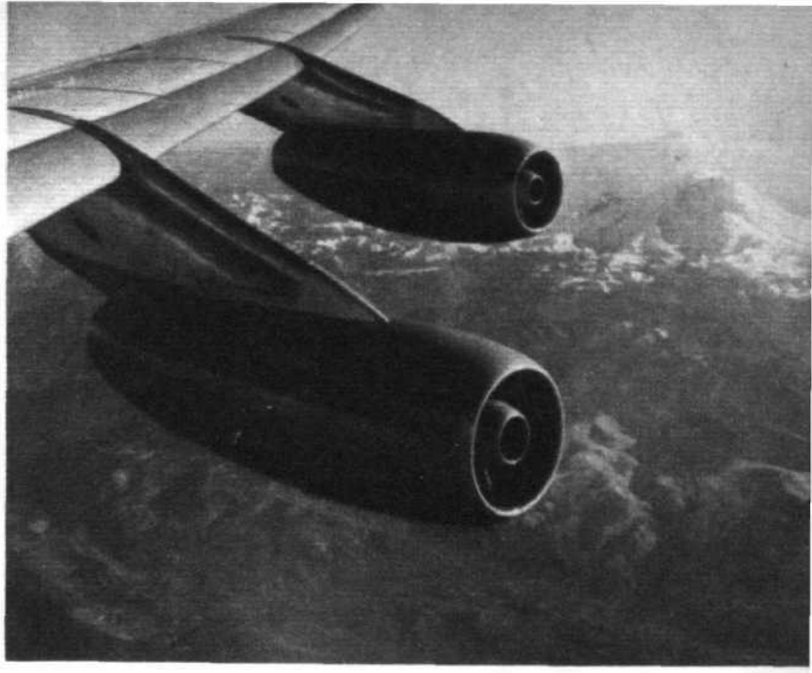
BOEING 707 REVELATIONS

New Data on the Seattle Family of Jet Transports



FIRST-HAND information on the development of the Boeing 707 family of jet transports was given to *Flight* last week by Mr. A. T. Curren, Boeing preliminary design engineer. For the past three months Mr. Curren has been backing up a 707 sales team on a tour of European operators, and it was on the day of his departure for Seattle that we discussed the aircraft with him.

No inside knowledge is required to see that competition between Boeing and Douglas has reached a peak, each company offering—and selling—remarkably similar jet transports. This is the reason, presumably, for Boeing's decision to release information on the 707 which has previously been restricted to the higher councils of a limited number of major airline operators. With the exception of engine performance, there were few aspects of the aircraft which Mr. Curren was not prepared to discuss.

Before outlining the development background and design philosophy behind the 707, he gave Boeing's answer to the various doubts, printed and spoken, which have been cast on the company's ability to make good its performance and delivery promises. And here we must say that the quiet confidence of the Boeing argument, and the absence of derogatory references to competitive products, struck us as no less convincing than the reasoning behind it. These were some of the points made:—

Boeing's studies on the design of the 707 had been in progress since 1949, and the 367-80 prototype, embodying the major results of those studies, had been flying for 19 months. In that time it had "racked up" 375 hours of flying. From the B-47 (over 1,000 delivered) and B-52 (in quantity production at Seattle and Wichita), Boeing had built up unrivalled experience in the design and production of large, multi-jet, high-speed aircraft.

Deliveries of production B-47s had begun within three years of the prototype's first flight (late in 1947), and the equivalent period for the B-52, a much more complicated aircraft, had been only a few months longer. The interval allowed between the first flight of the 707 prototype and initial deliveries to airlines was more than four years. As the civil aircraft was a less complex machine than either of the bombers, and embodied the experience accumulated with both, this period seemed adequate.

Jigging and tooling for production of the KC-135 tanker, which had the same aerodynamic shape and the same systems as the 707, had been completed and the first production model would fly before the end of this year. By November 1958, when first airline deliveries of certificated 707s were due, KC-135s were expected to have completed 50,000 hours' flying.

As to engines, Boeing were completely confident that the J57 (for the 707-120) and the J75 (for the 707-220 and -320) would give the power required at the times stipulated in the development and delivery programme. They were not permitted to disclose future ratings for either type of engine, or actual thrust figures now being achieved. The Rolls-Royce Conway, which was not at a more advanced stage of development than the J75, could be installed at an operator's request, but the programme did not depend on it.

