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OPTICA

Flying the Bugeye

BY STEVEN L. THOMPSON

The way the gentlemen responsible for bringing it into the world tell it, an airplane that looks like a flying termite is long overdue. After all, they say that there are at least 8,000 aircraft flying the world today that are used for ground observation and that "by far the most common are single-engine fixed-wing types designed, not for the observation role, but for going from one place to another." Hence, courtesy of a hurricane in Australia, a reeducated civil engineer, a smallish grant from Her Britannic Majesty, a largish dose of private enterprise and a lot of yellow paint, the Edgley Optica.

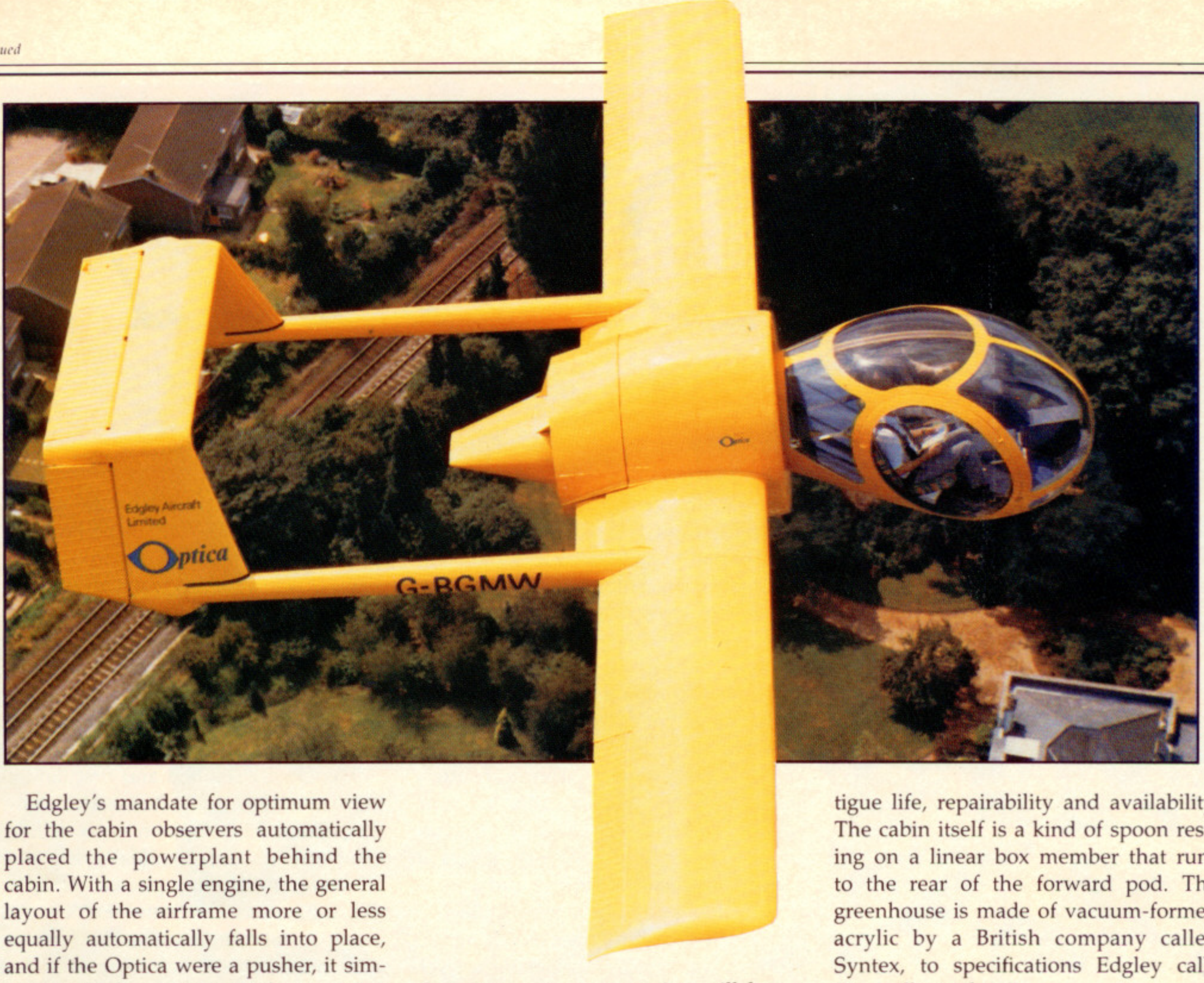
The paint defines the thing. It's yellow. Caterpillar tractor yellow. Forklift yellow. Hard-hat yellow. What this paint says about Mr. John K. Edgley's airplane is that it's a piece of equipment. Period. And where the paint stops in describing the Optica, Joint Managing Director William A. Fraser picks up the story.

