EAA® Technical Counselor News

OCTOBER/NOVEMBER 1987

people, a new and updated 51% program is being developed. At the present time a kit that is approved in one FAA region may not be approved in another. Of course, there have been changes in the amateur-built movement during the past five to seven years. Composites and items molded and available in different materials may not quite fit the all wood, steel tube or aluminum philosophy of the past. One area where I think we need to do a little better is the collection of data as to what we are finding good, or not so good, in the relicensing of amateur-built aircraft before completion. I don't think our inspection reports are giving this information. It does not put us in the best position in showing very positive maintenance and care of amateur-built aircraft and others in similar categories.

I'd like all of you to know how proud I am of the work that you and past volunteers have been doing for aviation and for the Experimental Aircraft Association. You would be very proud, too, if you could be with me on my many trips to Washington to hear great things about your organization ... the self-help, the self-policing and the high quality of our aircraft. Our future at times does not look too good as far as restrictions and planned airspace requirements that will and are coming out of government, such as expanded TCA's, lowering of controlled airspace to 10,000 feet, the requirement of having to have Mode C altitude transponders anywhere in the United States above 4,000 feet, and even one recommendation that the only uncontrolled airspace outside of TCA's and ARSA's would be from ground level to 1,200 feet. You will be reading more about this.

During my last week's trip to Washington, I found out that the National Park System is pushing for restricted airspace up to 14,000 feet and no aircraft are to be operated in their space. FAA has asked us to look into the matter and fight that battle! Yes, we have many challenges ahead. I need your help to keep our problems in maintenance and construction, to a minimum.

EDITORIAL
by Paul H. Poberezny

This year's EAA Convention Workshops were deemed the best ever with the variety of skills and education being offered. However, this work is being done by very few volunteers along with our full time staff people. As some of the old-time volunteers have said, we've got to start to come up with some new blood to replace us. The woodworking, building of wing ribs, welding, sheet metal, etc. are extremely important to those enthusiasts who are considering building their own airplane. And though everywhere we look there's education offered, these "hands on" endeavors are extremely important. We should begin our planning and working now toward improving our workshops for 1988. I'm requesting any of you who can spend a week ... even beforehand, as some do ..., a couple of days, or even a day in aiding this very educational program. Or if you have any ideas for any other programs, please let Ben Owen know so that we can begin to build our program and coordinate with our workshop supervisors for the coming year. We always receive a great many recommendations from attendees, but they're all too few of us available to carry them out.

The success of the amateur-built program over the past thirty-five years can be attributed to EAA's programs and the participation of our Technical Counselors. The FAA has long recognized your worth and contributions to the amateur builder's program, aviation and EAA. Due to our program, the FAA has not pushed the need for greater regulation of homebuilt aircraft, ultralights, or warbird aircraft. If we don't continue our assistance program, and as more and more FAA rules are developed, they could sincerely jeopordize our movement and our freedom to design, build and fly.

As most of you know, in today's world of aviation, the amateur-built aircraft program is the most significant area that is keeping aviation together. It's holding the fort for better times, and kit aircraft are becoming more and more popular. In my recent visit to Washington and my continuing meetings with key FAA

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Safety

SAFETY

DeVore Sunbird 100
April 18, 1987
Albuquerque, New Mexico

From the EAA Chapter 159 Newsletter

The 44 year-old commercial pilot escaped injury when the prototype DeVore Sunbird stalled and crashed during an off-airport landing attempt necessitated by the plane's inability to maintain flight out of ground effect. The crash came on what was variously considered the plane's first or second flight.

The Sunbird represents the only current U.S. effort to build a new-design light, affordable two-place aircraft that can be certificated under FAA rules. It is a high-wing monoplane with a pusher propeller driven by an Emdair two-cylinder engine nominally rated at 60 horsepower.

The pilot, with more than 2,880 total hours, had made prior arrangements with the tower at Albuquerque International, intending a takeoff from the 6,500-foot runway 21, then a turn and a landing on runway 30. As the pilot accelerated for the 8 a.m. takeoff attempt, he later told investigators, he found the engine was reaching the 3,100 rpm "target" speed and all other indications were normal. Upon reaching the targeted 50 knots, he rotated, broke ground and accelerated to 60 knots.

The airport is on a mesa at an elevation of about 5,350 feet, with about a 1,000-foot drop-off at the end of the runway, the pilot noted. As the terrain began to fall away, the pilot realized the plane not only could not climb, but could only maintain a 75-foot-per-minute descent with full power. He located a spot for an emergency landing but, as he slightly adjusted the pitch attitude at about 20 feet AGL before landing, the plane stalled and slammed down hard. The nose dug into soft soil and the plane pitched over inverted, breaking off the tail boom.

Company Vice President Arnold Robinson characterized the crash as a "fantastic crashworthiness test," since the pilot was unharmed and some major structures, such as the fuel tanks and the engine, remained intact. Robinson asserted that the landing might have been normal if the ground hadn't been so sandy. However, the pilot told investigators the plane was fully stalled at impact, with the one saving grace that roll control was maintained until ground contact; elevator control had become ineffective.

