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AIR TRACTOR AT-502

Air Superiority

Firepower of a Warthog; agility of a Tomcat

BY BUZ MARTEN

If anyone asks which new turboprop has the size of a King Air, the payload equivalent of 23 passengers, the price tag of a Bonanza, and the thrill of a big warbird, we have the answer: the Air Tractor AT–502. Agricultural airplanes and crop dusting are strange to many of us, so a little background is called for. ■ Leland Snow built his first agplane at age 23, while still in college. The young aeronautical engineering graduate student was seeking to improve upon the converted J–3 Cubs in which he earned his way through school, spraying crops in the lower Rio Grande Valley. The S–1 was Snow's first design. It flew well with a 190-horsepower Lycoming (and better with a 220-hp Continental), and with its low wing and forward cockpit, it offered far better visibility than a Cub or biplane. The S–1 begat the long, successful line of Snow (now Thrush) agplanes. In 1970, Snow left Thrush (by then a Rockwell Corporation subsidiary) to start a new company in Olney, Texas, which would produce his all-new Air Tractor design, the AT–300. ■ With its long cantilevered wing and clean lines, the 450-hp Air Tractor could haul a payload as great as a 600-hp Stearman and work it off much faster with its wider swath and greater speed. Snow, starting with four employees, got the aircraft certified by the Federal Aviation Administration in only 59 days and by 1975 was building 20 airplanes per year. Today, his 112 employees turn out two aircraft per week for eager buyers who feel that Air Tractors are the finest agplanes available. ■ The line has grown over the years, with more than a dozen models now certified. These range from the AT-300 and 600-hp

PHOTOGRAPHY BY MIKE FIZER

AT–301 (both now out of production) to the turbine-powered AT–502 and AT–802, the latter being a huge 15,000-pound-plus, 1,424-shp fire-bomber yet to be certificated.

AOPA Pilot's search for an AT–502 to fly and evaluate put me on the telephone with Al Grouleff, AOPA 197958, who, with sons Don and Greg, runs Grouleff Aviation, an aerial application company and Air Tractor dealership in San Joaquin, California. We had anticipated difficulty in finding someone who would let some writer from out of town fly a single-seat, high-performance turboprop aircraft worth about seven years' pay, but Grouleff could not have been more agreeable.

"Come on down," he said. "We'll put you in the 502. It's so fast and powerful and easy to fly, you're really going to love it."

I tended to believe him.

The next week found me and photographer Mike Fizer Skyhawking down to San Joaquin in fine flying and photographing weather. Upon arrival, at the airport, we were greeted by Grouleff on the ramp at one of the cleanest and best-managed aerial application operations that I've seen. We went to work at once.

By way of a check-out, Grouleff put me in the rear cockpit of his nicely restored, 300-hp Lycoming-powered Stearman, which he had prewarmed. Within minutes, we were off and in the 400-foot pattern. I had not flown a Stearman before and was a bit uneasy about the complete lack of forward visibility in the three-point attitude. I liked the way it handled, though, and found it easy to see and control by using a 180-degree turn from downwind to threshold, rather than a squared-off pattern. I managed to keep the nose pointed down the runway through three bouncy landings, whereupon Grouleff deemed me fit for duty in the AT–502.

To one used to light singles, the AT–502 is imposing. Sitting on the ramp with empty hopper, full fuel, and me, N1532A weighed 5,503 pounds—a full payload could add 4,000 pounds to that. The 50-foot, high-aspect-ratio, low wing is clean and faired and rests upon the tall conventional gear. The 502's low wing is about level with that of my high-wing Cessna 172. The horizontal tail sits at about eye level over a castering, lockable tailwheel, the same size as my Skyhawk's nosewheel.

Today, Snow's employees turn out two aircraft per week for eager Air Tractor buyers the world over.

At my request, the Grouleffs had previously sent me a copy of the pilot's operating handbook for the Air Tractor 502, which I had studied for a few hours to save time on flight day. The preflight inspection consists of the usual push and poke items, plus several others peculiar to turbine operation, such as untethering the propeller, which must be tied to keep from windmilling the PT6A-15's free turbine without oil pressure. One also carefully notes the wind velocity, repositioning the aircraft if necessary to avoid starting the engine with a strong tailwind. This I assumed could contribute to a hot start, but the book does not explain.

The AT–502's tough and reliable P&W PT6A, crisp handling, and crashworthy design make it an ideal platform for ag pilots. Efficient equipment fills the 500-gallon hopper quick-turn style.

