

it done." Contact:

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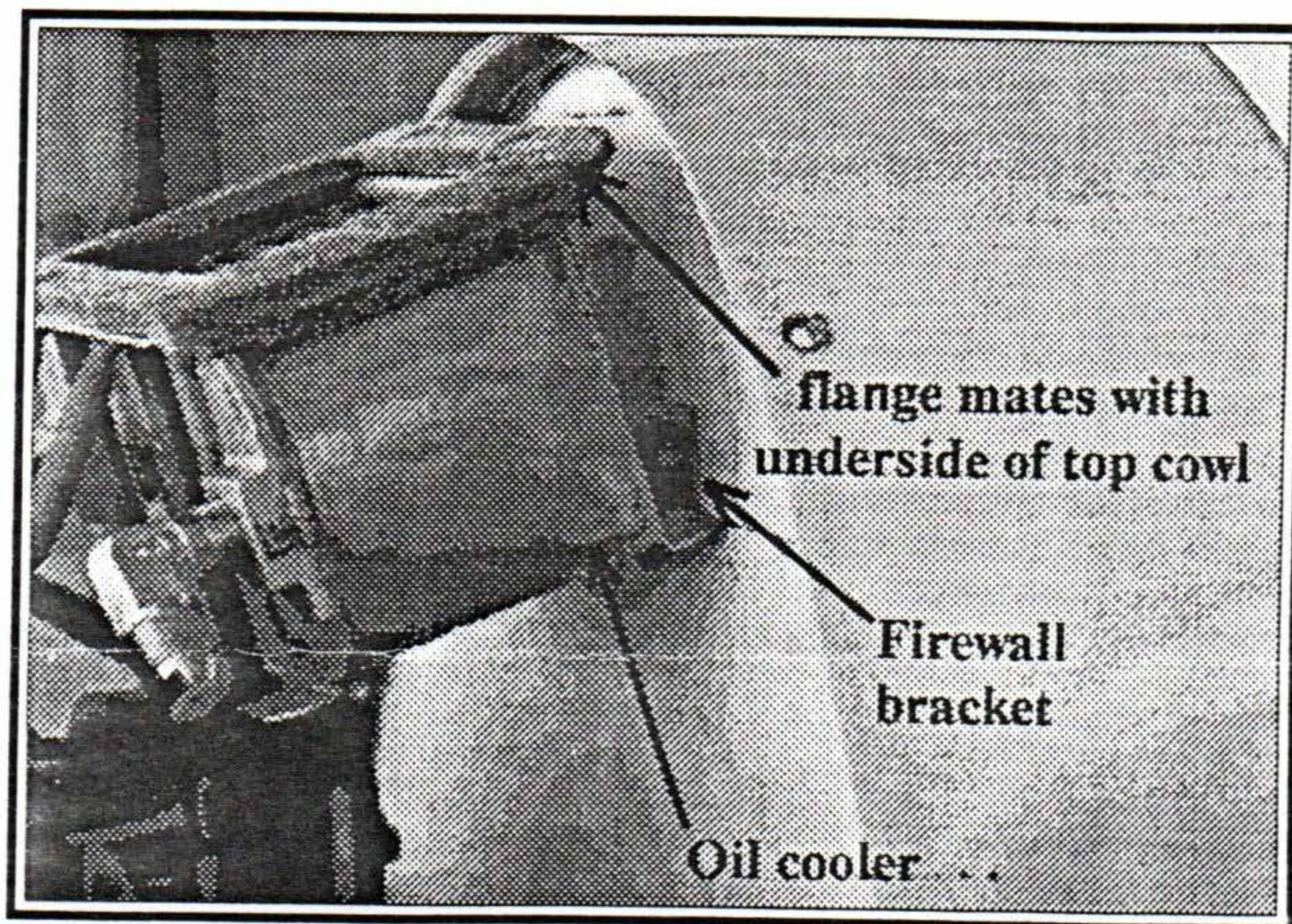
Top Mount Oil Cooler

Bob Davenport - It has been recommended by some in the past to mount the oil cooler up high in the engine cowl adjacent to the firewall. This location keeps the oil reasonably cool, but the primary reason for this location is to provide a "chimney" type vent for the cowl when parked after flight. This in turn, adds longevity to the mags and vacuum pump while keeping the oil cooler as close to the CG as possible.