In a remarkably candid report to investigators, the pilot wrote, "had this flight been conducted in a fully certificated aircraft, it would be a clear-cut case of (1) improper, inadequate and incomplete flight planning, and (2) a failure to maintain flying airspeed. Unfortunately, in attempting first flight in an experimental aircraft, one has to base decisions on instruments and projections, realizing that hoped-for margins may be non-existent and that known adverse conditions may be greater than anticipated. I have piloted an F-111 at more than twice the speed of sound, confident that nothing unusual would occur. The first guy didn't have that luxury."

The pilot outlined two sets of factors in the crash. One set involved the human element. The pilot stated that he had taken over as test pilot for the Sunbird when the originally scheduled pilot found another job 10 days before the accident. He said there was considerable pressure to fly the airplane in anticipation of a scheduled April 21 "extravagant all-day press introduction."

Second, there were not only a number of "nuisance" problems that had cropped up during taxi tests, such as engine cooling problems, carburetion, and the like, but also some serious technical roadblocks to a successful flight.

First, he noted that estimates of the actual horsepower available had been mistakenly set at 45 to 47 HP due to an engineering vice president's error in reading a power chart. The horsepower available at the time of takeoff was actually 39.7, it was calculated after the crash.

Second, the airplane was excessively overweight. The pilot stated that the original design for the Sunbird called for a gross weight of 960 pounds, but this had ballooned to 1,200 pounds as of the latest design revision. Nonetheless, the weight at the attempted takeoff was about 1,375 pounds—with only one occupant. Because of the prototype's method of construction of the tail structure, it was very much heavier than the design called for, necessitating 50 pounds of ballast in the plane's nose to bring the center of gravity into an acceptable range.

Third, the pilot said despite the ballast, the c.g. was at 34 percent MAC (mean aerodynamic chord), which is very near the projected aftmost limit. This may have been responsible for the prompt stall when he adjusted the pitch prior to the attempted landing, he said.

The pilot also said some options had been limited because there was no mixture control in the cockpit. The mixture had been set outside the airplane and had been adjusted at a temperature of about 80 degrees the day prior to the crash, instead of the 60-degree conditions at takeoff.

The pilot said an ambitious weight program, as well as modifications to the engine to add power, will be pursued prior to another flight attempt of the Sunbird, which he described as "obviously underpowered." He said during an attempted flight a few days prior to the accident, he had been allotted a 13,375-foot runway and used up about 12,000 feet of it (all full power) without becoming airborne. On another trip down the runway, the plane broke ground once and lifted to about 15 feet before settling again, the pilot said.

Company Vice President Robinson estimated the altitude of this hop as 50 feet, and said the pressure to fly the plane before the press introduction had been removed; the operations of the day of the accident were to be "cooling tests" and no takeoff was intended. He said the pilot's belief that a takeoff was intended may have been a result of a "misunderstanding". Asked about this, the pilot told Aviation Safety there was no question about the takeoff, and that the company President personally helped close the door to the cockpit with the words, "let's go for it."

AIRCRAFT HEATERS

By Paul Mikonis, EAA #61250

I am enclosing some information that should concern all of us who use aircraft heaters.

The theory suggests that some aircraft heaters may produce carbon monoxide poisoning **even though they are perfectly leak-proof**. To avoid carbon monoxide poisoning some designers have built double muff heaters. These are probably a correct solution but not for the reason they were designed.

The theory says if iron or steel is heated over 400 degrees Centigrade (Celsius) or about 752 degrees Fahrenheit, an activation of the air occurs which produces carbon monoxide in the blood, even though **chemical test will not detect it in the air samples**.

Obviously we don't have cabin heat coming in at that temperature. However, if some air is contacting a very hot exhaust pipe before it is diluted with cold air it would meet the conditions to beware of. A double-walled heater would be unlikey to have any molecules that had contact with sufficiently high temperatures to produce this effect.

You will not find the above information in any U.S. medical, biology, or physics texts. And obviously it must sound strange. So let me give you the very interesting references. The book is a translation from the French. BIOLOGICAL TRANSMUTATIONS by C. Louis Kervran. From the flyleaf of the book, "C. Louis Kervran has, since 1946, been Director of Industrial Hygiene Services, Vocational Diseases and Industrial Medicine in Paris.

"Directed scientific conferences for the Plytechnic schools (University of Paris) and for the Institute of the Social Sciences (Faculty of Paris) on problems of industrial electricity and atomic energy.

"Member of the Conseil d'Hygiene of Seine since 1946, the New York Academy of Science since 1963, UNESCO advisory councils for scientific research."

I understand he was nominated in 1977 by the Japanese for the Nobel Prize. Low energy transmutation of elements has been confirmed by some Japanese scientists (physicists) who have been following Kervran's work and replicating experiments.

My occupation is as an electronics engineer working for the U.S. Navy, rating GS-12. I hold no degrees. My very conservative colleagues will find the information above "too far out".

Some experiments could confirm the theory. If an aircraft carefully instrumented to detect carbon monoxide does not detect it, blood tests of pilots and passengers could detect it. If pilots and passengers complain of feeling tired after only a short winter trip in certain type aircraft, an examination and correlation could point to the type of heater design in use.

