

PILOT REPORT:

Eurocopter EC175

by R. Randall Padfield

Eurocopter launched its medium-class EC175 four years ago at the Heli-Expo show in Houston, Texas, showing a fuselage mockup of the new helicopter. Last month, AIN editor-in-chief Randy Padfield had the opportunity to fly one of the EC175 prototypes at Eurocopter's main facility on Marseille Provence Airport in France. This is his report of that flight.

Alain Di Bianca, chief test pilot of the Eurocopter EC175 program, and Michel Oswald, flight engineer, made it clear to me before our demonstration flight in January that the aircraft we would be flying is a prototype, in fact, the first of two EC175 prototypes. Therefore, it is not fully compliant with the production EC175s, two of which are in final assembly at Eurocopter's Marignane, France facility. Certification of

the new model in its configuration for the oil and gas market is pegged for the end of this year.

Di Bianca and Oswald explained that several components of prototype PT1 are not representative of the production aircraft, and they warned me it might suffer some failures during the flight, particularly with the autopilot. This proved prophetic.

Then Di Bianca asked me to sign a document that released Eurocopter of all liability in case of an accident. "It is standard procedure for any non-Eurocopter pilots," he said. I signed without hesitation. The two prototypes had logged some 270 hours since the first one made its [initial flight](#) on Dec. 4, 2009. I was sure PT1, which had accrued 190 of these hours, was safe.

Earlier that day, EC175 marketing manager François de Bray told me the new model's main markets are the oil and

gas industry, search-and-rescue (SAR) and VIP transport, in that order, but the most important is oil and gas. SAR is a dual market, for stand-alone SAR operations and for oil-and-gas operators who need to provide quick-change SAR services for their customers.

A seven-metric-ton-class aircraft, the estimated 16,500-pound EC175 fills an empty niche in Eurocopter's product line between the Dauphin series (AS365N3+ and EC155B1) and the Super Puma series (AS332L1 and EC225). Its main competitors are the 14,000-pound AgustaWestland AW139 (in production) and 17,500-pound [AW189](#) (planned for first deliveries in 2014), as well as a new helicopter, which Bell is expected to launch here at Heli-Expo. One could also add the larger Super Puma and Sikorsky S-92, many of which

are already in the fleets of operators who constitute the EC175's target customers.

With these markets in mind and feedback from current Dauphin and Super Puma customers, Eurocopter engineers set about designing a medium-class offshore helicopter that could also perform SAR or be purpose-built for other missions, including VIP and law enforcement. Safety, comfort, reliability and performance better than current offerings were the main goals. Eurocopter has not publicly announced prices for the EC175.

Information Display

On our demo flight the safety aspect, particularly from the pilot's perspective, was evident from the engine start. The EC175 cockpit borrows heavily from the EC225, and includes several improvements and features to simplify the pilot's job while protecting the passengers, crew and components, particularly the single largest-cost item, the helicopter's Pratt & Whitney Canada PT6C-67E turboshaft engines.

Eurocopter is taking a bold step in how it presents information to the pilots. The goal is to reduce pilot workload by showing information about systems

EC175 Development and Certification

Eurocopter, a division of EADS (Booth J23), is developing the EC175 in cooperation with Avicopter, a subsidiary of Avic, in China. Avicopter is the sole-source provider of the fuselage. Eurocopter is the technical lead and systems integrator and has responsibility for the MGB, tail rotor, avionics, autopilot, hydraulic and electrical systems, doors and windows.

Avicopter's version of the helicopter is the [Z-15](#), which is being produced by Avic's Harbin Aviation Industry Group (Haig). Haig is responsible for the airframe, tail and intermediate gearboxes, main rotor, fuel system, flight controls and landing gear.

Eurocopter expects to obtain EASA certification for the EC175 before the end of this year and deliver the first aircraft to the launch customer soon after.



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Alain Di Bianca, chief test pilot for the Eurocopter EC175. The two prototypes of the helicopter have more than 270 flight hours.

only when they warrant attention, and in a graphically clear manner. This is made possible by providing a greater degree of automatic control by the aircraft's many systems, primarily the avionics, autopilots and full-authority digital engine controls (Fadecs). If you want a fictional example, think of Hal in the book and movie *2001: A Space Odyssey*, but in a nicer way. Eurocopter calls this new system Helionix.

Take the oil and hydraulic



F-WWPB is the first EC175 prototype (PT1). The medium twin features a new-generation Spheriflex five-blade main rotor and three-blade tail rotor.

