Celebrating 50 Years

Howard 500: Bold End to an Era

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Howard Aero challenged Grumman to a duel, and lost, but not for want of mechanical brilliance.

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A half century ago, commercial jetliners were making their debut, but business aviation had yet to embrace turbine power. Big radial piston twins, mostly World War II-vintage transports, bombers, patrol planes and trainers converted for the carriage of executives, were then the mainstays of the business aviation fleet.

In the mid-1950s, however, Grumman Aircraft decided to challenge the long-standing piston paradigm by creating the Gulfstream, a clean-sheet, long-range, high-speed, pressurized turboprop intended to replace the lumbering converted warbirds used by companies as executive transports.

Powered by new 1,950-shp Rolls-Royce Dart turboprop engines, Grumman's Gulfstream would be able to climb to 30,000 feet and cruise as fast as 280 to 300 KTAS, which was 15,000 to 20,000 feet higher and 30 to 50 knots faster than most of the World War II vintage piston twins. At 250 KTAS, the Gulfstream could fly more than 2,000 nm with the smoothness and quiet only a turbine-powered aircraft could deliver.

Leroy Grumman threw down the gauntlet before everyone in the warbird conversion business when he launched the Gulfstream development program. Most conversion shops knew their business-as-usual days were numbered when they learned of Grumman's plans. But not all.

Durrell Unger "Dee" Howard of San Antonio, one of the most successful warbird conversions specialists, wasn't about to kowtow to Grumman. Howard had been quite successful converting surplus WWII Lockheed piston twins into executive ships, especially the PV-1 Ventura. He painstakingly updated Ventura systems, adding wet wing fuel tanks, stretching the fuselages by 48 inches, adding panoramic cabin windows, fitting more powerful engines and converting bomb bays to baggage compartments. He even offered a JATO package as an option. The result was the Super Ventura, an aircraft claimed to cruise at 260 KTAS and fly 1,800-plus miles.

Faced with the looming Gulfstream challenge and lacking Grumman's military-industrial war chest, Howard decided his best countermove would be to create a clean-sheet, higher-performance, pressurized variant of the Super Ventura.

The result was the Howard 500, an aircraft Howard promoted as flying faster and farther than Grumman's new business airplane. Moreover, its base price would be $565,000, or roughly half that of a finished Gulfstream. Howard believed that ended the contest, since he was sure no company would pay the $1 million for an executive airplane.

But Howard was both a perfectionist and piston engine purist. His craftsmanship was legendary. And so, too, were his manufacturing costs.

"I have a lot of respect for the Old Man. He tried to do everything in house, no matter what the cost. He was a man of his word," said Bulmaro "Cisco" Alarcón, Howard's shop foreman for nearly four decades.

Pressure on the Howard 500 development program increased sharply when Grumman earned CAR 4b transport category type certification for the turboprop Gulfstream in May 1959. The Howard 500 didn't even make its first flight until 1960. But Howard pressed on undeterred. He was determined to beat Grumman in the marketplace, regardless of its time advantage and his development costs.

"Dee also made the pitch that you couldn't get turbine fuel at general aviation airports. He also said that you couldn't load baggage in a GI (as the Gulfstream was later known) without a ladder and it couldn't operate from dirt strips," Ed Swearingen, a longtime Dee Howard collaborator, recalled for this article.

It would be another three long, market-losing years before the Howard 500 earned CAR 4b certification. But the Gulfstream's four-year head start was only one or the hurdles facing Howard's formidable piston flagship.

Along with the high costs associated with the manufacturing precision demanded by its creator, the Howard 500's systems complexity, maintenance-intensive piston engines and challenging handling characteristics, all factored into its competitive performance. Yes, the Gulfstream beat it into service, but more than that its ease of operation, mechanical reliability and relative simplicity of its systems were all well documented by the time the Howard finally entered operation. And the comparison was harsh.

Ultimately, Dee Howard only built 16 of what are arguably the most advanced piston twins ever put into production. They are works of mechanical art. Of the run, only two remain in airworthy condition today, and one of those garnered our careful, hands-on attention and appreciation.

Since the Howard 500 represents the pinnacle of business aviation's Big Piston era and its rejection the arrival of the For-Business Turbine era, we thought a review of Dee Howard's brilliant but failed classic appropriate for this issue.

Business & Commercial Aviation launched because its founders regarded the Gulfstream as the start of something new and important, the confirmation of a new important activity and community. Our 50th year celebration underscores the rightness of their prediction.