BIOLOGICAL TRANSMUTATIONS by C. Louis Kervran is published by BEEKMAN PUBLISHERS, INC. ISBN; 0 8464 1069 9 $14.85

If you are like me you probably do not trust aircraft heaters much. I usually use lots of fresh air input to breathe if the heater must be used.

I hope you find the subject of interest. I became a Private Pilot in 1945 so am not a bold pilot. Sadly I'm a low time pilot still looking through the airport fence. And too many I have been acquainted with, people and planes, have "bought the farm".

AUTO FUEL AND THE CARBON MONOXIDE DETECTOR

By Gary Collins from EAA Chapter 174, Cincinnati, Ohio

When flying cross country in an aircraft STC'd for auto fuel, it's wise to filter the fuel you use. I have carried fuel to my plane in various containers of questionable cleanliness. Auto fuel, or aviation fuel for that matter, at many small airports comes from tanks that are in a state of severe underuse. I filter all fuel through a Drew-Shell Model 8PG funnel made for fueling airplanes. It has two layers of special fabric that will filter particles as small as 4 mil and will also stop water. The funnel is made of a conductive plastic to help reduce the static electricity problem. The practice of filtering my fuel led to a totally unexpected problem. I flew back from Michigan at 9,500 ft., the OAT 52 degrees F, cabin heater off and the fresh air vents open. I was dressed in a pair of shorts and a T-shirt!

The carbon monoxide (CO) warning detector under safe conditions indicates a pinkish color, however at the beginning of this trip the indicator had changed to the color of black, warning of an unsafe environment. After two hours of flying, it had turned back to the normal safe color, but I was turning blue!

During the flight, I had plenty of time to think about this and began to wonder if gasoline fumes would turn the CO detector warning spot black. I had fueled the plane with five gallon cans the night before the trip, and put the wet funnel in the cabin. I had just put on new door seals, so the cabin was quite air tight. After landing, I walked over to Sporty's to warm up and buy a new CO detector. I exposed it to gasoline fumes in a glass beaker, and in 15 minutes there was a noticeable color change. In one hour it was black.

A call to EAA HQ confirmed they knew about this phenomenon. I suggested they add to the auto fuel STC package some information on the danger of gas fumes and their effects on carbon monoxide detectors.

If a funnel like mine is to be stored in the aircraft, it should either be dried first, or placed in an airtight container.

KOEHLER KORNER

From Chapter 186 Newsletter
"Stick & Rudder"

A few years ago while I was building my KR-2, there was a major accident with one breaking up in flight. The problem was aileron flutter; the result was two deaths.

The original Ken Rand design did not have balance weights on any surfaces. The small displacement VW engines did not pull the diminutive birds much above 120 MPH and control balancing was not a problem. However, the design was very clean, being on the first foam/fiberglass (dynel then) airframes and it could accelerate quickly in a dive. Rand, I've heard, calculated that the upper surface piano hinged ailerons (like a Cessna 150) could flutter catastrophically over 180 mph indicated air speed. The elevator was also suspect around 200+ indicated. Rand added balance weights to the ailerons and recommended a red line of 180 indicated. As people added bigger VW conversions and O-200s to the KR-2, these limitations could be relatively easily exceeded.

The above KR breakup happened in a power dive for a fly-by. It was estimated that the KR-2 was near 230 indicated at the time. One aileron (missing its balance weight) was found several hundred yards prior to the main wreckage. The general opinion for the accident cause is that the balance weight broke off (it was cantilevered on a narrow aluminum bracket) and the aileron went into catastrophic flutter.

So, the lessons to be learned here are:

1) Don't exceed the original design or powerplant limitations without very careful consideration/understanding of the engineering, aerodynamics, and structure.

2) If the plans call for balancing the control surfaces, do so, using exactly the procedures called for.

3) Flight testing for control surface flutter is a good way to die. There is usually no warning for catastrophic flutter.

4) If you repair, change, paint or otherwise modify a balanced control surface, it must be rebalanced. This applies to span canners too.

It always grates on me when I read of a home builder diving his new bird to so many knots "without a sign of flutter". If there had been a sign, he'd probably be dead. The KR-2 main spar is designed for 22 Gs. It lasted about one second when the wing went into flutter.

FUEL SAFETY

The cause of a fire recently was due to the composition carburetor float becoming saturated and sinking. This caused the fuel to overflow from the carb, and one thing led to another, and things got really hot for a brief time. So at annual time, or if the fuel pressure becomes low or erratic (which did occur in this aircraft) check the float to be sure it is metal, as now required, and not leaking! It is a pain to pull the carb just to check this out but it is a lot better than being in serious trouble, particularly in the air.

