Twin Commanche

PA-30-160
This Aircraft Converted to C/R

This particular airplane was converted to a “C/R” by replacing the right engine with an LIO-320 engine and the appropriate propeller. Most of the other required items for the conversion were standard on PA-30-1849 as it was delivered from the factory.

Twin Commanche - Early History

The Twin Comanche was initially very popular with flight schools for use as a multi-engine trainer. There was a noticeable increase in the accident rate during training. The FAA performed additional flight testing of the airplane and determined that the airplane was really not the problem. The flight instructors of the era as well as some of the training and testing procedures of the day were the real issue.

The FAA made some changes. I will start with the only one that was rather silly. They merely increased the published Vmc speed from 80 mph to 90 mph. This really did nothing to change the way the aircraft performed. Merely changing where Vmc is depicted on the airspeed indicator does nothing to change the handling qualities of the airplane. The remainder of what the FAA did was spot on, and pretty much solved the problem!

Procedures: Many dangerous procedures, such as very low altitude Vmc demonstrations, single-engine short field landings as well as landing with a feathered propeller were customary in those days. Simulated engine failures at rotation were common. In many cases, these engine failures were simulated with the mixture control making it difficult to restore power quickly.

failures on the ground or at rotation are ok in FAR part 25 airplanes, but a bit risky in light twins. Many training and testing procedures were modified. A little applied common sense did make multi-engine training a whole lot safer. Instructors: In those days, any holder of a flight instructor certificate with an airplane rating could teach in a multi-engine airplane as long as they themselves had a multi-engine rating on their pilot certificate. Any CFI who could teach in a 172 or Cherokee could teach in a twin as long as they were multi-engine rated. This was, in a manner of speaking, children teaching children. Airplanes were crashed and lives were lost as a result. The FAA needed to take action, and did so quite effectively in a way that produced results.

The first phase of this fix was to require anyone who held a Flight Instructor Certificate to take their multi-engine checkride with the FAA, not a designated examiner. This sent a message regarding instructing in twin's. The second phase was to create an "Airplane Multi-Engine" rating, required on your flight instructor certificate if you were to instruct in multi-engine aircraft. FAA also later required that the flight instructor have at least 5 hours PIC time in a particular type of multi-engine airplane, or helicopter in which they were to give instruction. These were well thought out changes to the regulations that definitely made training in multi-engine airplanes safer.

The combination of these changes resulted in a substantial improvement in the safety of multi-engine instruction, and proved that the Twin Comanche itself was not the problem. It was, and is a great airplane. The Twin Comanche, however, is an airplane that must be treated with respect. It is a high performance airplane with a laminar flow wing, making it about 20 kts faster than the Seminole even though the Seminole has 40 more horsepower. If you mishandle the Twin Comanche, it will bite you in the ass, unlike the Seminole, or with the Seneca with its "Hershey Bar" wing. In the hands of a properly trained pilot, the Twin Comanche is in a class by its self. It goes almost 200 mph using 14 gallons per hour. I consider it to be the "E Type Jaguar" of airplanes. Having owned both, I speak from experience.

After an Annual Inspection and a C/R conversion, it flew after 14 months. I must say that even though it is smaller, lighter and less powerful, the handling qualities of the Twin Comanche are as good as the airplanes I fly for a living….Falcon 900 and Gulfstream IV thru 650. That is quite something for an airplane built in 1969.

When & How Many

First Flight Nov 7, 1962 2156 Twin Comanche's Built

1963 PA-30-002 thru PA-30-142

1964 PA-30-143 thru PA-30-627

1965 PA-30-628 thru PA-30-862 PA-30-854 thru PA-30-901

Twin Comanche B Model

1965-1968 PA-30-863 thru PA-30-902 PA-30-1718 thru PA-30-1744 and PA-30-1716

Optional Tip Tanks– Adds 30 Gallons &Slows cruise speed by ~ 4 kts

Additional Side Windows & Optional 5th& 6th Seats

Rear Seat Weight Limit:

Combined Passenger Weight Seats 5 & 6 Max 235 lbs

250 lbs Maximum weight in baggage in compartment.