Still, what went before gave foundation for what followed. And the Howard 500 embodied magnificently the firmament upon which today's business aviation world now stands. So, quite appropriately, the remainder of this report considers in detail that which was and is the Howard 500, with the intent of exploring its brilliance and shortcomings for the transitional time in which it was created.

Structure and Systems

The overall aircraft essentially was built around an all-new, fail-safe, semi-monocoque construction pressure vessel having an overall length of 38.9 feet. The Howard 500, as a result, had a far different fuselage structure than Howard's earlier converted and stretched Lockheed PV-1 Ventura twins, which were unpressurized. The Howard 500 had a completely redesigned fuselage, with hoop frames spaced at about six inch intervals, double or triple channel reinforcements around the window cutouts and double-pane windows. Virtually all of the fuselage structure features flush riveting and butt-jointed skins to reduce drag. During CAR 4b transport category aircraft testing, the pressure vessel sailed through the 33 percent over-pressure tests.

Building the fuselage was labor-intensive, and therefore costly. Thousands of assembly hours were required to complete it, representing a large increase in manufacturing cost over the Super Ventura.

Three heated windscreen panels afford bird-strike resistance. Large opening weather windows on both sides provide excellent ventilation on the ground. The cabin has five 15- by-22.5-inch side windows. There also are pairs of small windows on each side of the lavatory to provide ambient light.

The outward opening main entry door, located at the left rear side of the fuselage, measures 2.8 feet wide by 4.9 feet tall. It's a vault-latch design and it's secured in place by nine pins and one bayonet latch. The conventional landing gear configuration provides the door with a conveniently low sill height, so most passengers don't need a boarding ladder. A single, 24.8-inch by 36-inch emergency exit, located adjacent to the forward divan, provides egress over the right wing.

The 592-square-foot wing, built in three sections, uses vintage NACA 23018 inboard and 23008 outboard airfoil sections, according to David Lednicer of Seattle-based Analytical Methods, Inc. It features three-spar construction, all of which pass through the pressure vessel above the cabin floor. Aspect ratio is 8.35:1, taper ratio is 4.59:1 and there is 6.25 degrees of dihedral.

Dee Howard designed a new wing center section for the aircraft, one with a wider span than that of the Lockheed PV-1, thereby moving the engines farther outboard to decrease cabin noise and also increasing internal volume to hold 1,200 pounds more fuel. The center section, built as an integral part of the fuselage structure, holds the engine nacelles and main landing gear. It also houses forward and aft wet wing fuel tanks, the two engine oil tanks and anti-detonation injection fluid and deice alcohol tanks. Float sensors in each of the wing fluid tanks provide level quantity indications in the cockpit.

The left and right outboard wing sections, attached to the newly designed center section, were carried over from the Lockheed PV-1. The changes further added to the cost of building the aircraft.

Aircraft systems are quite complex by current turbine business aircraft standards. The following synopsis is intended for our most ardent technocrats.

Fuel is contained in six wet wing tanks having a total capacity of 9,276 pounds. Each tank has its own over-wing refueling port. The center section's left- and right-side front tanks each hold 1,146 pounds and the left and right rear tanks each hold 1,302 pounds. The outboard wing sections each hold 2,190 pounds.

DC electric boost pumps provide 22-psi fuel pressure for engine starting and function as backups to the engine-driven fuel pumps. The boost pumps may have to be used in conjunction with the engine-driven pumps during high-altitude cruise to prevent pressure fluctuations. All main fuel system fuel boost pump functions are manually controlled.

The front inboard tanks are used for takeoff and landing. During cruise, the outboard tanks are selected next and finally fuel is consumed from the aft inboard tanks. If the aircraft is loaded close to aft c.g., the inboard aft tanks may be selected prior to using the outboard tanks.

To guard against inadvertent fuel starvation to an engine, an automatic auxiliary fuel system supplies fuel to the cross-side engine in the event that on-side fuel pressure drops to a minimum value, if the mixture control is positioned forward of idle cutoff. The auto crossfeed is manually reset by pressing a disarm button.

The main electrical system is 28 VDC, supplied by two engine-driven 300-amp, 30-VDC generators, feeding a parallel bus system with essential, left main and right main distribution buses. Bus-tie switches allow the main buses to be split during electrical emergencies. Normal engine ground idle is 800 rpm and the generators don't deliver enough power below 1,000 engine rpm to prevent draining the batteries. So it's advisable to limit ground operations without external power.

