B/CA Analysis: Piper's Cheyenne 400LS

A two-stop, round-trip flight under typical operating conditions demonstrates the usefulness of the Cheyenne 400LS' high-stepping ways.

By John W. Olcott

Altitudes above FL 350 are no longer the sole province of jet aircraft. AM With its powerful Garrett TPE 331-14-801 turboprop powerplants and capable systems, Piper's Cheyenne 400LS operates quite comfortably at altitudes as high as 41,000 feet while achieving impressive speeds and fuel economy, as B/CA experienced recently.

When we flew the Cheyenne 400LS (see Cheyenne IV) about a year ago (B/CA, June 1984, page 36), the aircraft had yet to be certificated. Its aerodynamic and system configurations bad been frozen, but the test article we flew lacked some of the final touches that only come from exposing an aircraft to the discipline of the marketplace. Final performance figures were not available, the Garrett -14s were not adjusted to their final power specs and some of the avionics reflected the test environment that the aircraft had been experiencing rather than real-world business operations.

Thus, B/CA requested the opportunity to evaluate the Cheyenne 400LS on a typical mission in order to prepare this feature, now that most of the relevant performance data are available in the aircraft's operating manual.

Since the average business trip is about 80 to 90 minutes in duration, we selected a three-segment course that included some rather short legs: Lakeland, Florida to Savannah (253 nm), Savannah to Atlanta (186 nm) and Atlanta to Lakeland (361 nm). We wanted to determine if the Cheyenne's altitude capability was effective on typical trips or whether an operator could take advantage of the aircraft's higher operating altitudes only on longer flights and at lighter weights.

With four souls, about 60 pounds of baggage and 3,000 pounds of fuel on board, our ramp weight, as we cranked the No. 1 engine at Lakeland was 11,479 pounds, 656 pounds under the aircraft's certificated limit of 12,135 pounds and typical of a mission such as we were commencing. Had we not been content with a short hop to Savannah, our fuel load would have been sufficient for a flight of about 1,250 nm in four hours, plus a 45-minute reserve at 5,000 feet.

Start-up procedures for the powerful Cheyenne are uncomplicated. With the exception of those for the fuel pump, all push-to-activate switches in the pilot's overhead panel are in their proper position for starting if they are illuminated in green; since the panel-activated fuel pumps must be in the "run" position for start but are not highlighted in green until they are re-positioned to "auto" for normal operations, white lights initially annunciate the proper position for fuel pump switches. The fuel selectors are safely in their correct locations, provided the door covering them on the floor of the cockpit (between the pilot and copilot seats) can be closed.

The start sequence itself is fully automatic: Depress the start/enrich switch momentarily and monitor fuel flow, ignition, oil pressure, exhaust gas temperature and the fuel enrichment annunciator. When the engine rpm stabilizes at 65 percent and the fuel-pump switch has been placed in the "auto" Position and verification is made that the starter did indeed disengage, the start is complete.

Starts employing the aircraft's internal batteries in parallel are approved if the outside air temperature is above O°C; below that temperature Piper recommends use of either a ground power unit or a series start, in which the aircraft's dual nickel cadmium batteries are electrically aligned to provide greater voltage for starting the Garrett fixed-shaft turboprops. If a GPU is not used, the second engine must be started with the assistance of the generator from the operating engine.

Taxiing the Cheyenne 400LS is particularly easy on the brakes since operating the propellers in the "beta range" (the ground idle and feather positions) provides ample control over thrust and deceleration. Even reverse thrust is available should there be an unusual requirement to back into or out of a tight parking area, although such a procedure is not recommended. The wide-chord, 106-inch diameter Dowty Rotol props, which give the Cheyenne 400LS its responsive acceleration and deceleration to power changes, are constructed of carbon-fiber composite lades mounted on conventional aluminum hubs, and they rotate in opposite directions to eliminate the slipstream effect on directional control,

Handful of Goodies

With the capability of producing 3,290 thermodynamic horsepower from its two Garrett TPE 331-14 turboprop engines (each flat-rated to 1,000 shp), the 400LS might be suspected of being a handful in terms of power management. Such is not the case, however. In fact, the responsiveness of the -14s to movement of the power levers is gratifying and very easy to control. Small refinements in taxiing speed are accomplished quite easily; with proper anticipation, stopping usually requires no application of brakes.

