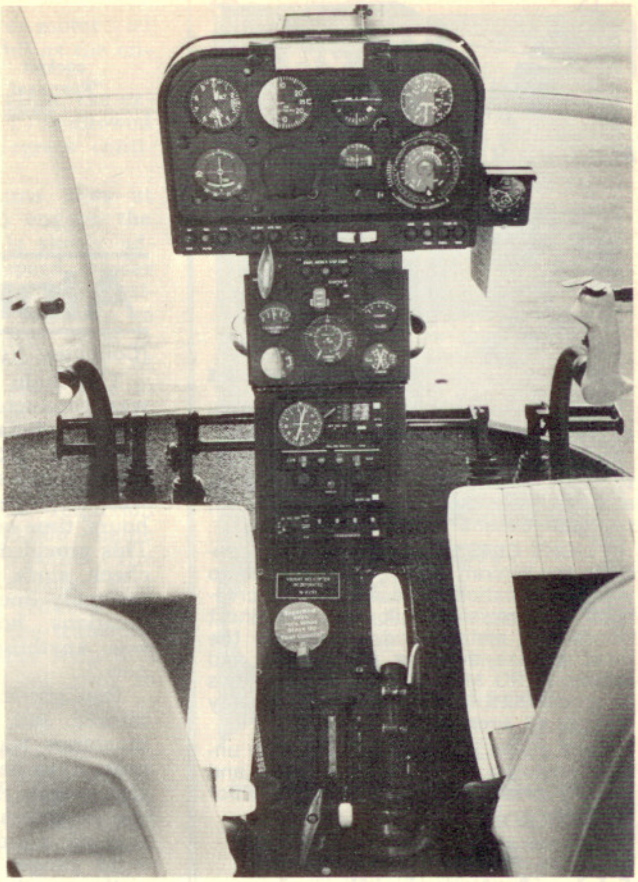
Pilot Flight Check:

Alouette III Helicopter

'A truly outstanding helicopter,' says evaluator. Entire rotor system turns in direction opposite to those in American-built helicopters, but no problem in adapting

by ROBERT W. SWEAZEY / AOPA 387609



All photos by author, except as noted

The European-built Alouette III boasts a unique instrument, called a "power computer" (top panel, second row, on the right under airspeed indicator). It has a circular computer that, "with one setting," allows pilot to determine density altitude, percentage of collective pitch that will result in maximum allowable power, and maximum allowable gross weight.

Assume you are an experienced helicopter pilot with a considerable number of hours logged, but all of them in American-made rotorcraft. Through training and experience, you will have acquired the knowledge that whenever collective pitch is increased, an increase in power is necessary. To compensate for the increase in torque created by the addition of engine power, you also will have learned that you must push on the left pedal. Conversely, if collective pitch is reduced, then compensation must be made to the tail rotor by pushing on the right pedal.

But now consider the European-built Alouette III helicopter, which is built so that the entire rotor system turns in a direction *opposite* to that of American-made helicopters.

Question: If you try to fly the Alouette III and its "backward" rotor system, will your finely honed American experience—"add power, push left pedal; reduce power, push right pedal"—cause a problem? None whatsoever. At least that's the conclusion I reached after recently flight-checking the Alouette III for THE PILOT.

I really shouldn't have been too surprised though. After all, a helicopter pilot, no matter what he's been flying, is accustomed to using whichever pedal is necessary to keep the heading under control. Due to this almost ingrained response, when the pilot flies the Alouette III he finds himself almost automatically adapting to the reversed pedal configuration.

The Alouette III is built by Aerospatiale, the French aerospace conglomerate that also builds, among other things, the Rallye lightplane series and the upcoming Corvette SN-600 business jet. Vought Helicopter, Inc., a wholly-owned subsidiary of LTV Aerospace Corporation, distributes and markets the Alouette III, along with four other Aerospatiale helicopter models, in North America.

The seven-place Alouette III figured in one of the highest-altitude mountain rescues in North American history earlier this year. Vought reported an Alouette III, owned by Anchorage Helicopters and piloted by Gene Lloyd, airlifted an injured mountain climber from the 17,300-foot level of Mt. McKinley on June 4.

The Alouette III is actually built, inspected and test-flown by Aerospatiale in Marignan, France, but then it is disassembled and shipped via air charter to the Dallas-based facilities of Vought, where it is reassembled and again test-flown.

The Alouette III is a sophisticated machine, with a list cost in six figures. Though it is primarily aimed at the corporate and executive market, some of its rather unique features can, quite naturally, be expected to show up in lower-cost helicopters as time goes by. Its origins actually can be traced back to the late 1950's, when the U.S. Army showed some interest in it. The initial models, equipped with a 300 hp engine, reportedly were considered underpowered plus there were reports of reliability problems. Since then, the Alouette II, with its 500 hp engine, has proven its versatility and reliability and the Alouette III is an outgrowth of the success and acceptance of the II.

