Above: Open cockpit has been standard since 1957, remains as today's Ag-Cat configuration.

PILOT REPORT

# GRUMMAN AG-CAT

*In its sixth year of working the nation's farms, this rugged descendant of the long Grumman line fits a new engine ahead of the big hopper and reinforced cockpit*

By RICHARD BACH



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IT IS BIG and square and built for a hard life. It carries a 1,200-pound payload in front of what might well be the strongest cockpit in general aviation. Technically, it is called the Model G-164; more informally it is the Grumman Ag-Cat.

This modern metal biplane has been skimming the nation's fields in growing numbers since its first production flight in October, 1957. Today Cat number 208 is coming off the Schweizer Aircraft Corporation's Elmira, N.Y. assembly line where the airplane is built for the Grumman Aircraft Engineering Corp of Bethpage, N.Y., and there appears to be no end to its production. The Ag-Cat has recently been developed to take a redesigned 300-hp Jacobs R-755 engine, a new Grumman propeller, and a cockpit canopy.

The additions will offer the agricultural operator a wide option of equipment, performance, and comfort. He can have a duster or a sprayer or both in one aircraft; he can have an open cockpit or a closed one; he can fly with a 220-hp Continental, a 240-hp Gulf Coast modification of the Continental W670-240, or the 300-hp Jacobs engine. If he likes, he can install a 450- or even a 600-hp engine for high-altitude operation. Yet the Ag-Cat, Grumman says, is an airplane designed to fly on its wings instead of its propeller, and the Jacobs is as big an engine as the company plans to install on production models.

The Cat was not built to be a sport airplane or a trainer or a means of transportation. It was designed to be a piece of farm machinery. Cost of the 220 sprayer-duster is $17,960; of the 300 in the same configuration: $21,120.

Distinguishing features are the tall headrest/overturn structure behind the cockpit, spring-steel Cessna 195 landing gear, all-metal fuselage skin held with Dzus fasteners to the steel tubing.

Safety in the Ag-Cat is a point of justifiable Grumman pride. In the course of its low-level flying over the past five years, the biplane, like other ag airplanes, has not been immune to occasional mishaps. It has been dragged to the ground by fences, has tangled with high-tension lines, has buried itself in trees. According to one operator's report, an Ag-Cat struck a telephone line after its pass across a cotton field, slammed into the ground, and "flipped through the air, landing squarely on its back." Its headrest dug a deep furrow in the earth, but the report notes that the pilot crawled out uninjured.

Another Ag-Cat made a hard turn at low altitude to avoid colliding with another cropduster, caught a wingtip on the ground, and cartwheeled end-over-end across the ground. From the accident report: "No malfunction of aircraft or engine. Three wings gone—engine nose case busted—twisted fuselage—gear off—cockpit section was intact and unbent—the airplane did not go on its back—will not rebuild. Injuries—none."

Terrell Kirk, Ag-Cat sales manager at Elmira, said, "Pilot safety in this aircraft is just uncanny. I think the 40-G cockpit and a good turnover structure has kept many a boy from getting hurt." To date, Grumman says, a pilot has never been killed or seriously injured in an Ag-Cat.

Though you may be armed with sheets of dimensions and days of study about the Grumman G-164, it is still an impressive sight when you walk outside with (*Continued on page 62*)

*Left:* Latest Cat includes 300-hp Jacobs engine, cockpit canopy, Sensenich-designed Grumman propeller. *Below:* Bug's-eye view of working Ag-Cat. Spray system delivers up to 20 gallons per acre.

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## Grumman Ag-Cat

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clipboard and helmet to go flying. A Super Cub is a tiny dwarf of an aircraft alongside the biplane, whose upper wing is almost 11 feet above the wheels. The yellow and grey exterior paint was selected not for beauty and glossy finish but for its urethane resin content that resists abrasion and corrosion by the potent dusts and sprays of agriculture.

Preflight offers as its only unusual check the security of the ribbed Dzus-panel fuselage skins. They remove for complete and thorough cleaning of the fuselage structure, and to lose them in flight would turn the Ag-Cat into a latter-day Bleriot.

The empennage is covered with cotton fabric; Grumman's philosophy here being that there will be no undetected corrosion from chemicals seeping within the vertical or horizonal stabilizers if the surfaces are inspected and recovered every few seasons. One set of landing wires and one set of flying wires cross between the wings, and there is a set of cross-wires between the cabane struts above the cowl. There is no complex rigging system. Wings can be removed in the field and once the dihedral is set, the wings reassemble only in a properly rigged condition.

THE cockpit is more simplicity. As you strap into the combined seatbelt/shoulder-harness you notice that the instrument panel carries only a spray pressure gage, combination oil temperature and oil pressure gage, a magnetic compass and an altimeter. A good piece of human engineering put the airspeed indicator, tachometer and stall warning light on the top of the cowl some four feet ahead of the cockpit. I discovered that there is no better place for them when you spend the day flying low and wish to keep your head out of the cockpit as much as possible.