Like most airplane companies, Edgley Aircraft Limited, of Old Sarum Airfield near Salisbury, Wiltshire, England, has a vast store of company lore. Unlike most, it's accumulated it in a very short time. According to Fraser, the idea for the Optica smote Chairman and Joint Managing Director Edgley when he was engaged as a civil engineer in Darwin, Australia, working to clean up the aftermath of a devastating hurricane. Edgley's task involved aerial damage surveying, which required that he hire a helicopter. As he rode around above the city, so the story goes, he made two pivotal observations: First, that in his capacity of civil engineer attempting to design roofs that wouldn't blow off in high winds, he actually was dealing in aerodynamics, and second that helicopters cost a lot of money to operate. What he saw in Australia evidently convinced him that a market existed for a purpose-built light observation aircraft of unusual design, because he did a preliminary market survey and then took a degree in aeronautical engineering from Imperial College in London to ensure that his intuitive notions could take wing from solid engineering ground.

The Optica resulted and first flew in public at the 1979 Paris Air Show. Subsequent development was in the capital-acquisition, manufacturing site-selection and staffing phases, until, by the 1983 Paris Air Show, Edgley was ready to take orders. On the opening day, there were 39, according to Fraser, and 60 days later, another 21. Considering that the airplane's British certification isn't expected until late in 1983, and considering that Edgley wants to limit production to about 100 aircraft per year, to have more than $5 million in orders before the first production aircraft is built is a remarkable demonstration that more than a few operators share Edgley's views on the overlapping shortcomings of helicopters and conventional fixed-wing observation aircraft.

As Government Sales Manager William J.S. Purbrick explained it, the mandate of fitting the airplane into this zone of mutual incompetence between helos and fixed-wings virtually designed the aircraft. Edgley knew he wanted ruggedness, system simplicity, economy, quietness and, above all, as unencumbered a groundview for the observers in the aircraft as possible. The Optica was not to be a cargo carrier, a STOL virtuoso, a high-altitude spy nor a fighter-bomber. And thus relieved of the burden of fulfilling roles with contradictory requirements, the resulting aircraft is far less radical than its bugeyed appearance suggests.

PHOTOGRAPHY COURTESY EDGLEY AIRCRAFT



Edgley's mandate for optimum view for the cabin observers automatically placed the powerplant behind the cabin. With a single engine, the general layout of the airframe more or less equally automatically falls into place, and if the Optica were a pusher, it simply would be a more modern version of a configuration typified by the Stearman Hammond Y of the 1930s, the Abrams Explorer of the 1940s and a host of even less well-known failures. What sets Edgley's design apart is that the Optica's engine—either a 200-hp Lycoming IO-360 or a 210-hp TIO-360—works as a ducted-fan tractor, by driving a five-bladed fixed-pitch wooden prop within the complex shroud that is the Optica's thorax.

Solving the practical problems that this design created is the real achievement of the Optica, but from Edgley's viewpoint, the alternative—a pusher—was beset by too many problems to be useful. Pushers are plagued by a host of irritants that limit component lives of engines, propellers and airframe pieces. Their chief drawbacks are noise and cooling, but even such mundane matters as exhaust routing loom large as the designer struggles to get the efflux away from the prop arc; left within that arc, the exhaust emissions increase noise and erode or corrode the prop itself. With a tractor arrangement, Edgley avoided all those problems.

Anyone who's ever had to do more than just peer at an engine will know that Edgley also created some problems with the ducted-fan design. Access to the engine is very important, especially under the field conditions the airplane will encounter if it is used as planned. Further, a look at the Optica's innards shows that Edgley had to be simultaneously clever and practical in laying out control runs. His solution to all this was to use modular thinking. As shown by the cutaway illustration (see p. 35), the entire engine can be demated and removed from the airframe by undoing a few bolts. There are, of course, access panels for routine maintenance chores, and David Lee, Edgley's maintenance chief, claims that even top-end service can be done on all cylinders except number one with the engine pod still installed.

