FAIRCHILD 300

A Merlin by any other name

BY EDWARD G. TRIPP

PHOTOGRAPHY BY ART DAVIS

continued

The Merlin . . . (was) designed around our basic philosophy of matching pressurization to the altitude performance capabilities of the airplane. Our aim is to fill a void that existed for a light transport type airplane in the six to 10 place category that offers high performance and pressurized comfort up to 30,000 feet—an airplane that cruises between 250 and 300 miles per hour, yet still is able to use small airports with 2,000 to 2,500 foot runways, and that can be marketed in the $200,000 to $300,000 price category.

That is a quote from remarks made by Edward J. Swearingen Jr. in January 1965 to introduce the Merlin. Both the designer and the airplane are still active, even though both the man and the product, together with the company he had formed, have gone through many changes.

Swearingen got the airplane from first flight to certification in 15 months and made the first customer delivery three months later. That, in the current cycle of four-to-six year development cycles, is as amazing as the difference between the first retail price of $335,000 and the current version's $1,970,000 (both without avionics).

As the accompanying spotter's guide indicates, there have been almost as many changes to the Merlin in the ensuing 19 years as there have been to the value of our dollar. But the current version, the Fairchild 300, shares many common characteristics with the first Merlin. It is a round, tubular fuselage (round is best for pressurization according to the engineers) sitting on a wing; the fail-safe approach to structures is very much a part of both, as is flush riveting. Visually, the lineage is obvious.

The 300 is a development of the last

model called Merlin, the IIIC (model designation is SA227-TT), which was introduced in the fall of 1980. It had significant changes over previous models that improved operational flexibility and utility, maintainability and operating characteristics. It was also the first general aviation aircraft certificated to Special Federal Aviation Regulation (SFAR) 41. To oversimplify, this category provides a way to get around the ancient and arbitrary 12,500 pound maximum takeoff or gross weight limit that separates light aircraft from air transport category aircraft. For operators of approved aircraft, it expands operational options, providing increases in both payload and range. For the Merlin, it expanded the envelope by 730 pounds: maximum takeoff weight increased from 12,500 to 13,230 (maximum ramp weight is 13,330 pounds; maximum landing weight is 13,230 pounds).

The tradeoff for greater operational flexibility is more stringent standards for structures, systems, operations and crew qualification. Performance requirements for such parameters as balanced field length and single engine climb are more demanding. Fire protection standards are higher. For instance, fire detection and extinguishing systems must be installed in the engine compartments, and fire containment properties must be satisfactorily demonstrated (fire walls are stainless steel in the Merlin IIIC/300). Flammable fluid lines must be isolated from electrical sources. Interior materials must meet air carrier fire resistance standards.

Any aircraft operated at weights above 12,500 pounds requires the pilot in command to be type rated. Initially, Merlins that were operated under SFAR 41 required a two man crew, although they now are approved for single pilot operation.

In terms of structure and systems, the Merlins have reflected the design philosophies of heavy transports more than some other general aviation turboprops. In its current form, it includes a fail-safe primary structure, fail-safe structures at all critical load points, multiple spar webs and other features to ensure that, in the event of failure of or damage to any critical airframe element, structural integrity is maintained. The airframe has a safe life of 35,000 hours. Environmental and operational systems are dual throughout. The electrical system employs three buses.

The horizontal stabilizer is mounted well above the fuselage, basically a cruciform tail. It is pivoted near the rear spar, and the entire surface moves with pitch trim commands through electrically operated dual jack screws. There are visual and aural trim indicators in the cockpit. The pilot and copilot trim systems are separate.

The primary flight controls are actuated by directly linked push rods. The slotted flaps are hydraulically actuated and mechanically linked to preclude a split flap condition.

Earlier Merlins had a relatively slow, high-drag gear extension and retraction system that was gradually improved through several model changes. The IIIC introduced an improved system coupled with a new engine cowl design that greatly improved serviceability and access (the company claims that an engine can be disconnected and removed in less than 30 minutes without requiring rerigging after replacement). The new gear system operates more quickly. It also eliminated the high-drag door on the nose-

continued

wheel. The gear doors close after the gear is extended, which reduces drag and keeps snow and slush from accumulating in the gear wells.

Large, four blade, advanced airfoil section Dowty Rotol propellers were another new feature introduced on the Merlin IIIC.

Control harmony has not been the strongest suit of the Merlins. Lateral control required much higher force than pitch and yaw. This is one tradeoff for the direct, mechanical linkage that provides the solid feel and direct response to pilot input. Servo-action trim tabs were added to the IIIC to reduce the force. The Merlin yoke, by the way, looks like a refugee from a World War II bomber in terms of its herculean size, which provides greater leverage to the crew.

The IIIC also featured cockpit improvements, including flap preselect, self-locking gear handle, improved power control friction locks and upgraded lighting.