For this FLYING report I flew the open as well as the closed-cockpit version of the 240-hp Ag-Cat and the 300-hp, Grumman-prop 498 Yankee, first production aircraft with the big engine. First flight was with an empty hopper in the 240 open-cockpit. With 15 shots of primer into the long primer line, the Continental started with a twist of the prop supplied by Terrell Kirk.

While the engine warmed, he pointed out the cockpit controls for the hopper gate and airfoil spreader, and the brake lever for the little Sensenich wooden-propeller that drives the spray pump.

After runup, I took the green light from Elmira Tower, and lined on the 4,700-foot concrete runway 24. Throttle full forward, a touch of right rudder to keep the airplane straight. When the time approached that I thought I should begin to consider the advisability of getting the tail up in preparation for flight, the Cat was 100 feet in the air. The empty-hoppered biplane had used less than 400 feet on its takeoff roll, and by the time my thinking caught up with the airplane, I was some 500 feet above the end of runway 24. A look down and back was unnerving; a combination of sitting high in the cockpit and the relatively narrow aft fuselage of the Cat made me feel as if I were riding a motorized broomstick. But a feeling easily accustomed to, and completing a picture of good visibility. Looking forward, you see quite a bit more than could normally be expected of a biplane. The upper wing is set about 30 inches above the forward fuselage, and is set at a six-degree angle of incidence. The combination provides a view of the wing that is almost edge-on, and only the thickness of the wing obstructs the view.

Four minutes later, at 4,000 feet, I tried some stalls to get used to the airplane, for I had never met the biplane that didn't have some unusual characteristics or point requiring special care. I learned that stalls, at least, are not the point of care in the Cat. Power on, the amber stall warning light blinked on below the range of the airspeed indicator, at what I estimated to be 35 mph. The first break in the airflow over the wings came at about 32 mph. There is bound to be a substantial position error at such low airspeeds, but the indicated stall speed is the key for the man in the cockpit, and for this, Grumman should install an indicator that begins numbering at less than 40 mph. Power off, the airplane stalled at 42 mph, and I began to get the feeling that I would be hard-pressed to hurt myself in this airplane. Sitting in the stressed cockpit, wearing seat belt, shoulder-harness and crash helmet, there was just not much that one can do at 42 mph to entertain danger.

One of the most difficult maneuvers for me to perform with the Ag-Cat was to fly it straight and level. On reaching 4,500 feet for cruise speed tests I lowered the nose to what I felt should be a good attitude, allowing for the sloping cowl. Power back to 1,900 rpm and trim lever forward. The Cat kept climbing. Six degrees is a great deal of incidence in a set of wings, and by the time I had finally levelled the airplane I was at 5,000 feet and had to hold the upper wing almost on the horizon to keep the airplane from climbing. A 1,900 rpm level-flight cruise came to 89 mph indicated airspeed, about 92 mph TAS (true airspeed). At 2,000 rpm and on the step, the Cat showed 98 mph.

DESCENDING for some low-level passes over the winter-deserted runway of the sailplane mecca at Harris Hill, I felt as if I were not flying an airplane at all. Visibility forward and down was especially good in the diving turn, and I felt strangely unhurried and at ease. There are not as many blind spots as one would expect from a biplane. The impression is one of being able to take all the time in the world for a pass, because every hillock and blade of grass is visible and in order.

A few more runs, and the fuel gage jutting from beneath the upper-wing centersection fuel tank showed that I had about a quarter of a tank of 80 octane remaining.

I dropped from the Hill down into the pattern at Elmira, and set up a final approach at 65 mph, which was far too fast. A 1.2 Vs (120 per cent stall speed) approach in the lightweight Cat would have come to 50 mph. As a result the airplane floated several hundred feet then bounced as I tried to remember where that

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sloping nose should be for a three-point attitude. I was waiting on the rudders and ready to fight any fishtailing or veering that the airplane would offer. But the flight is over when an Ag-Cat is on the ground; the airplane used about as much runway to stop as it had taken to become airborne on takeoff. Rudder control and tailwheel steering were hardly needed before it was time to add power and taxi clear of the concrete. During fertilizing operations, ag pilots can make as many as 10 landings per hour, and the first airplanes, Kirk had told me, saw problems with brakes and with tailwheel shimmy. The brake design and shimmy damper were changed, and in all the Ag-Cats that I flew, I found very effective braking and no sign of tailwheel shimmy.

By the time the 240-hp engine died with its mixture back to idle-cutoff, the 300-hp version with canopy was waiting a few yards away, engine ticking over and ready to fly. The side windows and top of the canopy fold away for easy entrance, and as I slid down into the cockpit, Kirk pointed out that this was a demonstrator model, with a complete electrical system, starter, radio and navigation lights.