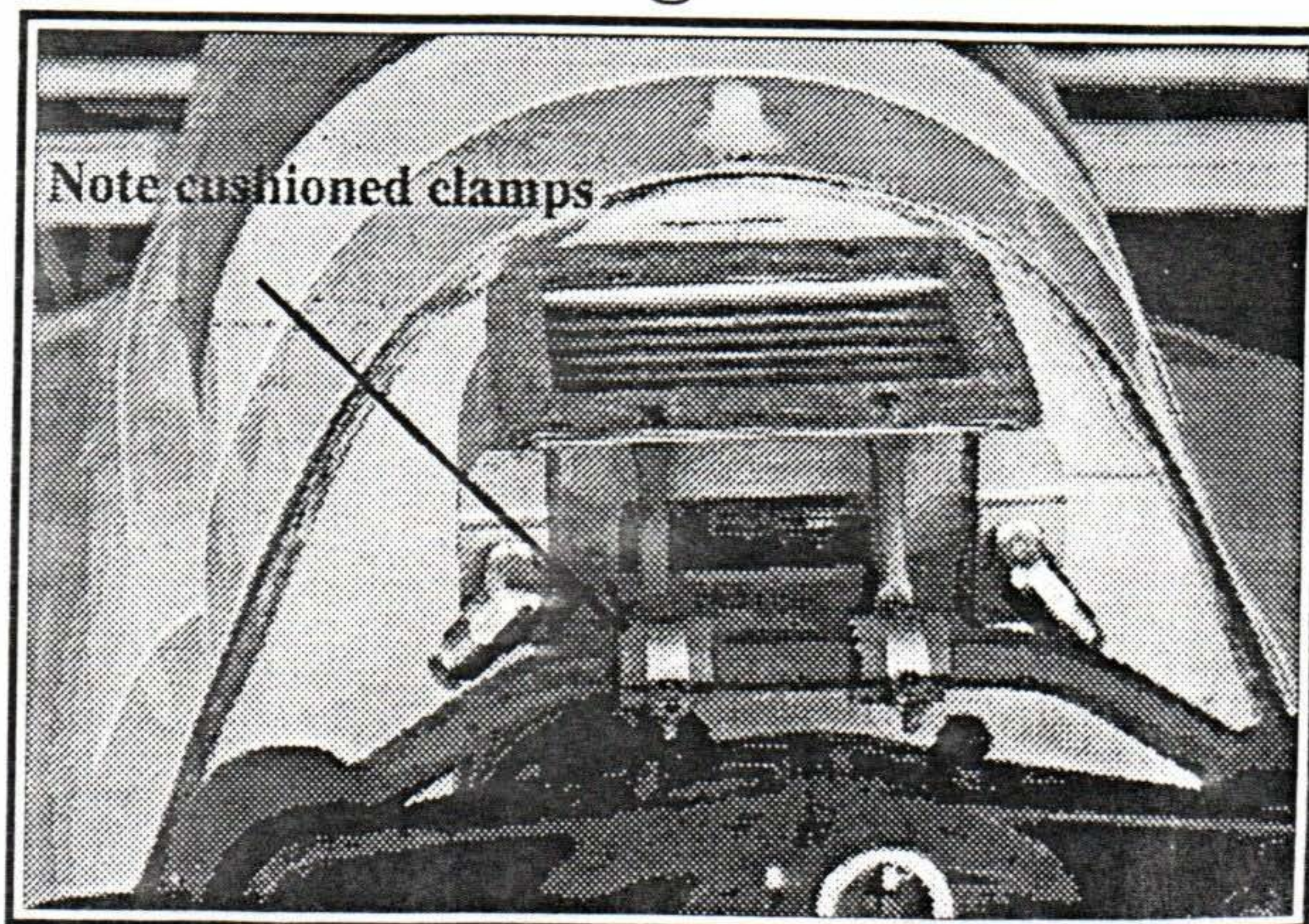
The photos show the installation on N282RD where the front of the oil cooler is supported by a light angle bolted to the firewall. The rear support consists of a pair of struts clamped to the dynafocal top cross over tube. The clamps fasten around rubber tubing to minimize vibration. A 1/4" thick felt seal bears against a mating flange of the vent duct which is built into the upper engine cowl.

If there is any interest, a bolt-on type kit for this installation can be provided for under \$45 delivered in the US.

Bob Davenport
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Looking forward





Frequently Asked Questions

Certification

1. Is the XP-360 Engine® a new zero time engine?

Yes. The XP-360 Engine® is a brand new, zero time engine designed to meet the increasing demands of the Sport Aviation market and airframe manufacturers. Each XP-360 Engine® comes with an Operator's Manual and new logbook.

