ARROW

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PIPER ARROW

Piper drew a bead on the light single-engine retractable market and let fly the Arrow.

BY MARK R. TWOMBLY

Nineteen years and more than 6,000 units after the Piper Arrow was introduced, it still is in Piper's new-product lineup, though only in turbocharged form. The Arrow's longevity cannot be credited to unmatched performance, superior load-carrying capability or sex appeal. Its virtues are timing—Piper was the first of the big three to offer a light, retractable single—ease of operation and the lack of any real shortcomings.

"It's like a pair of old shoes," explained Bruce D. Jenkins, AOPA 445605, of Mt. Airy, Maryland, whose 1969 Arrow 200 is pictured on page 39. "I've thought about getting something with a little better performance, but the Arrow is so fa-

The Arrow III embodies all of the best features of the design: tapered wing planform, stretched cabin and conventional tail.

miliar and fits so well I found I just couldn't sell it."

With thousands still flying and many for sale, the Arrow is a good candidate for a used aircraft purchase. Prices begin at about $18,000, so there is one to fit most budgets. The Arrow may be a good choice for a pilot with little complex aircraft experience or one who does not fly often. It was designed to be an easy step up for pilots transitioning from a trainer to a single with retractable landing gear and controllable-pitch propeller. There are no cowl flaps to open or close, the flaps are manually controlled by a "Johnson bar" and the gear extends automatically if the pilot forgets to put it down. What it lacks in performance, it makes up in simplicity.

The Arrow's design roots go back to December 1956, when Fred E. Weick, the designer of the Ercoupe, and Howard (Pug) Piper, vice president of research and development for Piper Aircraft, began to collaborate on specifications for two new Piper aircraft. One was to be a state-of-the-art agricultural spray-plane, the Pawnee. The other, an all-metal, low-wing, 160-hp four-place single, would replace the aging Piper Tripacer. More important, it would usher in a new, more efficient approach to manufacturing because it required fewer parts and materials and took less time to build. John W. Thorp, a Lockheed engineer and light aircraft designer, was hired to do a preliminary design study of the new PA-28 single, later to be named the Cherokee. At the time, no one contemplated a retractable-gear spin-off of Piper's next-generation basic airplane, because the Comanche was just going into production. But, as the Comanche grew over the next 10 years in horsepower, sophistication and cost, Piper recognized a need to fill the widening gap between simple fixed-gear aircraft and complex singles. The answer was the Cherokee Arrow.

The 1967 Cherokee Arrow 180 contained half as many rivets and other metal parts as the Comanche and sold for $16,900 compared to $24,680 for a new Comanche 260. (The Comanche 180 and 250 no longer were in production.) According to Weick, Piper executives insisted that the Arrow cabin be two inches narrower than the Comanche's just to give some justification to the price spread.

A number of innovations first appeared on the Arrow. It was the first Piper model to incorporate an automatic landing gear extension/anti-retraction system. The panel featured the new standard T-configuration of flight instruments in front of the pilot and a multi-engine-style power control quadrant in place of the traditional push/pull throttle, propeller and mixture controls. In 1972, it became the first light aircraft to have factory-installed air conditioning. The 1977 Turbo Arrow III was the first light single-engine production aircraft to be offered with a factory-installed fixed-wastegate turbocharger system. (The volume of exhaust gas directed to the turbocharger compressor is fixed, so that the throttle directly controls the amount of induction manifold pressure-boost the turbocharger provides. Piper chose a fixed-wastegate system for the Arrow because of its lower cost and weight compared to other turbocharger system configurations.)

The Arrow's most unique feature is the automatic gear. Piper anticipated that most of the people who would be flying Arrows would have little or no experience in retractables. To ease their transition into complex aircraft and reassure FBOs that would be using the Arrow for training, Piper designed a system that, operated properly, makes it extremely difficult to land wheels-up. The mechanism prevents the gear from being retracted on takeoff until a safe climb speed is reached and automatically lowers the gear when power and airspeed are reduced below a certain point. A lever located between the two front seats allows the pilot to override the automatic system and control the gear with the selector switch.