The side windows of the canopy are of plexiglass, but the forward three panes of the windshield are of safety glass, to eliminate scratches and the need for precautions when cleaning chemicals and dirt from the surface. A canopy kit for open-cockpit Ag-Cats costs $595.

I was prepared, this time, for a quick takeoff, and after another less-than-400-foot takeoff roll, held the climb airspeed to 65 mph. The result was a very steep climb that I estimated to be about 1,500 fpm as the Cat broke away from the runway elevation of 951 feet. Measured more exactly at 1,700 feet, the climb came to 1,300 fpm. I still had trouble levelling the airplane, and at 4,500 feet and 1,900 rpm gave up in disgust and deliberately put the nose just below the horizon in what I felt would be a level-flight attitude for a non-agricultural airplane. The resulting climb came to 650 fpm.

The power-on stall came at an estimated 35 mph, power-off at 44 mph. Stalling out of a turn gave the ever-reassuring feeling of rolling toward the high wing and recovering to level flight. The Cat's stall is an unusually clean and gentle one, which was a surprise. It has no tendency to fall off to one side or another, and recovers quickly with forward stick.

SINCE it is not uncommon for Ag pilots and airplanes to spend a 16-hour day climbing and turning over the fields, and every ounce less pressure on the control stick means a great deal less pilot fatigue at the end of the day, Grumman chose to give the ag pilot a light stick and maneuverable airplane.

After some more passes over Harris Hill, I dropped down into the pattern for runway six, and stopped before the first intersection. Full back-stick and moderate pressure on the very effective brakes brought the Cat to a stop in a cloud of dust, as it were, and in this case I still had 4,000 feet of runway ahead of me.

The next morning we began flying the Cat with various loads of water in the 220-gallon hopper. Flying a closed-cockpit 240 sprayer with 1,100 pounds of water, I discovered why the empty Ag-Cat had such outstanding performance. If it hadn't, it would never get off the ground with a full load.

The technique of takeoff in a fully loaded Ag-Cat, according to Grumman, is to hold the airplane on the ground until the stall-warning light goes out, then keep the airspeed at a recommended 75 mph for climb. This worked well, and the airplane took roughly 900 feet of sod next to the concrete runway to become airborne. Rate of climb after takeoff was 670 fpm, decreasing to 240 fpm at 5,500 feet. Stall speed was increased to 55 mph power off and 50 mph power on; the same characteristics prevailed. The runs over Harris Hill were made now with spray pump fan engaged and the spray dispensing handle forward. The white-dialed spray pressure gage with its black needle was not difficult to see with peripheral vision; when it drops off suddenly to zero the ag pilot knows that the hopper is empty.

WITH about 900 pounds of water in the tank and a line of trees east of the sailplane runway slowly approaching, I pulled the nose up and at the same time pulled the red emergency dump cable. There was a little airy pop from forward of the cockpit, and the Cat hurled suddenly up through the air, clearing the trees by several hundred feet. Specifications say that it takes six seconds to dump a full load when the emergency cable is pulled. It seemed considerably less than that to me; the effect was the same as if the cable had been connected to physically and instantly increase the wings' angle of attack, and instantly the Cat became the same STOL airplane that it is when it is empty.

Back to Elmira and a quick turnaround into the 300 Cat with an overload, the condition most often flown in the field. With 180 gallons of water in its hopper, the Cat weighed 4,100 pounds, about 300 pounds over its maximum gross weight. The takeoff here took about 1,000 feet of concrete, and the climb to 2,000 feet went at 325 fpm. One gains a lot of respect for the sheer weight of water when there is 1,450 pounds of it gurgling around in the same airplane with one. At this weight the Cat felt very heavy indeed, and stalled power off at 56 mph. Power on it stalled at 41 mph; a lower figure than the 240, thanks to the big Jacobs engine and the Grumman prop. At 2,500 feet and 1,900 rpm the airplane indicated 77 mph, 87 mph at 2,100 rpm. A few more passes with very delicate turns, the tremendous thrust upward when the dump cable was pulled, and back to Elmira for the fourth flight of the day, to photograph the 300 in flight.

Terry Kirk flew the 300 for its photos. Flying loose formation in a 240 Cat, I was using both hands to operate the camera, which proved to be a good test for the airplane's trim. I could trim the Ag-Cat level and hold the wings steady with rudder alone for some minutes at a time, though I still had to reach down and make power adjustments. On the way back to Elmira, Terry pulled the 300 into a steep climb as I held in formation on his right

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wing. The airplanes slowed together through 50 mph, through 40 mph, and then, despite full power and as delicate a stick as I could manage, the lower-powered Cat stalled and dropped back. Terry held the 300 in the climb for another minute, then nosed down to allow me to rejoin. A good demonstration of an engine with which Grumman hopes to penetrate the markets in high-altitude ag flying.