Twin nicad batteries were standard equipment when the aircraft originally was delivered, but most Howard 500 aircraft later were fitted with lead-acid replacements.

A wild-frequency 115-VAC alternator, fitted to the right engine, supplies power to heat the three bird strike-resistant windshield panels. Two 28-VDC to 115-VAC 400-Hz inverters, plus a standby instrument inverter, provide power to various components through essential, nonessential, generator and instrument buses. If the alternator fails, essential AC bus power can be used to heat the left windshield.

Virtually all the bus circuit breakers are mounted on an electrical panel behind the pilot's seat, providing ready access during electrical emergencies.

The 1,400-psi main hydraulic system, powered by left and right engine-driven pumps, provides power to operate the landing gear, wing flaps, wheel brakes, rudder boost and air-cycle machine ground cooling fan. An electrically driven aux pump, automatically activated if system pressure drops below 600 psi, can supply 1,000-psi hydraulic pressure to operate the landing gear, brakes and rudder boost system, plus serve as a backup to the main system.

Each essential hydraulically powered subsystem has additional backups. The landing gear, for example, has primary and auxiliary electrical circuits for the gear selector handle. The gear may be retracted or extended with either the main or aux hydraulic system, plus the gear system has a protected reservoir that assures adequate hydraulic fluid is available if a leak develops in the main system. The landing gear also may be released from the retracted position by using mechanical up-lock releases. And if the gear fails to lock down, a nitrogen blow-down bottle provides pressure to complete the process.

Similarly, the Goodyear wheel disc brakes have dual sets of three-puck actuators that prevent rupture of a single line from causing a brake failure. To actuate the brakes, the aux hydraulic pump provides a backup to the main hydraulic system, plus a nitrogen bottle provides emergency actuation pressure by means of left and right brake levers located on the overhead panel in the cockpit. Anti-skid is available if the brakes are being powered by either hydraulic system.

The rudder boost system is essential because of the otherwise excessive rudder pedal forces encountered during an engine failure on takeoff. Left- and right-side actuators, mechanically tied through the rudder linkage, provide two-stage boost. High boost is available below 139 KIAS and low boost kicks in above that speed. Rudder boost reduces pedal forces by 80 to 83 percent. A hydraulically powered artificial control feel system is operable above 104 KIAS, providing rudder pedal feedback in proportion to aerodynamic displacement of a yaw (beta angle) vane.

The other primary flight controls are manually actuated. The right aileron has a servo tab to reduce roll control effort. Notably, the NACA 23000-series wing's notorious stall characteristics required installation of an angle-of-attack actuated stick shaker.

The flaps are electrically controlled and hydraulically actuated. They are longtravel, slotted Fowler wing flaps, designed by Ed Swearingen and they have up, 14-degree takeoff/approach and 35-degree landing positions.

Hydraulic power also is used to drive the air-cycle machine (ACM) ground cooling fan. But that function is almost superfluous because the ACM is virtually ineffective at engine idle power settings on the ground.

An 88-hp compressor, mounted on the left engine accessory case, provides air for cabin pressurization and air-conditioning through the ACM. The stand-alone compressor is required because the engine superchargers are downstream of the fuel/air mixing in the carburetors, thus high-pressure induction air cannot be used for cabin pressurization as it is on current-generation, turbocharged, port-injected aircraft engines.

The ACM is virtually identical to the unit Lockheed fitted to the L-188 Electra, so it has plenty of cooling capacity once the left engine is operating at normal flight rpm. A 50,000 BTU gasoline-fueled heater, supplied from the right engine fuel system, provides supplemental heating when needed. It's mounted in a stainless-steel box in the belly for fire protection.

Pressurization differential is controlled by means of a conventional vacuum-powered control unit in the cockpit, controlling the actuation of aft normal and forward safety outflow valves. This aircraft also was fitted with an optional supplemental oxygen system with plug-in ports at each crew and passenger seating position.

Left and right engine-driven wet vacuum-and-pressure pumps provide pneumatic power for deice boot inflation and deflation, along with the copilot's flight instruments and pressurization controls. The left-side vacuum normally deflates the boots and supplies the pressurization controls. The right-side vacuum supplies the instruments. But a single vacuum pump can power the entire system when needed. Both pumps provide pressure to inflate the boots.

The aircraft has three-zone engine nacelle fire detection systems. Each engine has dual Freon fire extinguisher bottles. The gas-fired aux heater also has a fire detector and a CO2 fire bottle.