The objective of the automatic gear is admirable, but in certain circumstances it can be an annoyance and even dangerous. If the pilot does not disable the automatic gear system immediately after an engine power loss, the gear will extend, shortening the glide distance and robbing the pilot of the option of making a wheels-up landing in rough terrain.

ARROW

Some say the Arrow's handling traits took one step forward and two steps back when Piper introduced the T-tail on the Arrow IV.

The override also must be engaged before taking off from a runway hemmed with obstacles so the gear can be retracted quickly to build climb speed. Slow flight, stalls, power-off descents, even a pattern flown at normal speeds will be interrupted unexpectedly with a clunk and a drop in airspeed as the gear extends on its own. As a result, some pilots lock the override in the engaged position. According to FAA records, most gear-up accidents in Arrows occur because the pilot forgets to put the gear selector down after having engaged the override.

The automatic gear extension system is pneumatically controlled. A pitot-static mast on the left side of the fuselage that protrudes into the slipstream and propeller wash is connected by tubes to a sealed diaphragm located beneath the rear seats. When power-on airspeed exceeds 73 to 81 KIAS on the normally aspirated Arrow and 76 to 84 KIAS on a Turbo Arrow (the speed increases by about one knot for each 1,000-foot increase in density altitude), the pressure differential in the diaphragm chamber causes the diaphragm to flex, moving a plunger that closes off the landing gear hydraulic system and completes the circuit for the electric hydraulic pump. When the gear selector is placed in the Up position, the pump pressurizes the hydraulic lines to raise and hold the gear up. When power-off airspeed falls below 93 to 101 KIAS on a standard Arrow and 101 to 109 KIAS on a Turbo, the diaphragm relaxes, and a tensioning spring retards the plunger. The current to the gear pump motor is interrupted, and the hydraulic lines are opened. As hydraulic pressure deteriorates, the free-falling landing gear extends. The same system is used on the retractable-gear PA-32 Lance and Saratoga.

The pilot can override the system by pull-

ing up and locking into place a lever between the two front seats that pushes the plunger against the diaphragm, closing off the hydraulic system and interrupting the pump circuit. The locking pin was added in 1972. Before that, the lever had to be held up to disable the system. A yellow light on the panel blinks when the override is engaged. In the event of an electrical failure, the gear can be extended by pushing down on the override lever. This retards the plunger, relieving the hydraulic pressure holding the gear up.

Piper calibrates the automatic extension system on each Arrow before the aircraft is delivered by setting the tension on the plunger return spring. The tension can be readjusted by a mechanic if the spring has relaxed, but it is a difficult, trial-and-error process that must be done in flight. The mechanic has to crouch in the back with the rear seat removed to make small adjustments while the pilot executes full-power climbs and power-off descents, varying the airspeed one knot per second. The procedure is spelled out in the Arrow service manual.

The automatic extension system is prone to some maintenance problems. The natural rubber diaphragm used in early model Arrows can dry out and crack, allowing ram air to bleed into the static side of the diaphragm. The effect is to either increase the speed at which the gear will automatically fall or render the system totally ineffective. Piper replaced the black rubber diaphragm with orange-colored synthetic material on later model Arrows.

The speed calibration for automatic gear extension can be affected by bugs, ice or water clogging the pitot mast. The underwing

The 1969 fuel-injected, 200-horsepower Arrow had a little more heart than the fixed-gear Cherokee 180, but the same old soul.

airspeed pitot mast common to all PA-28 models is subject to the same contamination problems and, like the gear pitot system, cannot be examined adequately for blockage during a preflight inspection. The pitot mast for the gear is wired into the pitot heat electrical system, but pitot heat is an option.

According to Piper, the Arrow landing gear is constructed with a certain amount of play in the components to aid the spring-assisted, gravity extension system. If the gear is not lubricated regularly, the joints can bind and prevent the wheels from fully extending. Two airworthiness directives have been issued against the landing gear. In 1968, the FAA called for replacement of landing gear fittings and bushings on all Arrows within 50 hours flight time, and in 1976 the nose gear trunnion on all Arrows had to be replaced before further flight.

