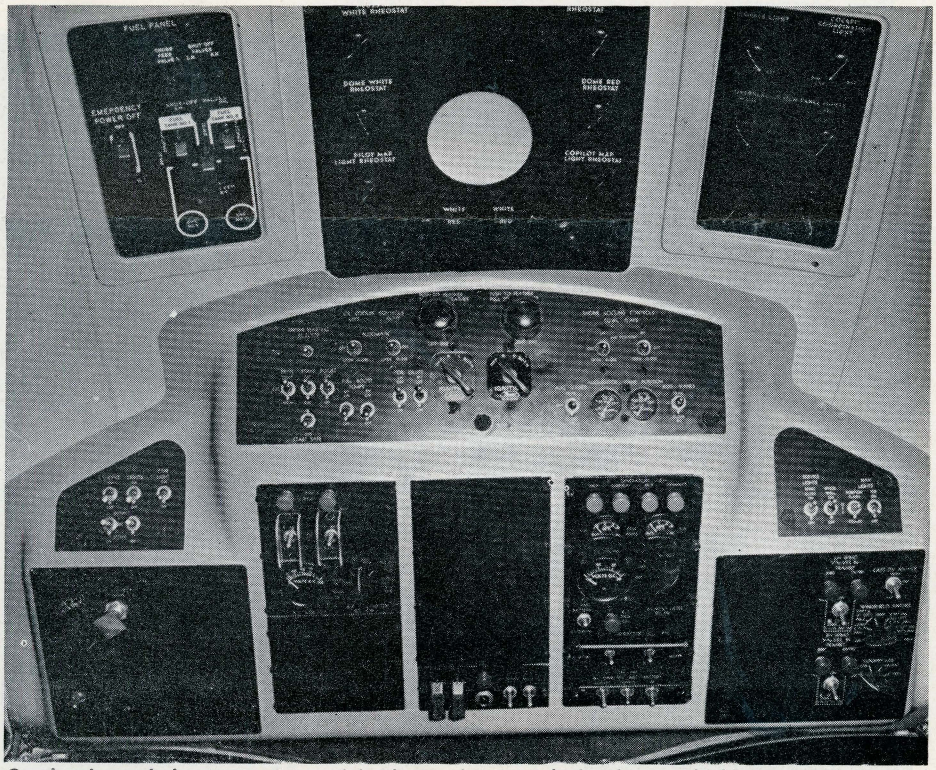
Instrument panel and engine control unit.

**Controls** on the throttle pedestal are convenient and easily accessible. It would have been an improvement, however, if the controls on the throttle pedestal had been rearranged so that the mixture controls were separated from the carburetor heat controls to *prevent accidental pulling of the mixture when reaching for the carburetor heat, as has been known to occur on the 240s.* This could have been accomplished by installing the mixture controls on the left side of the pedestal inboard of the pilot's throttles, where there is now a vacant space not utilized by the new auto-pilots.

The instrumentation, as observed on the UAL model, seemed convenient and satisfactory with the exception of the flap indicator. I am of the opinion that flap management is too important a *feature in the proper handling* of the 340, or any other modern airplane, to have the flap position indicated by so small an instrument located in the lower center instrument panel, where it cannot be quickly and easily read by the pilots. I believe that a flap indicator of standard instrument size of 3¼" diameter with 1° flap markings, as used in the 240, is a necessary installation. The flap indicator should be located in a position as near as possible to the upper righthand corner of the center instrument panel, so that it can be easily and accurately read by the copilot, and is also easily seen by the pilot.

The standard installation of oil quantity gauges on the instrument panel was a highly desirable feature. This item has been long advocated by the pilots as a necessary installation in order to correlate engine oil consumption with fuel consumption. Another standard installation item is the fuel flow meters. These in conjunction with accurate fuel quantity gauges give a much closer check on engine operation than by checking fuel gauges only.