The obvious difference between the IIIC and the 300 are the winglets. According to a Fairchild spokesman, they reduce spanwise flow, therefore drag, and modestly improve climb—particularly single engine rate of climb—and high altitude cruise. They also permit lower approach speeds, which reduces the amount of runway required for landing.

The aircraft we flew for this article, N447SA, is being used in the certification effort. Final performance figures have not been verified, so any improvement over the IIIC cannot be quantified now. Certification, originally expected in October, 1983, is now expected this month.

There is a new power brake/antiskid system. The ailerons and control linkage have been further changed to improve lateral control. This includes shaping of the trailing edge of the aileron to provide aerodynamic assistance to pilot control inputs.

The 300 is to feature dual Collins EHSI-74 electronic horizontal situation indicators, which will enable the crew to select information from various instruments and display it directly in front of them. When we flew N447SA the equipment was not installed, and the flight control system was disconnected. The aircraft was scheduled to go to Collins headquarters in Cedar Rapids, Iowa, for completion of the avionics system certification, including

the APS-80T autopilot.

When certification is completed, the aircraft equipped price will be $2,409,670, including $36,000 in interior and airframe options (it is fitted with a continuous alchohol/water injection system to improve runway and weight performance during hot and high conditions). Avionics options total $403,660.

The 300 created quite a stir when it arrived at the ramp in Frederick, Maryland. It was flown by James R. Milner, who is a Fairchild engineering test pilot, accompanied by Phil Van Ostrand, a former AOPA employee and *AOPA Pilot* staff member who now works for Fairchild.

People tend to think of it as the little Merlin because of its longer brother, the Merlin IV/Metro, which is currently undergoing a transformation to the Fairchild 400. However, it is a big airplane that can carry two crew plus up to eight passengers. The cabin is normally configured for six. Excluding the cockpit, it is just under 17 and a half feet long and more than five feet wide.

Typical of this category of aircraft, it was fitted with a full set of amenities, from a Wulfsberg Flitefone, refreshment center and cabinetry to a lavatory complete with flushing biffy. There is a large baggage compartment aft (and there is a nose baggage bay outside of the pressure vessel).

The cockpit is high (both in headroom and distance above the ramp), wide and handsome. A distinctive feature of the 300 is the three-panel windshield. The left and right panels are electrically heated glass. Organization of instruments, controls and systems is good; while the 300 is a highly complex aircraft, learning your way about the cockpit is simple.

Speaking of learning, Fairchild offers crew and maintenance training through FlightSafety International at a facility co-located with the factory in San Antonio, Texas. Initial and recurrent training should be considered mandatory by any operator.

Milner took a few of us on a walk around inspection before flight that was a typical thorough, first flight of the day check. He pointed out some of the features that distinguish the 300, including the new shape of the trailing edge of the aileron. Access to all the points that need a going over, including dropping the gear doors to check inside the wells, is good.

Start and operation of the 900 shaft horsepower (shp) Garrett TPE331-IOU-503G engines is simplified by automatic start sequencing, fuel control and Single Red Line (SRL) computers. The SRL computer senses temperature from several sources, computes the combined value against engine temperature limits and works to limit pilot input from creating an overtemperature condition—and the attendant expense. A negative torque sensing system (NTS) is another feature of the powerplant. It senses differential torque between the engines and automatically moves the propeller on the affected engine toward feather in the event of power failure. Coupled with the rudder boost system that automatically inputs yaw force toward the operating engine, it greatly aids aircraft control in the event of engine failure. It is a no-go item.

When all works as it is designed to, crew workload from start to stop is low. You are more a monitor of automated processes than a link in the chain of operations.

The equipped empty weight of N447SA is 8,350 pounds. Ramp weight at start, with four on board and 2,000 pounds of fuel, was well below maximum for FAR 23 operation at approximately 11,200 pounds, and 2,130 pounds below the SFAR 41 limit.

Milner took some time to brief me on the hydraulically actuated nosewheel steering system before engine start, since there are two levels of authority, one used for maneuvering in tight spaces that permits greater degree of nosewheel deflection, and the other for normal taxiing and takeoff. Steering is operated through the rudder pedals; the high authority mode is selected by actuation of a switch on the pilot's side panel, the normal mode through a switch on the left engine condition lever. With a little practice, ground handling is easy. The system permits taxiing on one engine.

A stability augmentation system (SAS), including an angle of attack indicator and stick pusher, is part of the basic equipment. It increases stick forces at low airspeed, nominally below 135 KIAS, to artificially eliminate pitch sensitivity.

The check list is long, as you would expect for an aircraft of this type. Since I had not flown a Merlin of any sort for quite a while, it took a bit of time to perform the checks and get to the departure end of the runway. However, there is nothing remarkable about the procedures or sequence.