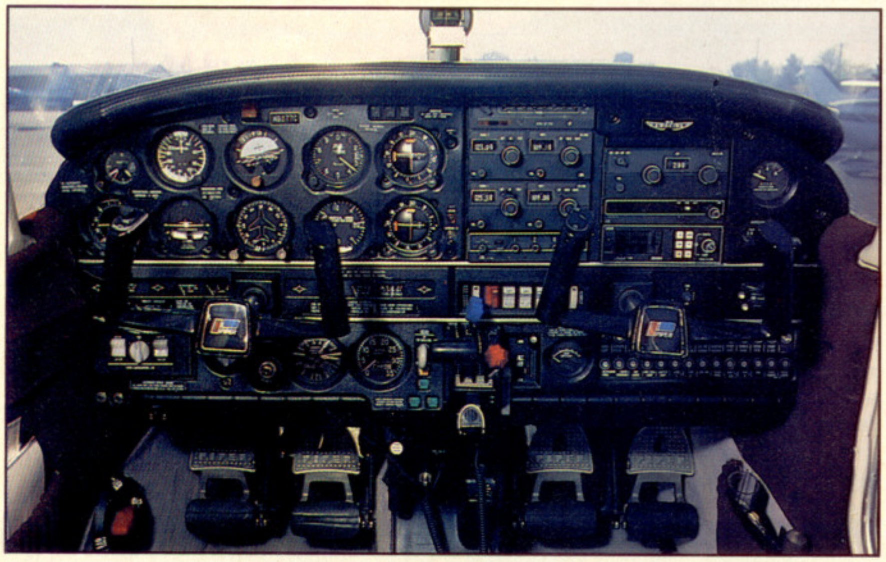
Sorting through the plethora of changes in the seven different Arrow models to find the one with the best combination of performance, comfort and price is enough to confuse the most determined shopper. Fortunately, there are only minor differences in the panel configuration, systems operation and handling characteristics between the earliest and the latest normally aspirated Arrows. Similarly, the Turbo Arrow III is virtually identical to the Turbo Arrow IV except for the difference in stabilator positions.

The Arrow has undergone a long evolution, but there have been four improvements that have had the most significant effects on performance, utility and comfort: the introduction of a 200-horsepower model in 1969, a five-inch stretch of the fuselage in 1972, a 50-percent increase in useable fuel capacity in 1977 and the introduction of a turbocharged model the same year. Piper also increased the wingspan, enlarged the stabilator, dressed up the interior, changed the wing planform and switched to a T-tail.

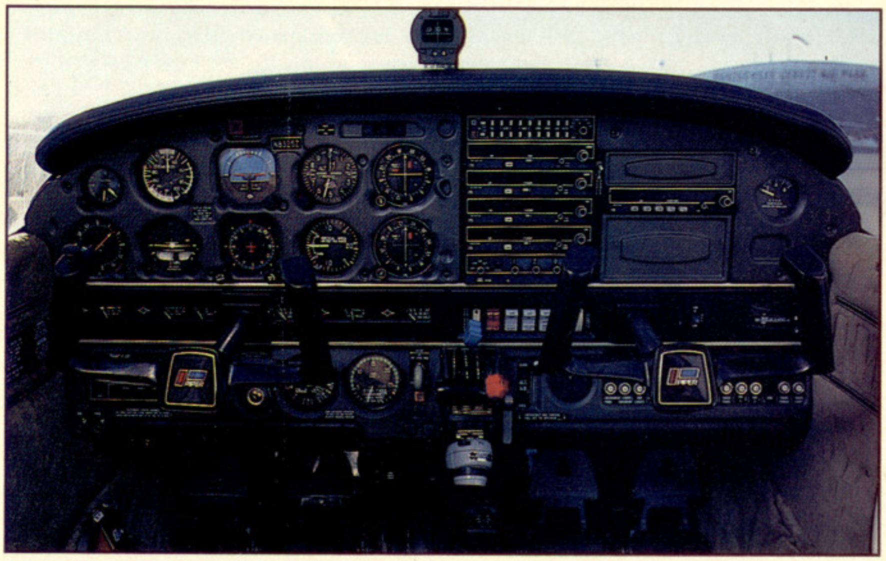
All normally aspirated Arrows have been powered by the same basic four-cylinder, fuel-injected Lycoming IO-360, but the 180-hp PA-28R-180 models lacked takeoff and climb performance with heavy loads and in high density altitude conditions. A higher-compression, 200-hp IO-360-C1C was offered in the PA-28R -200 beginning in 1969. The additional power decreased the Arrow's takeoff roll to 775 feet from 820 feet, increased the rate of climb to 965 feet-per-minute from 875 feet-per-minute and increased the gross weight and useful load to 2,600 pounds and 1,141 pounds from 2,500 pounds and 1,120 pounds. Piper claimed a maximum speed of 152 KTAS and cruise speed of 144 KTAS for the Arrow 200, or about four knots more than the 180.