PHOTOS: ERIC RAZE/EUROCOPTER



(L to r) Alain Di Bianca, EC175 test pilot, Michel Oswald, flight engineer, Francois de Bray (standing), EC175 marketing manager, Mickael Melaye, senior operational marketing manager (oil and gas applications), and the author. Left, the flight engineer's console, behind the copilot, takes up a large part of PT1's passenger cabin.

temperatures and pressures as an example. None of these, except when misbehaving, is shown on the multifunction displays (MFDs), called "flight navigation displays" (FNDs), in front of each pilot, because the FNDs show all the parameters required for flight management, but only these parameters. However, the non-critical information is available for the pilots to view on the vehicle management display (VMD) page on a second MFD in front of each pilot, which is used during most of the flight as a mission display. This MFD also displays a digital map, helicopter terrain awareness and warning system (H-Taws), forward-looking infrared (Flir) and electronic flight bag.

All systems' parameters are constantly monitored by the Helionix system. If the main gearbox (MGB) oil pressure decreases, for example, an alert appears in the "Master List" at the bottom of the FND. This Master List color-codes items by severity and lists them by priority. If the severity of the condition warrants a red alert, an

automated voice announces the warning to the pilots. The MGB, by the way, has already proved it can run for more than 30 minutes after losing lubrication.

Redundancy in the Helionix system works such that pilots can access all information on a single monitor, if need be.

Helionix goes beyond the way information is displayed (or not) and uses the dual flight management system (FMS) with GPS, four-axis automatic flight control system (AFCS, from the EC225) and dual-channel Fadecs to provide flight-envelope protection as well. H-Taws and Tcas II (traffic alert collision avoidance system) are also included. A complete rendering of this philosophy as it applies to the EC175 would require a much longer article, but a few examples will show how it is applied.

The VMD page is used for engine start. During the start, the dual redundant Fadecs keep engine rpm and temperature within limits, and shut down the engine automatically if necessary. Engine starts are done with the rotor brake off, so the rotor begins to turn as soon as an

engine speeds up enough to turn the connection to the MGB. The pilots need only monitor the VMD page for any warnings as the engine and rotor speeds increase to idle. For the rest of the flight, the VMD page stays out of view and the secondary MFD is used to display multiple mission functions, including digital map, H-Taws, Flir, electronic flight bag and more.

For our engine start, Di Bianca demonstrated use of the optional "declutch" feature that is available for the left (number-one) engine only. The design objective is to provide electrical power without adding the cost and weight of an aircraft auxiliary power unit or the need to engage the MGB and turn the rotors when an external power unit is unavailable. One of the main reasons to have electrical power is to run the displays, hydraulics and radios and the heater or air conditioner for either the cockpit or the cabin. Interestingly, the customer must choose which one when selecting this option. SAR operators may want the cockpit heated or cooled, while VIP aircraft operators would probably select the cabin.

Before starting the left engine, the crew must select the declutch switch. Then the engine is started, but it remains declutched from the MGB, turning only a generator, and the rotors don't move. When it is time to go, the pilot starts the right engine, which engages

EC175 Dimensions and Weights

Fuselage width	7.4 ft (2.25 m)
Main rotor diameter	48.6 ft (14.8 m)
Length from main rotor tip to tail rotor tip	59.3 ft (18.06 m)
Height from ground to top of tail rotor	7.5 ft (5.34 m)
Clearance from ground to tail rotor	17.5 ft (2.3 m)
Clearance from ground to bottom of fuselage	1.3 ft (0.4 m)
Cabin	Length: 12.8 ft (3.9 m)
	Width: 7 ft (2.13 m)
	Height: 4.6 ft (1.4 m)
	Volume: 434 cu ft (12.3 cu m)
Cargo compartment volume	95.3 cu ft (2.7 cu m)
Approximate maximum weight	16,500 lb (7.5 metric tons)
Maximum fuel	4,660 lb (2,590 liters) gravity refueling
	4,710 lb (2,710 liters) pressure refueling
External cargo hook limit	6,600 lb (3,000 kg)

EC175 Performance and Maintenance

Maximum speed (Vne)	175 kts	
Best range speed	140 kts	
Best endurance speed	Not yet defined	
Radius of action, offshore configuration	6 pax	135 nm
	18 pax	100 nm
	12 pax	190 nm
Engines (two)	P&WC PT6C-67E, with dual-channel Fadec	
Maximum power	about 2,000 shp each	
Power ratings	OEI 30 seconds, OEI 2 minutes, MTOP allowed 50 minutes	
Estimated fuel consumption	1,035 pph (470 kph)	
Engine TBO	5,000 hours	
MGB TBO	5,000 hours	
Main and tail rotors	“on condition”	

EC175 Additional Features

- New-generation Spheriflex, five-blade main rotor
- New-generation Spheriflex, three-blade tail rotor
- Five-tank fuel system complying with latest crashworthiness requirements
- 18-person life rafts and personal locator beacons in the steps
- Automatically deployable emergency locator transmitter (floating) on tail boom
- Emergency locator transmitter in cockpit next to copilot
- Emergency flotation certified to sea state 6
- Cockpit video camera
- Tail-fin video camera showing on MFD in cockpit
- Ice-protection development to come in 2012

the MGB and turns the rotors. The Fadecs bring the rotor rpm to idle. After the pilot switches off the declutch switch, the Fadecs gently accelerate the left engine so it engages the MGB as the power turbine speed (NF) increases to idle.