When a pilot flies the Alouette III for the first time, the initial few times of lifting it to a hover should be deliberately executed very slowly. This allows an easy transition to the use of the right pedal as the "power pedal." For the American-trained pilot flying a European-model helicopter for the first time, using the right pedal for power increase should present no real difficulty; however, making hovering autorotations can be a slight challenge until he becomes more accustomed to the reversed rotation.

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PILOT evaluator says visibility from cockpit "is excellent" and interior is roomy. "Rear-seat passengers enjoy almost the same visibility available to the pilot," he says.

Alouette III

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The flight check of the Alouette III was conducted with the assistance of Vought officials, Andreas "Andy" Aastad and R. L. "Ron" LaFleur; and the flight check-demonstrator aircraft, N8261, was a model 3160 with almost 600 hours' time on the engine and airframe. This provided a realistic aircraft for the check, since it was not fresh from the assembly line. There were no visual indications, however, that suggested it was anything except "brand-spanking new."

Preflight inspection was easily accomplished and, compared to some other machines, was a real pleasure. The pilot must have been in mind during the design stages. All of the fluid levels, with the exception of the fuel and transmission oil, are easily checked by means of sight gauges that are visible during a walk-around inspection.

One of the most significant features of the Alouette III is its gas turbine engine—the Artouste IIIB. This engine is certificated to run on just about anything that burns—automotive gasoline,

PRIMER ON FLYING A HELICOPTER

■■ The conventional helicopter is considered to be one with a single main rotor and a tail rotor. The main rotor consists of two or more airfoils. These airfoils, or "wings," produce lift just as the wings of an airplane do.

A helicopter achieves the necessary passage of air past the rotor blade by rotating its "wings," thereby generating its own relative wind.

The flight controls of a conventional helicopter consist of a collective pitch lever that controls altitude, a throttle that controls rpm, tail rotor pedals that control heading while in a hover and trim while in forward flight, and a cyclic pitch stick, that controls direction of travel.

The amount of lift produced is regulated by the collective pitch control. This lever-type control, operated by the pilot's left hand, increases or decreases the angle of attack of the main rotor blades collectively—all together—hence, the name "collective pitch control."

Whenever the angle of attack is increased by use of the collective pitch, a corresponding increase in drag occurs. Since this drag must not be allowed to slow the rotation of the main rotor, engine power must be increased simultaneously with the increase in angle of attack. Conversely, if the collective pitch is reduced, engine power must be reduced to prevent rotor overspeed.

In a reciprocating engine-powered helicopter, the pilot maintains the correct rotor rpm by use of a motorcycle-type throttle located on the end of the collective pitch control lever. In a turbine engine-powered helicopter, the rotor rpm is maintained at the desired kerosene, automotive or marine diesel oil, aviation gasoline or jet fuel. These fuels can also be used separately, or even mixed together. The operator's manual does list a few situations in which an anti-icing additive must be used with the fuel and there are other instances where a limit of 25 hours' engine operation is imposed. Otherwise though, these unorthodox fuels may be used with complete safety and reliability.

The Artouste IIIB engine is rated at 858 shaft horsepower (shp), which makes it the largest engine in this class of helicopter. In the configuration used in the Alouette III, the engine is derated to 542 shp. Because of this, it can deliver a full 542 shp all the way up to 16,400 feet density altitude. This provides an enormous power reserve, even at maximum gross weight.

Starting the Alouette's Artouste IIIB is extremely simple for a turbine engine. Pre-starting checks include ensuring that the fuel is turned on, that the fuel flow lever is in the lowest position, and that one rotor blade is straight ahead. This prevents the other blades from heat damage as a result of being positioned directly over the tail pipe during starting. The engine starting sequence is controlled by a unit known as the "starting box." The starting box automatically controls the starter motor and the starting fuel flow, as well as the entire starting process.

During the starting operation, the exhaust gas temperature (EGT) is allowed to rise as high as 630 degrees centigrade.

After starting, the engine idles at about 15,000 rpm and to engage the rotor, the fuel flow lever is slowly advanced. As the engine speed passes 19,000 rpm, a centrifugal clutch is activated to bring the main rotor up to speed. The rotor engagement cycle is very smooth with no indication of roughness or of gyrating from side to side, as is the case with some other helicopters.

With the fuel flow lever fully advanced, the engine rpm is governor-controlled at 33,500. The gear reduction necessary to reduce the 33,500 engine rpm is accomplished at two points: The front case of the engine contains a gear reduction assembly that reduces the rpm sufficiently to power the transmission; and from there, further reduction takes place to provide 2,001 rpm to power the tail rotor and 353 rpm to operate the main rotor.