The 200 horsepower IO-360 initially had a TBO of 1,200 hours compared to 2,000 hours for the 180. A 1971 airworthiness directive on the 200-hp Lycoming called for repetitive inspections to check for shifting of crankcase main bearings. Lycoming switched to larger bearing dowels in 1971, and TBO increased to 1,400 hours. In 1973, a redesigned camshaft boosted TBO to 1,600 hours and it has since increased to 1,800 hours on engines that have been overhauled with new bearing dowels and camshafts. From 1976 on, Arrows

The Arrow's all-new panel featured a multi-engine-style engine power console, flight instruments arranged in a T-pattern, an avionics stack in the center and rocker switches.



A padded glareshield was added and the color went to all-black, but the Arrow instrument panel changed little over the years. The panel in this 1977 Arrow is very similar to...



...this Arrow IV panel, which is almost identical to the 1969 Arrow 200 panel pictured at top. One change: the "Override Engaged" light was moved down to below the gear switch.

were delivered with 1,800-hour IO-360-C1C6 engines.

The five-inch fuselage stretch in the 1972 PA-28R-200 Arrow II increased leg room for rear-seat passengers about 50 percent. Piper also made the door wider for easier entry. Air conditioning was offered as an option, but the 70-pound package reduces useful load and extracts a six-knot, seven-horsepower penalty and reduces range about 30 nautical miles when in use. A large padded glareshield added in 1973 had the unfortunate effect of reducing forward visibility. Piper offered an optional soundproofing package in 1974 with double-thick windshield and windows, foam-backed carpeting and higher-density soundproofing material.

A major airframe change occurred in 1977 on the PA-28R-201 Arrow III when Piper switched from the homely constant-chord wing to one with the same airfoil section but a tapered planform that had first been used on the Warrior and Archer nearly four years earlier. The two wing-leading-edge fuel tanks were enlarged to hold a total of 77 gallons (72 useable), which increased range about 50 percent. The Arrow II, which holds 48 gallons of useable fuel, has a maximum range, with 45-minute reserves, of about 530 nautical miles at 75-percent power. The range of the Arrow III under the same conditions is about 810 nautical miles.

The inboard section of the wing is the same constant-chord section as earlier Arrows, but the leading and trailing edges of the outboard panels taper in towards the wingtip. The Arrow III has a slightly longer wingspan than the Arrow II and much longer ailerons, but wing area is the same. The new ailerons and tapered wing improve roll response and stability and increase the service ceiling to 16,200 feet.

1977 also marked the introduction of the PA-28R-201T Turbo Arrow, powered by a six-cylinder, 200-hp Continental TSIO-360-F engine, Rajay turbocharger and optional three-blade propeller. It is the same basic engine that Piper used on the Seneca II. The turbocharger enables the engine to maintain full power to 12,000 feet density altitude and 75-percent power to 20,000 feet. Power management is critical on the Turbo Arrow. The manifold pressure limit is 41 inches, and it is easy to overboost the engine at low density altitudes. Recommended takeoff technique is to hold the brakes, advance the throttle to about 30 inches and 2,575 rpm and wait for the turbocharger to spool up. Then release the brakes and add more power until reaching the 41-inch limit. A yellow light on the panel illuminates if the limit is exceeded. Power is reduced to 33 inches and 2,450 rpm for cruise climb at a speed of at least 104 KIAS to keep cylinder head temperatures below 460 degrees. The Arrow does not have cowl flaps, and it may be necessary to climb at a higher indicated airspeed to keep temperatures in the green, especially in a Turbo.