The integral loading door on the forward lefthand side is standard on all models. The service door and the rear cargo doors are in the same places as on the Model 240. The 340 has an additional forward cargo loading door opposite the passenger entrance. The door latching mechanism and the door seals have been changed completely in design from the 240. The bayonet locks that held the outward opening doors on the 240 have been eliminated. All doors, except the galley service door, are hinged at the top and open outward from the bottom. The doors are held shut against pressure by means of forged, steel latching hooks. The door forms a section of the hoop construction which comprises the fuselage and is held shut by the "stretch wrap" principle. The manufacturer indicated that one latch was adequate to hold the door shut under full pressure differential. While the latch system has obviously met required tests by a safe margin, I personally have faith that the bayonets cannot come out under pressure, whereas latches might crystallize and break under the maximum tension of full pressurization differential. However, the latches are readily inspected, both on the ground and in flight; and with proper inspection and maintenance, the doors should be trouble-free. From a maintenance standpoint, the 340 latches should be a big improvement over the 240, as the bayonet locks have required considerable maintenance to keep them adjusted.



Overhead panel showing position of feathering buttons which pilots would like to have relocated at a point below glare shield.

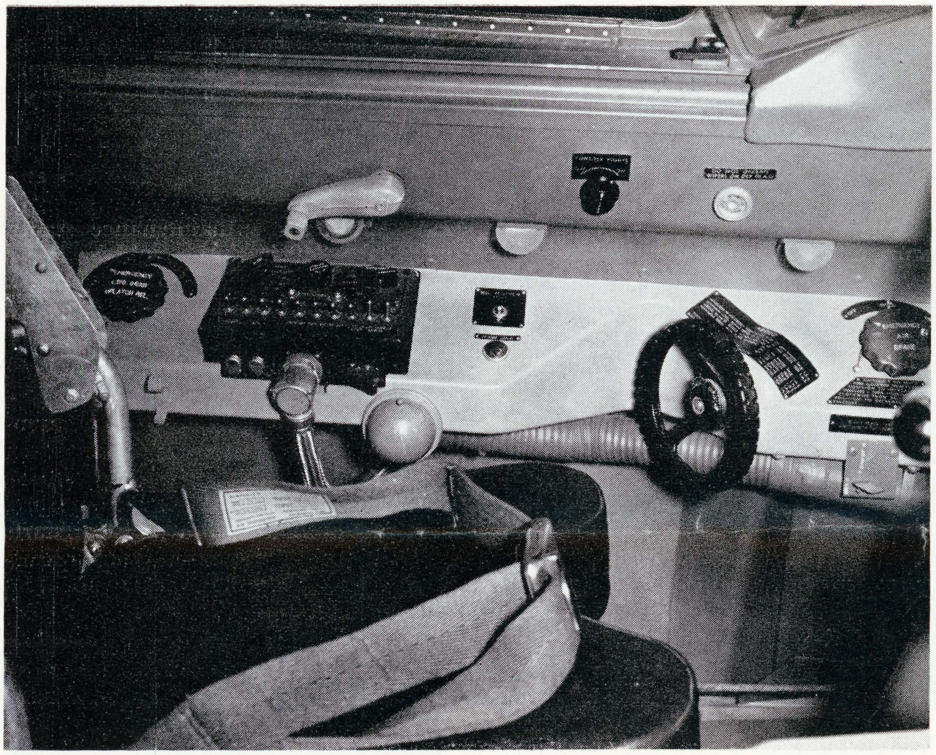
The door seal is accomplished by a novel and basically simple means. The rubber seal consists of a diaphragm-like formed seal with vent holes on the inboard side. The door can be closed easily when not under pressure, and yet as soon as the pressure starts to build up in the cabin, the pressurized air enters the holes in the seal and inflates it, effectively closing the opening. If the seal becomes broken or torn, it can be repaired by means of a simple cold patch or can be readily replaced. This should have a long service life, and should give a minimum of difficulty.

The 340 is designed for maximum pressure differential of 7 p.s.i. and will be pressurized to a maximum differential of 4.15 p.s.i., as against the 3.25 p.s.i. differential on the 240. This increased pressurization differential is definitely an improvement over the 240, which has been penalized at times by its high speed in relation to its low cabin pressure differential — thus preventing the maximum utilization of airplane performance and efficiency on some short hauls.