Twin Comanche C Model

1969 PA-30-1745 thru PA-30-2000 and PA-30-1717 Updated Instrument Panel & Thicker Stabilator

New Stabilator – More effective at low speed

More resistant to flutter & Handles Ice Better

The "C" model has the battery in the nose compartment. I believe this was to avoid an aft CG issue with passengers in the rear seats. The thicker and more effective Stabilator may have been installed to compensate for the more forward CG with only two people aboard. As I have said elsewhere in this guide, my battery is being moved aft, to the original design location in order to optimize my CG for operation with a maximum of 4 occupants.

Twin Comanche C/R

1970-1972 PA-39-1 thru PA-39-155 Essentially a PA-30 "C" with Counter Rotating Engines & Props

I invested a considerable amount of time and resources to convert my PA-30 "C" Model into what is effectively the same as a PA-39. After having flown the same airplane in the two different configurations, I am very pleased with the results. Without all of the monkey motion as a result of Torque and P Factor it is a much nicer airplane. Is it worth the time, expense and hassle of doing the conversion? This will depend 100% on your own likes, dislikes and available resources. It's a subjective decision. I am pleased with my decision.

Systems and Limitations Overview

The following is an overview of the basic systems on the Twin Comanche. It is not intended to provide enough information for you to build the airplane. It is intended to provide general information for familiarization and review. For the latest and most accurate information, refer to the current AFM. Many flight manuals on older airplanes, if subjected to inspection, will be found to be out of date. Guess who gets the shaft if there is a problem, and you were operating with out of date information. Look in the nearest mirror and see!

Dimensions

Twin Commanche

Wing Span	36'
Stabilator Span	12' 6"
Gear Track	9' 10"
Overall Length	25' 2"
Wheelbase	7' 4"
Turn Radius	25' 6"
Prop Ground Clearance	10"

Limitations

Weights

PA-30	Standard	Tip Tank
Max Ramp	3,600 lbs	3,725 lbs
Max Takeoff	3,600 lbs	3,725 lbs
Max Landing	3,600 lbs	3,600 lbs

Note: All weight in excess of 3,600 lbs must be fuel in the Tip Tanks.

Other than emergency, tip tanks must be empty for landing.

The above weights are maximum certificated limits. The actual safe maximum weights for a particular flight may vary due to the performance limitations. Although Normal Category airplanes are not specifically weight limited due to performance, you would have a very difficult time explaining why you were operating at a weight higher than your takeoff or landing performance would allow.

Unlike their Transport Category (FAR Part 25) big brothers, normal category (FAR Part 23 Twins), there is no requirement for Your Twin Comanche to be able to climb with an engine failure after takeoff. This being said, you can find yourself in a situation where you can't stop, and you can't go! I am not saying don't go to a high elevation airport and take off. Single engine airplanes do this all the time. I am saying BE AWARE of what single engine performance you should have, and plan accordingly regarding an engine failure during the initial climb after takeoff so you will know what to do in case it happens. For more information, see the "Jet Performance" section of this website.

For landing, I recommend that you determine the actual required landing distance according to the flight manual, then divide that number by 0.6 to give yourself a little margin. That's what the transport category aircraft do. The fact is that you can land an airplane places from which you do not have enough runway to take off ! The spirit of Charles Darwin is alive and well, and will not hesitate to intervene if you get stupid.

Center of Gravity

I was a bit concerned when I reviewed the CG envelope for the Twin Comanche. The forward limit was at 7% MAC. The PA-39 came with a revised forward CG limit. It was changed from 81 to 82 inches aft of the datum, or 8.754% MAC. Most aircraft have CG limits between 14% MAC forward limit and 30% MAC aft limit. The PA-30’s that were converted are subject to the same 82 inch forward limit as the PA-39. Why was the forward CG limit revised with the introduction of the PA-39 (Counter Rotating Props)? In my opinion it was because the forward limit on the earlier models was a bit too far forward in the first place. This provided a chance to revise it on a later model with no admission that the limit on the previous Twin Comanche’s was wrong in the first place. Most Twin Comanche’s with 2 people and fuel tend to be close to, or even forward of the forward CG limit. This is especially common in a “C” model, or the PA-39’s. A DPE friend of mine found that 100 pounds of weight in the baggage compartment was required to be within the CG limits for a checkride he was to give in the airplane.