Turbocharging significantly improves the Arrow's climb and cruise performance. A Turbo Arrow will climb from sea level to 20,000 feet in 32 minutes at its best rate-of-climb speed, according to Piper, while a normally aspirated model requires more than 45 minutes to reach its 16,000-foot service ceiling. At 18,000 feet and 75-percent power, with the mixture leaned to economy setting, a Turbo Arrow will cruise at 163 KTAS, according to Piper. A normally aspirated Arrow operating at 6,500 feet at 75-percent economy power will cruise at 135 KTAS. Although the Turbo Arrow's endurance under those conditions is just 3 hours 45 minutes—two hours less than the normally aspirated Arrow—both models will cover about 790 nautical miles with a 45-minute reserve.

Turbo Arrows not equipped with pressurized magnetos can suffer from misfiring. At higher altitudes or in high ambient temperature conditions, the ignition spark can arc across the distributor block, causing the engine to misfire. Piper offers an inexpensive kit that siphons a small volume of induction air and directs it to the magnetos to pressurize them. A 1978 Continental service bulletin recommends inspecting and cleaning of ignition system components every 100 hours on TSIO-360 engines that do not have pressurized magnetos.

The last major change in the Arrow occurred in 1979, when Piper introduced the PA-28RT-201 Arrow IV and PA-28RT-201T Turbo Arrow IV, which featured T-tails. The high stabilator, which is almost eight feet off the ground, makes the Arrow IV appear much larger than earlier models. It looks good, and because it is above the propeller wash and wing, there is little trim change with a change in power or gear and flap extension. Leading edge slots and vertical fences on the inboard section of the stabilator direct airflow over the top surface to ensure pitch effectiveness at low speeds and high angles of attack.

The T-tail also altered the Arrow's takeoff and landing characteristics—for the worse. Pitch forces are much heavier on rotation and landing even with generous aft trim, and the stabilator is ineffective in raising the nose to increase propeller clearance while taxiing over soft ground or loose gravel. Piper's specifications do not support the claim, but many pilots feel the T-tail Arrow gobbles up more runway on takeoff. The takeoff roll can be reduced substantially by applying 25 degrees (two notches) of flaps.

Several modifications have been developed for the Arrow to improve climb and cruise performance and to reduce operating temperatures. Knots 2U, Incorporated (1941 Highland Avenue, Wilmette, Illinois 60091; telephone 312/256-4807), has designed flap and aileron gap seals for all model Arrows. Knots 2U conservatively estimates that flap and aileron seals can boost the true airspeed of an early-model Arrow with a constant-chord wing by six knots and also improve takeoff and climb performance and lower the stall speed. The same kit on a tapered-wing Arrow increases cruise speed by about four to five knots. The kit costs $750 for a constant-chord wing and $825 for a tapered wing and takes an estimated 10 hours to install.

Laminar Flow Systems, Incorporated (Post Office Box 8557, St. Thomas, U. S. Virgin Islands 00801; telephone 809/776-5515/0107), offers wing, flap hinge and wheel-well fairings and aileron and flap gap seals for all Arrows. The company claims these items improve rate of climb, cruise speed, range and fuel economy (see "Alternatives: Beyond Book," September 1985 *Pilot*, page 68).

Precise Flight, Incorporated (63120 Powell Butte Road, Bend, Oregon 97701; telephone 800/547-2558), has certificated a vacuum-operated speed brake system for the Arrow that significantly increases descent rate without risking shock-cooling of the engine. With the wing-mounted devices deployed, an Arrow will descend at 1,650 fpm at 150 KIAS, 2,400 rpm and 24 inches manifold pressure, according to Precise Flight. Speed brakes would be of most value on a Turbo Arrow because of its higher operating altitudes. The speed brake kit costs $2,995 and requires an estimated 40 hours to install.

Turboplus, Incorporated (1437 West Valley Highway, Auburn, Washington 98002; telephone 800/742-4202), manufactures an intercooler kit for the Turbo Arrow. The kit includes an intercooler and induction system, magneto pressurization kit and a panel-mounted gauge to monitor induction air temperature. Turboplus claims the intercooler kit increases the Turbo Arrow's critical altitude by 3,500 feet and decreases cylinder head and oil temperatures, which could prolong engine life. The kit sells for $4,495 and takes an estimated 33 hours to install.