The engine operates at a constant 33,500 rpm throughout the flight regime and there were no indications during the flight check that the governor could not respond to changing power requirements.

Looking at the Alouette III's instrument panel, the pilot finds it contains a very unique instrument known as the "power computer." The basic presentation consists of a needle showing the

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value by use of a governor mechanism on the engine. This governor automatically increases or decreases engine power, so as to maintain the correct rotor rpm.

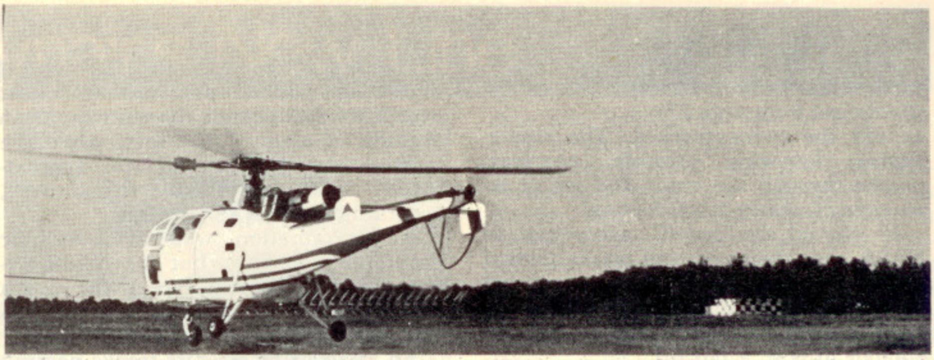
Since the fuselage of the helicopter acts as a pendulum hanging from the center of the rotor, any increase in engine power delivered to the rotor results in an increase in torque, which tries to rotate the fuselage in the opposite direction. This tendency of the fuselage to turn in the direction opposite that of the rotor cannot be dismissed lightly.

To prevent unwanted rotation of the helicopter, the tail rotor is used to develop a thrust, or force, sufficient to offset the turning force of the fuselage. The amount of tail-rotor thrust is controlled by the pilot through the use of the pedals. In order to maintain a constant aircraft heading in an American-made helicopter, left pedal pressure must be increased whenever power is increased, or right pedal increased whenever power is reduced.

The cyclic stick, resembling the control stick in an airplane, is operated by the pilot's right hand and controls the direction and speed of horizontal movement of the helicopter. This can be easily understood if the rotor is considered as an entire disc and not as a set of individual blades. As long as this disc is level, the forces developed will be acting vertically as lift. If this disc is tilted by movement of the cyclic stick, then a portion cf the lift is acting horizontally as thrust and it moves the helicopter in the direction the disc is tilted. A greater tilt of the disc causes a greater speed of the helicopter.

The cyclic stick causes a tilt of the rotor disc by increasing the angle of attack on each blade during only a portion of each revolution. This causes the rotor to produce more lift at one point of rotation and less lift at an opposite point. (It is much the same as banking an airplane, an action that diverts some of the lift to turn the airplane in flight.)

Because the helicopter's tilted rotor disc diverts some of its lift to thrust, lift is reduced. To compensate for the loss of lift, collective pitch must be increased. This, in turn, requires the addition of power to maintain rotor rpm, and the left pedal must be further depressed to maintain coordinated flight and heading. The complex interrelationship between controls is challenging to the student learning to fly a helicopter, but it is easily mastered with training and experience. □



The tail section and wing of a turbine-powered Learjet provide a three-sided frame for Vought Helicopter's turbine-powered Alouette III.

Alouette III

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percentage of collective pitch being used. Surrounding this is a circular computer that, with only one setting, enables the pilot to determine density altitude, what percentage of collective pitch will result in maximum allowable power, and the maximum allowable gross weight.

On other helicopters, the preceding information can normally be found only after a careful search of the operator's manual. By use of another simple calculation on the power computer, the actual gross weight can be determined while at a hover. Having these items of information available all the time tends to make a much more efficient operation, as the optimum point is always being used. Besides, having this information easily and quickly available greatly enhances the safety of the flight, since it removes a number of "unknowns."

One of the first things you notice after lifting to a hover is the genuinely solid feel of the aircraft. Both the collective and cyclic controls are connected via servos to the main rotor system; so control pressures are very light. There is even a friction lock attached to the pilot's cyclic stick to allow him to adjust the desired amount of stiffness. This lock can be tightened to permit "hands off" during ground operations.

The collective is equipped with a lock that can secure the collective in a "full down" position while conducting ground operations. In flight, the collective has a very solid feel. It stays where you leave it, with no tendency to increase or decrease. Although the tail rotor system is not servo-operated, the tail rotor pedal pressure is very light, without any jittery over-responsiveness.