I am going to move my battery from the nose to just aft of the rear cabin bulkhead, as it was installed in the early model airplanes. This should move the CG about 1.2 inches aft. That is a start. Some ballast in the rear of the aircraft will be added as well. My goal is to place the CG about half an inch forward of the aft limit with 4 people and 50 to 100 pounds of baggage. This should place the CG more toward the middle of the envelope for operation with two people aboard. In the real world, many Twin Comanche’s are flown while the CG is forward of the envelope. This adds to the perception that the Twin Comanche is “difficult to land”. In general, forward CG limits are established with regard to low speed handling. With a CG that is way forward, it can be difficult to maintain sufficient control about the pitch axis. A very forward CG can make you unable to raise the nose for landing. Aft CG limits are mostly a function of dynamic stability as well as the ability to avoid or recover from a stall or stall/spin.

What the heck is % of MAC ???

Center of gravity is in light aircraft is usually expressed in “Inches aft of Datum”. In order to have a controllable airplane that is dynamically stable, the center of gravity must be somewhere close to the center of lift, generally a bit forward of it due to the fact that most aircraft have a Stabilator or Horizontal Stabilizer & Elevator that exerts a force down on the tail of the aircraft. This compensates for the CG being slightly forward of the center of lift, and makes the airplane dynamically stable.

With a wing that is not swept or tapered, generally if the CG is between 14% and 30% of the way between the leading edge and the trailing edge of the wing makes the airplanes flying characteristics of the airplane acceptable. When the wing is tapered and or swept, such as most of the larger and faster aircraft are, it is a bit more of a challenge to visualize where the center of pressure of the wing lies. Enter the term % MAC. To make this work, we compute the "Mean" or more or less average of

where the aerodynamic leading edge of our wing would be. This is called "LEMAC", or Leading Edge Mean Aerodynamic chord. The same is done for the trailing edge, and it is called "TEMAC", or Trailing Edge Mean Aerodynamic Chord.

If you take "TEMAC" and subtract "LEMAC" you get MAC. MAC is generally expressed in inches. For example, if TEMAC is 90 inches aft of datum and LEMAC is 80 inches aft of datum, then MAC = 10 inches. If the CG is at 82 inches, CG expressed in % MAC would be 20%, or 20% MAC. Formula: CG in % MAC = (CG-LEMAC) / MAC. I hope that makes sense. You need not know this to fly your Twin Comanche, but it does make the airplane's handling characteristics a bit easier to understand.

Speeds

Vne	200 kts
Vno	165 kts
Va	141 kts
Vfe	109 kts
Vlo	130 kts
Vle	130 kts
Emergency Gear Extension	87 kts
Vmc	78 kts

Holding Speed

Recommended	100 kts

Note: The "Recommended" holding speed is derived as follows. Vy = 97 kts. This will be very slightly above "Max Endurance" speed. The difference in fuel flow between these speed will be so slight it does not matter. It will also keep you from having to make as many power adjustments, as you won't be on the edge of being on the back side of the power curve. In this airplane, you will not have to worry about exceeding the maximum holding speed required by the FAR's. This would require the turbo model to be holding at max cruise, and that would be rather silly.

Recommended Minimum Maneuvering Speeds

Configuration	Recommended / Minimum
Flaps Up	90 kts
Flaps 15 deg	85 kts
Flaps 25 deg	80 kts

These speeds should keep you out of trouble if you keep the bank angle under 30 degrees.

Altitudes & Misc.