The pressurization compressor is installed on the accessory section of the right engine. A very commendable feature of this installation is that, during the takeoff, with the auto-feathering system armed, the compressor is automatically disconnected upon an indicated loss of power of the left engine sufficient to trigger off the auto-feathering system. For cruise this feature is connected into the manual (normal) feathering system. This permits quick recovery of the 75 horsepower required to drive the compressor for use during single engine operation.

**The Flap** on the 340 has been increased in span by 14.51 feet. There is a double flap installation on each side. The inboard flap starts approximately 15 inches from the center of the fuselage and runs to the outboard side of the wheel nacelle. The outboard flap reaches from this point to the aileron.

The inboard flap extends to 45° full travel while the outboard flap is ex-



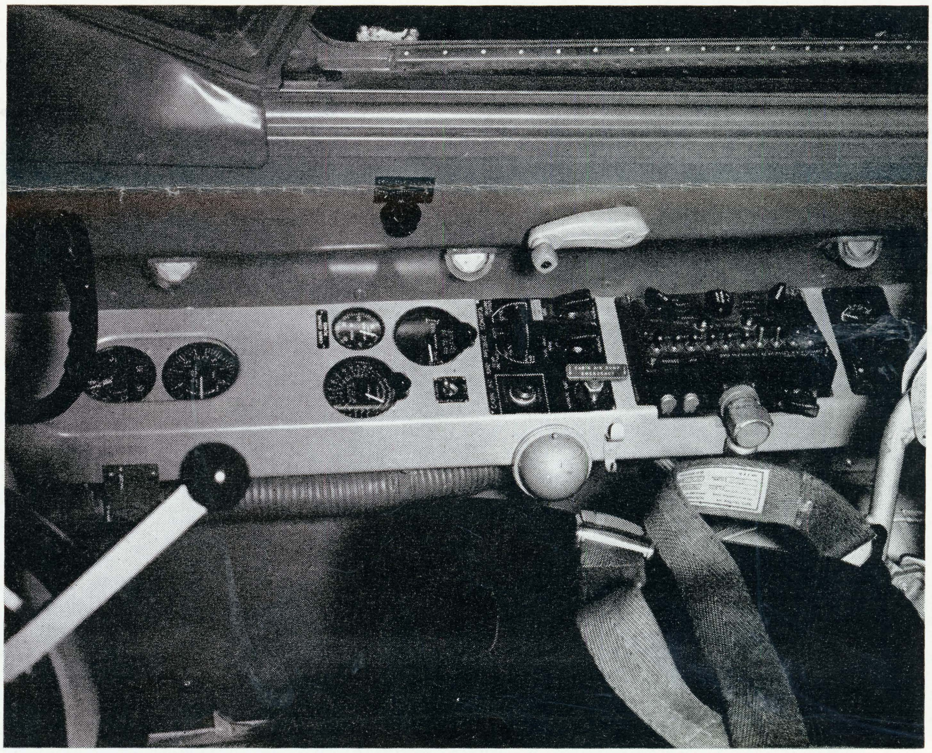
Lower left side cockpit wall showing emergency landing gear up latch release, nose wheel steering, and emergency air brake knob.

tending to 40° full travel. This is accomplished by means of a common torque tube upon which are mounted cable drums of different sizes. The flaps are activated by means of two electrically controlled, hydraulic motors interconnected by a torque tube. A torque-sensing assembly is mounted on the interconnecting torque-tube between the two motors. This automatically shuts off electrical power to the hydraulic motor solenoid valves in the event excessive torque is applied to the interconnecting torque-tube, through the failure of one flap motor, or binding in the flap assembly. This prevents inadvertent extension or retraction of the flaps on one side and not the other. This is a very desirable feature on the 30, and for all airline airplanes, and should be practically foolproof, barring the actual mechanical failure of the interconnecting torque-tube linkage.

The flap management on the 340 is basically the same as on the 240. The airplane will not be certificated for zero flap takeoffs. The throttle warning horn is interconnected with the flaps, so that if an attempt is made to open the throttle for takeoff without the flaps extended, the horn starts sounding intermittently. Such "reminder" devices are indications of sound cockpit engineering. The manufacturer's tests indicated that it would be possible to maintain aileron control with the flaps on one side fully extended and the other side fully retracted.

