Pilot Flight Check:

HS 125 Series 700

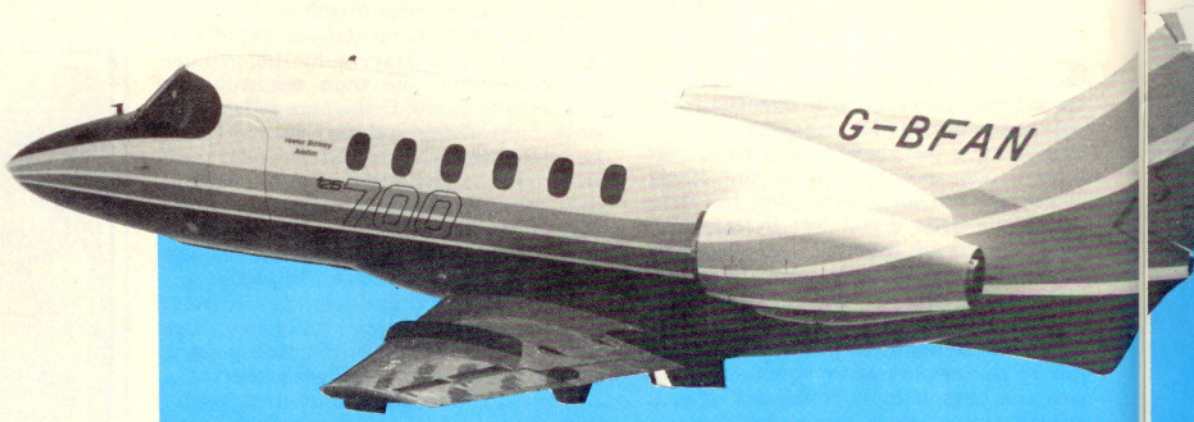
by ALAN BRAMSON

■■ The first de Havilland 125, introduced in 1961, was something of an ugly duckling. The design team had been instructed to provide a small jet aircraft with true stand-up and walk-around capabilities, not only in the entrance area, but over the wing junction as well. Clearly, this had to result in a deep fuselage and a wing that passed under, rather than through, the cabin area. The early 125 was a sawed-off, chunky beast.

However, in 1971, with the craft built under the Hawker Siddeley banner, the garden rakes and other avionic ironmongery were traded for fully flush antennas. The fuselage got a two-foot stretch and another pair of cabin windows. Updated Rolls Royce Viper turbojets allowed an increase in maximum weight. And, the new HS 125 Series 600 became quite an aircraft in both looks and capabilities.

A problem remained with the much improved 600 series, though. The reliable and trustworthy Rolls Royce Viper engine was originally intended for a pilotless target aircraft, dating back to the time when fuel economy and external noise were less in everyone's mind than they are today. The Viper-engined 125 tends to draw attention to itself when taking off from some smaller airfields. Consequently; in 1976, Hawker Siddeley surprised the aviation world by announcing a new fan-engined version, the HS 125 Series 700.

The result of fitting Garrett AiResearch fan engines to an outstanding airframe is a very quiet aircraft, inside and out, and an increase in maximum range from 1,600 nm to over



2,300 nm on the same fuel as before.

Most of the fuel is carried by the swept-wing, small ventral and dorsal tanks bringing the total up to 1,410 U.S. gallons. Because of its single-point refueling system you can refuel a 125/700 in only six minutes. Double-slotted flaps lower to 45 degrees and, after landing, selection of "lift dump" moves them to 70 degrees and also raises the hydraulically operated air-brakes which extend above and below the wings. For in-flight use, these air brakes are cleared for operation at any speed. Wing fences are provided just inboard of the ailerons. The large fin carries a conventional, swept stabilizer and separate elevators. All primary controls are simple pushrod and cable operated, there being no complex power jacks and artificial feel—all of which cost money to maintain.