COG BELT DRIVE SYSTEMS

By Mike McClelland

I am writing this letter in regard to a potential safety problem that may exist with anybody that is using a cog belt drive system in conjunction with a 45 to 65 horsepower 2 cycle engine such as ROTAX. I have got a Denney KITFOX airplane and have had problems with the cog belt drive system. The problem lies with the belt and also with the bearings. I would like it to be known that Dan Denney the designer of the KITFOX has not notified me of any potential problems with this design of drive and that he has about 68 kits out with this belt drive. The designer of the belt drive Hegar 4 Products in Milwaukee has been more than helpful in trying to resolve the problem. I feel that there is a potential for disaster here and that any manufacturers of airplane kits as well as ultralights should set up an inspection and maintenance program and notify and inform their customers that might be affected.

The problem is two fold:

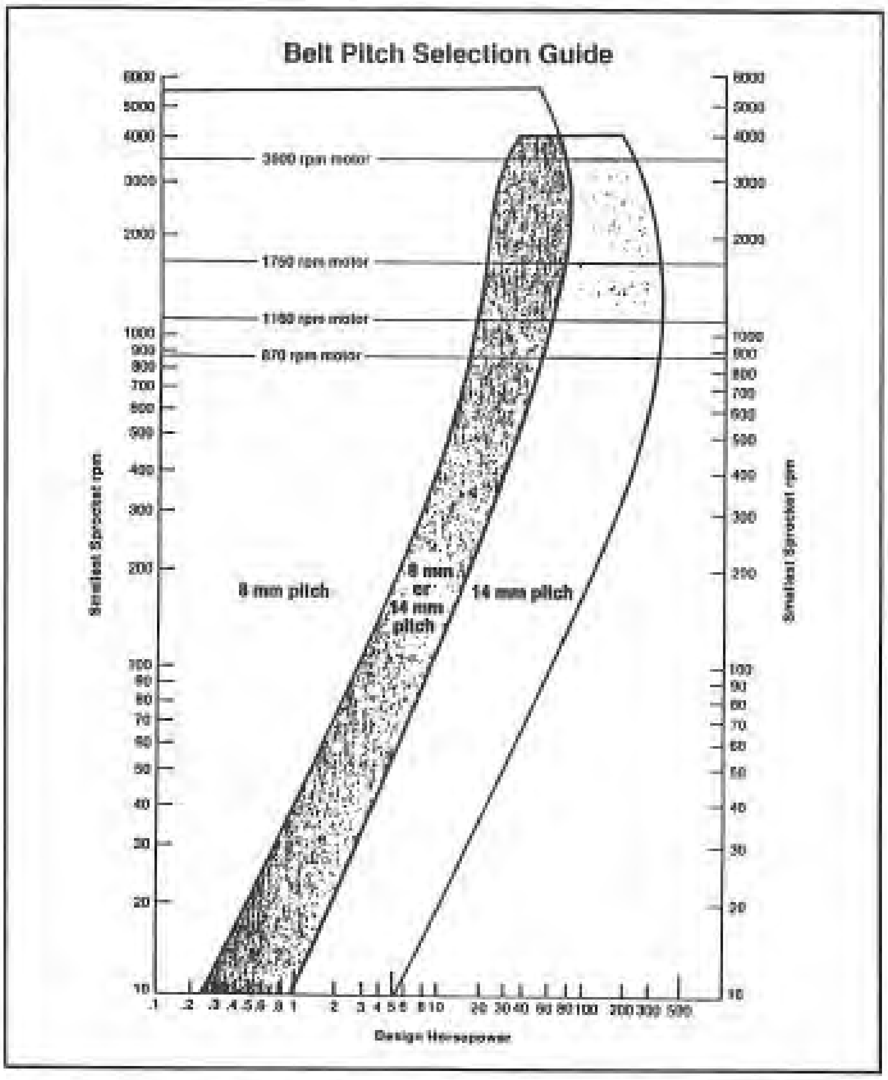
1) The cog belt used is designed for maximum of 50 HP and a maximum RPM on the PTO sprocket of 5500 RPM. This puts the belt at optimum with no safety factor. Under these conditions proper belt tension and inspection for wear become critical. The belt will probably not show wear but should be replaced after 50 hours use.

2) The second problem is with the bearings. The bearings will lose their grease and become dry, turning on the aluminum sprocket. To check for this wiggle the end of the prop, if you can feel some play, this is probably an indication that your bearings are dry and are starting to work free. Consult your kit or ultralight manufacturer as to what to do about the problem.

With proper inspection and maintenance procedures this potential problem can be monitored with a certain degree of safety.

Mike McClelland
Ontario, Canada

Editors Note: Gates Rubber Co. does not recommend the use of rubber drive belts for aircraft propellers, however, we have a belt pitch selection guide shown here for your information.



PLEXIGLASS BY GEORGE OPACIC OF EAA CHAPTER 185 - CANADA

First, let's deal with the alternative materials. Plexiglass is a trade name for acrylic sheeting. Other trade names are Perspex, Lucite, and Rhomaglas.

Lexan and Tuffan are trade names of a ploycarbonate sheet material.

Lucite actually has a thin layer of mylar bonded to its faces, making it more resistant to scratching. Other plastic formulations have been developed for the eyeglass industry which have excellent properties, but they do not appear to be generally available as sheets, yet.

Both the polycarbonate sheets and the acrylics do deteriorate in the sun's ultraviolet (UV) rays, unless they have been formulated with a UV resistance, or coated with a UV filtering agent. When buying windshield material, make sure you specify that it is for outdoor use.