One of the most encouraging and satisfying sights to the Committee was watching the machining, construction, and assembly of the wing. After watching the manufacturing of a wing assembly, from the milling of the top and the bottom spar beams, through the fabrication of the spar, to the assembly of the wings in the back, one could not help but be impressed. The assembled wing definitely gave each member of the Pilot Committee a feeling of security and faith in its ability to withstand tremendous loads. The cross-braced baffling within the integral tanks and box construction under the stressed skin assembly met with our admiration and approval. The wing is a single unit from the center of the belly to the wing tip, with the only splice in the spar in the middle of the belly. The nacelles are attached as an integral part of the wing assembly, and the fuselage is literally set on top of the wing and fastened down in position.

**The Fuel Tanks** are constructed as an integral part of the wing, with the front and rear spars forming the fore and aft bulkheads. The inboard bulkhead ends approximately 10″ outboard of the wheel nacelle. The outboard bulkhead is at a line about two-thirds the length of the aileron from the wing tip. The fuel tank is sub-divided by four bafflle plates, which are also part of the cross-bracing of the wing. All rivets, bolts and fittings within the tank have been treated before installation with sealant and, in addition, are coated with additional protective sealant on the inside of the tank after assembly. The integral tank construction with a single tank and a single fuel valve for each engine offers some advantages



Lower right cockpit wall showing cabin pressurization controls.

over the multiple tank installations. The minimum of valves, with the one fuel valve and the one cross-feed valve for each tank help eliminate the dangers caused by malfunctioning of electric fuel valves.

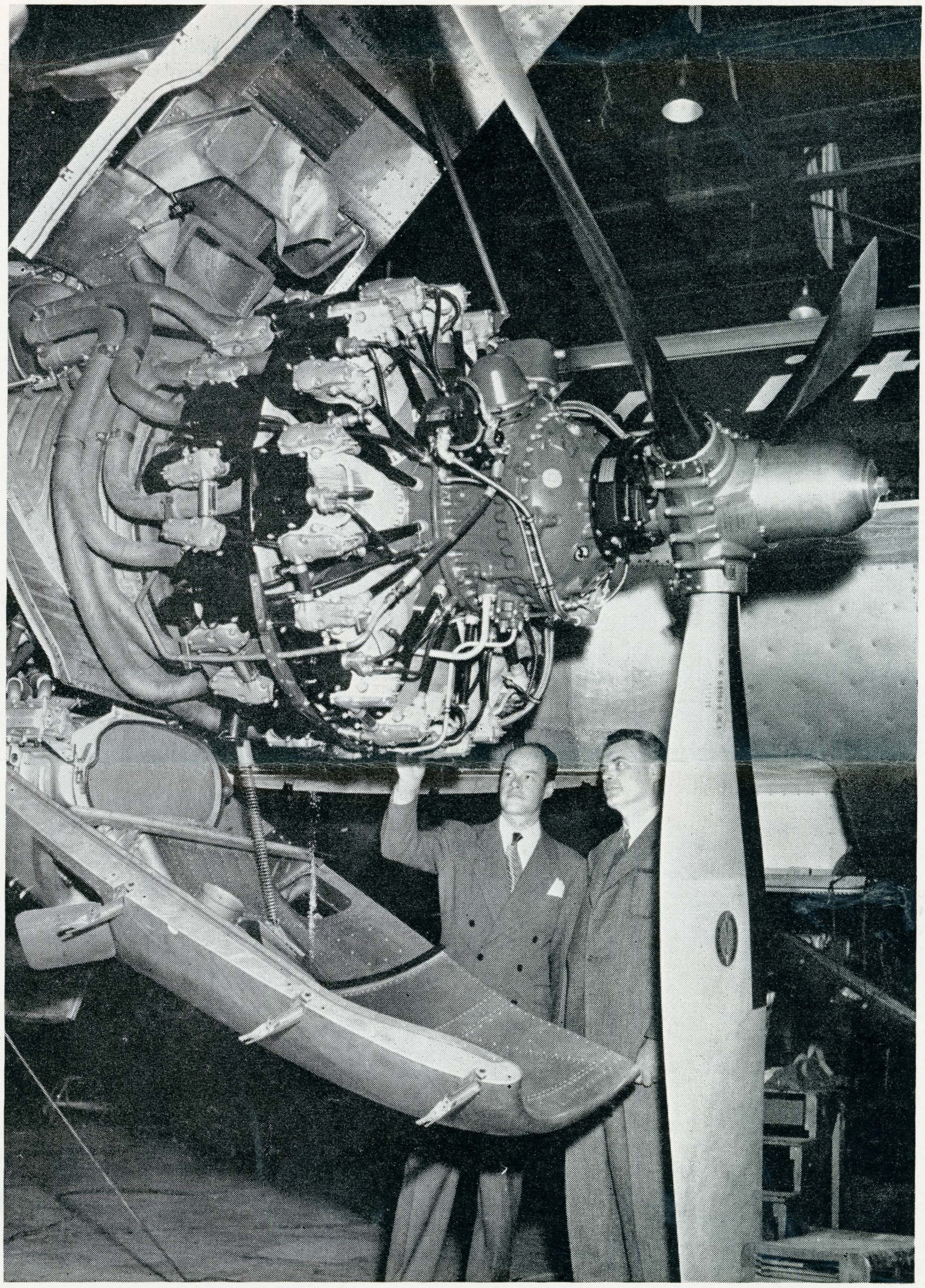
The added safety factor of having all fuel carried within the wing and outboard of the nacelle has already been well demonstrated in some non-fatal accidents during the good 5-year service record of the 240. The only fuel contained within or under the fuselage is in the crossfeed line, which is located between the spar cups, and was given special protection.