The aircraft is approved for flight into known icing. Deice boots are installed on the leading edges of the wings, vertical fins and horizontal tail. Methyl alcohol, contained in a 15-gallon wet-wing tank in the left center section, supplies fluid for prop and carburetor inlet deice. A similar, 17-gallon tank, housed in the right center wing section, holds a mixture of methyl alcohol and deionized water used for anti-detonation injection.

Heated air for carburetor anti-ice is supplied by cuffs and ducts on the engine exhaust pipes. Electrical power is used to heat the pitot probes and windshields.

Passenger Accommodations

The main cabin has a wide flat floor and slightly tapering width and height in the main seating areas. It has three seating sections, including a forward area with a 6.5-foot-long, three-place, side-facing divan on the right side and galley plus entertainment center on the left side. The center of the cabin has a four-seat club section with 19-inch-wide by 31.5-inch-long foldout worktables. The aft cabin has two forward facing chairs, but two additional aft-facing chairs may be installed to provide a second club-seat section.

Directly across from the left-side entry door, there is a hanging luggage area. There is sufficient room behind the aft-most passenger chairs for light carry-on luggage. Two doors on the left lower side of the fuselage provide access to a 100-cubic-foot, unpressurized, under-floor baggage compartment, capable of holding eight sets of golf clubs.

A large, full-width lavatory, aft of the main cabin, has a solid door for privacy. The compartment has small left- and right-side pairs of windows that admit ambient light, a large vanity mirror with lights, sink with running water and a forward-facing toilet. Headroom and available width in the lavatory is somewhat reduced because of the aft taper of the pressure vessel.

Each individual passenger chair can be reclined about 45 degrees. The seat backs are 22 inches tall and 18.5 inches wide at the base. However, there are no headrests. The seat bottoms are 17.5 inches wide at the front and 19 inches wide at the base. The seat cushions are 20 inches long, thereby providing good thigh support. Armrests measure 3.5 inches wide. Each chair has a pair of mini-jacks to accommodate stereo headphones to connect to either the audio/visual system or separate audio system. A 15-inch LCD TV atop the galley/entertainment center has both AV entertainment and nose-mounted video-cam inputs.

The galley has a top-accessed cold beverage compartment and various storage closets. The forward section houses DVD and CD players.

Serial number 105's custom interior was designed and completed by Mike Henderson Aviation, using a rugged Old West theme. The overhead panels are covered in sand-tone stretched wool and they're held in place with Velcro to permit easy removal and replacement for maintenance operations. The upper sidewall panels also are covered in sand-tone stretched wool and the lower sidewalls are covered in distressed leather.

Each of the individual passenger chairs is covered in heavy leather and the three-place forward divan is covered in brown-and-white Guernsey rawhide cow skin. Olive cut-pile wool carpet covers the floor and bottom sidewall kick panels.

Custom cabinetry, bulkheads and side ledge rails feature bird's-eye maple solid wood construction or veneer coverings, as appropriate.

Flight Characteristics

David Cummings, chief pilot of s.n. 105 for the past 15 years, has logged more than 6,000 hours in large multiengine piston aircraft and 1,800 hours in the Howard 500. He's also a licensed A&P and created a customized, FAA-approved, 100-hour interval maintenance inspection program for the aircraft. We haven't yet flown the Howard 500, so what follows is a summary of his experience flying and maintaining it.

For every flight hour, Cummings spends eight hours attending to the aircraft on the ground. Since it's a flying antique with complex systems, it demands constant attention. This is no gas-and-go airplane similar to most turbine business aircraft.

"I can teach anybody to fly it. The trick is maintaining it," Cummings explained. "You have to be part steamship captain and mechanic when you're on the road with it. Before you set out, you have to be confident you can bring it home."

The Howard 500, similar to most aircraft with large radial engines, consumes about one gallon of oil per engine per flight hour. Thus the oil tanks must be replenished to at least 25 gallons for flight. ADI and deice systems also must be refilled with deionized water and/or methyl alcohol, as required. Each of the six fuel tanks must be replenished through the over-wing refueling ports. All those chores are done atop the wing, so they're not menial tasks in inclement weather.

Other preflight tasks are straightforward, including draining the fuel sumps, checking tire and fire bottle pressures, and verifying no excessive hydraulic or oil leaks.