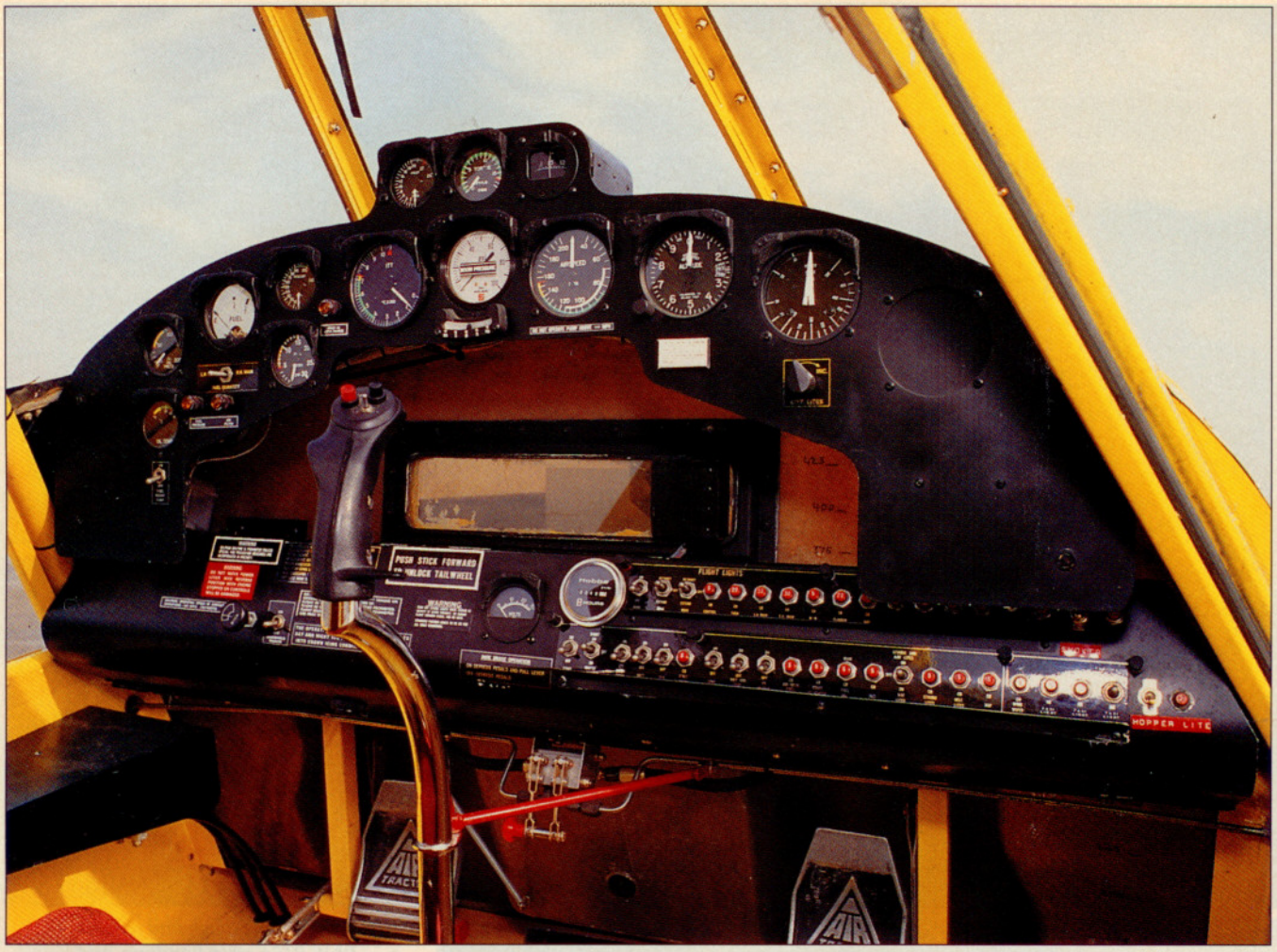
Ascending to the cockpit requires three big steps and great care with handholds. Losing your grip on entry could easily put you headfirst onto the ramp, 10 feet below.

Once buckled into the three-point harness, though, you are settled into perhaps the safest seat to be found in an aircraft.

Beyond building in virtually vice-less flying characteristics, Snow has shown particular leadership in making the aircraft astoundingly crashworthy. The loaded hopper precedes the pilot and acts like a big water pillow in a collision. Fuel-bearing wings are designed to break away while absorbing energy. The fuel lines and fittings are confined to the left side of the fuselage and separated from the right-side electrical harness and fixtures by the 500-gallon hopper. Crash fires in Air Tractors are rare.