With the exception of the cabin, the airframe that surrounds this clever engineering is pretty routine stuff and deliberately so. There is almost no composite material in the aircraft, the monocoque structure being virtually all-standard British L72 duralumin sheet, which Edgley compares to American 2014 T3 aluminum for fatigue life, repairability and availability. The cabin itself is a kind of spoon resting on a linear box member that runs to the rear of the forward pod. The greenhouse is made of vacuum-formed acrylic by a British company called Syntex, to specifications Edgley calls "optically perfect."

The aerodynamics that get all this airborne are as straightforward as the construction. Sprouting from either side of the thorax, the Optica's wings lift by way of a NASA GA(W)-1 airfoil —just like the Piper Tomahawk—and are augmented by electrically operated Fowler flaps outboard of the tail booms and slotted sections inboard. Surprisingly, company officials say that the shape of the cabin doesn't much affect the efficiency of the fan and that, after attempting to optimize airflow around the forward pod to the powerplant with designs that somewhat restricted the view of the observers, they realized that a helicopter-style cabin would not penalize efficiency and produced the current format. Sales Manager Purbrick said that in this process, as in matters affecting corporate graphics, Edgley's wife Fiona—who is an "internationally known fashion jewelry designer"—helped by pointing out to Edgley that an insect's eye is the optimum shape for wide-angle viewing. Corporate lore holds that the bugeye is the direct result of her observation.

Mrs. Edgley's touch is immediately

evident too when you swing wide the Optica's door and step inside. The seats are attributed to her, and, given the lack of solid walls within the greenhouse, the prototype's green-yellow-and-red striped seats dominate the interior. The pilot in command's station is at far left in the prototype, with another stick and rudders available to the center seat. The far right seat is an observer's station, and the panel is placed between the two pilots. Power controls, flap control and flap-position indicator are placed on an armrest between the pilots. Each seat has its own three-point shoulder harness, and a small storage bin lies behind the seats. In front is only a sloping deck and the world outside.

In his first few moments aboard the Optica, a pilot is bound to notice not the similarities to "conventional" aircraft, but the differences. During the 1983 Paris Air Show, I had the chance to fly the airplane with one of Edgley's two test pilots, Hugh O. Field, an RAF Wing Commander who also is chief of public relations for British Aerospace on the BAe 146 project and a former editor of *Flight International*. During our preflight walk-around, Field noted dryly that I would find the aircraft "just a bit different." As I strapped into the second pilot's position, it seemed like a classic bit of British understatement.

As Field and I sat on Le Bourget's ramp and went over the plan for our brief flight, we were part of the Optica's 850-pound useful load. We did not carry max fuel, so we would fly with less than the 60 gallons stored in the two leading-edge tanks (which Edgley's figures show to be virtually all usable). We were therefore far below the airplane's max ramp weight of 2,725 pounds—and, given the constraints imposed by the cabin layout, weight and balance would not be a problem. With the Optica's simple fixed gear, and the prototype's primitive "development" panel and simple electrical and fuel systems, start-up would be simple. It was.

The engine needed a little prime in the dank French morning, but lit off and steadied into an even idle at 1,000 rpm. As Edgley's promotional material had promised, the perceived noise in the cabin was far less than in a "conventional" aircraft equipped with a similar engine, and vibration was minimal. Edgley claims a loiter noise level of 65 dBA in the Optica, which is an almost incredible figure for a light airplane, given that a Lincoln Continental registers around 70 dBA at 70 mph on a smooth road. As I sat on the ground with the headset off, I wondered at the