Our calculated rotation speed for the

weight and conditions was 100 knots, with initial climb speed at 116. Best twin engine climb speed was 142 KIAS; best single engine rate speed was 136. Calculated runway distance required was 2,200 feet, accelerate/stop 3,700 and accelerate/go to 50 feet 4,500.

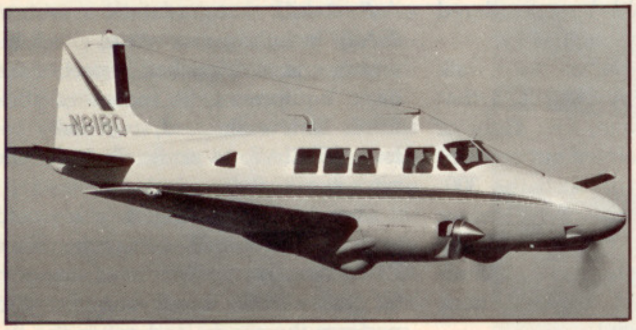
To say that acceleration was fast is an understatement. There is a marvelous rush provided by 1,800 shp. I released the brakes with about 60 percent power applied and had accelerated through 85 knots before the rest of it was in. Aerodynamic steering was available shortly after brake release. On the first takeoff, I rotated tentatively, which required more ground roll, but the 300 was off and flying before my brain was.

After we cleared the airport area, we

SPOTTER'S GUIDE

The appearance of a Swearingen turboprop on an airport ramp often gives rise to some confusion: Is it a Merlin or a Metro? Here is a simple way to tell the difference. Merlins are corporate aircraft; Metros are commuter aircraft. Following is the Swearingen aircraft lineage.

Swearingen Excalibur. The Excalibur, a modified Beechcraft Twin Bonanza, was introduced by Swearingen Aircraft in 1962. The airplane is powered by two 380-hp, geared, supercharged Lycoming engines with low-drag cowlings. According to company figures, the Excalibur's 75-percent power cruise speed at 13,500 feet is 226 knots.



Swearingen Queen Air 800. In 1964, Swearingen reengined the Beechcraft Queen Air with two 400-hp, non-supercharged Lycoming IO-720 eight-cylinder engines. Sixty-five-percent cruise speed at 10,000 feet is 195 knots. The Queen Air 800 still is produced by Excalibur Aviation in San Antonio, Texas.

Merlin IIA. In 1965, Swearingen Aircraft mated a new pressurized fuselage to a pair of Queen Air wings to create the Merlin. Designer Edward J. Swearingen originally intended to build two aircraft—the Merlin I with Lycoming TIGO-540 piston engines and the Merlin II with P&W turboprops. But plans for the Merlin I were scrapped when Lycoming said the delivery of the new TIGO-540s would be delayed a year. The prototype Merlin II was powered by 500-shp P & W PT6 turboprops. The Merlin IIA, introduced in 1966, has a 30-inch longer fuselage and is powered by 578-shp PT6s. Maximum cruise is 243 knots.

Merlin IIB. The Merlin moved up the power curve in 1968 when Swearingen gave the IIB 665-shp Garrett AiResearch TPE 331-1-151G engines. Cruise speed increased to 256 knots. Note the difference in engine cowlings.

Merlin III. The first all-Swearingen Merlin is the III. It has a Swearingen-designed wing and Swearingen-designed landing gear (Twin Bonanza gear had been used originally). The Merlin III's major distinguishing feature is its cruciform tail. The engine cowlings for the Merlin III's 840-shp Garrett engines also are configured differently, with the air intake at the top rather than at the bottom. The Merlin III is 24-and-one-half inches longer than the IIB. Maximum cruise speed is 274 knots.

accelerated to a cruise climb speed of 180 knots. Rate of climb averaged 2,000 fpm up through 16,500 feet, where we leveled off to try a variety of configuration changes, slow flight, missed approaches, simulated engine failure and stalls. It is a big, stable aircraft. Control forces are high, but the 300 maneuvers well. At the stall, the stick pusher wakes you up with a pronounced yank on your arms.

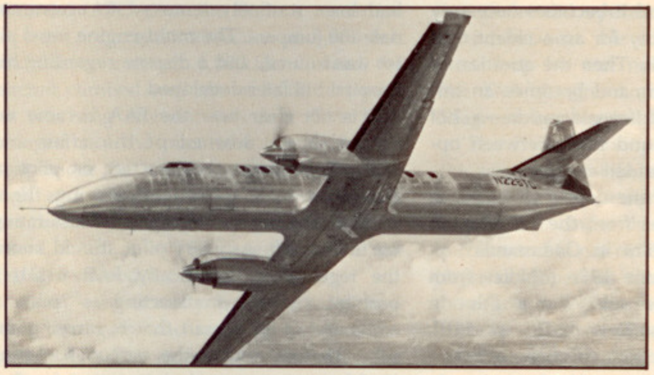
The only problem I had with it was caused by the different shape of the power levers. The left lever knob is a different shape and larger than the right. My lack of familiarity with the aircraft caused me regularly to apply differential thrust. When you do that with all the power available, and those large propellers, you know you have done something wrong. On one balked landing simulation, I thought initially that I had lost an engine. It is, as they say, an attention grabber.