It is difficult in this type of report to evaluate the effectiveness of a spray or dust delivering system, but this one did not leak or malfunction during the hours that I was in the cockpit or watching it at work. The greatest difficulties that face agricultural airplane manufacturers are in the field of spreading and dispensing equipment. After a long period of disharmony with various spreader systems by other manufacturers, Grumman has finally settled on a design by its own systems development chief Garland "Sparky" Hieston. Called an "airfoil spreader," it has proven itself in dispensing all forms of solids without leaking or binding gate controls. The Grumman unit works and requires just 10 minutes to change from dusting to spraying operation.

The Ag-Cat is designed to be maintained completely in the field and such instructions as, "In case it is necessary to hoist the nose of the airplane, as in changing the main landing gear . . ." and, "In leveling the airplane it is recommended that the tailwheel be tied down . . . particularly if the tail surfaces are not on the airplane . . ." are common in the flight handbook.

The all-metal basic construction with its double coating of protective primer results in an airplane that requires minimum maintenance during or between flying seasons. Low operating and maintenance costs over years of service, Grumman says, make the Cat a more economical system than war-surplus aircraft. One Cat operator said that it took just $160 to get his airplane ready for its second season, $300 for the third.

Over 195 Ag-Cats have been sold to date, and today they are selling at a gradually increasing rate.

And as more of the metal biplanes skim the tops of the nation's fields, delivering tons of payload and becoming covered through the day with mud and dust and the chemicals of the ag industry, they are proving that Grumman Ag-Cats are some of the most rugged, useful and economical pieces of farm machinery on wings.

**GRUMMAN G-164 AG-CAT**

**Specifications:**

| | |
|---|---|
| Engine: 220-hp Continental W-670; 240-hp Gulf Coast W670-240; 300-hp Jacobs R755 | |
| Propeller: Ground-adjustable. McCauley 41D5926 or Grumman 5405R/MA96K, designed by Sensenich | |
| Span | 35 ft. 8 in. |
| Length | 24 ft. 4 in. |
| Height | 10 ft. 9 in. |
| Wing area | 326 sq. ft. |
| Passenger & crew capacity | 1 |
| Empty weight | 2,150 lbs. |
| Licensed hopper load | 1,200 lbs. |
| Gross weight | 3,750 lbs. |
| Fuel capacity | 32.7 gals. |
| Oil capacity | 5 gals. |

**Performance** (three figures show 220-, 240-, and 300-hp versions respectively):

| | |
|---|---|
| Maximum speed (redline) | 131 mph |
| Maneuvering speed | 104 mph |
| Working speed | 75-80 mph; 75-85 mph; 75-90 mph |
| Rate of climb (full gross weight) | 460 fpm; 560 fpm; 645 fpm |
| Stall speed (normal landing weight) | 48 mph; 49 mph; 49 mph |
| Service ceiling | 7,000 ft.; 9,400 ft.; 11,500 ft. |
| Takeoff distance (ground run) | 735 ft.; 700 ft.; 625 ft. |

## Smoke-Eaters

(Continued from page 29)

pilots were given the details of another fire in the county. With a Division of Forestry patrol airplane leading, several of the pilots took off for the new fire while the others remained for a few last loads on the Aero Stud fire.

At that time the planes were not equipped with radios so the problem of communications between the flyers and the men on the ground at the fire was solved by having a forestry officer available with a radio at the airport. The planes were numbered one through seven so that ground men at the fire could radio results of the drops to the refill port. The pilots follow the fire boss' instructions as long as they believe they can do so safely. If no communications are available, they drop on the hottest flames they can handle.

Communication was not their only problem. Often the smoke and turbulence prevent the planes from flying low enough for an efficient drop and sometimes the facilities at the closest airport were not good.

Though water has proved efficient, their best results have been from the several chemical drops they have made during succeeding summers. A finely ground mixture of sodium calcium borate was added to the water at the rate of four pounds per gallon. Because of the heavier weight of the chemical, this mixture penetrated the tree and brush foliage more thoroughly. The white coat it left on the leaves acted as a marker to show the pilots where previous drops had been made, and the borate continued its retarding effect on the fire after the water had evaporated. In recent summers a bentonite mixture has been used. This leaves a pink coating, is cheaper and lighter in weight.

The present air tanker and use of solutions is not the result of the work of any one man or group but of trials and tests that began in 1936. The first experiments at that time were made by the Forest Service in cooperation with the Air Corps dropping metal containers of water on fires. Balloons filled with water were dropped, all with discouraging results. One big drawback was that dropping containers made it necessary to evacuate personnel from the area; thus the advantage of the ground men's immediate followup work at the fire was lost.

Experiments were made near Missoula, Montana shortly after World War II with