COMET REDWINGS

Progress of a Proving Flight

"EASILY the most beautiful airliner to visit Zurich" was the tribute readily accorded to G-APMB, B.E.A.'s first Comet 4B, on its proving flight to Switzerland last week. This was one of the last of a fortnight's series (described in *Flight*, December 11) that were being conducted before the Comet is introduced into passenger services on the *ad hoc* basis that precedes formal introduction in April, May and July next year. The writer was among the 66 passengers who comprised the sample payload.

The attraction of jet flying, even over short European stage-lengths, is considerable. Viscount flight time from London to Zurich is 2 hr 5 min; the time scheduled for the Comet is 1 hr 25 min; and on the proving flight the actual return time was estimated as 1 hr 10 min—which, but for poor weather and a delaying G.C.A. at London, might have been a record.

In the left-hand seat on this fast flight back to London was Capt. G. T. Greenhalgh, manager Comet Flight, and author of "The Gentle Jet," an article about the Comet 4B which was published in *Flight* for December 11. Two senior captains, Capt. Peter McKeown and Capt. Bill Fittall, respectively occupied the right-hand seat and the systems panel that is the third pilot station, while a de Havilland engineer kept a watching brief from the fourth seat in the cockpit (there is a jump seat as well).

Once the engines were started—in a rapid 4, 3, 2, 1 sequence and with the minimum of fuss—it was Capt Greenhalgh who issued the now normal, good-public-relations warning about the Comet's steep angle of climb: "There is plenty of power available for take-off," he said, "and we are helping to reduce airport noise. I hope," he added, "that you enjoy this take-off as much as we do." And, thus prepared, everyone did.

Because the pilots cannot see the wing tips, taxying requires a good deal of caution, but there was no hanging about at the runway holding point; the Avons are wound up to their full 8,050 r.p.m. (revs are in most cases 50 r.p.m. up on those for the Comet 4) as the Comet swings on to the runway, and from that point onwards the sensation is akin to that of a gimbal-mounted lift. No blast-off this; the acceleration is smooth and progressive, and rotation and unstick come satisfyingly quickly.

Leaving London the day before, Mike Bravo had been up into the 1,000ft cloudbase before reaching the end of the runway, this despite a suspected faulty micro-switch which at first prevented action of the damper strut which allows the bogie beam to trail into the "retract" position. From Zurich the rotation and steep climb were equally impressive, with streaks of the de-frosting fluid that had been sprayed on just before take-off streaming past the windows. In the climb, the r.p.m. soon came back to 7,400, but the speed increased rapidly and the steep ascent continued.

The very steepness of the climb can make it difficult for the cabin crew of two stewards and two stewardesses to serve drinks and meals to up to 86 passengers, but in fact only on the Comet route to Dusseldorf (where the scheduled time is 1.05 hr) should the shortened flight time be an embarrassment.

To the cabin crew in the 64-passenger tourist section, the change in noise level as they walk up and down the cabin from their galley must be very apparent. Anywhere ahead of the jet efflux—that is, in *any* seat—the level is satisfactory by any standard, and the Comet is possibly quieter, seat for seat, than the Boeing 707. But it doesn't follow that the noise level decreases as you move forward, because quite a lot of air-conditioning noise comes from behind the perforated headlining cloth about halfway down the fuselage. I judged this to be at its most intense about three rows aft of the big adjustable bulkhead that separates a 15-seat tourist compartment from the remainder of the tourist seats, but it is much less apparent from the seat itself than when one is standing in the aisle. Noise level rises quite a bit in the rear galley and—not to put too fine a point on it—the two toilets at the extreme aft end of the cabin are no place for meditation; the efflux adds a vibrant roughness to a considerable level of noise.

This is a small criticism of a cabin that, in all other respects, is outstandingly good. The colour scheme—particularly the tomato and charcoal of the seats—is the best that B.E.A. have ever offered, and in conjunction with the new external colours (about which a typical comment seems to be: "The more I look at it, the more I like it") they add appreciably to the passenger's enjoyment of the Corporation's jet.

