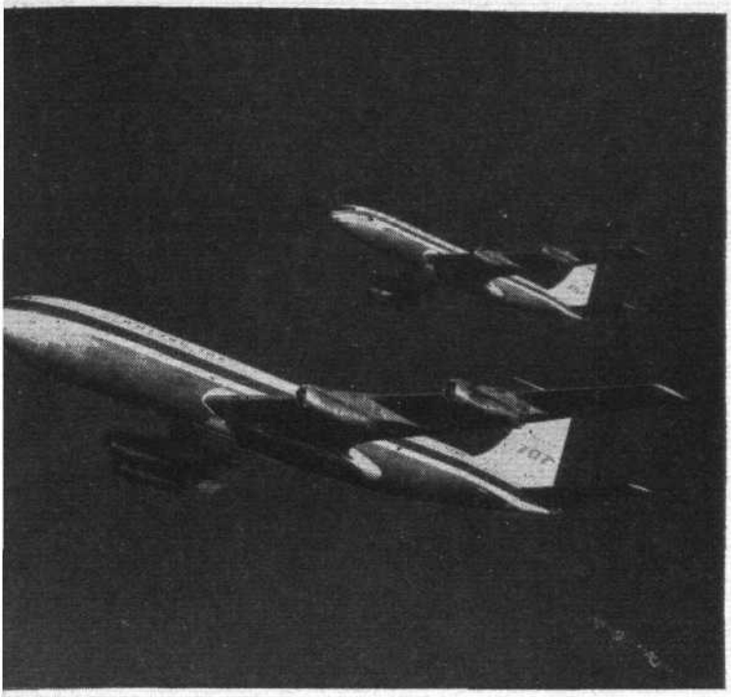
Boeing 707 . . .



Higher echelon: two early production Boeing 707-120s.

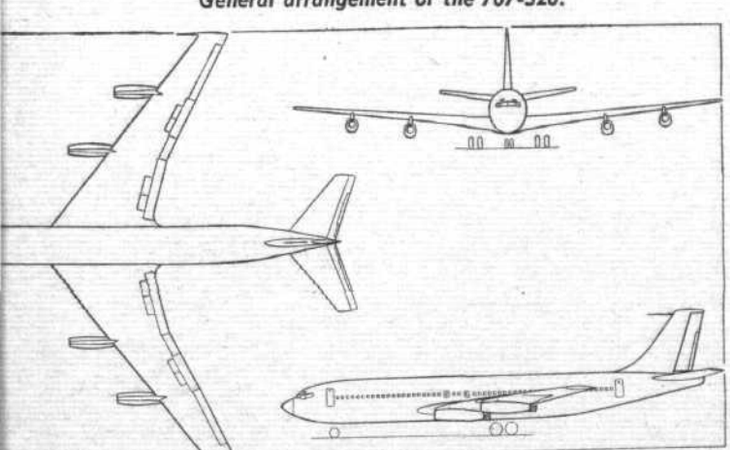
employed. The detailed description which follows applies to the Boeing 707-420, but reference is made to other variants where major differences occur.

Fuselage The three main sections of fuselage—nose, main cabin including the centre section, and tail cone carrying the tail unit—are joined with tension bolts. Semi-monocoque construction is employed embodying Z-frames at 20in spacing and top hat section stringers spot-welded to the skins. Heavy extruded frames are used at the wing spar stations and these are attached to the spars with forgings, so that the wing centre section is a permanent part of the centre fuselage. Transverse tie booms at the intersection of the upper and lower bubble radii form the basis of the floor structure everywhere except over the wing, where the floor is formed as part of the wing structure.

There are a multiplicity of rectangular 9in by 12½in passenger windows—54 on the port side of the fuselage—with two outward opening plug-type entry doors measuring 34in wide and 72in high on the port side and two 24in by 48in galley service doors on the starboard side. Cargo doors, all of the sliding plug type, are positioned opposite on the starboard side; the forward cargo door measures 48in × 50in and the two aft cargo doors measure 48in × 49in and 30in × 35in respectively. The first movement of the passenger door handle reduces the height of the door so that it can pivot and slide out edgeways through its opening. Inward-opening escape hatches measuring 20in × 38in are located between the frames of the 23rd and 27th windows from the front. The specification states that the passenger cabin floor shall be resistant to the impact of high-heel shoes and absorption of water.

Wing The five-part wing consists of a centre section, inboard wing panels and outboard panels including removable tips. The main and inboard sections form a common structure with the fuselage and are not detachable. The primary structure consists of two widely spaced spars forming a box with rib-supported upper and lower skins stiffened with extruded stringers. The spars largely carry the shear loads while bending loads are reacted in the skins.