Because of the enclosed tail boom and small vertical stabilizers, fuselage streamlining effect contributes greatly to directional stability. This positive directional stability was even observed with an estimated 10-knot wind while hovering, when large power applications were made. There was almost no indication of heading change. This characteristic streamlining effect is a real work-saver for the pilot and makes a much smoother ride for the passengers.

The flight-checked aircraft was outfitted with seven seats, the maximum approved for the Alouette III. Despite the maximum seating configuration, the interior still seemed roomy and not at all squeezed or crowded. The seats themselves were arranged three across the front and four across the back. Other interior refinements, such as litters and pop-up seats, are available as well as a normal choice of VIP appointments.

Although the operator's manual for the Alouette III lists a cruise speed of 115 mph at gross weight, the flight check showed an indicated cruise of 125 mph. This was with four people aboard and full fuel, utilizing a recommended cruise-power setting of 80% collective. The only vibration noticed during cruise was around 120 to 125 mph. Below this speed, vibration, by helicopter standards, was hardly noticeable.

With almost no obstructions in the cockpit area, visibility is excellent. Rear-seat passengers enjoy almost the same unrestricted visibility available to the pilot.

Alouette III (Model 316B)

Seating capacity	7
Powerplant	Artouste IIIB, 848 shp, derated to 542 shp
Maximum gross weight (lb)	4,850
Empty weight (lb)	2,467
Useful load (lb)	2,383
Main rotor diameter (ft-in)	36–1⅞
Overall length (ft-in)	42–1½
Fuselage length (ft-in)	33–4⅜
Tail rotor diameter (ft-in)	6–3¼
Fuel capacity (gal, maximum)	148
Cruise speed (mph, maximum gross weight)	115
Maximum range (nm, 4,630 lb at 6,500 ft)	295
Maximum endurance (hr, 3,300 lb at 17,000 ft)	4.8
Suggested list price	$208,900

At one point during the flight check, I tried to hover at 1,000 feet above the ground. The aircraft was slowed to zero airspeed and power was increased to maintain the hover. But the helicopter didn't want to stay there. A glance at the vertical speed indicator showed a climb of 500 fpm, even though we were at zero airspeed and certainly out of ground effect. Reducing the collective returned us to hovering at a constant altitude. That quickly taught me that because of the Alouette III's abundant power reserve, one does not simply "pull off all the power you've got" to maintain a hover.

The in-ground-effect hovering ceiling is 21,300 feet at a gross weight of 3,150 pounds, or 7,800 feet at 4,600 pounds gross weight. (Two versions of the Alouette III have been produced to date: the Model 3160, with a gross rate of 4,600 pounds; and the Model 316B, with a gross rate of 4,850 pounds. According to Vought officials, all future deliveries will be the newer 316B.)

Fuel capacity of the Alouette III is 148 gallons, with 145 gallons usable, which gives a range of about 370 nm at 3,750 pounds at 10,000 feet, or 295 nm at 4,630 pounds at 6,500 feet, with no reserve. Maximum endurance is 4.8 hours, achieved at a weight of 3,300 pounds at 17,000 feet. This, of course, is also with no reserve.

Autorotational characteristics are quite docile with an approximate 1,700 fpm rate of descent. Pitch pull at full gross weight is adequate, but not exceptional. *Because of the drive system employed in the Alouette III, power recoveries cannot be made during autorotations. They must be carried through to touchdown.*

Approaches, both normal and steep, require no special effort. The Alouette III tends to float when slowing down, due to lift produced by the fuselage. Anticipating this prevents a tendency to overshoot the desired approach angle, As with most turbine-powered helicopters, a slow, powered approach seems to work best.

Because of the enormous streamlining effect of the tail boom, the Alouette III, unlike some of the smaller helicopters, requires a slight pedal pressure in the direction of a turn during cruise flight.

The helicopter also has wheels, an advantage in ground maneuvering, especially when working around people or other aircraft. If there are no wheels, hover power has to be used, thereby creating much more potential for wind disturbance of other aircraft. The Alouette III's wheel arrangement also permits very steep slope landings.

On the negative side, N8261 *was* equipped with a parking brake, but the added installation of individual toe brakes would be much better, since the parking brake requires pumping before it is used and does not permit differential braking.

The Alouette III boasts over 100 cubic feet of cabin space, 16 cubic feet of additional baggage area, a cargo sling that can lift 1,800 pounds, an external hoist that can lift 385 pounds, exceptional cockpit visibility, and sea-level power all the way up to 16,400 feet.

Incidentally, the Alouette III incorporates several major changes from the Alouette II, which is still being sold. Most of the III's improvements are in the realm of increased useful load, increased sling-load capability and increased cabin capacity.

These and other features add up to a truly outstanding helicopter. □

THE AUTHOR

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