The polycarbonates are normally extruded, whereas the acrylics are usually cast. Take a look along the surface of the material and you will see the wavy die marks on extruded sheets. The cast sheets will have much better clarity. Either type is all right for a windshield, but perfectionists will find themselves cursing the minor distortions of extruded sheets.

Polycarbonate sheets bend more easily around minor curves, and they can be cut and drilled without the same worry about cracking that one has with acrylic sheets. Because of its greater flexibility, a polycarbonate windshield is also stronger. The infamous "flying chicken test" was, apparently, successful on a sheet of polycarbonate when the small chicken (already deceased, one presumes) was flung at it with a speed of about 70 m.p.h. Anyway. . .

Acrylic sheets must be handled with care. The following information can be applied to polycarbonates, also, but they are much more forgiving of the ham-handed cutter.

Do not use standard drill bits for any holes. Cracks will result. Period. A drill bit needs to be reground so that the rake angle is flat. An angled tip will bite too much into the material and begin to jam up and push the cuttings into the surrounding acrylic, forcing cracks to develop. Some experimentation may be necessary to get a bit just right - use a set of the cheapy bits and a scrap of acrylic.

The size of the hole for fastening to a structure must be well over-sized. Acrylic will expand and contract in the sun at a greater rate than the structure holding it (at about 1/6th inch per foot, over 100 degrees F), so a rubber grommet, or similar system, should be used with the attaching hardware. Otherwise cracks will result after a period of use.

Longer cuts of the material for initial sizing can be done with a band saw - use 1/4 inch wide blade with at least 14 teeth per inch; or, use a table or circular saw - use a cross-cut or finishing blade set low. Never force the material through. A very gentle push must be maintained. It is wise to use some kind of backing on the acrylic when cutting. Make sure it isn't scratched by the saw or table while cutting (one method is to use masking tape right over the cutting line - thereby reducing the edge burring - and tape down a plastic or paper cover for protection). Another cutting method that works is using "abrasive cut-off disks". The aluminum oxide or silicon carbide disks of six inch diameter can be used.

For the shorter cuts, use a hand coping saw with very fine teeth - 30 per inch, at least. If the blade tends to bind, try using it backwards.

Edge finishing can be done with 00 sandpaper or a small drill-mounted drum sander. It is important to clean up the edges so that cracks do not begin at a rough spot.

Using heat to bend a portion of the canopy seems to be a good idea, but the whole canopy may end up cracking later. This is because the sheet is heat treated in the factory, and subsequent localized heating will build up stresses. The only sure way of putting a bend or compound curve into acrylic is to heat the whole sheet in an oven. This will normalize it into the new curvature.

A fairly simple oven can be built. One person even used cardboard with an inside coating of aluminum foil. Since acrylic softens at 275 degrees F to 320 degrees F (less than cooking ovens usually operate at) the contraption can be quite temporary. However, remember that the heat should not be applied directly to the acrylic, as with a flame. If an electric heat source or a flame is used, place a sheet of metal between the acrylic and the heat so that the material is heated uniformly with indirect heat.

A mold can be made over which the acrylic will drape itself when heated. This requires no work during the heating period by you. The mold can be made of any material that will retain its structural integrity in the oven. Usually, plaster is used with a suitable support. If your fuselage is steel tube, and is at the point where nothing meltable has been installed around the cabin, the tubing itself can be used as the basic structure for the mold. Needless to say, the plaster should be built up to the shape of any supporting channel members that may not be installed. A covering of soft felt of similar cloth is placed over the smoothed plaster prior to laying the acrylic on it. Every little imperfection will show up in the acrylic, so do a good job of sanding the plaster. Before heating, and any other time when lots of dust and stuff needs to be cleaned from the acrylic, use plenty of water and a soft cloth. The water can contain a non-abrasive soap. Never use the smelly petroleum-based cleaners, since they will damage the acrylic (and they will positively eat the polycarbonates). Remove grease or oil with kerosene or rubbing alcohol.

A protective coating may be applied with a good quality automotive wax (carnuba type) using a soft cotton cloth (cheeseclothes and paper towels are too scratchy).

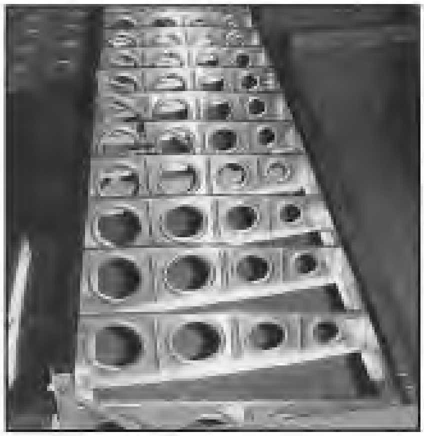
Technical Counselor Paul Guay of Crystal River, Florida reports on a Dragonfly built by himself and two other members. He formed a corporation known as the "Dragonfly Aero Club Inc."