Recently, the Grouleffs investigated the crash of a turbine Air Tractor. The pilot did not see a steel standpipe and ran into the immovable object at 120 knots. The left wing was torn off, slamming the aircraft to the ground. At various times, the airplane was on its back, its nose (where it left an imprint in a road), and its tail (which was torn off). The propeller disintegrated, and the PT6A was torn into three pieces. The cockpit was completely intact, and the pilot walked away with no injuries. He said it was a wild ride.

Start procedure, while new to me, is standard PT6A. With the brakes set and the fuel on, the power, prop, and condition levers (which are marked the same as, and nearly analogous to,



BUZ MARTEN

The AT–502's flight deck (top). Longtime ag pilot Al Grouleff, proprietor of Grouleff Aviation. The older, but no less spry radial-powered AT–301A (above).

throttle, prop, and mixture, respectively) are checked in the aft position. The fuel boost pump is turned on momentarily to bring up fuel pressure. Then the start switch is pressed on and held, followed by the ignitor switch to the Start position at 12 percent Ng (gas turbine rpm). At 50 percent Ng, the starter is released, and the condition lever is moved to the Run or ground-idle position. All the while, one monitors various caution lights and the interturbine temperature (ITT) to guard against a hot start. The procedure is far more difficult to describe than to do. It's actually much easier than starting a hot Bonanza.

Taxiing is very easy, with excellent visibility over the long, drooped nose. The castering tailwheel is unlocked for turns by moving the stick forward. When headed in the desired direction, one moves the stick aft to lock the tailwheel and maintains direction with rudder, small power bursts, and an occasional stab of brake. If too much speed builds up, the prop can be moved back into the Beta (reverse) range to save the brakes. That might be necessary with a strong tailwind, but I found that I needed more than ground-idle power to maintain a reasonable taxi speed.

There's no runup per se, but as one lines up for the first takeoff of the day, the power is set at 600 foot-pounds of torque with the brakes held, and the propeller is cycled once, just as in a piston aircraft.

My first takeoff was a thrill. Releasing the brakes at 600 ft-lb torque, I moved the power lever smoothly forward. Acceleration was brisk, and we were airborne well before reaching the 1,628 ft-lb torque limit. The ITT stayed

well below the 695-degree limit on this ISA plus 18° day and should rarely be the limiting factor in this type of operation, which bodes well for a long engine life. (In this Restricted category, Federal Aviation Regulations Part 91 operation, overhaul is "on condition," with hot section inspections at factory-specified intervals.)

By the time I adjusted the power back to 1,100 ft-lb and 1,900 prop rpm and had one scan of the gauges, we were through 1,500 feet agl at 90 knots and were still climbing at about 1,000 feet per minute. Leveling off at 2,000 feet, I left the power set and fed in a bit of forward trim as the aircraft accelerated to 130 knots. Finding level attitude with the down-sloped nose required some trial and error with several glances at the altimeter, but with that sorted out, I tried some steep 90° to 270° turns, rapidly rolling in and out. The control forces were extremely light and quite responsive for an aircraft of this size, and I bobbled a bit before acclimating to the delicate touch required. Thereafter, the aircraft had a very precise "put it where you want it" feel. The controls are boosted in all axes by small tabs that are simply connected—through horns and push rods—directly to the stabilizer or

Dusting in the Dark

Nighttime nap-of-the-earth; midnight massacres

After sundown, you might expect most agplanes to be put away—not so in California and the Southwest (and increasingly elsewhere), where larger, less obstructed fields prevail and where many excellent reasons for night aerial application became apparent more than 15 years ago.

With the phaseout of DDT came the increased use of carbamate and organophosphate pesticides. These chemicals decay rapidly upon exposure to air, and the reactions are accelerated by sunlight. While fresh, many of the chemicals are toxic to humans, honeybees (needed for pollinating), and other good critters. Night application allows the materials to be active on the plants for a longer time, during which the good guys are asleep in their beds and hives. Many plant pests lay low during daylight, under bottom leaves or down in the soil. At night, they move into the plant tops to feed. A more effective kill can thus be made at night, using less insecticide.

Airplanes fly better in the cooler, still night air, and the pilot's work load is eased somewhat, not having to deal with low-level turbulence. The spray or dust also has a greater tendency to sink and swirl down into the crop rather than being uplifted by daytime thermals and gusts, which can disperse the material into unwanted areas. Evaporation rates are lower after dark as well, further lowering the gallons per acre needed for best results.

Darkness is, of course, the daunting part. Surprisingly though, once pioneer operators like Al Grouleff made their first trepidus moves into night work and got their equipment and technique developed, they found the risk factors to be quite manageable. FAA accident statistics show the rate of stall/spin and pilot-disorientation type accidents to be slightly higher at night, but there doesn't seem to be any difference in the number of collisions with wires or other obstacles.