Starting the engines requires some art and some science. If the engines are not equipped with an electrically powered oil scavenging system, the starter motors are engaged for a 20 blade count to scavenge oil from the bottom cylinders, then mags are switched on, followed by priming until the engine fires. When the engine starts to idle, the mixture control is advanced part way to auto lean and the throttle is adjusted to hold about 800 rpm until oil pressure rises to the normal range. The AFM then calls for 1,000 rpm at idle. (Serial number 105 has an oil scavenging system, so the extensive prestart cranking and scavenging is not needed.) It takes several minutes for the engine temperatures to stabilize in the green arcs in cold weather. Only then may the pilot release the brakes for taxi. Engine idle is reduced to 800 rpm and the aircraft begins to roll because of the considerable residual thrust.

The Howard 500's tail wheel freely casters with the yoke full forward. And the aircraft has a considerable yaw axis polar moment of inertia. Think 17-ton yacht at mooring speeds. To start a turn, the pilot increases outside engine speed by 100 to 200 rpm and taps the inside brake pedal as necessary to achieve the desired turn radius. Halfway through the turn, the outside engine is retarded to idle and inside engine rpm is increased to slow and then stop the turn rate. There's no steering tiller on the left-side ledge because there's no way to steer the tail wheel directly.

As a result, it's very easy to wear out a set of brakes because differential power and braking are needed to keep the aircraft pointed in the desired direction at slow taxi speeds. Old pros taxi a little faster so that the rudders start to become effective for steerage. But being a 34,000-pound tail dragger, the aircraft can become directionally unstable on the ground quite quickly anytime it's in motion.

Pre-takeoff checklist chores are extensive. There are checks for prop governor, carburetor heat, high/low supercharger, prop auto feather, minimum power, magneto, generator and ADI. The takeoff checks are performed using a challenge/response protocol, leaving no chance of items being overlooked. The flaps are set to the 14 degrees takeoff/ approach position.

Once cleared for takeoff, the aircraft is aligned with the runway and the yoke is pulled back four inches, thereby locking the tail wheel. Holding the brakes, power is advanced to field barometric pressure and the ADI system is armed.

As power is advanced for takeoff, Cummings finds it necessary to advance the left engine MAP by as much as 20 inches to counter P factor. As speed increases and the tail lifts, the right engine throttle is matched to the left engine and both throttles are advanced to achieve 59.5 inches MAP, the maximum allowable takeoff power with 100LL fuel. Engine speed stabilizes at 2,800 rpm. Fuel flows are 3,120 pph.

The V1 decision speed at MTOW is 98 KIAS and V2 is 111 KIAS, which is also the speed for liftoff. Positive rotation at V1 is needed to fly the aircraft off the pavement. "She's a land-loving lady and you really have to pull her off the runway," Cummings said.

With a positive rate of climb, Cummings calls for gear up and METO power. The gear retract in only two to three seconds, aided by the slipstream. The copilot pulls back MAP to 48.5 inches and the props to 2,600 rpm. Fuel flow drops to 2,580 pph.

As speed increases through 139 KIAS, Cummings then calls for flaps up, ADI and auto feather off, along with "climb power." The copilot reduces MAP to 38 inches Hg and pulls back the props to 2,400 rpm. The boost pumps are switched off. Fuel flow drops to 1,100 to 1,150 pph.

When speed reaches 160 to 170 knots, Cummings increases pitch attitude to hold the speed, resulting in a 1,100- to 1,200-fpm rate of climb. Passing through 10,000 to 11,000 feet, he pulls back MAP about four inches Hg and shifts briskly to high blower. He then advances the throttles as needed to reestablish climb power. Normal cruise altitudes are FL 190 to FL 210, levels that are reached 20 to 25 minutes after takeoff depending upon ATC limitations.

"Above FL 210, wing performance really starts to roll off on you," Cummings explained. "You need to be light for it to fly well above that altitude." But at high cruise power settings, indicated airspeed is sufficient to ensure good handling qualities all the way up to FL 250, the aircraft's maximum certified cruising altitude.

Normal cruise is 260 to 265 KTAS, using 1,200 hp per side. This is achieved with 32.5 inches Hg MAP, 2,200 rpm and mixture leaned to achieve about a two-pound drop in brake mean effective pressure (BMEP), an indirect indication of engine power output derived by measuring reduction gear box torque. Fuel flow stabilizes at 1,134 pph.

"You can pull back the mixtures until you see a 12-pound drop in BMEP, but we've found that leads to cracked cylinders. Running on low-lead fuel, we still experience one cracked jug [cylinder] per engine at least once per 100 flight hours."

Cabin sound levels during cruise are relatively quiet for a prop aircraft, because of the 6.75-psid pressurization system, heavy acoustical insulation in the fuselage and relatively slow 990 prop rpm.