T-88 GLUE WARMER

After warming up the two synthetic T-88 glue containers in a water bath numerous times, I decided there had to be a better way. I took a two bottle wooden gift wine box with a sliding top, installed a 100 volt lamp socket in one end and placed a 15 watt light bulb in operation. With the box turned up on end, the two bottles of the 1 quart kit fit neatly inside the box on either side of the light bulb. By experimentation I have learned how tightly to close the sliding door in relation to the expected overnite temperature in the shop to keep the glue components at about 75 to 80 degrees. The wintertime temperatures in this part of the state seldom reach down to freezing so the 15 watt bulb produces plenty of heat, however in colder climates a larger wattage bulb might be necessary. Much time can be saved in the gluing operation if the glue can be maintained between 75 and 80 degrees Fahrenheit.

Taken from the Osprey II Newsletter.

Technical Counselor Paul Regan reports on builder John Horst's Van's RV-4. Most of the flying surfaces are completed - - - excellent work! John hails from Wisner, Nebraska.



Fuel Systems

ALCOHOL IN FUEL AND ITS EFFECTS ON FUEL LINES AND POSITIONING OF THE ELECTRIC BOOST PUMP

By Art Bianconi

One of the characteristics of engines used at Bonneville for record attempts was exceptionally high compression. Seventeen to one ratios were typical and made necessary because the "Flats" are almost a mile above sea level. The lower density of the air demands that it be compressed just to compensate for the loss of volumetric efficiency and related power losses. The ability to really squeeze the mixture this much was made possible because of the fuel used which was predominantly methanol alcohol with varying degrees of water plus an oxidizing agent. The latter was usually in the form of nitromethane. The water cooled the valves and the "nitro" provided the extra oxygen that the engine needed to burn the extra fuel.

To give you some idea of how the high compression affected these engines mechanically, the amount of free volume left in the combustion chamber at the Top Dead Center was so small that if the engines were not turned backwards by hand each morning **before** they were started for the first time, the overnight accumulations of condensation in the cylinders was sufficient to cause hydraulic lockup; the engine would be totally destroyed before it even finished its first complete revolution!

The popular carburetor of the sixties was the Stromberg model 97 and a factor contributing to its popularity was its adaptability to a wide assortment of fuels and mixes by simply changing the main jets. This made it possible to race weekends on a variety of fuels and still operate on gasoline during the week. On racedays you could, in a matter of minutes, re-jet the carburetors with larger main jets and run a methanol mix. Presto! Instant power increase and, with it, a host of other consequences, some of which weren't so nice.

Because alcohol has a high specific heat, it draws off surrounding heat more readily than gasoline thereby helping to prevent detonation in high compression engines. However, alcohol does not produce as much energy by volume as gasoline. That was why we had to go to the larger main jets when racing: to provide the extra volume of fuel needed to offset the reduced thermal output. This placed a demand on the fuel delivery system since it had to work harder to provide the supply. No problem as there were plenty of ways to get the pump to do its job of drawing fuel from the tank. Right? Wrong! Engines started blowing like mad and it took a mistake in plumbing before one guy discovered that we should be pushing alcohol from the tank, not pulling it. We were getting vapor lock. How ironic: the engines were running lean and experiencing detonation because of the very same fuel characteristic that normally prevented it! Vaporized fuel was forming bubbles in the fuel line and the pump couldn't cope with it. **So, we installed high volume electric pumps right next to the tanks and pushed the stuff through** fuel coils wound inside of cans filled with ice just before the race. Some "stock" car huh?!

About one season of this and we started having engine failures again. The engines were blowing for the same reason as before: detonation. I pulled some spark plugs from other, undamaged cylinders and found tell-tale signs of lean mixtures. Lots of people tried lots of tricks but it wasn't until one guy found particles of rubber in his carburetor float bowl that someone started getting suspicious of the lines. A timed volume test was performed and when the fuel system failed to provide the expected volume, a section of armored rubber fuel line was sacrificed to a hacksaw. The inside of the line was found to be slimy with black goo and the inside diameter had shrunk down to one third of the original size. Other cars were checked and we got the same results. The only common denominator? Methanol fuel mixes. The problem had been found: the fuel line was both swelling and desolving and in so doing, it was cutting off the fuel supply. Soon thereafter, everyone went to steel lines wherever possible and replaced the short flex lines once a month, just to be sure.

Recently I had occasion to work with some U.S. Coast Guard engineers who had adopted computer aided design (CAD) software. Since my wife Betty and I are sailing enthusiasts too it was inevitable that I would get drawn into a discussion on boats, power plants, etc. What surfaced out of the discussion is worth noting: the Coast Guard and the SAE have issued a new standard (J-1527) for rubber hoses. This standard replaces J-30 and all boat owners using gasoline engines are cautioned to examine fuel lines for deterioration due to exposure to gasoline containing alcohol! Apparently, the problems I chronicled earlier are now happening to members of the boating community plus one more: hardening and cracking of the rubber fuel lines. I did some more investigating and here's what surfaced:

Gasoline containing a 10% mix of methanol will permeate the walls of rubber lines as much as 400% faster than straight gasoline if the line is constantly exposed to the fuel. Some lines will actually start to sweat fuel through the walls within minutes! The chemists explained that the reason for this is that the alcohol displaces the plasticizers that are part of the rubber compound (I forgot to ask him what the plasticizers do but I suspect that these keep the line flexible through temperature extremes). The line eventually swells up and gets real soft. Aside from the obvious sweating of raw fuel, the ability of such lines to contain any pressure or resist collapsing under suction is lost.

