INTERNATIONAL AEROBATIC CLUB
I.A.C.
MEMBER

TECHNICAL TIPS MANUAL

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(S.A. = Sport Aerobatics Magazine)

Aerobatic Aircraft Malfunction And Defect Report

Aircraft Pitts Special — 108 Hours, Engine 0-290 D-2 — 1135 TT, Propeller Sensenich M74DM-2-54 — Hours Unknown.
Description of Malfunction or Defects:
Inverted oil valve stuck in inverted oil pressure position resulting in no oil pressure right side up — landed with no power within one minute of oil pressure loss.
Cause:
Engine not completely broken in and "sliver" caused reamed fit slide tube to hang up in inverted position.
Corrective Action:
Cleaned oil screen, changed oil and had no further problem in 105 hours use for aerobatics.

Aircraft Pitts Special — 209 Hours, Engine Lycoming 0-320 — 334 Hours, Propeller Sensenich DM-74-53 — 137 Hours.
Description of Malfunction or Defect:
Excessive oil leakage around inboard pushrod housing seals during outside maneuvers.
Cause:
Insufficient preload on inboard seal.
Corrective Action:
Install new seals. Coat seals with non-setting form-a-gasket prior to installation. Install double spring tensioner on rocker arm end of pushrod housing.
NOTE: This procedure reduces heat tolerance between pushrod housing and engine case. It has not caused any problems on my engine which does not exceed 220 deg. centigrade cylinder head temperature. For engines which run hotter, I have no experience to relate.

Aircraft Clipped Wing Cub — 2400 Hours, Engine C-90 — 180 SMOH, Propeller Fixed 7146 — 1100 Hours.
Description of Malfunction or Defect:
Front windshield frame broke in upper section near cluster.
Cause:
Frequent operation at or near red-line airspeed.
Corrective Action:
Added a support brace near center of windshield to support excessive pressures encountered at high airspeeds. Tail brace wire fittings are replaced with new ones every year as precautionary measure.

Aircraft Piper J-3 — 1100 Hours, Engine Continental 90 — 340 Hours.
Description of Malfunction or Defect:
Aft left rudder pedal broke off at tab connector to cable.
Cause:
Believed to be a faulty weld.
Corrective Action:
Replace rudder pedal.

Aircraft Gusty — 115 Hours, Engine Continental C-85-FJ — 115 Hours, Propeller Hoffmann — 115 Hours.
Description of Malfunction or Defect:
Left inboard aileron hinge pin came out.
Cause:
We did not have washers between I bolt and cotter key; cotter key became worn and broke off and pin worked loose (we think). Did not catch it on pre-flight and upon reaching approximately 115 mph to cruise to air show there was a strong low frequency flutter. First thought was prop. It proved to be left aileron. Flutter frequency after starting varied rapidly with mph. Slowed down and landed without incident.
Corrective Action:
Old pins showed signs of wear. Replaced all pins with new ones **and** with washer between cotter key and I bolt. Will definitely always check hinge pins in future before flight.
NOTE: Within ten minutes airtime of incident, I had indicated 185 mph G meter from previous flight read -4.5 G ‡ 5.5 G and I had finished up trying tailslides. If it had to fall out it sure picked the right time!

Aircraft Thorp T-18 — 225 Hours, Engine Lycoming 0-290 D-2 — 1109 TT 225SMOH, Propeller Sensenich M76AM-7-67 — 225 Hours.
Description of Malfunction or Defect:
Low oil pressure and bronze flakes in oil screen was enough reason for teardown. Center main crankshaft bearing was found to be rotating with the crank.
Cause: ?
Corrective Action:
Center main bearing bore in case was line bored to 2.687 and installed 0-320 bearing#77034 and Dowels #67453.

Aircraft EAA Bi-Plane — 100 Hours, Engine 0235-C1 — 500 Hours, Propeller Sensenich.
Description of Malfunction or Defect:
Improper rudder fin attach causing flutter — according to other builders it is common.

Cause:
Seems to be because of loose attach or pliable attach.
Corrective Action:
Redesign.

Aircraft Starduster Too — to be tested yet, Engine Lycoming 0-360-A2A, Propeller Sensenich.
Description of Malfunction or Defect:
Bulletin on Sensenich 70x60 prop for the 180 Lycoming. Due to vibrations prop must be modified in 500 hours or less. Seems it vibrates around 2350 and develops cracks and/or weakness. Prop is thinned down and new airfoil section developed.
Cause:
Corrective Action:
Return to Sensenich for modification.

Aircraft Starduster SA-100 — 20-22-30 Hours, Engine Lycoming 0290-G — 20-22-30 Hours, Propeller Sensenich — 20-22-30 Hours.
Description of Malfunction or Defect:
Complete engine shutdown by itself in a vertical climbing roll.
Cause:
MA3-SPA carb. installed, float type, when vertical, would allow the float to pull the needle valve off its seat and increase the mixture to an unburnable value, causing the engine to stop turning.
Corrective Action
At 20 hr. removed carb. and overhauled.
At 22 hr. landed and made arrangements to purchase, and have overhauled a PS5-C carb.
At 30 hr. dove the aircraft to 160 mph to get the engine to turn and start again, returned to field and installed the returned from overhauled PS5-C carb. and complete inverted fuel system. This action corrected the problem.

Aircraft Starduster SA-100 — 42 Hours, Engine Lycoming 0290-G — 42 Hours, Propeller Sensenich — 42 Hours.
Description of Malfunction or Defect:
Installed 3-way oil control valve during climb good oil pressure, inverted-good oil pressure, rolled right side up — no oil pressure, rolled inverted-no oil pressure.
Cause:
The ball check valves were both seated, resulting in oil starving the oil pump.
Corrective Action:
Placed "X" shaped spacer between the ball check to keep them apart — this action corrected the defect.

Aircraft Champion 7ECA — 155 Hours, Engine Lycoming 115 H.P. — 155 Hours, Propeller Std. with this model — 155 Hours.
Description of Malfunction or Defect:
Weldment failure & other associated cracks on exhaust pipes near heater muffs. Excessive & continual tailwheel vibration and chatter. Oil (engine) thrown overboard (as would be expected). Inner door fiberglas molding broken near latch & rear strut (wing) bent.
Cause:
1. Vibration
2. Short periods of inverted flight
3. There are several hypotheses — none proven
4. Heavy winds on surface (to 75 mph) at Kenosha forced locked door open and repeated slamming against strut were deemed to be the cause.
Corrective Action:
1. Addition of supportive brace to exhaust stack and engine
2. Complete check of bearings tire and adjusting screws
3. Install inverted oil system
4. Door and strut replaced

Aircraft Citabria KCAB — 145 Hours, Engine Continental 150 HP — 145 Hours, Propeller Standard for aircraft — 145 Hours.
Description of Malfunction or Defect:
Ruptured seam in the right wing fuel tank, necessitating that the tank be removed and repaired.
Cause:
The aircraft has been used for routing aerobatic maneuvers which have not exceeded the structural limits in any way.
Corrective Action:
Since the Champion factory burned down, the fuel tanks were not directly available and it was necessary therefore to weld the seam by the local A & E.