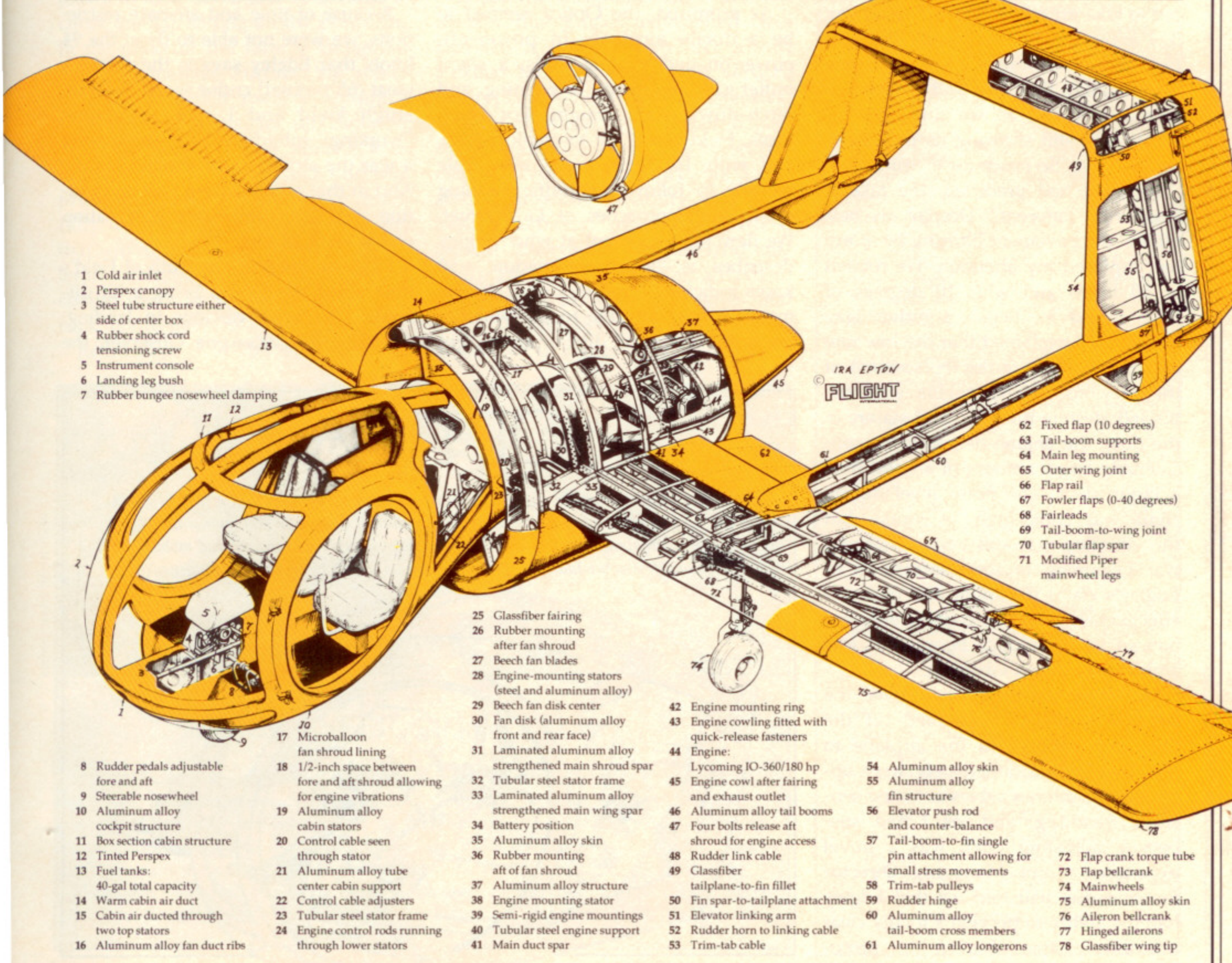


ILLUSTRATION BY IRA EPTON, COPYRIGHT FLIGHT INTERNATIONAL

continued

number, because while the noise was low, it was still enough to make low-voiced conversation out of the question. Further, its quality was that of a whirring whine rather than the flat staccato we usually associate with light singles; it reminded me of nothing so much as a massive ultralight.

The simile was reinforced by the view out the greenhouse. In the second pilot's chair I was in the center of the cabin, and even on the ground, the view was stunning. With effort I could see the wingtips, but the rest of the airplane was hidden. Only the doorframes, abbreviated deck and rear bulkhead restricted view. Because of the low ride height, we seemed to squat only three inches above the ground. So overwhelming is the impression of being suspended in space that I wondered how one got reliable pitch information in flight; all my usual visual cues were gone. As we taxied out to take off on Le Bourget's Runway 3, I realized that even using the attitude indicator wouldn't help; the one in G-BGMW that day had decided to take a rest and as we lined up for runup was still showing us in a steep turning dive. So much for instruments.

As Field had predicted, the takeoff was "a bit different." Despite my best efforts, the pavement blurring by at my feet captured my attention. We rotated at 50 knots and with 10 degrees of flaps dialed in, began a rather lazy climb. Field explained that the low rate of climb was due to the replacement of the previous 160-hp engine with the IO-360; despite the reworked stators in the duct, the engine demanded a considerably larger amount of air and thus a larger duct. The noise level during climb was fairly high, of course, but the vibration was still very low, and I was beginning to see the essence of Edgley's claim that pilot and observer effectiveness could be considerably enhanced in the Optica because of low ambient noise and vibration.