Three 707 Variants

As first reported in the preceding issue of *Flight* there are three airframe-engine combinations in the 707 family, the characteristics of which are outlined in the accompanying table. The "basic" Stratoliner is the 707-120, which is intended to be the most versatile of the three, operating at a lower direct seat-mile cost than the "classic" DC-6B over routes of 500-4,000 miles (the all-important coast-to-coast route, of some 2,500 miles, is thus well within its capabilities). Its wing area of 2,433 sq ft was matched to the J57 turbojet which, to quote Boeing, "was offered at 12,500 lb s.t. at sea level, with a potential future growth programme culminating in 1960."

For operators with field-length problems, the 707-220 is being developed, embodying larger and more powerful J75s but retaining the basic "small-wing" airframe. This will be the fastest of the three aircraft and it will have slightly more range than the 120, but take-off performance will be its key characteristic.

The 707-320 is to be a specialist long-hauler designed for the North Atlantic and similar long over-water routes: hence the name Intercontinental. Wing area will be increased to 2,908 sq ft; the fuselage will be 10ft longer. In the design of the 320, the company claims, full allowance has been made not only for the adverse weather and headwind conditions encountered on the North Atlantic route, but also for the increasing traffic-control problems which might well be expected by the time the aircraft enters service. The Intercontinental, they say, should thus have sufficient endurance in hand to operate—when required to do so—below the optimum cruising altitude and without recourse to pressure-pattern flying or inflexible cruise-climb procedures.

There is no intention of offering the 707 prototype for certification or of building further prototypes. Final phases of airworthiness testing will thus be undertaken with production Stratoliners. Delivery of the first certificated 707-120s is planned to take place in November 1958, though the programme calls for delivery of non-certificated production aircraft to both PanAm and American Airlines some four months earlier for crew training and route proving.

Thrust reversers and silencers will be standard equipment on the 707; design of both devices is well advanced. Boeing have tested several silencers based on the designs of Mr. F. B. Greatrex of Rolls-Royce, Ltd., and four corrugated tailpipe nozzles are now being fabricated for the 707 prototype. A braking parachute is fitted to the prototype as a "back-up" device, but fully duplicated wheel-brakes and thrust reversers are expected to obviate the need for parachutes on production 707s; nor is there any present intention of using afterburning, jet flaps or boundary-layer control. The company states that its intention is to make the 707 "as simple and fail-safe an aeroplane as it is possible to build."

No decision has yet been taken on the question of whether or not to tank-test a complete fuselage. However, Mr. Curren told us that Boeing will certainly "go under water" with sections of the pressure cabin. The designed differential pressure for the aircraft, incidentally, is 8.6 lb/sq in.

A feature of the civil 707 which has attracted some comment is the extremely large number of cabin windows, which will, in fact, be spaced at intervals of only 20 inches. Mr. Curren briefly explained the reasoning behind the "concept of the small window" which, he said, had been pioneered by Boeing. By far the most important reason for the decision was the assumption that at some time in the life of the aircraft a window would fail. The smaller the window, the less violent would be the decompression and the less serious its effects. Incidental factors were that, assuming equal structural strength, the desired "lighted area" could be obtained at a lower weight penalty; that 20in spacing of windows eliminated the problem of lining-up seats with windows in a

CHARACTERISTICS OF THE BOEING 707 FAMILY

	707-120	707-220	707-320
Power unit (P. and W.) ...	JT3C-4 (J57)	JT4A-3 (J75)	JT4A-3 (J75)
Gross weight (lb)	247,000	258,000	295,000
Max. landing wt. (lb) ...	165,000	175,000	195,000
Optg. wt. empty (lb) ...	111,000	116,000	128,670
Zero fuel wt. (lb.)	155,000	160,000	175,000
Design payload (lb)... ...	31,250	31,250	38,000
Fuel capacity (U.S. gal) ...	17,398	18,078	23,580
Wing span (ft, in)	130 10	130 10	141 6
Aspect ratio	7.06	7.06	6.92
Wing area (sq ft)	2,433	2,433	2,908
Fuselage length (ft, in) ...	128 10	128 10	138 10
No. of seats (1st cl.) ...	109	109	122
Usable cargo (cu ft) ...	1,290	1,290	1,500
Max. cruise speed (m.p.h.)	592	608	599