Aircraft Champion 7KCAB (1967) — 500 Hours, Engine Lycoming 0-320 — 500 Hours, Propeller Mc 72-54 — 500 Hours.
Description of Malfunction or Defect:
1. Right stringer on belly rotten (1969)
2. Dope cracking and flaking off over the first two ribs on both wings (1969)
3. Throttle knob broke off — three times (1970)
4. Dope cracking and flaking off over entire aircraft, also having problems holding inspection plates and rings on (1970)
5. Starter flywheel wearing into cowling, also electric fuel pump failed (1970)
Corrective Action:
1. Replaced stringer
2. Redoped and taped the first two bays
3. Welded twice unsatisfactorily, then replaced with a newer and stronger one
4. Recovered entire aircraft with Stitts Poly Fiber (I think it will be better than Ceconite)
5. Replaced bushings and refiberglassed cowling and repaired fuel pump

Aircraft Citabria — N/A, Engine N/A — N/A, Propeller N/A — N/A.
Description of Malfunction or Defect:
The ends of the screws that hold the windshield side moldings rub against the fuel lines and actually wears into these lines. After noticing this on mine, I have observed this on other Citabrias — could cause ruptured line in flight.

Aircraft Champion 7ECA — 300 Hours, Engine Lycoming 115 — 300 Hours.
Description of Malfunction or Defect:
1. Right aileron bowed up at trailing edge — one aileron rib crimped slightly
2. Ribs behind fuel tank crimped
Cause:
1. Excessive aileron input at high speeds
2. ?
Corrective Action:
1. Straightened by hand
2. None yet — just noted

Aircraft Champion 7ECA — 500 Hours, Engine Lycoming 108 HP — 500 Hours, Propeller Standard — 500 Hours.
Description of Malfunction or Defect:
1. Fabric Defects — Fabric fastening screwheads cause overlay tape to crack on wing and tail surfaces
2. Under belly access cover plates located under rear seat area appear to vibrate and resonate such that fabric failure develops.
3. Oil venting should be improved. To eliminate messy oil covering under belly, oil vent pipe should be extended.
Perhaps extension of vent pipe along undercarriage to vent near one wheel (as per Stinson) would help Better yet Champion should offer an inverted oil option with or without inverted fuel option for the 108 Lycoming.
Corrective Action:
All of the above items should be corrected by Champion. I've noticed fabric cracks in 1970 models with less than 100 hours on tach.

Aircraft Champion Decathlon.
Description of Malfunction or Defect:
During inverted flight, rear seat belt broke at attach point.
Cause:
Faulty factory weld.
Corrective Action:
Hopefully dual seat belts and harness will be installed in all cockpits.

Aircraft Pitts S1S — 20 Hours, Engine 0-360-A4A — 20 Hours, Propeller Sensenich 76-60 — 20 Hours.
Description of Malfunction or Defect:
Shock cords not strong enough. Gear sagging.
Cause:
Improper gear alignment.
Corrective Action:
Re-aligned gear and replaced 1280 HD shock cords with 1380.

Aircraft Pitts S1S — 300 Hours, Engine IO-360 — 75 Hours, Propeller Sensenich 76-60 — 50 Hours.
Description of Malfunction or Defect:
Aileron brackets loosening up at attach point to rear spars allowing lateral movement of ailerons.
Cause:
Fitting improperly designed, should have more contact area on rear spar.
Corrective Action:
New fittings with more bearing surface on rear spar.

Aircraft Pitts (4 aileron) — 125 Hours, Engine 0-360-A4A — 125 Hours, Propeller Sensenich 76-58 — 125 Hours.
Description of Malfunction or Defect:
Weak shock cords — Gear sagging
Cause:
1280 HD Shock cords not strong enough.
Corrective Action:
1380 shock cords installed.

Aircraft Pitts (4 aileron) — 115 Hours, Engine 0-360-A4A — 115 Hours, Propeller Sensenich 76-58 — 115 Hours.
Description of Malfunction or Defect:
Seventeen ribs broken or deformed. Damage found in all wings.
Cause:
Improper fabric tightening and rib stitching and continued tightening of fabric as aircraft aged in sun.
Corrective Action:
Wing ribs spliced and gussetts added to all ribs.

Aircraft Great Lakes — 235 Hours, Engine 165 HP Warner — 235 Hours, Propeller Aeromatic 220-85 — 235 Hours.
Description of Malfunction or Defect:
1. Gas tank leaks (several)
2. All cobane and interplane strut bolts deformed
3. Exhaust stack broke off
Corrective Action:
1. Removed tank, soldered all spots, used 3 coats sloshing compound in tank. Used heavier plywood in bottom, used metal cover top center section to facilitate removal of tank if future trouble develops.
2. Replaced all interplane struts and cobane bolts
3. Replaced stack

AVCO LYCOMING SERVICE BULLETIN

April 30, 1971
Service Bulletin No. 240F
(Supercedes Service Bulletin No. 240E)
Engineering Aspects are
FAA (DEER) Approved

Subject: Replacement of Parts at Normal Overhaul

Models Affected: All Avco Lycoming aircraft engines.
Time of Compliance: At overhaul.

At overhaul of any Avco Lycoming engine, it is recommended that certain parts be replaced, regardless of their apparent condition. The following is a list of parts so recommended.

- All engine oil hose
- All oil seals
- All cylinder base seals
- All gaskets
- All circlips, lockplates, retaining rings and laminated shims
- Piston rings
- Propeller shaft sleeve rings
- Pinion shaft rollers (reduction gear pinion cage)
- Thrust bearing, TIGO-541 series
- Supercharger bearing oil seal (mechanically supercharged series)
- All exhaust valves (escept Inconel alloy valves)
- All exhaust valve retaining keys
- All bearing inserts (main and connecting rods)
- Cylinder fin stabilizers
- Magneto drive cushions
- Stressed bolts and fastenings as follows:
  - Stationary drive gear bolts (reduction gear)
  - Camshaft gear attaching bolts
  - Connecting rod bolts and nuts
  - Crankshaft flange bolts
- Damaged ignition cables
- Crankshaft sludge tubes
- Counterweight bushings in crankshaft (See Service Instruction No. 1142 for instructions)
- All fuel line hose for model IGSO-540-A series

Although the above list is a recommended replacement list, the replacement of all exhaust valves except Inconel exhaust valves (No. 74802, 74052, 76076 and 76081), all stressed bolts listed and crankshaft counterweight bushings are mandatory; no engine should be overhauled without the replacement of these parts.