Stablilized in level flight over the suburbs of Paris, Field bled off the flaps and handed off the airplane to me. Two things immediately were apparent; the aileron cables defeated sensitive handling, and, as I had suspected, adjusting pitch was a novel experience. Joint Managing Director Fraser earlier had told me that Edgley had the ability to provide a totally clear greenhouse, free of even the prototype's doorframes, but that experiments had revealed excessive pilot disorientation—and I easily could believe it. After a few moments, peripheral clues became embedded for me, though, and I began experimenting with control responses and pressures.

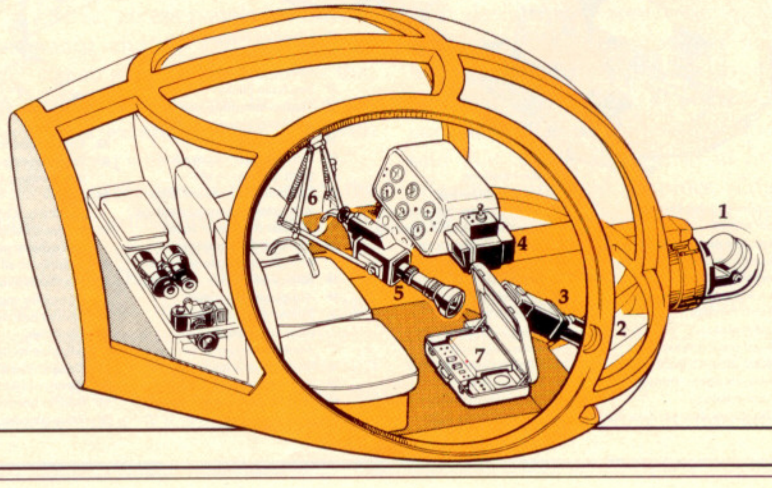
As promised, the Optica seemed to be a docile airplane. In power-off, power-on and turning stalls, a slight buffet gave me plenty of warning, and pitch-down was straight. For steep turns, Field asked me to crank in flap, and with 10 degrees, we were able handily to follow the traffic building up to the approaches of Le Bourget. We flew for a moment at what Edgley describes as "loiter observation"—50 knots indicated—and lacking a decibel meter, I was not able to tell whether the noise was at 65 dBA or above, but it was impressively quiet. Observation of the Optica at loiter from the ground drove home another oft-repeated company claim and that was that the airplane is also very quiet to those below. Not spy-plane quiet, perhaps, but markedly quieter than Wichita's offerings.

Because of time and airspace restrictions, we were not able to fly at the 94 knots that Edgley says is the Optica's ideal (65 percent) cruise speed. Instead, Hugh Field and I spent our time "working" suburban Paris, doing what it was the airplane was designed to do. And in that regime, there was no question that the company's observation claims were all true.

Likewise, though, the truth of Field's note about the Optica being a bit different was again obvious in landing. As with the Partenavia Observer, the

OPTICA

Configured for a personnel surveillance role, the Optica would mount a searchlight (1), a flat camera window in the nose (2) for the thermal imager (3) and its monitor (4), as well as a counterbalanced video camera (5), operator shoulder harness (6) and mobile tracking receiver (7). Also included in this configuration would be underwing loudspeakers.



effect of the clear view downward is to drive pilots to flare too high. Luckily, the Optica's gear was sturdy enough to take the "arrival" touchdown. And as odd as it may seem, the offset nosewheel has no real effect on ground handling; far more difficult to get used to—for me, anyway—was the "handbrake" style mainwheel braking lever. In his quest for system simplicity, Edgley discarded differential braking.

A brief flight over Paris does not constitute a rigorous test but even so, our post-mortem turned up some criticisms of the airplane, most of them ergonomic. Problems with power-quadrant design still plague the airplane; my feeling was that consolidation of the power controls, trim, flap and flap repeater all on the "armrest" between the pilots is an elegant engineering solution with too many real-world drawbacks. In flight, for instance, it is necessary to look down and backwards to check the flap setting on the prototype, in the midst of the turn, a vertigo-inducing maneuver. Further, the prototype's flap switch itself is simply a three-position toggle, for up, down or off. Company officials agreed with most of these criticisms and said that production aircraft will have more fully refined controls—refinements that will include replacement of the aileron cables with push rods, which should result in better feel and feedback, not to mention less control effort.