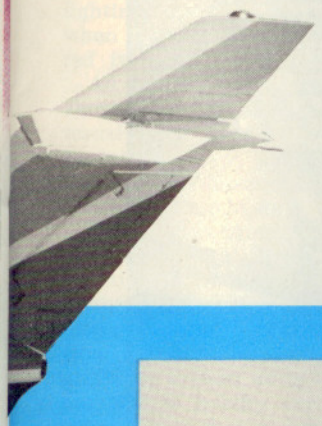
The rudder is fitted with an interesting feature which the manufacturer refers to as an "auto-bias strut." In essence, this simple device consists of a pair of double-sided pistons which are supplied with air from the engine compressors. When both jets are running, the pressure is equal on both sides of the pistons. But, in the event of a power failure, pressure on the live side causes the unit to apply proper corrective rudder, thus containing the yaw that would otherwise result from asymmetric thrust. Sufficient residual out-of-balance yaw is allowed to remain so that the pilot may identify the failed engine.

Double wheels are used on the undercarriage, the main units carrying Maxaret anti-skid brakes with double discs and sintered iron pads. The undercarriage is cleared for operation from unpaved runways. An entirely separate emergency circuit is provided for use when the wheels refuse to come down normally. All fuel lines, which are stainless steel, are routed outside the pressure hull.

The rear-mounted Garrett AiResearch TFE 731-3-1H turbofan engines are carried close to the fuselage. Their intakes protrude over the wing, which offers protection from debris thrown up while taxiing on a rough airfield. Full ice protection includes porous strips on all leading edges (through which deicing fluid is exuded under pressure), heated engine-air inlets and edge heating for the windscreens.

One enters the aircraft via a fold-down airstair and a vestibule area. Interiors vary according to customer requirements. G-BEFZ, the first production craft made available by Hawker Siddeley, was fitted out in the standard, eight-seat executive layout—although up to 14 passenger seats may be provided. Opposite the entrance was a large baggage area and to the left of it a small hot-meals unit. Next to the entrance was a well-planned refreshment bar, complete with sink and running water, and nearby was a full-length wardrobe.

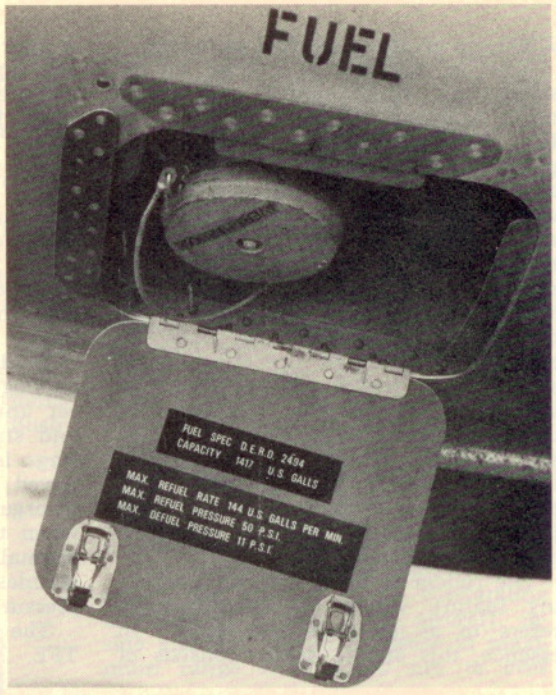
The distance from the flight deck divider to the rear of the cabin is 21 feet 4 inches. The cabin is almost 6 feet



Hawker Siddeley switches to a fan jet for greater performance, less noise

wide and there is 5 feet 9 inches of headroom throughout the center aisle. The demonstration aircraft was fitted with a three-seat settee on one wall, four large armchairs and a very comfortable corner seat. There were pull-up tables and stereo radio/tape is standard. All windows have Polaroid inner panes, which may be adjusted to keep out the sun. There are individual reading lights and fresh air vents and the usual emergency oxygen masks descend from the ceiling in the event of lost cabin pressure. Generally, the passenger area exudes an air of quiet, understated luxury.

At the back of the cabin, set in a nicely decorated bulkhead, was a door leading to an airline-size toilet room. There was a razor outlet, lighted vanity mirror, electric-flush toilet and—a simu-



Using the single-point refueling system in the HS 125/700, it takes only six minutes to fill the 1,410-gallon tanks, enough for a maximum range over 2,300 nm with the new Garrett AiResearch fan engines.