Requirements for replacement of parts for accessories such as magnetos, carburetors and fuel injectors are described in the Avco Lycoming Turbocharger Manual.

NOTE: Revision "F" to Service Bulletin No. 240 adds thrust bearing, TIGO-541 series to list of parts to be replaced at normal overhaul.

16502 - This number for Avco Lycoming reference only.

AVCO LYCOMING SERVICE BULLETIN

May 7, 1971
Service Bulletin No. 327A
(Supercedes Service Bulletin No. 327)
Engineering Aspects are
FAA (DEER) Approved

Subject: Inspection for Center Main Bearing Retention

Models Affected: All IO-360-A and -C series engines except the following:

IO-360-A, -C . . .S/N 7100-51A and up
All remanufactured engines shipped after January 26, 1970 are not applicable to the requirements of this bulletin except for the following:

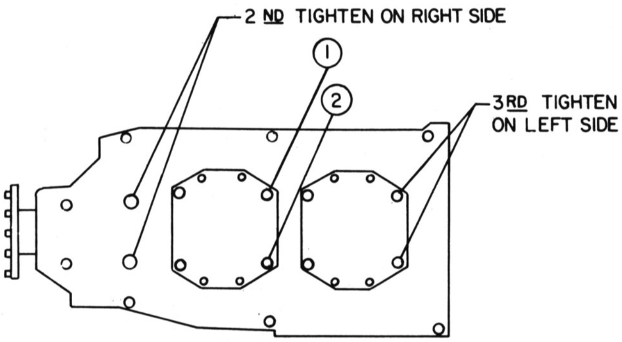
IO-360-Z, -C Series . . . S/N 354-51, 1049-51A, 3003-51A, 3281-51A, 6526-51A

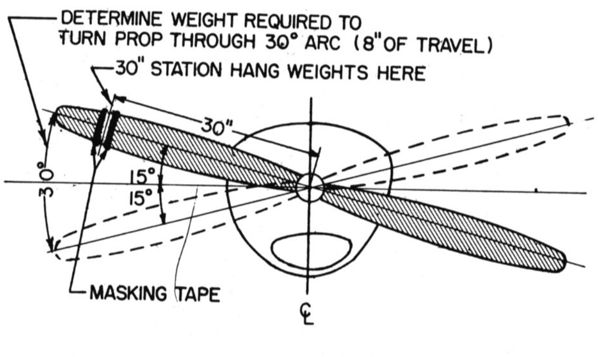
Time of Compliance: Within next 50 hours on engines that have accumulated 500 hours or more. Within next 10 hours on engines that have accumulated more than 600 hours.

Bearing and bearing dowel failures on the IO-360-A and -C series engines can be attributed to movement of the mating surfaces of the crankcase halves at the bearing supports. This condition is caused by gradual loosening of the crankcase thru-studs and shifting of the bearing inserts. In extreme cases the tendency of the bearings to turn causes failure of the crankcase dowels and subsequent engine damage.

The following inspection is required:

1. Locate the aircraft in area where the ambient temperature is between 60° F. and 80° F. Then with the ignition switch in the "off" position remove the lower spark plugs and turn the propeller to TDC position for no. 1 cylinder.





2. Mark a 30 inch radius on the propeller blade with masking tape as indicated in figure 2.

3. Turn the propeller to 15° above the horizontal as indicated in figure 2.

4. By means of weights or a spring scale, determine how much weight is required to turn the propeller thru 30° or 8 inches of travel as indicated in figure 2. Start the propeller moving by hand because the weight required to overcome the static friction may give a false indication of weight.

5. Check the torque on the center thru-studs. Do this by turning clockwise the nut on the upper, center thru-stud. See "1" in figure 1. If it turns at a value below 600 inch pounds, discontinue the turning effort and apply the wrench to the lower nut, no. "2" in the figure. If either or both nuts are loose, excessive crankcase wear may have occured. If both of the center thru-studs are found to be tight it may be presumed that no dislocation of the bearing has occurred and the remainder of this procedure may be omitted.

6. If either of the center thru-studs were found to be loose in the previous step, retorque all of the crankcase thru-studs to 600 inch pounds in the sequence indicated in figure 1, starting with "1'; and "2".

7. Repeat steps 3 and 4 to determine if any difference in weight is required to turn the propeller. If a difference of more than 5 pounds is required to turn the propeller it may be concluded excessive wear has occurred at the mating surfaces of the crankcase which will affect main bearing retention; in this event the engine must be disassembled, the crankcase repaired as described in Service Instruction No. 1112 and newly designed crankcase bearing dowels installed as directed in Service Bulletin No. 326.

A Smoke System For Your Airplane

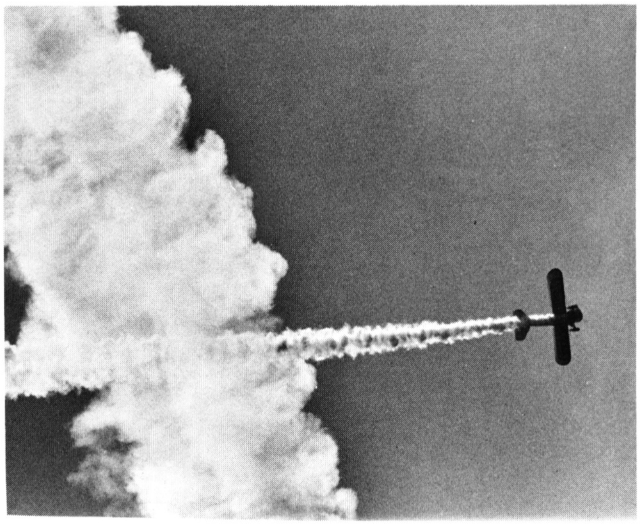
By Jim Lacey
IAC 6

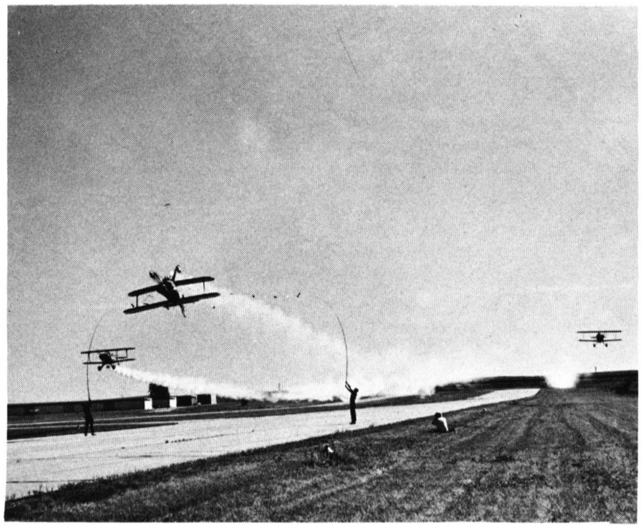
RFD. 1
Dundee, Illinois

Due to the increasing interest in a workable smoke system for the average homebuilt, we've decided to sketch the common Pitts smoke system.