General arrangement of the 707-320.



Tail construction is unexceptional. Each half of the variable incidence tailplane is bolted to a centre section box free to tilt in a rectangular cut-out in the fuselage. This is bolted to a pair of forged trusses hinged along a transverse axis behind the rear spar. Metal bonding is used for the attachment of stringers to skin throughout the tail construction, and bonded metal honeycomb is used for the control surface tabs.

The nacelle pods are slung from heavy ribs located diagonally to the inter-spar ribs and from a forging on the front spar. Structural fuses are incorporated in the pylon attachment to prevent damage to the wing during a belly landing; they allow the engine nacelle to break free.

Undercarriage The main legs, each carrying a four-wheel bogie, are mounted between "beaver tail" members overhanging the rear spar and bolted to a strong inter-spar rib. They are retracted inwards by hydraulic jacks. Tubeless tyres of 46 × 16in size are mounted on 17.00 × 20in wheels and inflated to pressures varying between 128 lb/sq in and 145 lb/sq in, depending upon the design weight. The Boeing 720, which has a similar but lightened undercarriage, carries 40 × 14in tyres on the main bogies. An anti-skid braking system is standard equipment in each case.

The nose undercarriage has a dual wheel axle supported by a vertical oleo which retracts forward. It carries 39 × 13in tubeless tyres and is steered by twin cylinders through 60 deg either side of centre. This gives a turning radius of 21ft about the inner bogies.

POWERPLANT As outlined in the introduction, there is no standard powerplant. The -120 is equipped with Pratt and Whitney JT3C-6s, and the 720 with lighter Pratt and Whitney JT3C-7s; the -220, the so-called "hot rod" ordered by Braniff, features JT4A-3s married to the Stratoliner airframe. This engine is also installed in the -320. The -420 and -520 are both powered with Conway 505s with a take-off static thrust at sea level I.S.A. of 16,500 lb. The first aircraft to fly were -120s powered by four JT3C-6s of 13,000 lb thrust wet. This engine is the commercial variant of the military J57 with tandem compressors, can-annular combustion chamber and most of the accessories grouped under the casing of the rear high-pressure compressor. A 5.75 gal oil tank is slung above the front low pressure compressor casing and oil coolers low on each side of the nacelle. About 700 gal water is available for injection at ambient temperatures in excess of 40 deg F. Engine starting is by pneumatic means, three engines being started from the first started by ground supply. Inboard engines on the Boeing 720 are fitted with in-line combustion starters. All engines are fitted with a combination noise suppressor and thrust reverser.

SYSTEMS **Fuel System** Total 420 capacity is 17,653 Imp. gal. Apart from 6,429 Imp. gal contained in the centre section bag tank, fuel is contained in integral cells within the wing box which is divided from root to tip into main tank No. 1, main tank No. 2, and a reserve tank. The capacities are respectively: 3,305 Imp. gal, 1,946 Imp. gal, 361 Imp. gal. In the 720 no fuel is carried inboard of the wing to fuselage support ribs and the total capacity is 8,403 Imp. gal (11,221 Imp. gal optional). Each tank is fitted with a transistorized capacitance-type fuel gauge, dripsticks and 3.0in diameter fuelling ports, and provision is made for underwing refuelling at 50 lb/sq in through four sockets. All main tanks can be refuelled at rates in excess of 180 Imp. gal/min. Fuel dumping arrangements permit one per cent per minute of the maximum take-off weight to be off-loaded down to a minimum of 15,000 lb fuel. For 707-120 capacities see drawing.

Flying Controls Internal balance plates, aerodynamic tabs, inboard and outboard ailerons (the latter operate only when the flaps are down) and spoilers are the basis of the Boeing 707's mainly manual control system, which also provides proportional feel, but rudder boost is used on the 707-220 and Intercontinental models for maximum rudder deflection in the low-speed, engine-out case. The spoilers are actuated hydraulically and are used differentially as aileron assisters or together as air brakes.

Double slotted flaps are divided into inner and outer portions along the wing with simple fillet flaps at the wing root. A hydraulic motor and torque tube actuates the inner flaps and an independent system the outer. Emergency operation is provided by an A.C. electric motor.

Cabin Air Systems Air drawn from ram air intakes above the main air intake is passed through multiple compressors powered by second-spool bleed air and passed into the cabin at a rate of 3,200 cu ft/min at all altitudes up to 40,000ft. The cabin dP is 8.6 lb/sq in between 22,500 and 40,000ft and the temperature and humidity are controlled by an air cycle cooling unit (a vapour-cycle unit is specified by certain customers) and primary heat exchanger cooled by ram air drawn from fairings over the nose-