The time that we were airborne was insufficient to satisfy me that the air conditioning would continue to give as comfortable a cabin atmosphere as it did between Zurich and London. Then, temperature everywhere seemed remarkably even and the atmosphere pleasantly fresh; it was particularly noticeable that hardly anyone on board felt the need to use their punkah louvres. Indeed, the only inkling of the coldness of the outside air at 31,000ft (it was −43 deg C) was frost on the knurled head of the screw securing the inner window-frame to the cold structure. Later, during the descent, frosty white patches formed on the red wing above the outer fuel tanks.

Two other jottings from the *Flight* notebook: no one seemed quite certain whether in the longer fuselage of the 4B, pilots—and perhaps the most forward-placed passengers—would notice greater accelerations during gusts and changes of attitude than they might with the shorter Comet 4; certainly from inside the fuselage the nose seems very long. Also, the upfloat on the ailerons is quite remarkable; they are rigged with the trailing edges about 1½in higher than those of the flaps and the discontinuity along the wing is rather startling. (This unusual rigging improves stall characteristics.)

Four-minute flight planning. On European routes the flight planning for the 4B has been reduced to a nimble art; the pilots speak of doing it in four minutes and, in fact, once the data is assembled this is all the time required. Some notes on the broad outline of the method appeared in *Flight*, December 11: what follows has particular reference to our proving flight to Zurich.

The basis of planning is a series of tables that are used to reduce arithmetic to the minimum. The first step is to establish the mean wind between 20,000ft and 30,000ft from those forecast for the sector, and to calculate the mean track along the known distance

The 22-seat first-class cabin of B.E.A.'s Comet with the revived name of Silver Wing. A 15-seat tourist compartment separates the first-class accommodation from the larger tourist cabin; there are galleys and toilets at each end. In the heading picture opposite: A Comet 4B on a proving flight to Zurich is serviced by Swissair

from departure point to destination. What follows is simply a tabular method of solving the equation for which a private pilot might use a Dalton computer. The table (Fig. 1) is "entered" at the mean track value, registered against the mean wind direction, the line followed down to the intersection with mean wind speed, and the positive or negative wind component is read off.

The next table to be used (Fig. 2) plots wind component (in 10 kt steps) against sector distance to give time of flight and fuel required for take-off, climb, cruise, descent to 1,000ft and five minutes' holding at 5,000ft. Since this table must assume a particular height (29,000ft) and a particular temperature (I.C.A.N.) two other simple tables (Figs. 3A and 3B) are used to correct the full figure. These are time against altitude ± 29,000ft, and time against ± I.C.A.N. temperature. In our particular case, the distance was 468 n.m. and the wind gave us a 10 kt tailwind component. The table showed that we should require, at I.C.A.N. temperature and 29,000ft, 1 hr 9 min to cover the distance and 6,550 kg of fuel. But in fact we were to fly at a 31,500ft quadrantal and the O.A.T. was −43 deg C −I.C.A.N. −5 deg C. The height variation made virtually no difference to our time and only 50 kg difference to the fuel required—a quantity so negligible that it could be ignored, as could the correction for temperature.

To the fuel quantity, a fixed allowance of 350 kg is added for taxying, and then the same process is repeated for diversion to the alternate. So, at this stage the fuel required consists of a sum of three quantities, the last being fuel required from wave-off at destination to climb to the optimum altitude for the distance to the alternate; cruise; descent; and five minutes' circuit fuel. Finally, to the total is added a fixed allowance of 3,150 kg for 45 min holding at 5,000ft. In our case the minimum fuel was thus 12,670 kg, and as a small additional reserve 14,069 kg were loaded. (The figure was not rounded off, because the underwing dripsticks are calibrated in gallons.)

This brought our take-off weight up to 55,052 kg, comfortably under the maximum permissible figure of 71,669 kg. In fact, B.E.A.'s Comet will very rarely be weight-limited, either as to take-off weight or payload, although on the shorter stages with rather distant alternates, landing weight can be exceeded.

The Comet 4B's cruising speed is normally about Mach 0.76. Following the track from Zurich (Hochwald, Chaumont, Troyes, Bray V.O.R., Abbeville and Cranbrook to Sevenoaks, Epsom and London), we were cruising at Mach 0.75 and making about 420 kt T.A.S. on 6,750 r.p.m. Practice and experience enable the pilot to estimate quite accurately what r.p.m. he is going to require at any weight, altitude and temperature, because the cruising r.p.m. band is relatively narrow, but the exact r.p.m. can in any case be obtained from a series of carpet graphs drawn for different weights. (What the actual weight is at any time is easily calculated by summing the four kilogrammes-gone flowmeter readings and subtracting them from the take-off weight: in cruise, fuel is used at a rate of rather under 1,000 kg/hr.)