2. Is the XP-360 Engine® certified?

No, although the majority of all components are FAA approved the XP-360 Engine® has not been Type Certified as a complete engine. Therefore, once assembled, the engine falls in the experimental category. Superior is in the process of Type Certification of a 180hp engine. The designation of this engine will be the SV-360 Engine.

3. What do you mean by the majority of parts are certified?

Superior has FAA approval on all major components and the piece parts with the exception of some miscellaneous hardware. Each of these components will be FAA approved once the SV-360 is certified.

4. When do you anticipate certification of the SV-360?

We anticipate the FAA type certification for the SV-360 engine in the third quarter of 2003.

5. Will the SV-360 replace the XP-360 Engine®?

The XP-360 Engine® will continue to be the branded product Superior sells to the Sport Aviation Market. This allows the customer to specify options currently available, yet not certified for his engine, such as high compression pistons, aftermarket fuel injection system or electronic ignition system. If a customer desires to have his engine Type Certified, Superior will have this as an option also.

6. If I purchase an XP-360 Engine[®] and you get certification on the SV-360, does that mean my engine is certified?

No. The SV-360 is a FAA type certified engine, manufactured and assembled under the guidelines and requirements of a Type Certificate number. The XP-360 Engine[®] is built under experimental guidelines and could have parts not applicable to the SV-360, such as high compression pistons, aftermarket fuel injection system or electronic ignition system.

7. Who builds my engine if I order an XP-360 Engine[®]?

Superior's new state-of-the-art build center is scheduled for completion in April 2003. Until this build center is completed Superior outsources the assembly and Acceptance Test to approved engine facilities.

Engine Characteristics

1. What is the difference between the XP-360 Engine[®] and a typical Lycoming 360?

The XP-360 Engine[®] includes the latest improvements in technology and many other custom enhancements, yet unavailable on a standard Lycoming factory engines.

- The crankcase has been strengthened with reinforced cylinder decks. The reinforced crankcase cylinder deck eliminates deck to deck cracking.
- The crankcase offers a balanced oil system. Totally redesigned, the balanced oil system lubricates the crankshaft and the camshaft from both sides to reduce oil pressure fluctuations and to equalize oil-flow through the entire engine.
- Pressured oil lubricates the crankcase thrust face, reducing friction on the loaded surface of the case where the crankshaft pulls the case forward. This process actually acts as a cooling system as well.
- A dynamically balanced VAR Steel crankshaft is balanced to within one-quarter ounce-inch to reduce engine vibration, component wear and pilot fatigue. Also, inside the front main reservoir, Superior's crankshaft has a smooth, groove-free plated I.D. surface that does not hold oil acids or corrode, eliminating the problems addressed in Lycoming's SB 505 inspection and corresponding AD.
- The weight-matched connecting rods and piston sets yield a statically and dynamically balanced reciprocating section for reduced vibration and reduced wear.
- Superior's exclusive computer optimized camshaft features new cam lobe designs for better cruise economy and lower valve train loads. This reduces cam and lifter spalling and decreases guide and valve train wear. The new cam is also optimized for smoother idle and power vibration characteristics, reducing pilot fatigue.

- Our Millennium Standard-Cast Cylinders provide 6% greater volumetric efficiency than conventional Lycoming Cylinders.
- Hi-flow, improved induction sump on standard updraft intake engine.
- Tri-metal bearings, state-of-the-art fatigue resistant bearing material.

As you can readily see, the XP-360 Engine[®] is significantly ahead of any other engine in its class. It comes with a comprehensive 3-year parts and labor warranty from Superior. Accessories are covered for 1-year from the date of installation.

2. What is the type and minimum grade of fuel?

The 180HP engine is approved for 91 octane unleaded auto fuel and a minimum of 100LL-aviation fuel. Superior recommends 100LL, although this is not a requirement.

A 170HP, 87 octane version is also available with 7.2:1 compression ratio pistons.

3. Does this mean I can use auto gas?

The XP-360 Engine[®] can operate and perform at rated power using unleaded fuel. When operating on unleaded fuel, Superior recommends using fresh, premium auto fuel available at a major brand, reputable gas station. Acceptable gasoline's are specified per ASTM D-439 and D-4814.

NOTE: Use of auto fuel blended with ethanol or gasohol is forbidden. Ethanol (alcohol) mixed with unleaded fuel can cause vapor lock, carburetor ice, reduction in range, carburetor problems and damage to the fuel system. The use of an alcohol (and water) tester is recommended.