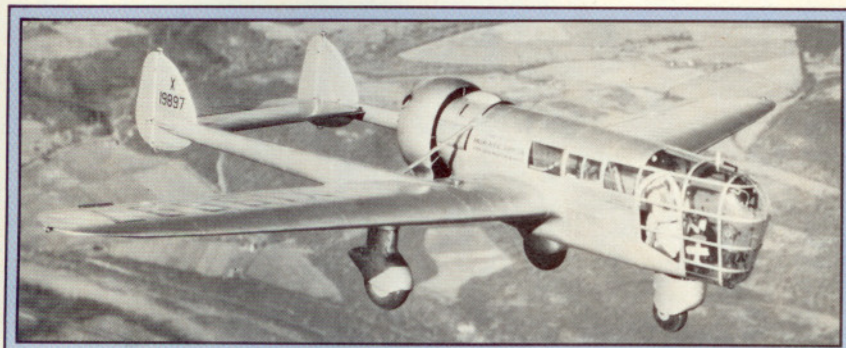
Refinement is in fact the word that best describes what the Optica needs, and Edgley Aircraft obviously knows it. The company is not seeking explosive growth and in its financial operations is mimicking the conservatism that marks the engineering of the airplane. The only government money in the company involves aid to purchase a British-made robot drilling machine, the rest of the company capital being entirely private. Joint Director Fraser came to Edgley as a financial analyst with broad experience—including aviation and work in the United States—and thus underscores the need for a cautious approach to marketing Edgley's bugeye. The strategy so far has been to sell to foreign markets through distributors, but the company plans to set up a subsidiary in the United States sometime during the winter of 1983-1984. American certification is targeted for "before April 1984."

Is this the cheap alternative to a helicopter that Edgley envisioned over Darwin a decade ago? At about $90,000 for a standard VFR version, the airplane is not exactly inexpensive, at least in initial cost. But if Edgley can make the airplane meet its claimed cruise endurance, its loiter ability, mission versatility and field maintainability, operators with a ground observation mission who currently are unable to find an aircraft to fill the gap between a Hughes 300 and a Cessna 185 soon may have an alternative to compromise. □

Edgley Optica
Base price $90,000

Specifications	
Powerplant	Lycoming IO-360, 200 hp @ 2,700 rpm
Recommended TBO	1,800 hr
Propeller	Edgley five-blade, fixed-pitch
Length	26 ft 9 in
Height	6 ft 4 in
Wingspan	39 ft 4 in
Wing area	170.5 sq ft
Wing loading	15.98 lb/sq ft
Power loading	13.62 lb/hp
Seats	3 abreast
Cabin length	8 ft
Cabin width	5 ft 6 in
Cabin height	4 ft 5 in
Empty weight	1,875 lb
Max ramp weight	2,725 lb
Gross weight	2,725 lb
Useful load	850 lb
Payload w/full fuel	490 lb
Fuel capacity, std	360 lb (360 lb usable) 60 gal (60 gal usable)
Oil capacity, ea engine	8 qt
Performance	
Takeoff distance, ground roll	650 ft
Rate of climb, sea level	720 fpm
Max level speed, sea level	109 kt
Cruise speed/Range w/45-min rsv, std fuel (fuel consumption, ea engine) @ 65% power, best economy sea level	94 kt/570 nm (54 pph/9 gph)
Service ceiling	14,000 ft
Landing distance, ground roll	850 ft
Limiting and Recommended Airspeeds	
Vne (Never exceed)	140 KIAS
Vs1 (Stall clean)	43 KIAS
Vso (Stall in landing configuration)	40 KIAS

Specifications listed above are based on Edgley Aircraft Limited's calculations of expected production-aircraft performance, based on certification testing with the Optica prototype, G-BGMW. For further information, contact Edgley Aircraft, Old Sarum Airfield, Salisbury, Wiltshire SP4 6BJ, England.



SMITHSONIAN INSTITUTION

SITESEER, 1938-STYLE

In 1938, ex-Navy pilot Talbert Abrams constructed the airplane that he figured would solve his photogrammetric problems. Called the Explorer, the three-place design was ultimately powered by a 450-hp Pratt & Whitney radial, which, combined with pressurization, gave the aircraft excellent altitude capability and 200-mph cruise speeds. Ironically, these are traits not possessed by the Optica, which shares some conceptual elements with the Explorer, but which, unlike the Explorer, has been ordered for series production. Abrams' aircraft flew four years on government survey duty, then was donated to the Smithsonian.