Max Alt T.O. & LDG (See Note)	10,000 ft
Max Altitude	20,000 ft
Min Temp T.O. & LDG Max Slush Max Water	-40 Deg C 0.75 inch 0.50 inch
Max Temperature Abv 10,000 ft	ISA + 35 C ISA +30 C
Min Temp SL - 3,500	-40 C
3,500 - 5000 Linear	-40 C to -35 C
5,000 - 10,000	-35 C
10,000 - 35,000 Linear	-35 C to -70 C
Above 35,000	-70 C
Max Demonstrated X-Wind	20 kts
Max Runway Slope	2%
Max Tailwind Component T.O. & LDG	10 kts
Load Factor Limit Flaps Up Flaps Extended	 3.8 G 2.0 G

Note: Regarding the altitude for takeoff and landing, the performance charts only address altitudes up to 8,000 MSL. Extrapolation of these charts is invalid. Although you are not specifically limited, you have no performance data for the airplane. This being said, if you take off above an altitude or temperature where published data exists for the airplane, you are now a test pilot. I am not saying that if you take off from Telluride, elevation 9,078, or Leadville, elevation 9,927 that you are going to die. Just be way on the careful side until you have the experience to know what your airplane will do when you are "Off the Charts" from a performance standpoint. An old rule of thumb states that compared to sea level, takeoff distance is double at 5000 feet, and triple at 8,000 feet. I would guess takeoff distance at 10,000 feet might be quadruple the sea level distance, but that is only a guess on my part. **BE AWARE !**

Lycoming IO-320-B1A Engines

	MP	RPM
Takeoff	Max	2700
Max Continuous	Max	2700
Recommended Climb	25"	2500
Rec Max Cruise	Max *	2400
Ground Idle	-------	1000

Note: Full throttle at 8,000 MSL is 75% power. If cruising below 8,000 MSL, adjust the MP accordingly.

Max Oil Temp	+245 F
Min Oil Temp for Start Pre Heat if Colder	-40 C

Flight Controls

The flight controls on the Twin Comanche are cable driven. Other than physical inputs from the pilot, the Autopilot is the only thing that will move the flight controls ailerons, elevator and rudder. The flaps are electric.

Ailerons

The Ailerons on the Twin Comanche are cable driven. Optional aileron trim is available but was not installed on the airplane at the factory. N8701Y is not equipped with aileron trim.

Stabilator

The Twin Comanche is equipped with a moveable Stabilator. The Stabilator is also referred to as a "Flying Tail". When you move the control wheel forward or aft, the angle of incidence of the entire horizontal tail. Is it better than the standard fixed horizontal stab and moveable elevator? Piper thinks so, as well as Lockheed (F-104 L-1011 & F-22) and the fine folks who built the F-4 Phantom and the builders of the F-8 Crusader. These folks had a better idea. Pitch trim is provided by cockpit adjustable "Anti-Servo Tab" mounted on the trailing edge of the Stabilator. This tab also increases the force required to deflect the Stabilator as pitch control inputs are applied farther from neutral and at higher speeds.

Rudder

The rudder, like the rest of the flight controls the rudder is operated manually. Rudder trim is available using a trim know just below the throttle quadrant.

Flaps

The flap system is electric. Flaps may be extended to 15 deg, and 25 deg. Flap Gauge

Max Flap Extension Speeds

15 deg	109 kts
25 deg	109 kts

Brakes

The normal braking system provides braking to all of the main gear wheels. The main wheel Autopilot

Autopilot - Altimatic III-B Autopilot

Autopilot - Altimatic III-B Autopilot

The Altimatic III autopilot was quite something in its day. It is a bit crude by modern standards. I will have more to say about this device after making sure the system is in proper repair.

Autopilot Limitations

Altimatic IIIB Autopilot:
Above Vmo/Mmo
Below 1.2 Vs
With Electric Pitch Trim Inop
During coupled approaches with an engine inop
During takeoff or landing

Engines

The standard Twin Comanche is equipped with two Lycoming IO-320-B1A 160 HP engines. The IO stands for Injected Opposed. The 320 is the displacement in cubic inches. B1A is the particular mode of the IO-320 engine. On the Twin Comanche's with counter rotating propellers, the right engine will be an "LIO-320-C1A. The "L" means it rotates to the left. This requires a different crankshaft, camshaft, and accessory case among other $$$ things. I was able to purchase an LIO-320-C1A and install it on the right side of N8701Y. Not wanting to have other problems, I replaced the propeller with one that works in the other direction. This should make directional control a bit easier.