4. Is there special or specific oil approved for the engine?

The recommended oil must meet MIL-L-22851, ashless dispersant grades. Multi-weights (15W50 or 20W50) are recommended for all temperatures and straight weight oils are recommended for various average ambient air temperatures.

5. Is the engine available in 12-volt and 24-volt configurations?

Yes, both 12 volt and 24 volt configurations are available.

6. Can I use my existing engine mount?

The engine mounts for the XP-360 Engine[®] were designed as a direct "drop-in" for a Lycoming engine replacement. Please note it is imperative to determine whether your existing engine mount is designed for #1 or #2 dynafocal mount or a conical mount style engine. The various mount types are part of the engine crankcase and cannot be modified once the engine is assembled.

15. Can I request optional accessories to the standard package?

Yes. Superior has several optional accessories available and will continue to add to the options as new ones come to the market. Currently, we offer packages for Lightspeed Ignition Systems, LASAR Ignition Systems, Aerosance FADEC Systems, Airflow Performance Fuel Injection Systems and Ellison Fuel Systems. See "Build an Engine" in Superior's web site www.xp-360.com for more details.

16. Can I buy replacement accessories from Superior

Aftermarket replacement accessories and spare parts are available from Superior's worldwide distribution network. For Distributor's and their locations see www.superiorairparts.com.

Performance

1. What is the maximum continuous horsepower rating of this engine?

Max continuous horsepower is 180 HP at sea level.

2. What effect does altitude have on this rating?

All aircraft engines are rated by the amount of horsepower they produce at sea level at standard ISA conditions. Superior's naturally aspirated XP-360 Engines[®] produce rated 180 HP -0/ +5% at sea level in standard ISA conditions. As with any naturally aspirated engine, as pressure altitude increases, available horsepower decreases, however, this effect does not change the rated horsepower of an engine.

3. Are Turbocharged versions available?

Superior is in the final testing stages of a turbo-normalized system for the XP-360 Engine[®]. Due to the variations in exhaust systems and cowlings, please contact the Superior sales staff for specific pricing. We anticipate this engine being available in the 4th quarter 2003. Check back at www.xp-360.com for the latest details.

4. What is the specific fuel consumption of this engine?

The specific fuel consumption of the Superior XP-360 Engine[®] is .43. ie; 10GPH @ 75% power, 8.7.

5. How does that compare to a typical Lycoming 360?

The Lycoming O-360-A1A burns 10.5 GPH at 75% power (compared to 10GPH for the XP-360) and 9.0 GPH at 65% power (compared to 8.7 GPH for the XP-360).

6. Are there performance curves available for the engine and how do I get them?

Yes. Superior has an XP-360 Engine[®] specifications sheet that provide dimensional data as well as power curves. They are available on our web site at www.xp-360.com.

TBO and Warranty

1. What is the TBO of this engine?

Superior has established a recommended 2000-hour TBO for the XP-360 Engines[®].

2. What is the warranty of the XP-360 Engine[®]?

Superior warrants the XP-360 Engine[®] to be free from defects in material and workmanship for THREE (3) YEARS from the date of purchase.

3. Does this warranty cover accessories?

Superior warrants the accessories for the XP-360 Engine[®] (Fuel System, Magnetos and starter) for ONE (1) YEAR, or manufacturers published warranty which ever is greater, from the date the engine is first placed in service.

4. Is there any specific warranty requirements for the engine such as; time between oil changes?

The XP-360 Engine[®] Operators Manual outlines the required maintenance to maintain warranty, including pre-flight inspections, the initial 25-hour inspection, and routine re-occurring 50, 100 and 500 hour inspections.

Service and Maintenance

1. What are the scheduled maintenance requirements for this engine?

The XP-360 Engine[®] Operators Manual outlines the required maintenance inspections including pre-flight inspections, the initial 25-hour inspection, and routine re-occurring 50, 100 and 500 hour inspections.

2. Who is authorized to perform maintenance on the engine?

The XP-360 Engine[®] is an experimental engine and as such, no specific FAA license is required. However, for the owner's safety and peace of mind, Superior strongly encourages owners to have a licensed mechanic work with an owner for the first inspections for the purpose of training and to insure the engine is thoroughly inspected.

3. Are piece parts readily available for the engine?

Yes. Superior has a network of Authorized Superior Distributors Worldwide that carries a large assortment of inventory. For a list of our Distributors, please review our web site www.xp-360.com.