The other problem is hardening of the hose. Some others report that when the line is only occasionally filled with gas/alcohol blend, the plasticizers don't leach out but instead are broken down at which point the line becomes brittle. Cracking is the most likely possibility here and the result is worse: a fire hazard, and at 15,000 feet, you can hardly jump overboard!

It would be wonderful if the problem could be stopped here by simply changing all your hoses to the new SAE specs. Unfortunately, you can't change the float in your carburetor or the diaphragm in your fuel pump(s) as easlily as that. It also doesn't address the vapor-lock problem.

"THE C-85 ENGINE AND STROMBERG NA-S3A1 CARBURETOR"

By Marvin Webster,
Technical Counselor #1667

At an EAA members request I recently made a trip to the airport to check on a "Rich running" Tandem T-Craft. At 5 gals. per hour it did not seem rich to me but on autogas the stacks were black. Found the carburetor mixture parts were still in but safety wired "Rich" and no control to the cockpit. We scrounged up a control cable and installed it temporarily as it was too short and he had a supply store back at his home base. Unfortunately I had not taken out my service truck and the temperature control hook up we came up with pulled apart on the test hop and left the mix "Lean". Fortunately I had advised him should this happen he should be able to maintain 1700 RPM cold and around 2000 to 2100 RPM with carb heat on so he was able to get back to the airport OK. Next step accomplished was to drill an AN-4 bolt with a hole for the wire and make an installation similar to the one Cessna used for a fix until he could get the Piper type parts I recommended. My thought is that the trouble with this carburetor mix goes so far back it could possibly cause our EAA members the same trouble we had with it originally and we should re-hash the reason it was either dismantled and plated over or safety wired "Rich" as this one was. My main trouble was with Ercoupes and rather than dismantle the system I drilled the leanest hole in the rotating plate to #55 (.052), according to my records. The rich or main hole is #30, the two inboard #51 and the two outboard #56. Subject hole is last outboard and as I remember a pilot took an Ercoupe to 16,000 and it still worked OK.

To summarize my recommendations:

1. Locate mixture control as far from the carburetor heat control as possible or fabricate a mix safety tab and use a red locking control if spring loading the mix arm to "Rich".

2. Install an EGT and cylinder head temperature.

3. Drill "Lean" hole in rotating plate to #55.

4. Fabricate or buy a Piper type attachment for the control to mix lever.

5. If possible anchor cable housing to engine rather than engine mount to allow for vibration—fabricate mount fitting to the left unused exhaust hangar bolt on the engine.

6. Use leaning procedures outlines in VFR Exam-O-Gram #38 to assure not going leaner than the .080 ratio (12 pounds air to each one pound gasoline).

My records indicate that the factory figures 5.4 GPH at 75% and I wonder if modern fuels won't allow a leaner GPH? I know the rotating brass plate is no longer available but cannot find my parts list in my records to get the right nomenclature or part number.