The tank used is mounted in the center section of the top wing. It has a capacity of 4.5 gallons of oil (see figure 3). It is constructed of .073 aluminum with no baffles installed. It is heli-arced and lapped ¼" on the sides. There is a flop tube installed with a flexible line weighted on the pick-up end. The tank is vented with the vent tube routed down the gear leg (see figure 2). From the tank the oil is drawn through a ⅜" aluminum tube through a firewall fitting (AN 832-6D) to the pump. This pump is a diaphragm pump set to 20 lbs. plus. Normally this fuel pump is used on a fuel injected engine. The oil is then pumped back through a firewall fitting (AN 832-6D) to a simple on-off valve located in the cockpit. From the valve the oil line goes back to a firewall fitting (AN 832-6D) (see figure 1) that has been cut off at the "b" nut and tapped to accommodate a ⅛" pipe thread. From here we install a tee fitting (AN 825-2D). We then route hoses to ⅛" pipe fittings in the exhaust stacks. These fittings (AN 840-2 steel) have the ends brazed shut and a number 60 hole drilled in each fitting. The brazing must be done with care so as to not ruin the pipe threads. These fittings are screwed into the ⅛" female pipe coupling which is welded into the stacks approximately 12-15" from the tail pipe end. This system should be adaptable to most any airplane. The only drawback is that you must use a gear driven fuel pump and they are expensive. Whether you're flying air shows or just playing, a smoke system is a fun thing to have. The one caution in operating the system is to never have oil pumped into the stacks below 2000 rpm (Lycoming engine) as it is flammable stuff and a big blaze looks great from the ground but is a heckava finish to your act. So always **turn it off** before reducing power.

Good flying and happy smoking!





(Ted Koston Photos)

No air show is complete without smoke. This can readily be seen in the above pictures of Nick Rezich (left) in his Travel-Aire and the EAA Red Devils at the 1969 EAA Air Museum Benefit Air Show.

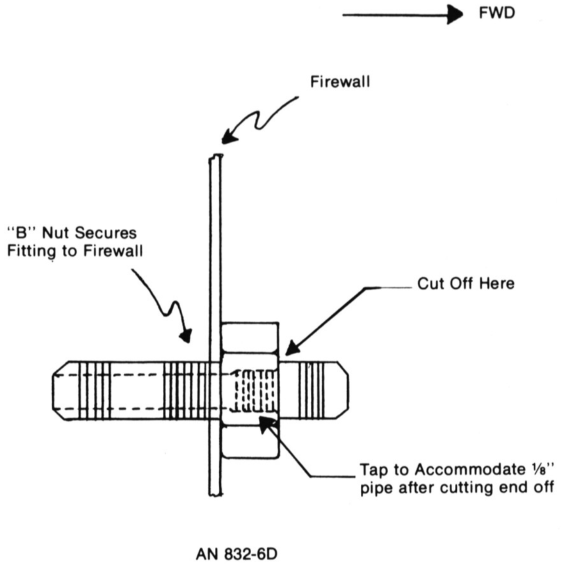


FIGURE 1

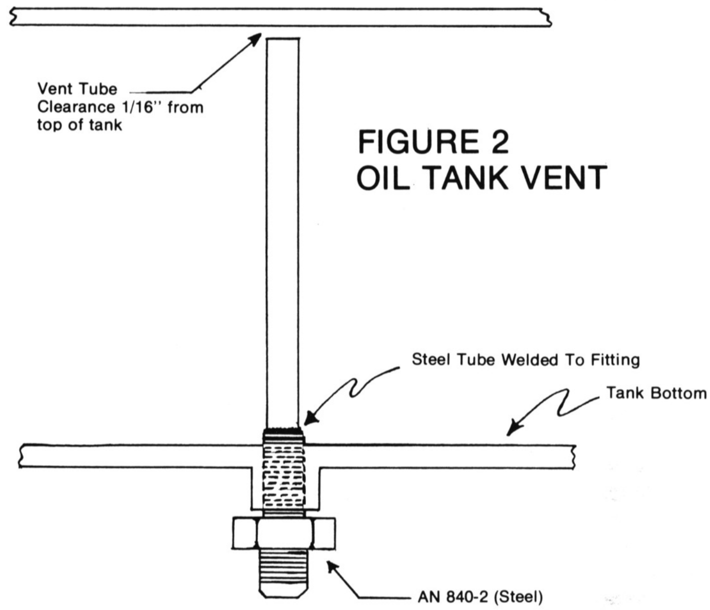


FIGURE 2
OIL TANK VENT

Note: Oil tank is airfoil shape and lapped ¼" on sides then heliarc welded.