All PA-39's have counter rotating engines & propellers. Best guess is around 159 of these were produced. Estimated about 100 or so PA-30's have been converted. None of the PA-30's are C/R from the factory.

Engine Gauges

The engine gauges installed in the Twin Comanche are:

Tachometer for each engine – I installed a dual needle tach.

Manifold Pressure Gauge – Dual needle

Oil Pressure Gauge for each engine

Oil Temp Gauge for each engine

Cylinder Head Temp Gage for each engine

Fuel Flow Gauge for each engine – Single Gauge – Dual Needle

EGT for each engine – Single Gauge – Selector for each engine

Tachometer Photo Manifold Pressure Photo Oil Pressure Photo Oil Temperature Photo Cylinder Head Temp Photo Fuel Flow Photo EGT Photo Lycoming IO-320-B1A& C1A

MP	RPM	Takeoff	Max	2700	Max Continuous	Max	2700	Recommended Climb	25"	2500	Rec Max Cruise	Max *	2400	Ground Idle	- - - - - - -	1000

Note: Full throttle at 8,000 MSL is 75% power. If cruising below 8,000 MSL, adjust the MP accordingly. The “B1A” engines require 91 Octane or higher. The “C1A” engine requires 100 Octane fuel. Both have 8.5:1 compression ratio. The “C1A” could have a turbocharger added, and was made mostly after the 91 Octane (Blue) fuel was discontinued. That is most likely the reason for the different requirement 91 vs 100 Octane. A normally aspirated “C1A” legally requires 100 Octane fuel, but would probably run fine on 91 Octane. Nonetheless, the requirements are what they are.

Max Oil Temp +245 F
Min Oil Temp for Start
Pre Heat if Colder -40 C

Since we are on the subject of engines, there are a few things you need to know. These engines are rated and approved to be run at 2700 RPM and full throttle for their entire lives. Those who think you harm these engines by leaving

them at takeoff power for a couple of minutes after takeoff are mistaken. Many engines have different limitations for takeoff and maximum continuous power. The “Takeoff Power” limit is usually 5 minutes in duration, and normally applies to turbocharged, supercharged or gas turbine engines. Normally aspirated engines can usually be run at full power indefinitely. As far as what I do, and teach in my airplane: Full power & 2700 RPM until 1000’ AGL. Then reduce to 2500 RPM & 25” Manifold Pressure. Maintain 25” MP in the climb as long as you can until full throttle is reached. Once you have arrived at your cruise altitude, allow the airplane to accelerate to cruise airspeed, close the cowl flaps, only then do you adjust your manifold pressure and RPM to cruise power.

Engine Start Panel

Electrical

The Twin Comanche is equipped with two alternators, or as on the earlier models, two generators.

Hydraulic

The only hydraulics on the Twin Comanche are used to operate the brakes. A brake fluid reservoir is located in the nose compartment. Each brake master cylinder receives fluid from the brake reservoir through its own supply line from the reservoir itself. Each brake master cylinder provides hydraulic pressure to its respective brake caliper through its own hydraulic line between each brake master cylinder and its respective brake. There no power brakes or anti skid system installed on this airplane.

Fuel System

The Twin Comanche Fuel System is simple. Fuel is stored in the wings. The standard airplane has 4 fuel tanks. The Main Tanks (Inboard) hold 30 gal each. The Aux Tanks (Outboard) each hold 15 gal. Tip tanks holding 15 gal each were an option.

There are many optional fuel tank STC's for the Twin Comanche. A baggage compartment 20 gal tank is approved. Nacelle tanks can be installed with ether 10 or 20 gal per side.