The prospect for continued production of new Arrows is uncertain. The normally aspirated Arrow was dropped after 1982, when Piper built only 26 of them. Production of all Piper piston-engine models, except for the Malibu, was suspended in February 1986. Piper said the demand for new aircraft was drastically reduced and blamed escalating product liability insurance costs for driving up the cost of new aircraft. (The base price of the Turbo Arrow IV climbed steeply from just over $49,000 in 1979 to $89,000 in 1986.) Last April, Piper announced that limited production of piston-engine models will resume in June. Sales figures from the last few years clearly indicate that few buyers are interested in paying big money for new aircraft that are essentially unchanged from models built and sold in the past for a fraction of the price. Piper officials have said a new evolution of the Turbo Arrow has been under development but is unlikely to be marketed until sales of new piston-engine aircraft improve.

Accident and service records support the Arrow's reputation as a safe, dependable design. The Arrow has been a popular training and rental aircraft from the beginning, and it probably has been exposed to more inexperienced pilots than other aircraft in its class. Lack of pilot experience has been a key factor in the many weather-related fatal accidents involving Arrows, as well as the runway overshoots and hard landings that typically account for the non-fatal accidents. None of the 16 airworthiness directives issued on the airframe has involved major modifications.

Deciding which of the seven Arrow models is best for a particular pilot is a matter of examining individual requirements and budgets. If the back seat rarely will be occupied and there is no need for long endurance, one of the early short-body, short-wing Arrows may be the one to consider. I prefer the early Arrow for its handling characteristics. It feels slightly more responsive in pitch and roll control, and there is more of a pronounced

For more information on the Piper Turbo Arrow, see "Turbo Arrow IV," January 1981 *Pilot*, p. 28; "The Turbo Arrow IV," March 1979 *Pilot*, p. 38.

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For more information on turbocharging, see "Performance: Fire and Air," January 1984 *Pilot*, p. 55; "Turbo Tips," May 1983 *Pilot*, p. 63; "In With the Old, Out With the New," January 1981 *Pilot*, p. 37.

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For more information on Piper's transition and recurrency schools, see "Malibu U," March 1985 *Pilot*, p. 109; "Seneca III," February 1985 *Pilot*, p. 48; "Aerostar 700P," November 1984 *Pilot*, p. 32.

buffet to warn of an impending stall. There is little tendency to float in ground effect, and the short wings and fuselage are easier to shoehorn into tight spots. The early Arrows have better visibility because there is no glareshield. On the other hand, interiors are more spartan, they hold less fuel and rear-seat passengers have less room. The stretched Arrow II has more legroom, and if you cannot stand warm cockpits you may find one with air conditioning. The Arrow III, which many consider to be the best value, has the extra room of the Arrow II, the tapered wing and increased fuel capacity of the Arrow IV and a conventional tail. If low time and good looks lead the list of requirements, a late-model Arrow IV may be the choice.

I recently completed a trip that included one non-stop leg of nearly five hours in an Arrow IV. The flight would have been over sooner and taken less fuel in a Mooney. I could have brought three friends and their baggage in a Skylane RG or turned more heads in a Rockwell 112. Even so, it was a trouble-free, comfortable, relatively economical and reasonably fast trip, and that is all anyone asks of an Arrow. □

SINGLES SCHOOL

The Piper Arrow is regarded as a relatively simple aircraft to fly and fix, assuming the pilot is familiar with the aircraft systems, operating procedures and maintenance considerations. This is not always the case, as indicated by reports of gear-up landings in Arrows, which are equipped with automatic gear extension mechanisms. Piper Aircraft Corporation recently surveyed 200 Arrow and PA-32 Saratoga owners to determine the interest in a pilot training school offered by the factory, similar to schools Piper conducts for Malibu, Aerostar and Seneca owners and pilots. Of those who responded to the survey, all but two said they were interested.