Hawker Siddeley 125 Series 700

Equipped price $3.4 million

Specifications

Engines	2 Garrett AiResearch TFE 731-3-1H, each 3,700 pounds thrust
Wing span	47 ft
Length	50 ft 8.5 in
Height	17 ft 5 in
Wing area	353 sq ft
Wing loading	68.55 lb/sq ft
Passengers and crew	up to 14
Cabin length (excluding flight deck)	21 ft 4 in
Cabin width	5 ft 11 in
Cabin height	5 ft 9 in
Typical operating weight (2 crew)	13,800 lb
Maximum zero fuel weight	16,050 lb
Typical load	10,400 lb
Maximum authorized takeoff weight	24,200 lb
Fuel capacity (standard)	1,410 gal (9,450 lb)

Performance

Takeoff (max. wt., balanced field)	5,500 ft
Climb to 31,000 ft	14.5 min
Maximum level speed	436 kt
Normal cruise speed	400 kt
Range at high-speed cruise (with 45-min reserve)	1,800 nm
Range at normal cruise (with 45-min reserve)	2,350 nm
Maximum operating altitude	41,000 ft
Single-engine ceiling	25,000 ft
Landing distance (22,000 lb)	4,500 ft

Flight deck has electric, fuel, deicing, air conditioning system and engine start controls on top; nav system selection on the glare shield; flight, power instruments on the panel and avionics grouped on the center console.

lated marble washbasin with gold-plated faucets!

The Series 700 flight deck is very much like that of a passenger jet, except the flight engineer's panel is banished to the roof where the electrical system, fuel, de-icing, engine start and full air conditioning are controlled.

In the glareshield are the remote course and heading knobs for the HSI, station switches that determine radio selection, altitude alerting and the autopilot/flight guidance panel. Directly below, on the main panel, are the engine instruments which, since the Garretts are two-shaft engines, include two rpm indicators, one for the fan turbine (known as N_1) and another which tells you the speed of the gas generator or core turbine (N_2). Just to the left is an RCA AVQ-21 weather radar. On the other side of the engine instruments, there is a comprehensive central warning panel with messages lighting in white for reminders, amber when caution should be exercised and red for the "nasties."

All avionics are controlled from just above the central console. The aircraft tested was pretty well all Collins equipped, except for an RCA transponder and a Marconi audio control/passenger address system.

The flight control system is based upon the new Collins FCS 80, in conjunction with dual FD-109 flight directors. The system is cleared for coupled approaches down to a 100-foot decision height. The new autopilot/flight guidance system suits the aircraft well, but this is hardly surprising; it is an open secret that much of its development flying was conducted in the HS 125/700.

Hydraulic-powered steering is handled by a small knob which falls nicely to the captain's left hand. The control wheels are of the "Rams Horn" type and are very comfortable to use. They carry buttons for electric elevator trim, transmit/intercom, autopilot cutout, "V" bar (FD-109) datum adjustment and remote transponder ident.

Finally, the 125/700 has a small Garrett AiResearch auxiliary power unit fitted as standard behind the pressure cabin. Some manufacturers take the view that modern fan engines are so economical that one can leave the starboard motor running on the ground to provide power for electrical systems and air conditioning, but Hawker Siddeley points out that at some airports prolonged ground idle is not allowed. In any case, the only way to ensure complete self-sufficiency at the most remote of airfields is to have an APU capable of generating enough power to start the main engines and support the air conditioning while on the ground.

The HS 125/700 has a maximum ramp weight of 24,500 pounds and up to 9,450 pounds of it could be fuel.

Most of the development flying on later models of the HS 125 has been done by Mike Goodfellow, chief 125 project test pilot. He explained that for the purpose of my test the aircraft would be loaded to 19,000 pounds, representing a typical weight for a 660-nm (760 statute-mile) journey with eight passengers and their luggage, allowing full IFR reserves. Such an aircraft would land with 1,500 pounds of fuel, enough for 75 minutes additional flying at cruising levels or 45 minutes low down.

Pre-starting checks completed, we cranked up the APU (there is a little panel for this purpose situated in the flight deck entrance) and then pressed the starter button for the starboard main engine. When at 10% N_2 rpm indicated (gas generator turbine), the high-pressure fuel cock was opened and within seconds the inter-turbine temperature (ITT) went up to 572° C, hitting a second peak of 608° C, which was well within the 907° starting limit.