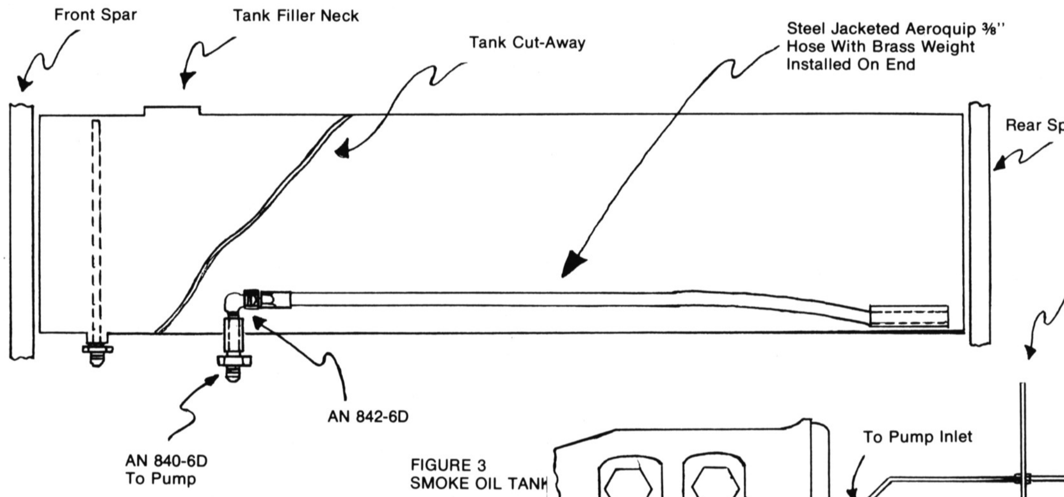


FIGURE 3
SMOKE OIL TANK SCHEMATIC

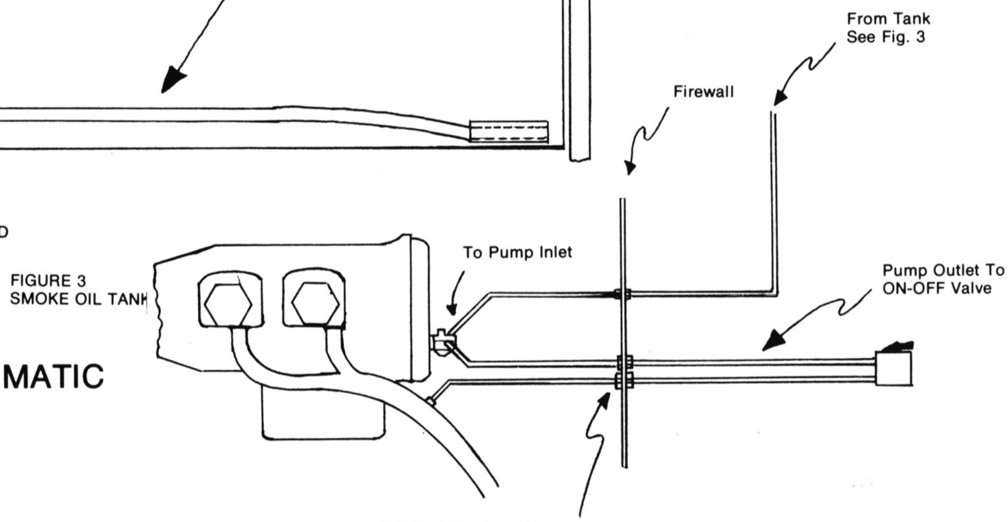


FIGURE 4

"T" Fitting goes here with one line to each stack See Fig. 1

Normal Oil Pressure . . . Inverted

by Jim Lacey (IAC 6) & Terry Tubb (IAC 346)

Happiness is normal oil pressure while inverted! Proper lubrication is one of the most important factors for long and reliable engine life.

The system we have drawn here is the most common one used on the Lycoming 0290, 0320, and 0360 series engines. However, it is readily adaptable to most engines by using the same principles. Basically, what we have done is dry-sump the engine, but continue to use the engine and sump as a storage tank for the oil.

First, we must have a suitable oil change-over valve (detail C), a workable slobber pot, (detail D) and change the method of pick-up by the pump. We do this on the 0290 and 0320 engines that use the vertical oil sump screens by fabrication of a modified fitting at the oil sump pick-up tube (detail A). On the 0320 and 0360 engines with the horizontal screens at the rear of the sump, we change the oil pick-up by blocking off the normal interior oil gallery by means of a fitting (detail B) and using the sump plug for oil supply to the valve.

Here is how the system works. In normal upright flight, (See figure I) the oil is drawn from the rear-most sump drain plug to the bottom port of the oil change-over valve, and out the center port, which always supplies the pump, to the modified fitting, and then to the oil pump. The engine is breathing through the normal breather which is plumbed to the top of the slobber pot. When inverted, the oil is drawn from the tee in the breather line to the top port of the oil change-over valve, out the center port to the modified fitting and then to the pump. The engine is now breathing through the normal oil sump. Also, the slobber pot is now filling up with the excess oil which the engine does not need. When rolling back to upright, the oil which has been stored in the slobber pot is returned to the engine via the line from the bottom of the pot.

Please note there is no plate between the sump and the engine and this system can be installed without any disassembly.

This system will insure normal oil pressure in all attitudes except straight down flight. This is because there is no pick-up for the oil available. We feel that if you should remain in a straight down attitude very long, engine damage will not be your primary concern. It is our hope that this article will take some of the "mystery" out of inverted oil systems, and will result in increased life of aerobatic engines. We also strongly recommend the oil be changed each 10 (ten) hours of aerobatic operation. This will insure the removal of any carbon, flecks of metal, etc. that would normally be recirculated through the engine. At this time, we also feel that it would be very wise to run a differential compression check on the engine. This will help insure your not becoming a victim of a "sick" or "dying" engine. Preventive maintenance on aerobatic engines and air frames is not an annual operation. The majority of failures can be directly attributed to poor maintenance or carelessness. This inverted oil system as drawn and described has been used successfully by many pilots, including the authors, for quite some time. However it is not approved by Lycoming or STC. It is presented for your information only and should be used at your own risk.

(Photo from Mel Barron Collection)

Normal Oil Pressure — inverted. This famour Great Lakes was previously owned by Rod Jocelyn and Frank Price and now owned by Mel Barron (IAC) 71) of Colorado Springs, Colorado.

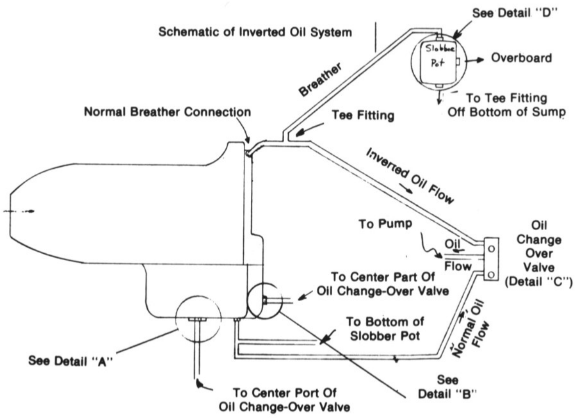
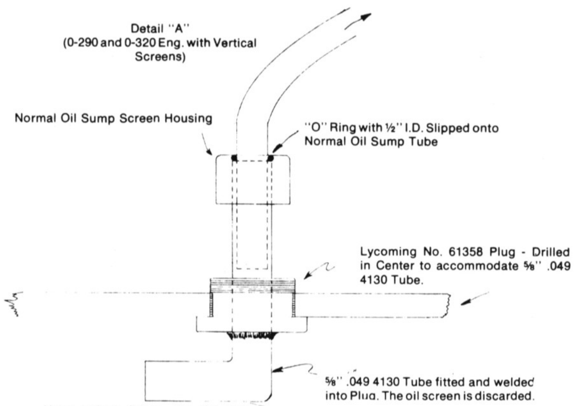
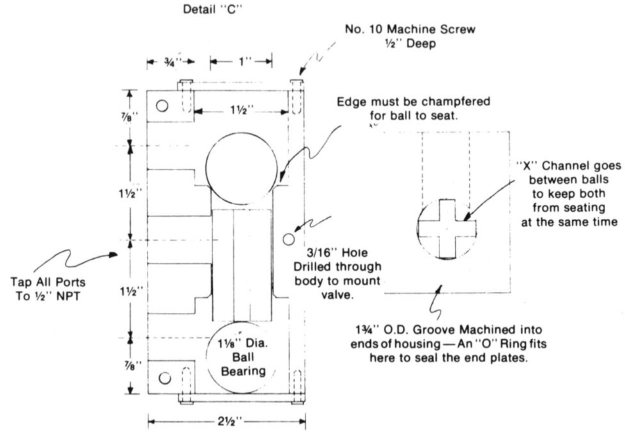
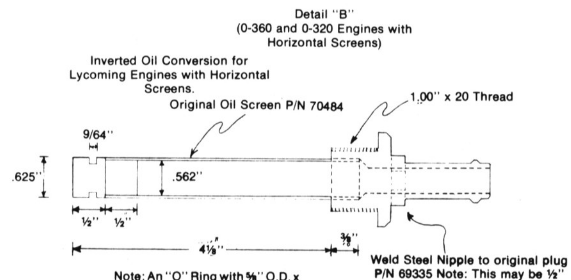