4. Are there specific break-in procedures for the engine?

Yes. Superior has a published Service Letter 96-008B that applies to our XP-360 Engine[®]. Procedures are also included in our Operator's Manual and can be found on our web site at www.superiorairparts.com.

Cost and Availability

1. What is the cost of the engine and what is included in the cost?

Due to the various options available on the XP-360 Engine[®], Superior recommends viewing the "Build an Engine" portion of our web site www.xp-360.com to determine the price with the options you prefer.

2. What is the cost of options for the engine?

Due to the various options available on the XP-360 Engine[®], Superior recommends viewing our web site www.xp-360.com to determine the price with the options you prefer or call our toll free number (800-420-4727) and ask for a sales person for a quote.

3. Can I order an engine today and whom do I order it from?

Yes! You can order your XP-360 Engine[®] online at www.xp-360.com or if you prefer, call Superior at 800-277-5168 or 972-829-4627 and ask for an engine sales representative. Our sales representatives can assist you in determining the exact engine you want and answer any questions you may have. We have many options available to you, including being present at the factory and viewing the assembly and testing of your engine. We also offer an option of building your own engine with the technical assistance of our trained staff.

4. If I ordered an engine today, when can I expect delivery?

Due to the overwhelming demand for our XP-360 Engine[®], the only way to determine delivery dates is at the time of order. Once the engine is ordered, depending on the backlog of owners ahead of you, we can give you a firm date for delivery.

5. Is a deposit required and is it fully refundable?

Yes, a \$1,000.00 deposit is required to place your order into our production plan. Superior will notify the customer in writing in advance of the actual build date and the current price for their XP-360 Engine[®] and require full payment of the balance. However, should the price for XP-360 Engine[®] have increased at the time of the build notice, the Customer may cancel the build and Superior will fully refund the down payment deposit.

Miscellaneous

1. I have read about a SV-360, a SL-360 and the XP-360, what is the difference between the three?

The SV-360 is the designator for the FAA certified engine. This certified engine is built and tested by Superior under a FAA Type Certificate and Production Certificate. This is supplied with a new Data Plate, a Superior logbook and Operator's Manual and is primarily for use in a certified airplane.

The XP-360 Engine® is the designator for the experimental engine. This experimental engine is built and tested by Superior and is supplied with a XP-360 Engine® Data Plate, a Superior logbook and Operator's Manual and is primarily for use in an experimental airplane.

The SL-360 is the designator for an Engine Parts Kit. The SL-360 Engine Parts Kit was developed for the experienced builder who has the tools and ability to assemble his own engine or has the ability to have an experienced person assemble the Kit to a complete engine. The SL Kit Engine comes with all the necessary parts for a complete engine like the XP-360 Engine®.

2. Does the SL-360 Parts Kit have the same warranty as the XP-360 Engine®?

No, the SL-360 Engine Parts Kit carries Superior's standard parts warranty which is ONE (1) YEAR. Superior warrants the XP-360 Engine® to be free from defects in material and workmanship for THREE (3) YEARS from the date of purchase.

Superior warrants the accessories for the SL-360 engine kit or the XP-360 Engine® (Fuel System, Magnetos and starter) for ONE (1) YEAR from the date the engine is first placed in service.

3. If I get an A&P mechanic to build a SL-Kit engine for me, can I get an XP-360 Engine® Data Plate?

No. The XP-360 Engine® data plate is supplied for the XP-360 Engine® only.

4. Is the XP-360 Engine® suitable for aerobatics?

Superior does not produce an aerobatic version of the XP-360 Engine® at this time. However, the present engine is capable of conversion to aerobatic flight.

5. Does a vacuum pump come with the engine?

Superior does not include a vacuum pump with the XP-360 Engine®. Because of the various applications the engine may fit in the kit plane market, some customers may not require a vacuum pump. Since vacuum pumps are readily available in the marketplace and to keep the cost down, we allow the customer to make the decision as to whether he needs a vacuum pump.

6. Where does the alternator mount?

Although the XP-360 Engine[®] is not supplied with an alternator, a provision has been provided to mount a bracket to the lower left front portion of the engine. Because of the various applications the engine may fit and the different requirements for electrical systems and to keep the costs down, Superior does not supply an alternator with the XP-360 Engine[®].

7. Is there a provision on the XP-360 Engine[®] for bayonet style cylinder head temperature probes?

Yes. Superior's Millennium Cylinders installed on the XP-360 Engine[®] have provisions for bayonet style cylinder head temperature probes.