Encouraged by the survey results, Piper created a two-day classroom and flight-training school for its high-performance single-engine models (PA-28R and PA-32). All of Piper's pilot schools are held in a new training facility near the factory at the Vero Beach Municipal Airport in Vero Beach, Florida. At the first high-performance single class, which I attended last April, there were four other students. Two fly Saratogas, one operates a Turbo Arrow IV and another a normally aspirated Arrow III. Robert D. Scott, manager of the Piper Training Center, originally put the Arrow and Saratoga together in one class because of the similarity in the systems, but he has since decided to hold separate schools for each model.

Why travel to Florida when you can read the aircraft information manual on your own and schedule a check ride with a local instructor? The strengths of the Piper school are the knowledge and experience of the instructors and the availability of other Piper employees to answer technical, operational and maintenance questions. Students are able to leave business matters and other distractions behind for a couple of days and devote their full attention to learning more about their aircraft and their flying habits.

During the one-and-a-half-day classroom portion of the school, we discussed aircraft systems: hydraulics and landing gear, flight controls, electrical, fuel system, engine, pneumatics and environmental; reviewed performance specifications and emergency procedures; performed weight and balance computations, and planned a typical flight profile. Scott also discussed factors that contribute to pilot-error accidents, such as stress, poor judgment and alcohol and drug use.

Much of the material covered in the classroom was taken from operating and service manuals for the PA-28R and PA-32, supplemented with opaque-projection schematics and slides of the hardware under discussion. Each new topic prompted a rash of technical questions. If one of the instructors could not provide an immediate answer, the question was referred to Donald W. Kraft, who teaches single- and multi-engine maintenance courses at the training center, or a telephone call was made to a Piper engineer or service specialist.

One student, Gerald M. Stevens, who owns an Arrow III, pointed out that a placard on the inside of the baggage compartment door cautions the pilot to check weight and balance data for baggage loading between 150 pounds and 200 pounds. Stevens thought there may be limitations on concentrating the baggage load in a small area, but there is nothing in the weight and balance section of the handbook referring to the placard. "Why the warning?" Stevens asked. Scott tracked down the answer: It is possible to exceed the aft center of gravity limit with little weight in the front seats and a load in the baggage compartment. The placard is intended to remind pilots to check weight and balance figures before loading the airplane.

The instructors—Scott, Lester J. Kyle Jr. and James F. McCarthy—offered some useful operating tips not found in the handbooks. For example, the manual for the normally aspirated Arrow recommends a cruise climb speed of 104 knots but does not list climb power settings. With no other guidelines, most pilots square the power at 25 inches manifold pressure and 2,500 rpm. Piper's instructors recommended 110 KIAS at maximum continuous power (full throttle and 2,650 rpm) to maintain a good rate of climb and improve forward visibility and keep engine operating temperatures down and ground speed up. Scott said that in smooth air, he descends from altitude at the maximum structural cruising speed of 149 KIAS rather than reducing power and descending at normal cruise speed. "Airplanes are supposed to save you time," he argued. "Why not take advantage of it?"

Scott also recommended that instrument approaches be flown at 120 KIAS, and suggested procedures and approximate power settings to use: 25 inches manifold pressure and 2,400 rpm on the initial segment, reduce to 20 inches to descend at 500 fpm, and gear down and 25 inches at the final approach fix. The relatively high approach speed enables an Arrow to blend more easily with other traffic in busy terminal areas and makes for smaller heading and pitch changes. This speed also provides a comfortable margin from stall speed and simplifies the missed approach procedure: apply climb power and pitch up 10 degrees.

Following the classroom sessions, each student flies in his or her own aircraft with a training center instructor. I was assigned to Kyle. We covered 17 procedures and maneuvers beginning with a preflight inspection. Kyle observed my walkaround and offered helpful advice. He recommended that I stow a can of MIL-H-5606 petroleum-base hydraulic fluid in the airplane to replenish the hydraulic fluid reservoirs and also to splash on a rag to wipe away the grit that collects on landing gear struts and wears the seals. The student is asked to perform a normal takeoff and cruise climb, set cruise power and trim, demonstrate fuel management and execute medium and steep turns, power-on and power-off stalls, simulated emergency procedures and landings, simulated instrument flying, instrument procedures (if instrument-rated) and short-field takeoffs and landings. The transition flight lasts two hours or longer, if necessary, and includes a biennial flight review and instrument competency check if desired by the student. Federal Aviation Regulations are covered for the biennial flight review and instrument competency check. The flight evaluation is scheduled for the second day and can include right-seat instruction for the student's spouse. At the end of the course, students are presented with framed certificates attesting to successful completion of ground and flight transition training in the systems and procedures of their aircraft.