Fuel	Main Tanks Each	Aux Tanks	Tip Tanks Each	Total
Standard	30 gal	15 gal	N/A	90 gal 540 lbs
Tip Tank	30 gal	15 gal	15 gal	120 gal 720 lbs

The fuel tanks on the Twin Comanche are bladders. If kept full, and maintained properly, they are not a problem. One thing that can be an issue: They are attached to the upper surface of the wing with a type of fastener. If one or more of these becomes loose or dislodged, the tank may indicate full when it is not. The maximum fuel capacity may be reduced substantially. You may think you have 90 gallons, but actually have quite a bit less. This is easier to discover regarding the aux tanks. You can simply burn them dry sometimes and see how much fuel it takes to fill them. This is not such a good idea with the main tanks, as they must be used during takeoff and landing.

Fuel System Controls

The engines on the Twin Comanche are fuel injected. Instead of carburetors, they have a thing called a "Fuel Servo" on each engine that meters fuel more precisely directly to each cylinder on the engines. Some automatic mixture adjustment occurs with these units. For high altitude climbs & cruise, they must be adjusted by the pilot.

Mixture Control

The fuel servo on each engine can be adjusted to optimize the fuel mixture for the engines during the different phases of flight; Takeoff, climb, cruise, descent, and single engine operation. This adjustment is made with the mixture control lever. There is one for each engine. They are on the right side of the throttle quadrant, and have tips that are RED in color.

Fuel Selector Valves

Fuel selector valves Left & Right, are mounted in the floor between the pilot seats. They can be selected OFF, MAIN, AUX or CROSSFEED. Crossfeed shall not be selected on both sides at the same time! If the Left fuel selector is in "MAIN", the left engine feeds from the left main fuel tank. If at the same time, the Right fuel selector is in Crossfeed, the right engine will draw fuel from the left main tank as well. If the Left fuel selector is switched to "AUX", then both engines will get their fuel from the left Aux fuel tank. It is actually quite logical.

Electric Fuel Pumps

There are two electric fuel pumps on the Twin Comanche. They are used to prime the engines for starting, as well as a backup for the engine driven fuel pumps during takeoff and landing. If a particular engine driven fuel pump fails, the electric fuel pump can enable the engine to operate normally for the remainder of the flight.

These pumps are located under the floor of the airplane, and are said to be a real pain in the ass to change.

Electrical System

Altitudes & Misc.

Alternators	60 Amps
Battery	12 Volt / 36 Amp Hour

Modern LED and HID lights produce more light and use much less electricity than the older light bulbs. Avionics of today also uses much less electrical power. The pair of 70 Amp alternators can produce up to 2000 watts of electric power. That is about 2.5 HP worth of electrical energy if you care to do the math. The alternator equipped Twin Comanche is not short on electrical power like some of its generator equipped ancestors.

Ice and Rain Protection

There are optional de-ice boots, alcohol anti-iced propellers, and a heated left windshield panel. These are not intended for flight into known or forecast icing conditions. They are a fallback position at best. Icing conditions are best left to turbine powered aircraft.

Note: Twin Comanche N8701Y, PA-30-160 SN # 1849 is not certified for flight into known or forecast icing conditions.

Engines

The engines installed on the Twin Comanche are not prone to problems related to icing conditions. They are fuel injected, therefore not prone to induction system icing. Should it occur, alternate air doors may be opened, supplying another source of air from inside the respective engine’s nacelle.

Propeller Anti-Ice

The propellers installed on the Twin Comanche can deal with light to moderate icing conditions, as the inner portion of each propeller blade can anti-iced with alcohol if the aircraft is so equipped. The outer portion of propeller blades do not accumulate ice due to temperature rise resulting from the speed of the blades….300 -500 mph at 2400 rpm. This results in a substantial temperature rise in the air being impacted by the propeller blades. As a result of this, ice does not tend to form on the outer portions of rotating propellers. The optional Wiggins Airways alcohol propeller anti-ice system may be installed.

Not installed N8701Y PA-30-160 SN #1849

Pitot Heat

The Pitot tube on the Twin Comanche is electrically heated. This is a required item for flight under IFR. In jets, we use the pitot heat from just before takeoff to right after landing. As for light airplanes, it is up to you. I recommend that you, at very least, use it when flying in any clouds or rain. In my training program, I plan to use it as it would be used in a jet aircraft. Why? To form the proper habits in those whose aim it is to make a career of flying airplanes.