After a simulated emergency descent, we went to Dulles to shoot approaches. There was a good mix of light and heavy traffic that day that resulted in approach giving us several runway changes and two go-arounds that provided realistic demonstrations of the 300's behavior in high-density, distracted conditions. It did well.

The return to Frederick involved another balked landing. On the second try, I intentionally set up an unstabilized final approach at just above minimum approach speed to see what it felt like. On short final, with full flaps, I again applied asymmetric power. Just as I was about to call a missed approach, Milner asked with a touch of nervousness: "Do you want a missed approach?" At that point, I sure did.

The next morning we flew a photo mission with N447SA, which provided another opportunity to sample relatively low speed, maneuvering characteristics, do some more takeoffs and landings and just nose around the airplane while *Pilot* creative director Art Davis was taking static shots. My offer to take it with me the next day on a business trip to the West Coast was for some reason rejected.

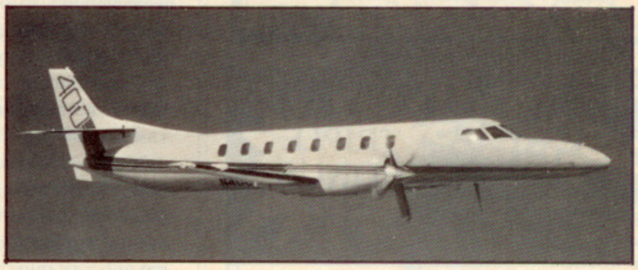
It would have been great to have had a chance to fly the 300 in the mission for which it was designed: long distance, high altitude cruising. Still air range at maximum cruise power at 26,000 feet is almost 2,200 nautical miles; true airspeed 275 knots. It is the right way to go cross country. □



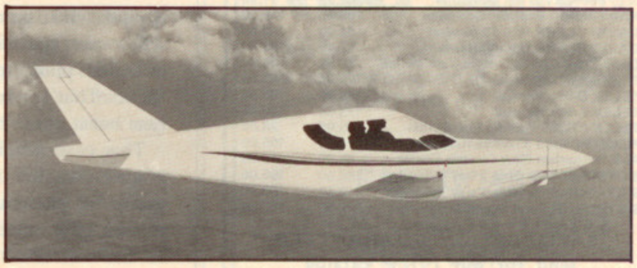
Swearingen Metro. A 19- to 20-passenger stretched version of the Merlin III was introduced in 1969. The Merlin IV, a corporate version of the Metro with luxo-interior for 11 to 15 passengers, was introduced the following year. The Metro was developed as a joint venture with Fairchild Hiller. In 1971, Swearingen Aircraft became a subsidiary of Fairchild.

Merlin IIIC. The Merlin IIIA and IIIB increased in power and weight until the 12,500-pound weight limit for aircraft certificated under Federal Aviation Regulation Part 23 was reached with the IIIB. The Merlin IIIC and Metro III were certificated under a new set of standards, Special Federal Aviation Regulations Part 41, which is more stringent than FAR Part 23 but less stringent than FAR Part 25, the regulation for transport aircraft. SFAR 41 allows gross weights of more than 12,500 pounds, but sets higher standards for single-engine performance and requires certain safety features, such as engine fire extinguishers. The pilot in command of an SFAR Part 41 certificated aircraft must have a type rating, and two pilots generally are required under these rules. (The aircraft can be operated under FAR Part 23 if gross weight is less than 12,500 pounds.) Most of the differences in the Merlin IIIC are not readily apparent to the eye. It has a maximum takeoff weight of 13,230 pounds and a maximum cruise of 300 knots.

Fairchild 300. Introduced in 1983, replacing the Merlin IIIC, the 300's major distinguishing feature is a new pair of winglets, designed to reduce spanwise airflow and drag. Garrett 900-shp engines supply the power. Maximum speed is 300 knots.



Fairchild 400. The 400, an updated Merlin IV, boasts 347-knot-plus speeds (400 mph) and is powered by two Garrett TPE 331-14 1,100-shp engines turning Dowty Rotol propellers. Certification is expected in late 1985.



Swearingen SX300. The SX300 is an aluminum kit-built airplane intended to be powered by a 300-hp Lycoming IO-540 engine. Projected cruise speed, according to Ed Swearingen, will be 239 knots at 75-percent power and 8,000 feet. First shipments are scheduled for mid-1984.

—J. Jefferson Miller