The high-performance single-engine transition class costs $500 and includes all classroom materials and the flight evaluation. The recurrency class, which includes one day of classroom review and a flight the next day, costs $400. Piper high-performance single-engine transition schools will be held July 28-29, September 29-30 and November 24-25. A recurrency school is scheduled for September 25-26. Aerostar, Seneca, Malibu and engine maintenance classes also are scheduled from July through December. For more information, contact the Piper Training Center, Piper Aircraft Corporation, Post Office Box 1328, Vero Beach, Florida 32960; telephone 305/567-4361, ext. 2370. *—MRT*

ARROW SPOTTERS' GUIDE

Piper introduced the Cherokee Arrow in 1967 by mating the fixed-gear Cherokee 235 airframe to a Comanche electrically actuated hydraulic landing gear and a 180-hp, fuel-injected Lycoming IO-360 engine. Piper claimed the landing gear could "think for itself" because it would extend automatically below 101 knots (power off) and would not retract at full-power climb speeds less than 73 knots. The Arrow also featured flight instruments arranged in a T-pattern and engine controls grouped in a "SportsPower" multi-engine-style power quadrant. The 180-hp Arrow quickly became the top-selling four-place single-engine retractable. It was discontinued in 1971 in favor of a higher-horsepower version.

In early 1969 Piper announced a 200-hp, Lycoming IO-360-CIC-powered version of the Arrow. Piper would stick with the 200-hp Lycoming for the normally aspirated Arrow throughout its production life. The additional power permitted a 100-pound increase in maximum gross weight and a 21-pound increase in useful load. The Arrow 200 also had a shorter takeoff roll, faster climb rate and cruise speed and a higher service ceiling than the 180-hp model.

The next big change came in 1972 with the introduction of the Arrow II. Piper added five inches to the fuselage in the passenger seating area. Externally, the Arrow II can be identified by the wider cabin door and the rounded window corners. The wingspan was extended 26 inches, and a larger, Cherokee Six stabilator was used. Maximum gross weight increased 50 pounds to 2,650 pounds, but empty weight went up commensurately, so there was no gain in useful load over the Arrow 200. Performance specifications for the two models were almost identical. Air conditioning was offered as a factory-installed option. Shoulder harnesses became standard equipment for front-seat passengers and optional for rear seats. The addition of bungee cords to the mechanical nosewheel steering system eased pedal pressure, and an optional soundproofing kit and thicker windshield were offered.

The Arrow III (top) appeared in 1977 with a new wing. Gone was the constant-chord wing. In its place was a double-tapered wing with a longer span but the same area as the wing of the Arrow II. The new wing gave the Arrow better roll response, a higher service ceiling, more docile landing characterisitics and a shorter landing roll. Standard fuel capacity increased from 50 gallons to 77 gallons. The first turbocharged Arrow, the Turbo Arrow III (bottom), was also introduced in 1977. Powered by the same 200-hp six-cylinder Continental TSIO-360 as the Piper Seneca II, the Turbo Arrow's fixed-wastegate Rajay turbocharger enabled the engine to develop full power to 12,000 feet. The Turbo Arrow is readily distinguishable by the steeply raked engine cowl and separate chin cowl containing the landing light, heater air intake and nosewheel well. Following incidents in which turbine engine oil was added to turbocharged Arrow crankcases, the FAA issued an airworthiness directive mandating removal of the word Turbo from the Arrow cowl.

The latest version of the Arrow is the T-tail IV series, introduced in 1979. The end plates and leading edge slots on the the Arrow IV and Turbo Arrow IV stabilators improved low-speed pitch response and reduced trim changes with changes in power, but pilots complained that the T-tail Arrow had a longer takeoff roll and required more pitch effort on rotation and landing flare. Production of the normally aspirated Arrow IV ceased in 1982.