8. Are there any other versions of the engine in development?

Yes. Superior is currently working on a 200 HP version with a counter-weighted crankshaft, a 320 cubic inch version, a front mounted prop governor version, a version with a solid crankshaft, etc. Our engineering research and development department will always be developing new products for the marketplace.

9. When will they become available?

We anticipate most of these options to be available in the first or second quarter of 2004. Check back at www.xp-360.com for the latest developments.

10. Can I put a deposit on one now, for delivery when it's available?

Yes. If Superior has determined the price for the version you request and an estimated completion date, we will accept your order and down payment. If the price and delivery date have not been established, we will accept your deposit to insure your place in line. When the price and delivery date have been established, we will contact you for an order. If you elect not to purchase the engine due to price or delivery date, Superior will promptly return your deposit in full.

11. Can I come to the factory to see my engine built?

Absolutely! We encourage all XP-360 Engine[®] owners to come to the Superior factory to watch their engine being built or participate in building their engines themselves. We also offer both engine assembly options for an additional fee. Please see our web site www.xp-360.com for more details.

12. Can I get the engine in the color of my choice?

Yes! Superior offers a number of different color choices for the customer that wants his engine personally customized. Visit our web site at www.xp-360.com for the various options offered. If it's not listed, call us. We are poised and eager to satisfy your requirements.

For More Information Contact:

**Superior
Attention Engine Sales Department
621 South Royal Lane
Suite 100
Coppell, TX 75019
800-277-5168
972-829-4627
Xp-360info.com**

Volumetric Efficiency

The following article was based on material taken from John Schwaner's Sky Ranch Engineering Manual (SREM). If you don't have it you are missing a lot of education. Call (916) 421-7672. At about a nickel a page you can't beat it!

"Volumetric efficiency is a performance measure of the cylinder as an air pumping device and measures just the efficiency of the cylinder and valves. Volumetric efficiency of a cylinder is limited by the flow resistance in the intake manifold and by the residual combustion products in the cylinder. The shape and size of the whole inlet system, from atmosphere to inlet ports, have a strong effect on the pumping efficiency of the cylinder."

*Improvements in volumetric efficiency increase fuel consumption. The more air you feed the engine the more fuel it needs to maintain the same fuel/air ratio. The more air and fuel you feed an engine, the more power is produced. Increasing air pumping efficiency through any means, including flow porting, requires additional fuel. Along with the increased fuel and air, comes **higher horsepower.**"*

The mass (weight) of the air entering the cylinder is of more importance than the volume of air. *"Power is roughly proportional to the rate of air*

flow through the engine, 6 pounds per horsepower on the average." We all know cold air has more mass than hot air and therefore provides a more powerful charge to the cylinder for combustion. *"Engine horsepower increases approximately 1% for every 10°F drop in air temperature."*

The cooler the fuel air mixture we feed the cylinder the greater power we will get from the engine. *"Lycoming engines have intake and exhaust pipes close together. An increase in volumetric efficiency can be gained by heat shielding or insulating the intake pipes. Bell Helicopter tried insulating intake pipes many years ago. Several problems resulted. The insulation trapped moisture and caused corrosion and the increased weight of the intake tubes wore the intake boss. Chrome plating the intake pipes was found to act similar to a heat shield by reflecting the radiant energy and slightly lowering the temperature of the intake air."*

There is no free lunch, however. When the induction air is cooler the engine will produce more power but with decreased fuel economy. "Cold induction air adversely affects fuel vaporization and consequently the fuel mixture has to be richer to compensate."

Many people believe if we ram the induction air into the induction system we will increase volumetric efficiency. While that may be true, it seems not a great deal is gained.

Impact pressure charts show only about 1/2 psi pressure increases at 170 mph. This all is effected by the design of the carb air box. There are many different designs out there and many different results.

Hal Hunt's Long-EZ Air Box literature states that Dave Ronneberg's air box design required, *"8 iterations in design and tooling (all of which degraded performance) before he hit upon the right balance of flow factors increasing engine top end performance."*

If you decide to build your own air box there are some "rules of the road" presented in the SREM.