Figure 1

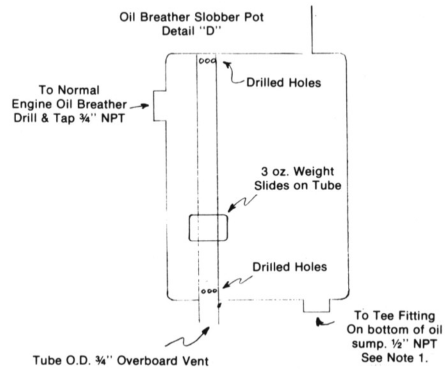


Note: When fitting the ⅝" tube through the plugs. First install plug in sump then slide tube onto normal oil sump tube. Mark ⅝" tube so that the length will be correct to make a snug fit against the oil screen housing.





Note: An "O" Ring with ⅝" O.D. x 3/32 - .444 goes into the 9/64" groove in the end plug.



Note 1: This port serves as an inverted breather and as an oil return to the sump from the slobber pot when the aircraft is right side up.

Installation Note: Place slobber pot as high as possible behind engine so that all of the oil drains back into the sump.

Construction Note: Construction is aluminum heliarced with aluminum baosses drilled and tapped to accommodate standard AN fittings. **Capacity should be approximately 2 quarts.**

In The Interest Of Safety

By Terry Tubb (IAC 346)

Last year 26 pilots were killed while engaged in some form of aerobatics. This is more deaths than the last 10 years combined and 1972 appears to be getting off to a similar start.

It has always followed that when accidents begin happening with any regularity, the FAA cranks up its rule-making machinery and literally tries to regulate fatalities out of existence. These regulations are usually in the form of blanket restrictions and could very possibly complicate sport aerobatics to the point of total frustration.

This writer believes that if the sport aerobatics as we know it is to survive, the aerobatic pilots as supporters of sport aerobatics must get together and begin a safety campaign. I feel that if this is not done soon, we will all be feeling the bite of new regulations.

It is up to the experienced aerobatic pilots in the IAC, the ACA and the American Tiger Club to offer suggestions and guidelines to the now very large novice group of pilots participating in the sport today.

Furthermore, it is the responsibility of all of us to ask the experts and the recognized leaders of our associations for advice whenever a doubt exists about doing a new unfamiliar maneuver or modifying our aircraft.

Although I am a novice in aerobatics, I have had the good fortune to know a number of experienced pilots in this sport. I have tried to learn something from all of them because they all have something to offer. The following items are not my own, but an accumulation of safety practices and information that I have obtained in my association with some very wise pilots.

The first and most obvious item is the aircraft. It must be designed for aerobatics. If it is a one of a kind aircraft or a new design and you don't have the knowledge to determine for yourself, have several experienced pilots and mechanics inspect it for you. Also make sure that you have a recording G-meter, it will be a good indicator of the quality of your aerobatics later on as well as a safety instrument.

Other things to watch for if you **do have an aircraft capable of aerobatics** is the over all condition of the aircraft.

The fuel system should have a filter, not just a gascolator, and it should be changed every 25 to 50 hours. If you happen to have a glass bowl gascolator, throw it away and get one with a metal bowl. The reason is that if the glass should break you are almost guaranteed a fire if the engine is running and your gascolator is mounted on the firewall.

Engine mounts should be very carfeully checked before every flight. This is the structure that has to withstand tremendous gyroscopic, torsional, shear and tension loads so a careful inspection is absolutely necessary.

The engine oil should be changed every 10 to 15 hours of heavy aerobatics and of course, all screens must be cleaned and checked for metal. Crankshaft flanges should be dye checked every 50 hours or so unless you have an 0290 GPU then I would avoid aerobatic entirely with the original crankshaft. A compression check should also be run at this time.

The propeller should be very carefully inspected for cracks and nicks before every flight. Even the smallest nick should be dressed out because a blade failure will almost certainly result in an engine loss — literally from the aircraft.

The aircraft should be thoroughly inspected before each flight. All attach fittings, hinges, and control linkages should be checked. Any change in flight characteristics, ripples in the fabric or skin should be looked into immediately.

If any modifications to controls, flying surfaces or fairings are made or if the aircraft is new, a complete flutter test should be made as per the article on flutter written by Phil Meyer several years ago in Sport Aviation.

The parachute should be freshly and regularly repacked and inspected. Also several practice emergency exits from the aircraft while on the ground would be advisable to be sure that you can get out before engaging in any aerobatics. Some aircraft are obviously difficult if not impossible to escape from in an emergency. This problem can often be remedied by a quick-release canopy or hand holds with which to pull yourself from the cockpit.
with an emergency escape. Many pilots wear beltless jump suits for this reason. Goggles should be worn in lieu of sunglasses when doing aerobatics. Anyone who has ever had a gas cap come off while inverted and gotten two eyes full of avgas can tell you why. This could be fatal during a low altitude air show routine.

Now we move to the flying safety department.

First, safety in a high performance aerobatic aircraft must be a constantly maintained altitude. No matter how well your aircraft is maintained, if you drive it into the ground because you were too low, you are going to be just as dead as if you had a structural failure.

Competition aerobatics and air show routines should always be practiced well above the minimum safe altitude for the aircraft. This is the altitude that in the event a structural failure occured or the aircraft became uncontrollable, a safe bail-out could be executed.