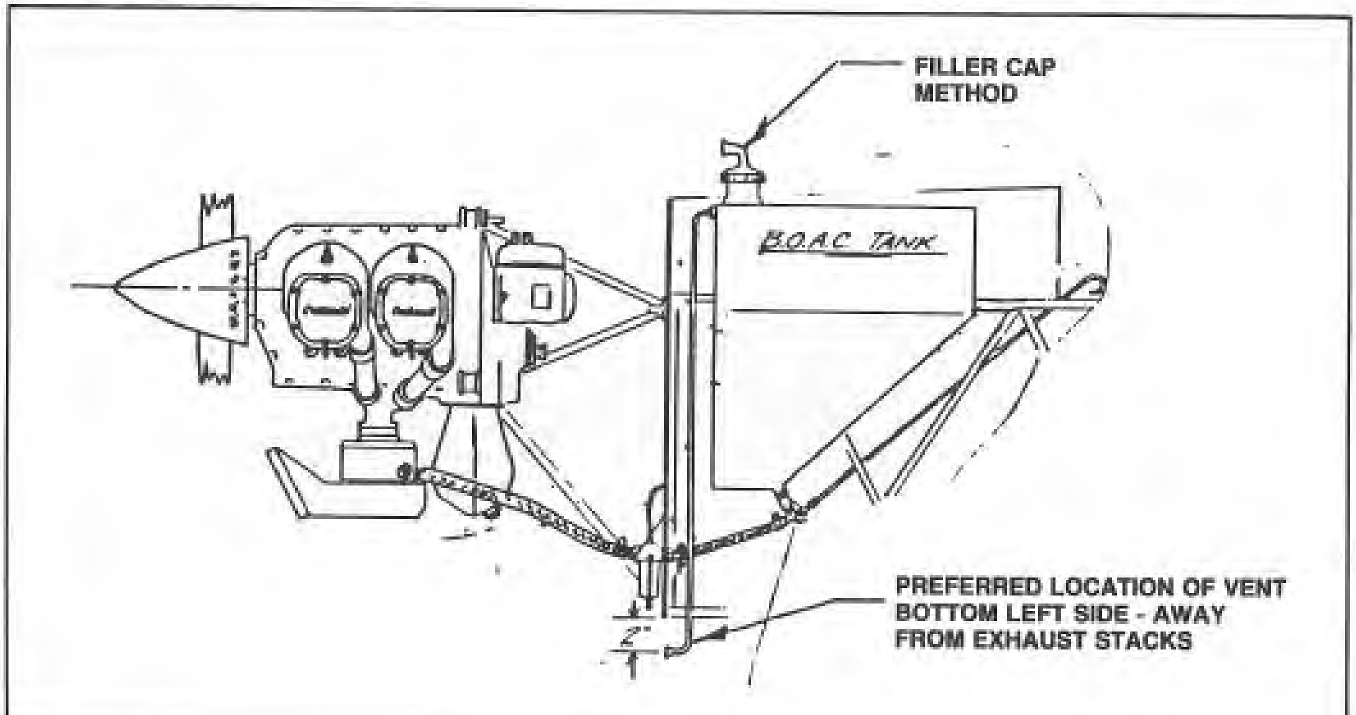
BABY LAKES FUEL SYSTEM ALERT

Some Baby Lakes builders reported fuel starvation problems on take off. The Baby Lakes, like other aircraft with rapid takeoff acceleration rates, need fuel system features that will prevent fuel starvation during this acceleration period.

First, be sure that your fuel tank vent is installed so that it takes advantage of the ram air to lightly pressurize your tank, enhancing positive fuel flow to the engine. This is particuirly true if you have a gravity fuel flow system. The sketch below shows two methods for achieving this. One method has the tank vent mounted as an integral part of the filler cap, while the other is a vent line leading from the top front of the tank to two inches below the contour line of the fuselage. Notice that the vent line ends are **flared** and **point forward** for maximum ram air pressurizing effect. A small piece of screen mounted in the flare will help ensure that your vent line will not be clogged with bugs etc. This feature is especially important if you have a gravity type fuel system.

GRAVITY FUEL SYSTEM

Fuel systems with fuel pumps seem to have fewer problems in this regard. The first Baby Lakes had an engine mounted fuel pump with a gravity feed type carburetor. That system had a "bleed off" line on the outlet side of the fuel pump that bled the excess fuel back into the fuel system on the other side of the fuel pump. Incorporation of the ram air fuel vent system is still a good idea. Having the fuel tank vent mounted to take ram air below the fuselage is generally preferred over that of being mounted on the tank filler cap.



Technical Tips

PIETENPOL PROBLEMS

This is a Pietenpol built by Robert S. Nevin, 2994 S. Perry Way, Denver, Colorado 80236.

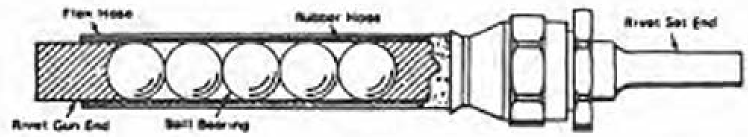
Robert has some questions about the angle of incidence of the wing. He states the wing is at 2 degrees and the engine is at -2 degrees and the ship's normal attitude in flight is 2 degrees down tail. As the wing functions best at 4+ degrees. Roberts says that Bernie Pietenpol told him that the ship will fly best with the engine at 0 degrees - no up, no down. He also has an airfoil down between the axles with about 4 square feet of area. They are flying at a field that is 5,280 feet up which has some effect on the angle of attack. Maximum altitude to date has been 1000 feet above the runway and the pilot is the builder's son who didn't feel he could get much higher with it. The elevator is also set at 0 degrees as the original was set up this way back in 1929.

If any of you have extensive Pietenpol experience, possibly you can contact Robert and give him some advice.

FLEXIBLE RIVET-SET DEVICE

A very simple device can be used to set rivets in confined places where the head of a conventional gun cannot be laid on the rivet. The rivet-set device may interest riveting gun users such as the builders and repairers of aircraft, ships, radios, and tanks. Previously, a special set had to be fabricated for each different situation, whereas this device suffices for all. A typical device consists of a (4-inch) length of rubber hose, with a (5/8-inch) inner diameter, encased in a similar length of braided metal hose. An anvil for the riveting gun is set in the driven end of the rubber hose which is loaded with five steel ball bearings of 1.58 cm (5/8-inch) diameter; a rivet set is mounted in the other end of the device. When the rivet-set tool is flexed to any degree between the head of the riveting gun (or any impact tool) and a rivet, the loss of impact is negligible. The tool may be made in any of many diameters and lengths, and its principle and use are not restricted to riveting. The ball-to-ball line of contact might be improved by the insertion of spacers. (W.H. Hespenhide of McDonnel Douglas Corp. under contract to Marshall Space Flight Center — MFS-20317).

Taken from the Fabricator Newsletter, EAA Chapter 90



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