After the start, Di Bianca taxied PT1 from the Eurocopter ramp on Marseilles Provence Airport, which held several other helicopters awaiting test flights or delivery, to a spot where we could hover. Oswald was sitting behind me at a flight-test console in the cabin, just behind the copilot's seat. In this position, he could see Di Bianca in the pilot's seat, but would

have to look around the console to see me. Flight-test equipment filled much of the rest of the prototype's cabin.

The EC175 was designed to accommodate 16 passengers for oil and gas operations. With this number of passengers, the helicopter has a radius of action of 135 nm. Eurocopter recently introduced an 18-seat cabin configuration, which cuts the radius of action to 100 nm.

The cabin length, from the back of the pilots' seats to the beginning of the shelf that defines the storage compartment, is 12.8 feet (3.9 meters); the height of the cabin is 4.6

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feet (1.4 meters) and its width is 7 feet (2.13 meters). In both the 16- and 18-seat configurations, most seats face forward, except for the front row, which faces back to make club seating with the first and second rows.

No passenger is more than one seat away from an egress door or window, all of which pop out. The seats comply with the latest crashworthy requirements. Eurocopter officials said the size of the storage area had been checked by filling it with 18 bags of the size typically carried by offshore oil workers.

With the autopilots in the three-axis mode (Eurocopter uses “autopilot” interchangeably with “AFCS”), Di Bianca showed how one can hover just about hands off, at least in the no-wind condition we had at the moment. Then he made a standard takeoff and climbed to the northeast. In cruise flight, Helionix holds rotor rpm at 97 percent when below 1,000 feet agl to reduce the 175’s noise footprint.

In the area of flight-envelope protection, Helionix safeguards the engines and MGB in both all-engines operating (AEO) and one-engine inoperative



PHOTOS: ERIC RAZE/EUROCOPTER



Helionix places two interchangeable, multifunction displays in front of each pilot. Eurocopter kept a caution/warning panel in the center to ease the EC175’s certification. The instruments above the glare shield are for flight testing only. Right, pilots can control many Helionix functions using the cyclic.



(OEI) conditions. The Pratt turboshafts have three OEI ratings, including “super emergency power,” which is the 30-second OEI rating. So if one engine had failed on our take-off, the AFCS would have put the aircraft into the correct attitude to obtain and hold V_Y (the optimum OEI speed) and the Fades would have increased the engine power to the 30-second OEI rating. If needed, the pilot could pull the collective past maximum power. Everything would have been clearly annunciated in the “Master List” on the FND and audio warnings provided.

During normal flight and with the autopilots in the three-axis mode, Helionix maintains airspeed between 60 knots and V_{NE} and will automatically activate control of the collective axis (thus adding the fourth axis) when airspeed decreases to 60 knots. In addition, protection from controlled flight into terrain (CFIT) is facilitated by automatic engagement of altitude hold when the helicopter descends to 200 feet above the ground and airspeed hold maintains 65 knots. And at low forward airspeeds and in hover, Helionix limits vertical descent to 300 feet per minute as a way to avoid settling with power (also known as vortex ring state).

When we reached a safe

practice area, Di Bianca demonstrated another example of the EC175’s flight-envelope protection. Eurocopter has designed the helicopter to be flown hands off using four-axis autopilot control, but pilots can also easily fly it without engaging any of the autopilot’s higher hold functions (altitude, heading, navigation, airspeed, glideslope and so on). Regardless of the autopilot modes engaged, if the 175 enters into a flight attitude in which the pilot feels unsafe, he or she can depress a designated button on the cyclic twice in quick succession and the autopilot will immediately take control to level the helicopter and hold heading, altitude and airspeed steady.

Di Bianca did this during a climbing right turn that skimmed the bottom of a ragged overcast. Then he let me try the function while in a descending left turn. In both examples, the AFCS took control immediately and we were quickly flying straight, level and safely. Sweet.

However, shortly after this demonstration, both autopilots



When opened, the sliding cabin doors do not block the baggage compartment doors on each side of the EC175, nor the pressure refueling port on the right side. All windows qualify for emergency egress by occupants.



dropped off line. I was still flying. Di Bianca noted the advisory messages on the NFD and said something in French to Oswald. I was still getting comfortable with both the cockpit displays and feel of the aircraft, which did seem a bit touchier than before, but not alarmingly so. Then I saw the indication about the autopilots. Di Bianca called this a “degraded SAS mode,” because the prototype has a rudimentary stability

augmentation system instead of the more capable back-up autopilot of the production aircraft. Nevertheless, PT1 still seemed fairly stable to me, about the same as flying a typical SAS in a light helicopter.