It is a good practice to go up and do a few maneuvers simulating an engine failure of the most critical time during the maneuvers, then see how much altitude is used to get the aircraft established in a normal glide for forced landing — the results will surprise you. Often very simple maneuvers are the most dangerous when done too low.

(Continued on Page 10)

A hammerhead for example would be fatal if the engine quit going straight up just before the turn around. The airplane would do a tailslide, whipstall and then hit the ground with no control possible from the cockpit. The Split-S is another very dangerous low level maneuver. Once it is initiated and the aircraft is pointed straight down, the pilot is committed to carry through the pull-out. If he had misjudged his altitude or if it is 20º warmer than the last time he tried it he may become an integral part of his instrument panel. I had a good friend killed this very way.

When a new aircraft is flown or when flying an unfamiliar aircraft in aerobatics, a full spin series should be done at high altitude.

Two turns each direction in a normal spin and two turns in each direction inverted should be sufficient. A word on inverted spins; Many times more complex maneuvers if done improperly will result in an inverted spin. A very experienced pilot once told me if you are spinning and you don't know for sure if you are inverted or not, pull the stick full back and neutralize the rudder. If you are in an inverted spin you should recover. If it keeps spinning you are more than likely in a normal spin, and a normal recovery should work. This is a general statement but in most cases works very well.

Along the lines of good safety practices it should be standard procedure to have a definite practice area and use it **always**. Be very sure to tell someone where you will be and when you will return. The reason here is obvious. Another simple procedure all good aerobatic pilots follow is that of zeroing the altimeter at the beginning of each flight so that you are reading altitude above ground at all times.

Last but certainly not least, the pilots health must be considered.

Don't fly aerobatics when you are sick. You are much more susceptible to incapacitation due to black outs during heavy G-loads and you are much more likely to make a serious error in judgment. This applies to hangovers also.

I hope that the information in this article will be of use to some of you but moreover, I hope that it helps foster an attitude of safety in aerobatics. The ease and swiftness that death can come while doing aerobatics doesn't hit home until you see a friend dead in a twisted wreckage and suddenly you think "Maybe if someone had told him", or "Maybe if we had looked over his plane to determine for sure it was a capable aerobatic craft". Possibly it could have saved his life — the blame may be partially all of ours.

It's time we all started watching out for each other.

Service Instruction

AVCO LYCOMING DIVISION
WILLIAMSPORT, PA. 17701

DATE:	April 9, 1971	Service Instruction No. 1228 Engineering Aspects are FAA (DEER) Approved
SUBJECT:	Modification of Cylinder Hold-Down Plates	
MODELS AFFECTED:	O-320-B, -D, IO-320, O-360, HO-360, HIO-360 conventional crankcase series, O-340, VO-360, IVO-360, GO-480-C, -G, GSO-480, IGSO-480, O-540, IO-540, IGO-540, IGSO-540, TIO-540, VO-540, IVO-540, TIVO-540 and IO-720 series aircraft engines.	
TIME OF COMPLIANCE:	At overhaul or at anytime a cylinder is replaced.	

To facilitate assembly and insure clearance with cylinder in the area of the hold-down plate a modification of the hold-down plate has been accomplished to provide a chamfer, on both ends of the inside edge, as shown in figure 1. It is recommended that hold-down plates not conforming to this modification be ground accordingly.

When reassembling the hold-down plates, assemble shims as shown in figure 2. Tighten the 1/2 inch nuts, in clockwise sequence starting at top right, to 300 inch pounds torque. Remove shims and tighten 1/2 inch nuts, in the same sequence, to 600 inch pounds torque. Tighten the 3/8 inch nuts to 300 inch pounds torque; the sequence is optional.

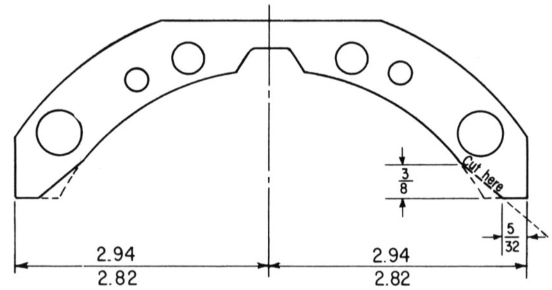


Figure 1. Hold-Down Plate

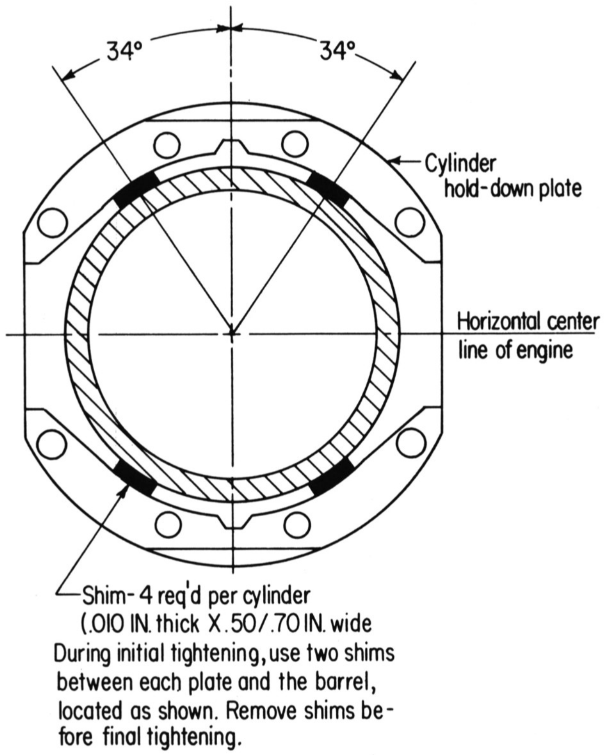


Figure 2. Location of Shims Between Cylinder Barrel and Hold-Down Plate

12703 - This number for Avco Lycoming reference only.

AVCO LYCOMING DIVISION
WILLIAMSPORT, PENNSYLVANIA 17701

Service Instruction

(L)

DATE: March 31, 1972

Service Instruction No. 1191
Engineering Aspects are
FAA (DEER) Approved

SUBJECT: Cylinder Compression

MODELS AFFECTED: All Avco Lycoming aircraft engines.

TIME OF COMPLIANCE: As required to determine cylinder compression.

The condition of the working parts in the combustion chamber of a cylinder can be determined by measuring the static leak rate of the cylinder as compared to the leak rate through an orifice of specified size. This is accomplished by attaching a differential compression measuring device, which incorporates the orifice, to one spark plug hole of the cylinder while the piston is at top center of the compression stroke.

The piston is held at top dead center by firmly holding the propeller to prevent the engine from turning when air pressure is applied through the differential compression device to the combustion chamber.