Garrett and Piper have implemented a simple (and typical) scheme for power management. In the ground idle and feather positions, which collectively are referred to as the "beta range," the power levers command propeller blade angle. Propeller reverse is selected by pulling upward on the power levers, moving them over a "reverse gate" and then fully aft. Ground idle is achieved by moving the levers forward of that reverse gate, which corresponds to the point of minimum fuel flow for the engine's underspeed governor and zero thrust when the aircraft is not moving.

A second gate separates the ground-idle range (where limited power is available for taxiing) and flight idle, the minimum power that can be achieved in flight. The power levers can be moved without restriction from the ground-idle range into the flight range, but they must be pulled up and over the "flight-idle" gate in order to enter ground-idle. From flight-idle forward, the beta lights on the annunciator panel are extinguished, and the power levers establish fuel flow rather than controlling propeller pitch directly.

Pilots also will appreciate several features that are found on the TPE 331-14s, such as the engine's integrated engine computers (IEC) and negative torque sensing (NTS) system.

The IECs provide torque signals to the engine instruments and calculate exhaust gas temperature limits for each flight condition as well as during the starting sequence. Hence, this function automatically limits the maximum torque available to 100 percent up to the critical operation altitude, which is 21,500 feet. Above that level, the IECs compute the maximum allowable EGT and limit power so as not to exceed that redline value. While the limiting features of the IECs may be overpowered in certain circumstances and should not be considered as a substitute for exercising proper care during the application of power, they do provide a pilot with protection against inadvertently over-torquing or over-temping the big Garretts.

Each integrated engine computer also incorporates another useful feature, known as the "personality module," which stores relevant engine data for use in trend-monitoring equipment. When the appropriate switch on the pilot's over head panel is activated; the personality module automatically makes a complete record of engine data at that moment. About 20 records can be stored before those data must be transferred to storage outside the aircraft.

As an aid to single engine performance, the TPE 331-14 is equipped with a negative torque sensing (NTS) system. If an engine loses power in flight, the NTS system automatically begins to relieve the pressure of the oil that controls prop pitch, thereby allowing the prop blades to move toward their high-pitch stops and reducing their windmilling drag. This action of the NTS occurs in pulses as the engine's rpm decays, but the prop will not feather. The pilot must overtly select the feather position to stop the prop and obtain minimum drag.

While the NTS system does not provide all the advantages of autofeather, it eliminates the necessity to feather immediately after determining that an engine has failed during a critical phase of flight, such as right after takeoff. In essence, the NTS feature provides the pilot with more time to react, which always is welcome, even in an aircraft that offers the good single engine performance of the Cheyenne 400LS.

Impressive Climb

As we were awaiting our release for takeoff on Runway 05 at Lakeland, a VFR aircraft stopped behind us and reported ready. The tower requested that we taxi across the runway and wait there, which certainly was reasonable but forced us to accomplish a 180-degree turn on the relatively narrow taxiway that existed on the far side of Runway 05. With a little help from differential power and with full rudder (and perhaps a modicum of braking, at least initially), the task was completed with amazing ease.

Cheyenne 40OLS takeoffs are exhilarating. The aircraft has sufficient power to accelerate smartly, and the counter-rotating props combine with the aircraft's ample vertical tail to provide good tracking during the takeoff run. A pilot new to the Cheyenne 400LS should experience no difficulty maintaining directional control, even in a brisk crosswind.

We rapidly reached our V/VR speed of 105 knots, rotated to an attitude of about 10 degrees and climbed initially at a V2 of 125 KIAS. After experiencing the aircraft's impressive climb angle at V2, we established a normal climb speed of 138 KIAS. Visibility over the nose was very limited at V2 but was adequate at about 140 knots.

We reached our initial cruise altitude of FL 270 in just under 11 minutes after brake release, having consumed 196 pounds of fuel. When allowances were made for our weight and for temperatures ranging from 13 degrees above ISA at takeoff to about two degrees warmer than standard at our cruising altitude, both figures were within a whisker of predicted climb performance.

ATC cleared us to FL 290 within minutes after we established our cruise at FL 270, and we completed the 253 nm to Savannah at the higher altitude. Indicating 210 with an EGT of 580°C and a fuel flow of 690 pph, we trued out to 339 knots (according to our handy CR-5). We cannot say exactly how these observed values compared with the book numbers, since the Cheyenne 400LS's POH does not contain charts for 96-percent rpm, which we were using, but the specific range we achieved was better than predicted for maximum cruise power at 98-percent rpm for our conditions of altitude and temperature.