Key night equipment includes navigation lights and careful cockpit lighting. For the latter, red post or eyebrow lights are preferred to provide adequate illumination with preservation of the pilot's night vision. Switches and other controls are arranged to facilitate operation by feel, as the pilot needs to keep his eyes pointed outside, where his surroundings are lit by an impressive array of brute candlepower. Grouleff's AT-502s carry the optional Air Tractor night package, which provides two fixed 450-watt "field lights" in the nose and a 450-watt "turn light" in each wing tip. In addition, there are two retractable, adjustable 600-watt lights just inboard of the turn lights. These may be toggled up or down from the cockpit to suit the pilot as he works off his load, with an ever-decreasing angle of attack. The package includes post lighting to which many operators add a turn and bank indicator for added protection against lost horizons.

The field lights are generally turned on as the pilot lets down to the field from his ferry altitude (200 feet or so) to commence his first run, at the end of which they are turned off as he pulls up. At about 100 feet, he switches on, say, the right turn light and rolls into a level 90° right turn, after which he rolls directly into a left turn, extinguishes the right light, turns on the left, and holds that turn for 270° back into the field. The turn lights—angled out 45° and down 45—orient the pilot to the terrain and pick up obstacles. Having spotted his flagger's light and made any needed heading correction, he puts out the turn light, fires up the field lights, and heads down once again.

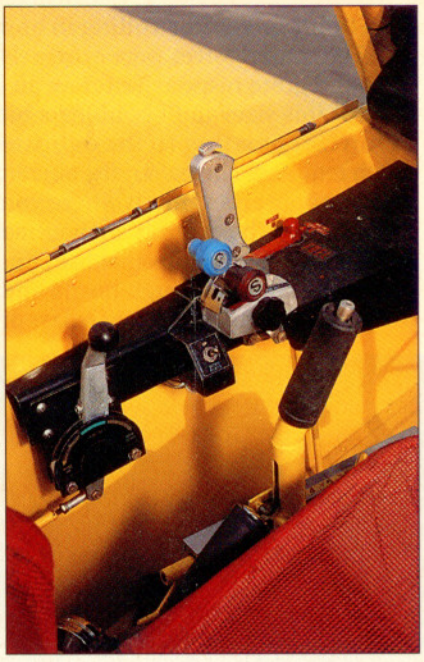
Often the pilot will use the turn lights in the ferry portion of the flight to illuminate landmarks as he navigates to the field. Once there, he uses them to make a circling survey for wires and such and to spot any access difficulties for the flaggers, guiding them by radio if necessary.

Two flaggers (using flashlights) are often needed at night, one at either end of the field to be sprayed, it being too difficult for the pilot to line up accurately in the dark on a distant flagger. The downwind flagger will mark from a closed pickup truck or wear protective clothing to avoid over-spray exposure.

Experienced daytime ag pilots can break into night work by initially selecting clear moonlit nights, starting to work at dusk with lights on, and flying a smooth transition into moonlight over a well-known field. Once fully acclimated, most pilots actually prefer dark, moonless nights with no background light, which can dilute their directed beams and lower contrast.

Good ag pilots are adaptable, taking serious, personal responsibility for keeping themselves rested properly as they move between day and night work. Nonetheless, in busy seasons, the Grouleffs schedule their pilots to work days or nights exclusively to avoid problems with circadian rhythm disruption and to provide a high-quality service with maximum safety.

Good night, bugs. —*Buz Marten*



Ascending to the cockpit requires three big *steps. A quick flip of the thumb latch allows the power lever to be moved back to Beta and then reverse for quick, straight stops.*

wing. Deflection of the surface (through push rods and bearings) causes the tab to move opposite. The energy for the boost comes from the slipstream.

Proper management of the risks associated with aerial application requires an airplane that handles well. Snow's Air Tractors redefine docile behavior. Stalls are the gentlest I've seen in any aircraft. No matter how aggravated, at whatever bank angle, the wing resumes flying with just some release of back pressure. Moreover, there is no combination of power changes, flap configuration, load dumping, and/or airspeed changes that will result in high stick forces. Re-trimming is always an option for the pilot to perform at his leisure. That's remarkable handling for any aircraft, let alone one that can haul and drop a payload equivalent to that of a B–25.