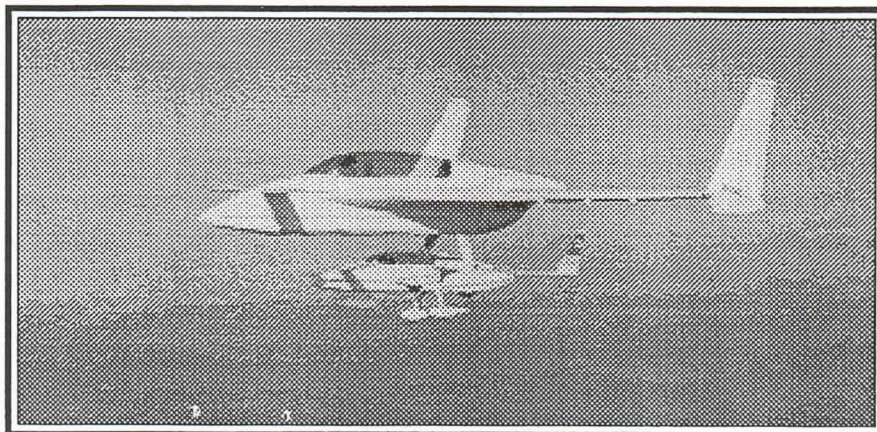
"The air box represents a diffuser whose purpose is to turn high velocity, low pressure air into low velocity and high pressure air as quickly as possible and with as little turbulence as possible. Tests at Lycoming have shown that for a cone shaped diffuser, the optimum design for volumetric efficiency is one where the total angle of expansion of the cone is 7 degrees. For a rectangular diffuser, the rectangular sections should have an 11 degree total angle of divergence."

Next SREM addresses pressure drop across the air filter. It shows pressure drop across a new Brackett air filter to cut the ram speed by about 70 mph. As the filter is used this - - - **Hey, go buy the book! It is low cost but valuable education!**

Bostic Long-EZ

This Long-EZ appears to be mating with an other. It seems to explain why California builders put out EZs at such an incredible rate. They have simply found it is faster to grow them than build them.

This beautiful 961 pound example, N68MB, belongs to Miles Bostic. It cruises at 165 kts with an O-320 Lycoming and B&T prop.



Herb Sanders (GA) - I was glad to see that you honored Vance Atkinson for his articles and participation in CSA. Many people may not have stopped to consider the significant value we get from Vance, Ken Miller, and others who do the same testing.

When a new system comes out that we all have an interest in and someone is willing to buy the system, go to the work of installing it, experience the risk of injury, death, or even worse (loss of his EZ), foot the fuel bill and expenses to do the flight tests, and then **give** us an unbiased report of the performance and results, we are certainly getting a lot for our nickel.

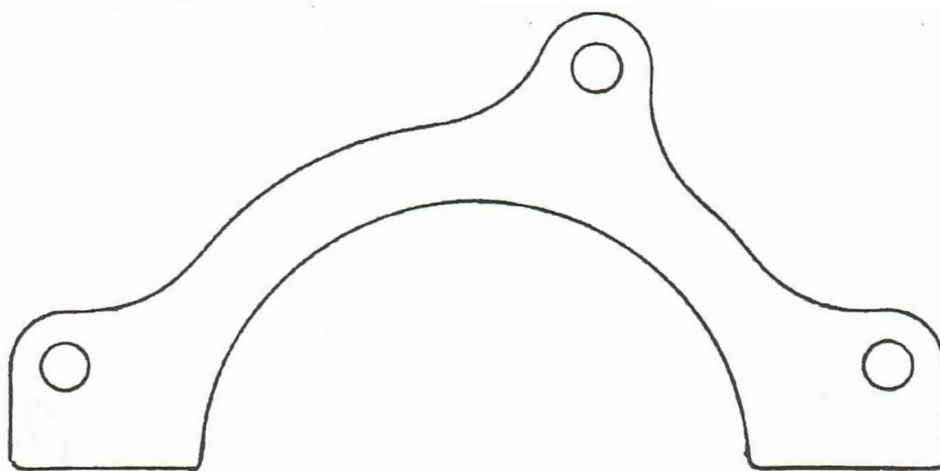
AMEN Herb!!

More Landing Gear Shake

Baine Whipkey (GA) - I have heavy duty Cleveland wheels and brakes on my Long-EZ. While doing taxi tests I experienced **SEVERE** vibration when braking from 40 mph on down. I checked disc run-out and found each one at more than .020". I called Cleveland and found their run-out limits were .020". They checked my set and found my discs were good but replaced both of my wheel assemblies.

On the new set I found run-out still over .010". I checked with Mike Melvill and discovered the run-out must be less than .010" to work satisfactorily. After much hassle I got a third wheel assembly from Cleveland that had less than .010" run-out. After that change I've had no further vibration problem.