At that point in the flight I had maybe 15 minutes of stick time in the aircraft, so I half expected Di Bianca to take control. This was a dual autopilot failure, after all. But he let me continue

flying all the way to touchdown at Aix les Milles, a small general aviation airport about 10 minutes away. After we landed, he tried resetting the two autopilots again, but only the number-one system came on. However, only one system is needed to engage the higher AP functions, had we wanted to use them.

Hovering did seem more stable with the autopilot back on. I did pedal turns in both directions and Di Bianca showed a max-rate pedal turn, which was much beyond passenger comfort, as well as my own. He demonstrated 50-knot sideways flight down an empty taxiway, after which I did the same at a much slower speed, adding a couple of 360-degree hovering turns as we glided back to takeoff spot. There was no wind, so I did not have to contend with cross and tail winds. I was quickly becoming comfortable with this helicopter.

I asked to see an out-of-ground-effect hover at 1,000 feet, thinking I’d take off, climb and then slow to zero airspeed. But Di Bianca took over, got clearance from the tower and quickly climbed straight up to 1,000 feet. From our high perch, I could not detect any drift over the ground. Granted, the helicopter was well below the prototype’s max takeoff weight of about 7.5 metric tons (16,500 pounds). We had taken off weighing just under seven



Eurocopter recommends that pilots elevate their seats in the EC175 to provide the best possible field of vision over the glare shield. The placement and size of the Helionix multifunction displays facilitate a good cross check from this position.

tons and flown for about 45 to 50 minutes, which gave us a weight of about 14,500 pounds. So we were medium weight, but that vertical climb was impressive nonetheless.

Di Bianca gave the controls back to me. I nudged the cyclic forward and lowered collective to gain airspeed in a dive. I was hard pressed to feel any change in vibrations as the aircraft moved through translational lift, and was reminded that I had not noticed an increase in vibrations on my approach to a hover at Aix les Milles either.

De Bray, the marketing manager, had said earlier that the EC155’s vibration level was the engineers’ benchmark for the 175. I have not flown that model, but Di Bianca claimed that customer pilots who have flown both agreed that the vibration levels of the two models are similar. Because vibration has been optimized at the source, using the MGB mounts and a torque-absorbing, flexible mounting plate inherited from the Super Puma, the 175 does not need an active-vibration control system, as many other helicopters do, de Bray had said.

As I flew back to Marseille Provence Airport, we passed over an uninhabited plateau. Di Bianca took the controls again, banked steeply, allowed the nose to drop and did a reasonable imitation of a strafing run before he banked into a hard right turn, pulling some more gs. Test pilots are fun to fly with. Some hikers below looked up and waved. Eurocopter, with around 8,500 employees in the area, is apparently well liked around Marseille.

The control tower directed us into the pattern behind an airliner as we flew over the Etang de Berre, a large, freshwater lake into which Runway 13L/31R protrudes. I made the approach and then ended at about 50 knots in a high hover-taxi down the 11,483-foot runway until I turned into the taxiway that fronts the Eurocopter facility. Our photographer waited

near the landing pad, so I made the touchdown as carefully as I could. The EC175 lifts off slightly nose up, with the right wheel coming up just before the left one, so when landing, the left wheel touches down first, just before the right one, and then the nosewheel.

Di Bianca had taxied out for our takeoff from Marseille, so this was my first chance to ground taxi. Under his instruction, I held the cyclic in a neutral position and pulled an inch or two of collective to get us rolling. Gentle application of tail rotor pedals kept us in the right direction and the brakes worked equally well. Ground taxiing the Super Puma can be a real bear, but the 175 was a piece of cake.

The new model’s landing gear, by the way, retracts such that it still hangs low enough below the fuselage to permit a landing without the bottom of the fuselage touching the ground, a customer request, Mickael Melaye, operational marketing manager, had said during another briefing earlier in the day.

Shutdown went so quickly I almost missed it. I saw that Di Bianca had engaged the rotor brake only after I saw the main rotor blades slowing. Our one-hour, five-minute flight was over. □



The EC-175s wide footprint gives it good stability during ground taxi. The landing gear retracts only partially up, so that the helicopter could be landed gear-up without the fuselage touching the ground.



ABOUT THE AUTHOR

Randy Padfield, AIN’s Editor-in-Chief, has some 9,000 hours flying helicopters in USAF rescue, North Sea offshore, Part 135 and corporate operations.