The 340 utilizes engine exhaust heat for cabin and cockpit heating and for the thermal anti-icing system for the wings and tail surfaces. This method is highly favored by the ALPA over the combustion heaters commonly used by other manufacturers. The heat source for cabin and wing heat is basically the same as on the Convair 240 in that a portion of the engine cooling air is passed through a heat exchanger muff to the cabin heating system and/or through the wing ducts for anti-icing purposes. The difference between the two systems is that in the 340 both augmenter muffs in each engine nacelle supply heated air through a common heat source valve to either the cabin and the tail surfaces or to the wing. This is an improvement; for, by reducing the heat supply to the cabin, it will be possible to supply considerably more heated air for anti-icing purposes. The improvements in the anti-icing system should enable the 340 to handle even more ice than does the 240. The wing heat exhaust in the 340 is in the wing tip rather than in the area of the aileron hinges, as on the 240. This change in exhaust port was required because of the increased length of the fuel tanks in the wing.

One item which has not as yet been installed as standard equipment on most of the 240s, or even on the 340, is a red collision warning light. Pilots have complained of this omission on some air transport planes for years. The closing rate of aircraft is continuously increasing, thereby requiring a greater warning distance. It was gratifying for the pilot group to learn that for the first time on an airliner, the 340 has made provision for the installation of a rotating collision warning light on top of the vertical fin. United Air Lines is now producing such a light for installation on their airplanes, which will be even better than a fixed collision warning light. Such a light should be installed on all Convair 340s before they enter schedule airline service.

The 340 has a fixed position "taxi" light installed on the nose-wheel. This similar type of installation is used by some operators of the 240. It was the unanimous opinion of the pilots inspecting the 340 that the light afforded greater safety and utilization if installed as a noselight for use as an "in-flight" light as well as a taxi light. Some of the 240s are equipped with such a noselight, and pilots flying these airplanes contend that the light is used for checkilng ice or other types of precipitation, for identification purposes, for attracting the attention of converging aircraft, etc., much more than it is ever used for taxiing illumination. All in-flight uses are eliminated by the nosegear installation, as neither gear nor landing lights can be extended above 200 mph, and the nosebear light is useless until the gear is down.

