Caravelle à la General Electric

BY ROBERT D. ARCHER, ARAeS

IT was one of those windy spring days typical of Edwards Air Force Base, California. There was very little test flying taking place as I walked around the Caravelle belonging to General Electric, my interest being concentrated on the two large "barrels" which had sprouted forth at the rear end of the engine pods. As I looked up from the rear I noticed the aft-fans rotating briskly, but there was no noise other than that from the wind.

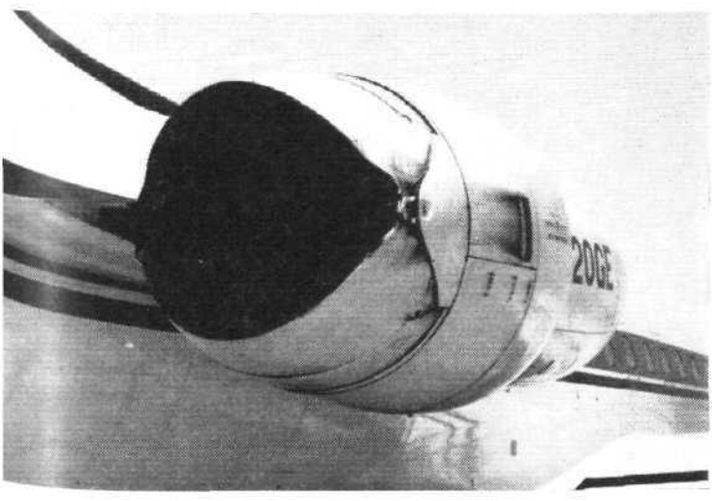
The Caravelle has proved to be of outstanding interest in the highly competitive American domestic civil transport field, not the least for being the first foreign design to be sold by the Douglas Aircraft Company. In order to stimulate this interest and to allow investigation of future developments of the basic airframe with their own engines, General Electric bought from Sud-Aviation a Mk 3 Caravelle. Under the Douglas insignia it completed an intensive tour last summer after making some 66 demonstration flights in the USA.

Thanks to the co-operation of both Douglas and General Electric, I was able to sample *Santa Maria*, as it has been called, both on its last demonstration flight before conversion and during its first Press flight after being fitted with the 16,100lb-thrust General Electric CJ-805-23C aft-fan engines. Outwardly the conversion has done little to change the appearance of the aircraft, except for the large-diameter barrel around the aft end of the jet pods. However, General Electric had to make many changes to fit the -23C engine. Because the engine-mounting points are different, the two mounting frames had to be re-located, and instead of the electric starter system a gas-turbine starter was installed in the rear fuselage tailcone, replacing the previously fitted drag-chute system.

Extensive recording instrumentation, including a 30-channel tape recording system, has been fitted at the rear end of the passenger cabin, and the new engine frames have made it necessary to re-locate the lavatories. The cabin air-conditioning system had to be revised because the bleed air from the seventeenth stage of the GE engine is hotter than that from the lower-pressure Avon. Aircraft conversion was done at Edwards by GE, but the pods were built by Douglas. The engines are almost exactly the same as those fitted to the Convair 990, and are about 80 per cent interchangeable with those used in the Convair 880—a point which should appeal to the airlines which have purchased these aircraft.

There is no doubt that the considerably increased thrust of the aft-fan engines—16,100lb versus the 11,400lb of the previously fitted Rolls-Royce Avons or 12,725lb of the latest Avon—has considerably improved the short-field capabilities of the Caravelle. The production Mk 7 using the aft-fan engine will take advantage of the greater thrust of the engines by providing a 39in fuselage extension forward and a 10,000lb increase in weight over the Mk 3.

The aft-fan consists of a single stage of what General Electric call "bluckets"—a corruption of compressor blades and buckets (American terminology for turbine blades). Reverse thrust is provided by two large clamshell sections similar to those on the CV-990, but opening in the vertical rather than the horizontal plane. The engine uses hot-air de-icing for both the fan and main engine intake. By-pass ratio is 1.56, and the aft-fan operates at a pressure ratio of 1.6.



Two photographs which highlight the change in appearance of an installation when an aft-fan is added; upper, the Avon 527, with silencer; lower, the CJ-805-23C, with reverser, installed in the same aircraft

Taken for a Ride

General Electric chief test pilot R. J. Scoles and Caravelle project pilot L. V. Davis briefed me on the conversion of the airframe, saying that while the Caravelle's fully powered control system had no manual reversion and only artificial feel (as opposed to current US practice) in their opinion it was far better than any of the power-boosted control systems fitted to other civil jets they had flown. Feel for the rudder and elevator is provided by a q-senser system and bungees, while the ailerons have torsion-bar feel without q-sensing. Because stability is positive about all the three axes, no artificial stabilization is needed or provided As the engine thrust lines are toed-in by 4° on each side, trim-changes are practically negligible in the one-engine-out case.

We then boarded the aircraft and I had a quick look at the rather unpleasant conditions prevailing: there was about a 20kt wind blowing fine sand across the main 15,000ft runway. As we taxied out I looked around the main cabin, which was unchanged from its original form except for removal of seats at the rear to make room for the flight-test instrumentation. The aircraft, No 42 off the production line, was finished throughout and equipped similarly to those used by SAS.

We took off at the maximum gross weight of 101,400lb; on the previous flight we had weighed 101,200lb. (Figures for the previous Avon-engine flight will be given in parentheses for comparison in