The most important thing I would like to pass on is that run-out is not necessarily only in the disc but may be in the two wheel halves. The wheel wobble causes the disc to also wobble. I find that just the paint between the two wheel halves makes a difference in run-out. You can also assemble each wheel in three differ-



ent positions - so pick the one with the least run-out.

Run-out on an automobile wheel is a problem when it exceeds .002". I fail to see how Cleveland expects us to accept ten times as much on their product. It's no wonder we are having problems with vibration.



John Nicholson (ONT) - When I built my O-320 powered Long-EZ in 1984 I could not get the 28 gallons per hour required flow because of a FLO-SCAN sender in the fuel line. If you look into the unit the hole appears quite large but it is a tapered hole and will not pass a 1/8" drill. I estimate the hole is less than 3/32" in diameter. While talking to the people at DPS Instruments, I learned they want the FLOSCAN sender to be installed downstream from the fuel filter.

In view of the tiny hole and the foam chips we sometimes find in our tanks I think it would be a good idea to warn builders, for safety's sake, that the sender **MUST** be installed downstream of the filter.

If FLOSCAN has redesigned their unit since 1984 perhaps this warning is no longer valid. I doubt it though!

Crankshaft Seal Retainer

John Nicholson (Ont) - Here is a drawing for a crankshaft seal retainer which I made and installed. The pattern is from a Lycoming part. Two are required for a complete extension. I made them from 1/16" cold rolled steel but aluminum would probably be OK. They were cut out with a hacksaw and filed to contour. They didn't take long to make.

To drill and tap the crankcase, first remove the prop and extension and draw the large prop bolt bushing out of the crankshaft flange using a socket and short 3/8" bolt as a puller. Through this hole you can drill and tap a hole for a 1/4"-20 x 1/2" bolt. Two people are required for this. One will drill and one will give drill alignment. With the airplane parked nose down it is almost impossible to line up the drill by yourself. Install the retainer plates with the 1/4"-20 x 1/2" bolts and lock washers.

Editor note: If you drill and tap a 1/2" deep hole you'd better use a bottom tap or you may run out of threads before you get the bolt screwed in all the way.

Reinstall the prop bushings, extension, and prop. You'll now have no more worries about losing your oil.

The installation takes about 2 hours if you have to drill and tap the crankcase, less if your case already has the holes drilled and tapped.

Brake Pad Change

David Haggard (KS) - My Long-EZ has heavy duty Cleveland brakes and has used the asbestos Parker Hanifin #66-102 pads until recently. I found they were no longer being sold and that the replacement pad, #66-106, was of a different thickness.

To change to the new size pads I was told I needed to purchase a special modification kit. It consisted of a spacer that is .098" aluminum, AN - 4H - 15A bolts, and the new pads. This wonderful kit, #199-2000, **ONLY** costs \$33 per wheel. I could have also made the spacer out of aluminum sheet and saved the Parker Hanifin charge.

I explained that I thought this was a real rip-off as **they** had changed the pad size for **their** convenience and that I had no control over the situation. I still wanted the old style pads that were thicker, therefore, giving a longer service life. After much discussion I reached Parker Hanifin's service representative, Sandy, at 800-272-5464. I explained the problem again and found she would send me a free kit for both wheels if I would use the magic words "warranty replacement" in my request. I wasn't really expecting free brake pads, however, the shim # 068-00401 should definitely be a warranty replacement.

Try it. It worked for me.

Keeping Cool

Fuel Line Failure

Vance Atkinson (TX) - Recently a new Cozy was damaged during an off field landing in the Washington, D.C. area. The forced landing resulted from power loss attributed to fuel starvation due to a broken fuel line. It seems the builder had an O-320 with an Airflow Performance fuel injection system installed.

The fuel line that runs from the throttle body to the fuel distribution block was made of solid metal line. The tubing flare broke, causing fuel starvation.

A call to Airflow Performance revealed that you are **NOT** supposed to run a solid line in that area. However, their instructions make no mention of that statement. I have all flex lines in my engine compartment.

Editor note: It is easy for me to see why the builder would use a solid line in this application. It has been accepted policy, by many, to run solid lines on engines between parts that are solidly connected to the engine. The theory is that they vibrate at the same frequency and shouldn't have any relative motion to cause fatigue. Evidently this thinking is not correct.

Roger Ramjet Sez

Some EZ flyers are really frustrated jet jockeys and like to keep up on the latest jargon. While at KCGIG 93 I asked Norm Howell, official Edwards AFB test pilot, what the latest buzz word was. He said the new acronym