Wings & Tail

The Twin Comanche may be equipped with optional Wiggins Airways wing and tail de-ice boots.

Not installed N8701Y PA-30-160 SN #1849

Windshield

The pilots windshield can be equipped with an optional external electrically heated pane for those aircraft with the anti-ice system installed.

Not installed N8701Y PA-30-160 SN #1849

Environmental

Ventilation System

I must say that the ventilation system in the Twin Comanche is quite good. After obtaining a Ferry Permit to fly the airplane to its new home, we headed out from Houston Texas. If you wish to know exactly how a lobster feels just before it dies in a restaurant, make your way to Houston in the summer.

On the way home, we climbed to 6,500 MSL, where the temperature was 30 deg C, or 86 deg F. That is hot! Flying along at about 165 knots, the ventilation system kept us quite comfortable. I was surprised how well it worked. Air enters the ventilation system thru a round hole at the forward end of the nose of the aircraft. The air finds itself in a chamber with two ways out. It can go into thru the heater, then into the heater outlet ducting into the cabin. If the heater is not operating, the air still flows into the cabin providing ventilation.Air can also go directly into the ventilation system. This system directs air to the cockpit fresh air outlets. A small amount of this air also goes to the instrument panel to provide cooling air for the avionics.

In the back of the cabin, there is an air outlet that allows the fresh air that enters the airplane to exit, keeping the air flowing as long as the airplane is flying. There is also an air inlet on the tail that provides fresh air to a pair of fresh air outlets for the passengers in the rear seats.

Heater

Heat for the cabin and windshield defroster is provided by a Janitrol heater that is located in the nose compartment. The Janitrol heater is controlled electrically and uses gasoline to provide the heat. Gasoline for the heater is supplied from the fuel injection system on the right engine. If the right engine has failed, the heater can be fueled by placing the right fuel selector to MAIN or AUX, and operating the right electric fuel pump. You **MUST**first place the **RIGHT MIXTURE** control in **IDLE CUTOFF** position. If you do not place the mixture in idle cutoff, you may get a visit from Mr. Charles Darwin, as you will have behaved stupidly enough to justify purification of the gene pool. If you have already reproduced, well, can't win them all.

Don't set the heater to full hot in order to expedite the defogging process. Excessive hot air directed to small places on the windshield can cause damage. A moderate amount of heat and a little time will do the job.

As far as defrost goes, don't expect this system to work as effectively as in a modern automobile. In cars, when defrost is selected, the air is cooled first, to wring out a bit of the moisture, then the air heated. The warm dry air defogs better than warm moist air. Be a bit patient. Bring some soft paper towels to help if the windshield is heavily fogged up. Once you get into the air, between the heater and the very effective ventilation system in the Twin Comanche, your defog problems should be mostly over.

If you happen to have been at a high altitude for a bit of time at cruise, and the weather is such that there is high humiditybelow, you might want to run the heater and defroster at a low level for a few minutes prior to, and during descent in order to prevent windows from fogging up on landing. A rapid descent from altitude (cold) into a warmer humid airport may cause the windows to fog up in the last few minutes of the flight. We have probably all experienced this. You are in a warm humid climate, Florida for example. It's a warm humid day. You have a glass of ice water on the table. At first, the outside of the glass is dry, but soon it is wet. Many say that the glass "sweats". The scientific term for this is "A load of Crap". The glass does not sweat. Nothing from the inside of the glass magically makes its way thru the glass. What is really happening is that the cold exterior of the glass cools the air that touches it. As air is cooled, it can hold less moisture than when it is hot. What you see is "Condensation", rather than "sweat". We all sweat, and the sweat contains salt, and other chemicals that are expelled from our bodies. The outside of the glass, however, contains only what was contained in the air, usually just water. That is what is on your windshield when it is chilled, and then exposed to humid air that is warmer than the windshield itself.

Warning Lights