Descents must be planned carefully to avoid shock cooling the cylinders.

"We have 36 cylinders out there in 30° below temperatures," Cummings notes, adding, "Remember, I'm the same guy who has to change cracked cylinders."

MAP is reduced only about one to two inches for the descent. Using a 500-fpm rate of descent, true airspeed increases to more than 320 knots. That slows to 250 KTAS at lower altitudes.

The aircraft has so much momentum that Cummings likes to start final approach about 12 to 15 miles from the airport. Indicated airspeed at level off is about 220 KIAS. But with enough time at level altitude, he can gradually bleed that off to the 191 KIAS landing gear operating speed and then it can be used as a speed brake during descent on the glidepath. Approach flaps can be extended as fast as 202 KIAS, but they provide more lift than drag, so they don't help slow the aircraft appreciably.

Final approach is flown at 120 KIAS, with gear down and flaps at 14 degrees, using 24 to 25 inches Hg MAP and 2,200 rpm. When landing is assured, Cummings calls for full flaps and slows to 105 KIAS over the fence, using 21 to 22 inches MAP and 2,100 to 2,200 rpm and crisply rolling in plenty of nose-up trim to counter the nose-down pitching moment induced by full flap extension. He plans for a wheel landing, followed by a light touch on the brakes to check effectiveness and then he flies the tail down to touchdown.

"It's very easy to bounce it on wheel landing. And you really don't want to chop the power before you touch down because you lose elevator effectiveness."

After touchdown, the real fun begins. You have to fly the aircraft with full concentration until it slows to taxi speed, using lots of rudder inputs and a deft touch on the brakes. After you clear the runway, you watch it carefully every foot of the way until it's chocked on the ramp.

All this might make a GI pilot cringe. But Cummings says he loves the challenge of flying the Howard 500 and it's very well built. He admits, though, that it's tough to maintain and there's always something that needs fixing. Those attributes are typical of the high-performance piston twins that were mainstays of corporate flight departments before the advent of turbine-powered business aircraft.

Price and Value

Glance please at the accompanying Range/Payload Profile. We've compiled the data from the Howard 500 Aircraft Flight Manual and cruise performance records supplied by Cummings, s.n. 105's chief pilot and maintenance chief for the past 13 years.

Howard 500 buffs claim the aircraft can cruise as fast as 348 KTAS. Cummings, though, said that the high power settings required to achieve such speeds were never published in the flight manual. Operating at such power settings is a sure way to crack cylinders, already some of the most statistically fragile parts of the aircraft.

Some industry sources also claim the aircraft can fly as far as 1,800 nm at 282 KTAS. Cummings said that's possible, if you cruise using the 1,200-hp "12 BMEP drop" lean-of-peak power settings published in the AFM and step-climb the aircraft from FL 190 to FL 250 as weight decreases. But he also says such lean-of-peak power settings shorten cylinder life, an assertion many radial engine transport operators might contest.

Cummings claims that slightly richer "2 BMEP drop" power settings prolong cylinder life, but he admits that it costs some range. The aircraft normally cruises at 260 to 265 KTAS while burning 1,100 to 1,150 pph at FL 190 to FL 210. A recent ferry flight from Van Nuys, Calif., to Anoka, Minn., verified those numbers.

So, the Howard 500 wasn't really ever a match for the turboprop Gulfstream in terms of speed, range or cruise altitude, if Cummings' experience with the aircraft is a valid indicator. Even more importantly, the GI required a fraction of the maintenance of the Howard 500 and it had markedly better dispatch reliability because of its newer and simpler systems.

While the Howard 500 indeed was a mechanical marvel -- the "Gulfstream IV of its day," said Ed Swearingen, one of Dee Howard's longtime collaborators -- even Swearingen knew the aircraft was doomed from the beginning because of its piston engines, high maintenance costs and inferior dispatch reliability.

Ultimately the Gulfstream (which, with the Gulfstream II's arrival became known ever more as the GI) would outsell the Howard 500 by 12 to one. Now, you'll only occasionally see one of the last Howard 500s at Aeroshell Square at the

Experimental Aircraft Association's AirVenture. But you'll still see dozens of GIs working every day for their owners throughout the world, even though some are nearly five decades old.

"I finally told Dee I had to leave because the Turbine Age was here," Swearingen said. "I told him he would go broke," he recalled. And that's precisely what happened to Howard Aero less than three years after the Howard 500 was certified.