At these conditions of relatively high indicated airspeed for cruise, the cabin sound level ranged from 84 dBA at the left forward seat to 80.5 dBA at the farthest aft right seat, with the average for the passenger compartment being 82.5 dBA. Cockpit sound levels averaged about five decibels higher.

(Had we flown this leg at a higher altitude - say, FL 330 or even FL 370, which would have been quite practical for our weight, even with the relatively short distance between Lakeland and Savannah - we would have cruised somewhat slower but achieved even better specific range and perhaps a half dBA quieter cabin.)

The 400LS's handling qualities in cruise were good, and the Collins FCS-65 digital flight-control system functioned nicely after we had had our fun hand flying the aircraft. The 400LS we flew was also equipped with the Collins EHSI74 electronic horizontal situation indicator, which offered a good presentation even in the bright sunlight of our clear skies at altitude. We placed that instrument in its are mode, where waypoint information is superimposed on an arc segment of an expanded compass rose, and the point depicting the Savannah VOR quickly came into view under an extended mileage scale.

Our descent into Savannah was made at the indicated airspeed that corresponded to the barber pole, which initially was about 240 KIAS, but increased as we descended. Handling was good, even though the ailerons are a bit firm at that speed, as is appropriate for an executive transport, and the pressurization system easily kept pace with our descent of about 2,000 fpm.

Ten degrees of flaps were extended as we slowed to below 194 KIAS, and the gear was extended below 170 KIAS. Full flaps (30 degrees) can be lowered at 161 KIAS. Our approach speed as we lined up with Savannah International's Runway 09 was a comfortable 105 knots, slowing to about 100 as we crossed the threshold. With its wide gear and large prop area, the Cheyenne touched down smoothly and decelerated smartly as the power levers were moved into ground idle. Reverse will be unnecessary for most landings.

The flight from Florida had taken 55 minutes and had consumed 713 pounds of fuel from takeoff to touchdown.

After dropping off a passenger and accomplishing a very quick turnaround at Savannah, we departed for Atlanta's DeKalb-Peachtree Airport, which lies just north of the city center in the heart of one of the busiest U.S. hub airports. Our objective was to see how well the Cheyenne could use its altitude capability in the midst of all the high-performance traffic that is attracted to Atlanta as if Stone Mountain were a magnet.

Obvious Versatility

In spite of the short distance between these two Georgia cities - only 186 nm - we filed for and received FL 310. Taking advantage of the aircraft's reduced weight (about 10,650 pounds) and the fact that only B/CA staffers and the Piper check pilot were on board, we executed a maximum-effort takeoff, which was really fun considering our weight-to-power ratio was only about five to one — better than most World War II fighters. By the time we had reached the far end of Savannah's 7,001-foot Runway 18, we were about 2,000 feet above the ground.

We quickly were above FL 250 when ATC gave us a final altitude of FL 290 as we whisked toward Atlanta at nearly 330 KTAS. About the time we had listened to the ATIS information for DeKalb-Peachtree, Atlanta Center cleared us to FL 240 and we began the letdown with an altitude restriction of 11,000 feet at the Turbo Intersection, which lay 34 nm ahead of us at the time of the clearance. The 400LS had no problem descending to the required crossing altitude in the allotted distance, and we settled nicely into the flow of aircraft that besieged Atlanta.

Elapsed time for the flight, even with the maneuvering and vectors that are typical of fitting into PDK's pattern, was 46 minutes, and the fuel consumed was about 660 pounds, including the taxi fuel at SAV and PDK.

At DeKalb, we dropped off one of our riders and added sufficient fuel to bring our takeoff weight up to 10,600 pounds. Then we accepted a clearance back to Lakeland at FL 370 and had no problem reaching that altitude as we competed for airspace with the many jets that operate in and out of Atlanta. In fact, on one occasion we received preferential treatment because of the 400LS's impressive climb capability and were thus able to continue essentially without restriction to FL 370, where we achieved a speed of 327 TAS and used only 1,040 pounds of fuel to reach our destination in 1+25.

As demonstrated by our two-stop, round-trip flight and illustrated by the charts accompanying this article, the Cheyenne 400LS is a versatile aircraft that can put its altitude capability to good use in typical business applications. B/CA