**When Taxiing,** the nosewheel steered a little harder than on the 240, but part of this was attributed to the extreme and unusual forward CG-loading being used for the tests, and to the maximum gross weight under which the airplane was tested, rather than to any difference in the basic steering mech-



Easy engine accessability made possible by cowl design feature.

anism. The nosegear steering cylinder valve has been located on the nosegear cylinder, and the valve is an integral part of the nosegear steering assembly. This should help eliminate the breaking of steering cables such as has occurred on the 240s. This has been further eliminated by the use of larger diameter pullies throughout the cable system. The contra-rotating dual nosewheels very effectively eliminate shimmy. The airplane steers harder at taxiing speeds than does a tricycle gear airplane with a single nosewheel. However, this is not objectionable, and is more than adequately compensated for by the increased safety factor of the dual wheels and of the positive anti-shimmy feature. On the takeoff roll, the airplane is very stable and holds straight down the runway without a tendency to yaw due to engine torque.

Within the limited amount of flying that was done at San Diego, I was satisfied with the flight characteristics of the 340. The 6° 30′ dihedral in the wing improved the in-flight stability of the airplane over that of the 240. The increased dihedral did not seem to affect the single-engine performance of the airplane.

**The General Feel** of the controls during the takeoff and landings and during flight was similar to the 240. The controls were easily coordinated and the response was firm, but not stiff. This airplane would fly "hands off," and was more directionally stable than is the 240. During a 2-engine, $V_2$ speed, climbout, the airplane responded readily without any tendency to overcontrol and, in spite of its tremendous acceleration, was easy to stabilize at the desired $V_2$ speed. As with the 240, $V_2$ speeds and flap settings must be closely correlated for maximum single engine performance.

During the stall tests, there were no undesirable characteristics noticed, and in approaching to a stall the airplane gave ample warning through the pronounced buffeting. The airplane had good aileron control during a stall, and it was possible to make right and left turns during the stalled condition while the airplane continued to settle. In the "power on" stalls, the airplane did not show any tendency to whip. During approaches and landings, the airplane handled very much like the 240 and responded nicely to power settings and flap management. The larger wheels and lower tire pressure permit smoother landings, with a wider degree of variation than is possible with the smaller high pressure tire on the 240. Prop reversal after landing was easy and normal. A single engine full throttle reverse, as tried on two different occasions, caused no undue yawing, and was readily held by nosewheel steering.

**A Feathered Prop,** single engine takeoff was accomplished at a gross weight of 47,000 pounds. The takeoff was made under normal conditions, and no attempt was made to anticipate "engine failure." Since $V_1$ exceeded $V_2$ for the runway in use, the left engine was cut at the takeoff $V_2$ speed, and the propeller automatically feathered. The automatic disconnection of the pressurization compressor on the right engine was readily appreciated when seen in operation. The left mixture control cut-off had been failing to stop the engine, so the ignition switch was also cut before the airplane was pulled off the runway. Even including this additional loss of time for the feathering procedure, the airplane climbed out readily at 59½ inches manifold pressure and 2800 rpm on the right engine. The airplane cleared the theoretical 50 foot obstacle at 4800 feet, and at the end of the first mniute's climb, had reached a height of 440 feet. At the end of 2½ minutes of climb under takeoff power, the head temperature reached the maximum allowable 263° and power was reduced to METO power. At this time the climb was temporarily discontinued for a few seconds to permit cleaning up the airplane by retracting the flaps, and to increase the airspeed to zero-flap $V_2$ speed. At the end of 4 minutes of left engine feathered climb, the airplane had reached an altitude of 1,000 feet above the runway, with a maximum gross weight of 47,000 pounds. This climb data was obtained under relatively favorable flight conditions, and should not be construed as performance available during all weather conditions. The current Civil Air Regulations do not provide for adverse climb conditions throughout the weather scale for all Air Carrier Operations. I am anxious to see the 340 along with the rest of the untested airline airplanes—tested under hot, humid weather conditions .

Previous zero thrust windmilling prop takeoffs clearly showed that a windmilling propeller has an adverse effect on the airflow over that wing, and definitely affects single engine performance. Even though the rpm was set for the calculated zero thrust at varying airspeeds, it was observed that the interruption of the airflow over the air foil had a decidedly detrimental effect on the flight charactertistics. If the propeller feathers properly on an engine failure, the airplane should perform satisfactorily under normal conditions.

If no unforseen characteristics are exposed during scheduled operations, the 340 should prove a very efficient and economical airplane, and one that pilots will enjoy flying.