An interesting point of technique arises here. Even with the height-lock in and correct r.p.m. set up, the Comet will not achieve its correct Mach number unless its altitude is also correct. If this is not done on rounding off from the climb, the aircraft will mush along below its optimum cruising speed even if power is increased. This is apparently a stable condition, and it may require a considerable rate of descent—something like 1,500ft/min—to get the aircraft back in its groove. That this phenomenon may also be true of the Caravelle is given weight by the emphasis given to attitude flying by pilots of Air France.

As with all jets, fuel management is important, and control is the third pilot's principal task. At intervals of, say, each half hour, it is one of his duties to prepare a fuel statement, the object of which is to show the amount of fuel in reserve and the amount that would be available at various alternate airports.

The statement is prepared by filling in on a prepared form: (a) E.T.A.; (b) observation time; (c) time to go (a−b); (d) fuel flows 1, 2, 3, 4 and total fuel flow; (e) total fuel loaded; (f) fuel used; (g) fuel remaining (e−f); (h) fuel required to destination (c×d) and reserve fuel left (g−h).

Since the amount of fuel required to reach various alternates has already been calculated, the amount that will be left in reserve for holding can be determined by subtraction. To some extent, therefore, the 3,150 kg holding fuel allowed can be regarded as being in part contingency fuel, since the quantity required for holding at 5,000ft for 45 min will allow holding for considerably longer at greater heights. What is important at this stage is knowledge of how long the reserve fuel will last at different holding heights, and the calculation of this forms a part of the weight statement (see Fig. 4). There is quite a big fuel penalty to pay if compressor air is being tapped for de-icing, and holding times are subdivided to take this into account.

All this takes longer to recount than it does to put into practice, and in fact much of it was run through for me by a busy crew flying a jet on a short sector on European airways. That this was possible is a tribute both to the essentially straightforward step-by-step techniques worked out for their Comet by B.E.A., to a highly skilled crew, and also to the essential simplicity of the aircraft itself.

Of the latter, one can only say that the Corporation's strictly commercial reasons for buying the 4B—to meet jet competition from other operators until the D.H.121 is available—takes scant regard of the genuine enthusiasm engendered everywhere by Britain's jet. Its value in prestige and profitability for the moment aside, the Comet is a wonderful way to travel. A. T. Pugh

Fig. 1

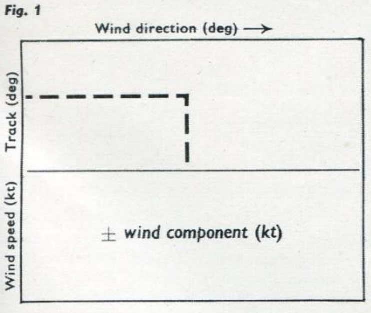


Fig. 2

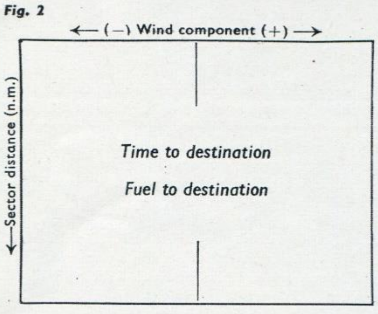


Fig. 3A

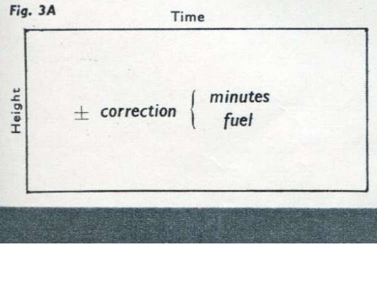
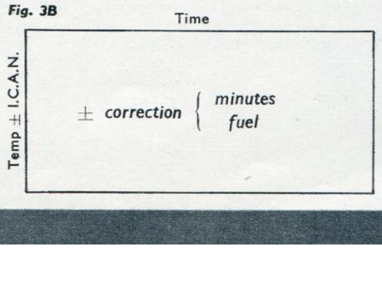


Fig. 3B



These four diagrams illustrate the speedy method of flight planning used by the Comet 4B crews and described above

Fig. 4