Taxiing is very easy, using the little, powered steering knob with the left hand, and turns may be made in a remarkable 30-foot radius during which the flight deck actually moves sideways. Visibility from the pilots' seats, which adjust for height and reach, is excellent. The brakes are superb but then in this class of aircraft they have to be. Personally, I would form the habit of taxiing on one engine because these business jets tend to go like an express train when the two fires are lit, even at idle power.

For our weight, V_1/V_r (decision speed and "rotate" speed are the same on a 125) was 109 knots and V_2 (engine-out safety speed) came to a modest 114 knots (light twin figures). We lined up on the runway, left hand on the steering knob, the right one holding the control yoke. Goodfellow opened up the power levers from the right hand seat and, as what little engine hum could be heard on the flight deck rose in pitch beyond the range of human hearing, I released the brakes.

We accelerated briskly and noiselessly. At 70 knots the rudder became effective and I transferred my left hand from the steering knob to the control yoke. With 109 knots on the clock, I rotated to 12 degrees nose-up pitch on the attitude director, lifted off, then rapidly went through V_2 and hit the 150-knot initial climbing speed, while the vertical speed indicator (VSI) hovered around 3,500 fpm rate of climb.

continued

Plush, executive-configured cabin, entered via an airstair door near the flight deck, offers almost six-foot, walkaround headroom, refreshment bar and airline-size rest room.

In 10 minutes we were passing 28,000 feet and the VSI was still indicating more than 2,000 fpm. At FL290 we set up the recommended high-speed cruise, which at our weight meant a fuel flow of 980 lb/engine/hour.

The combined Mach meter/ASI showed M .76 (284 knots), which trued out to 460 knots (530 mph), some 15 knots better than book value.

We climbed to FL390 and set up the long-range cruise which is the one usually adopted by most operators. We exceeded 400 knots for a total fuel burn of 1,200 lb/hour—the same as the Viper engines use while taxiing at ground idle.

A power lever was then pulled back and the engine was shut down with hardly a trace of yaw, while we descended at a modest 300-500 fpm. At maximum weight, the single-engine ceiling is 25,000 feet and an engine relight can be made at 33,000 feet. On one engine the aircraft will cruise at 280 knots or more, according to the weight at the time.

The clean stall, preceded by a strong stick shaker, came at 98 knots, while application of 45° flap produced a break at 80 knots. There is not the slightest tendency for a wing to drop. In a dive not much happens until M .85 (well above the red line) when the ailerons begin to vibrate and things start to buzz as compressibility sets in. The airbrakes will effect a recovery within a few seconds.

The HS 125/700 is certainly among the nicest aircraft I have flown. The ailerons and elevators are nearly perfect, the trimmers nicely geared and, although rock hard at cruising speeds, the rudder is very effective at lower airspeeds. In any case, the auto-bias strut takes care of most of the engine-out problem. The new Collins autopilot/flight system is the best I have handled. There is even a "half-bank" feature to limit rates of turn (for use when the company president is suffering from brewer's twitch and like occasions).

Returning to Hatfield, Hawker Siddeley's home base just north of London, the ceiling was down to 900 feet with rain and reduced visibility below. I took the opportunity to try a manual ILS using the flight director but not the autopilot. Speed around the circuit was a gentle 160 knots and, notwithstanding some turbulence on the approach, the craft went straight down the glidepath. Final approach was at 107 knots (lower than some of the turboprops) and at these speeds the controls were lighter than many a smaller aircraft. All trim changes were minimal and I would have thought the electric elevator trim to be unnecessary. Indeed, previous models relied on manual trim only and I suppect some pandering to fashion here.

The threshold came up, I eased back on the elevators and brought back the power levers. There was a brief float then the main wheels made contact, the nosewheel lowered, lift dump glued us on and the powerful brakes had us stopped by the first turnoff point. A great aircraft for passengers and pilots alike.

Some 376 HS 125 models have been sold and, although the new 700-series has barely been shown, over 18 have been ordered worldwide. The airplane's beauty lies in the fact that the designers got the mix right in the first place; not too big, but not cramped; not a too-powerful guzzler, but not too slow; not a toy jet, but capable of operating out of relatively small airfields. And what a way to travel. □