With power back to about 600 pounds, I entered the pattern at 80 knots, reduced to flight idle abeam the numbers, and toggled down 10° of flaps. (The ailerons droop with the first notch of flaps.) Final check was easy: prop and condition levers forward, check parking brake off. (There is no fuel management save a peek at the gauge.) A bit high on my turn to final, I added full flaps (26°) and dis-

The horizontal tail sits at about eye level over a castering, large, and lockable tailwheel.

covered that they produce much more lift than drag. That, combined with the sleek, pointy nose, makes the 502 a fine glider. My first approach became a go-around that was accomplished without a drop of sweat, and I flew the next approach a little slower to a wheel landing. Reverse thrust is available after touchdown, and though I never needed it, it was fun to try it a few times. With the power lever at the idle stop, one raises the small thumb latch on top, which allows the lever to move farther aft into the Beta range. Additional aft movement brings in reverse pitch and power together. Up to 620 shp is available in reverse, but I didn't use a quarter of that to achieve impressive straight-line deceleration.

After 45 minutes in the AT–502, I was getting a sense of the enormous enthusiasm shared by the folks who make their living in this aircraft. You could fly air shows in this thing.

I wanted to fly the AT–502's piston-powered sister ship, the AT–401. It's virtually the same airframe, with hopper size reduced to 400 gallons and mounting a 600-hp Pratt & Whitney R1340 radial. We could not find one in time, so I accepted "Agrobatics" pilot Wayne Handley's kind offer to fly his newly re-engined AT–301A, a six-year-old predecessor of the 401 with a 4-foot-shorter wingspan and unboosted flight controls.

The Air Tractor cockpit seemed familiar now as I started up the big chugger and taxied down Handley's decomposed-granite strip for departure. Takeoff weight would be 4,500 pounds. With the conventional runup complete, I lined up, locked the tailwheel, and fed throttle to the supercharged Pratt. It yielded 36 inches of manifold pressure and 2,200 rpm and a very satisfying push down the runway. We were airborne in about 400 feet, and with power reduced to 30 inches and 2,000 rpm, we started up at 1,500 fpm. A stall and turn series at 2,000 feet revealed delightful control feel and light stick forces even without the boost tabs. After some touch and goes, the airplane felt comfortable enough to work at crop height, and I spread an imaginary load on a nearby unobstructed field. This gave me a chance to try the Air Tractor pilots'

trick of using flaps in turns. A notch of flaps can be used at heavier weights, applied as the pilot rolls into his ag turn to provide extra lift and stability. At lighter weights, flaps can be used to tighten up a turn that would otherwise be wide of the mark.

Except for a lot more noise (very high-grade noise at that), the radial was as much pure fun as the turbine. So why would anyone go into more than double the debt to buy a 502 over a 401 ($360,000 versus $163,000)? Grouleff's quick and easy answer is: "To make more money with less work and a lot more peace of mind."

The Grouleffs have replaced four 401s with two 502s. The Turbine's three-quarter-ton greater payload and higher working and ferrying speeds put a lot more gallons on a lot more acres in a day. Much of that is net profit, because of lower maintenance and payroll costs and the elimination of satellite duster-strips and their attendant personnel and equipment.

To be sure, the PT6A costs a bundle, but once acquired, it could last the life of the airplane (9,000 hours or more), needing only about $4,000 worth of hot section and fuel nozzle work each 1,200 hours, versus the 1340 radial's need for an $18,000 overhaul at the same interval. Also, the 1340 requires lots of mechanical attention, all the while drinking gallons of oil, about half of which is barfed on itself and the hangar floor. Grouleff adds that, after working crops by air for 45 years (he's a very youthful 67 and a superb pilot), the reassurance to be found flying behind an engine that he knows won't quit is alone worth the higher price.

Al, Greg, and Don now find more time to play with their toys, which include the Stearman, a 200-hp RV-3, a Meyers 200, and assorted hot rods and motorcycles.

The Turbine's payload and speed put a lot more gallons on a lot more acres in a day.

While their missions differ greatly, it's interesting to compare the turbine Air Tractor with the similarly powered Cessna Caravan. The Cessna is about 30 knots faster, but the Air Tractor has a substantially greater payload (albeit more limited in bulk and type). Yet you can buy three AT-502s for the price of one C-208. (We'll compare unequipped base prices to factor out differences in mission-related equipment costs.) So what gives here?

Perhaps a major factor (I'm speculating) is product liability. Snow doesn't worry about it. He and his customers are close. They share common values. They accept some risk in order to participate in an exciting and rewarding industry. They're down-to-earth folks; many are farmers as well as airmen. Their families understand, share, and support their work. Most recognize and share in the great contributions that have been made by Snow and others to ag aviation safety, and they take personal responsibility for their occasional mishaps.

I find their integrity and independence to be quite refreshing. They seem somehow—in today's light—to be larger-than-life folks building and flying larger-than-life airplanes. □