CAUTION

Use gloves or rags to protect the hands while holding the propeller blade. Also, before attaching the compression tester, check the air supply regulator to make sure the air pressure to the cylinder is not excessive.

To assure that the piston rings are seated, the propeller is moved slightly back and forth with a rocking motion while air pressure is applied; thus providing a more accurate reading. Meanwhile, a second person adjusts the air supply pressure to 80 psi, indicated on the supply pressure gage of the differential compression device. Then, observation of the engine cylinder pressure gage will give an indication of the condition of the parts in the compression chamber of the cylinder.

NOTE

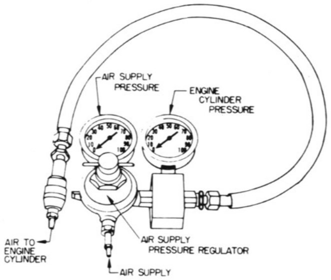
The orifice size of the differential compression measuring device is critical if consistent and meaningful cylinder analysis are to be obtained; the larger the orifice the less chance of detecting potential problems. Therefore, a specific orifice size that provides an acceptable leak rate has been selected for all Avco Lycoming engines; the instructions described herein are based on this orifice which is .040 in. dia. (No. 60 drill) x .250 in. long, with entrance angle of 59°/60°.

At any time loss of power, increasing oil consumption, hard starting or other evidence of unexplained abnormal operation is encountered, a compression check of the cylinders is recommended with equipment and in the manner described above by personnel experienced with the equipment and with the type of engine to be checked. In practice the procedure is as follows:-

1. Operate the engine until normal cylinder head and oil temperatures are attained; then shut down the engine making sure that magneto switches and fuel supply valves are shut-off. Proceed with the test as soon as possible after shut-down.

2. Conduct the test in accordance with the test equipment manufacturer's recommendations.

3. Interpretation of the results of the test is highly dependent on the skill and judicious opinion of the tester; however, the following observations cover the principle factors to be noted:



Typical Differential Compression Measuring Device

a. Pressure readings for all cylinders should be nearly equal; a difference of 5 psi is satisfactory; a difference of 10 to 15 psi indicates an investigation should be made.

NOTE

Unless the pressure difference exceeds 15 psi the investigation should not necessarily mean removal of the cylinder; often a valve will reseat itself and result in acceptable compression during a later check which should be made within the next ten hours of operation.

b. If the pressure reading for all cylinders is equal and above 75 psi; the engine is satisfactory; less than 70 psi indicates wear has occurred and
Service Instruction No. 1191
subsequent compression checks should be made at 100 hour intervals to determine rate and amount of wear. If the wear rate increases rapidly, as indicated by appreciable decrease in cylinder pressure, removal and overhaul of the cylinders should be considered.

c. Low pressure in a single cylinder is indicative of air passing by the piston or by the valve.

d. Air discharged from the breather or oil filler tube indicates leakage in the area of the piston and rings.

e. Air discharged through the intake system indicates leakage at the intake valve.

f. Air discharged from the exhaust system indicates leakage at the exhaust valve.

AVCO LYCOMING DIVISION
WILLIAMSPORT, PENNSYLVANIA 17701

Service Bulletin

(L)

DATE: August 25, 1972

Service Bulletin No. 327B
(Supersedes Service Bulletin No. 327A)
Engineering Aspects are
FAA (DEER) Approved

SUBJECT: Inspection of Center Main Bearing

MODELS AFFECTED: All IO-360-A and -C series engines and IGSO-540 series except the following:

IO-360-A, -C . . . . S/N 7100-51A and up
IGSO-540-A . . . . S/N 2537-50 and up
IGSO-540-B . . . . S/N 2541-50 and up

All remanufactured engines shipped after January 26, 1970 are not applicable to the requirements of this bulletin except for the following:

IO-360-A, -C Series . . . . . S/N 354-51, 1049-51A, 3003-51A, 3281-51A, 6526-51A

IGSO-540 Series . . . . S/N 747-50, 844-50, 852-50, 947-50, 1184-50, 1240-50, 1361-50, 1402-50, 1453-50, 1544-50, 1767-50, 1773-50, 1794-50, 1799-50, 1933-50.

TIME OF COMPLIANCE: Within next 50 hours on engines that have accumulated [illegible]00 hours or more. Within next 10 hours on engines that have accumulated more than 600 hours, or any time metal contamination is evident in the lubrication suction screens.

Bearing and bearing dowel failures on these engines can be attributed to movement of the mating surfaces of the crankcase halves at the bearing supports. This condition is caused by gradual loosening of the crankcase thru-studs and shifting of the bearing inserts. In extreme cases the tendency of the bearing to turn causes failure of the crankcase dowels and subsequent engine damage.

The following inspection is required:

NOTE

The following inspection procedure is applicable to both IO-360 and IGSO-540 engines except that no. 2 cylinder is removed and the center main bearing is inspected on IO-360 engines; on IGSO-540, no. 4 cylinder is removed and no. 3 main bearing is inspected. (On these engines no. 2 and 4 cylinders are located on the left, as viewed from the rear, no. 2 is nearest the front of the engine.

Examine the exposed portion of the main bearing that is visable between the crankshaft cheeks and the crankcase bearing supporting web. Look to see if the halves of the bearing shells have shifted. If the bearings are retained properly they will appear to be flush, or nearly flush at the ends of the parting line of the two halves; any noticable step of 1/32 inch or more is indicative of a worn bearing bore in the crankcase or a worn dowel; perhaps both. If either condition is found it must be corrected.

Dowel failure is evidenced by a bearing shell rubbing on a crankshaft cheek. This condition can only be corrected by disassembly of the engine and replacement of the dowel. This procedure is described in Service Bulletin No. 326, Crankcase Bearing Dowel Replacement.

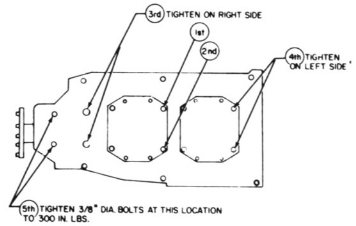


Figure 1. Diagram of Left Side of 4 Cylinder Engine Showing Sequence of Tightening

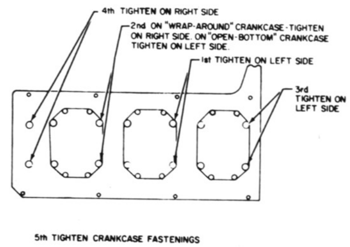


Figure 2. Diagram of Left Side of 6 Cylinder Engine Showing Sequence of Tightening

Member of GAMA
General Aviation Manufacturers Association

NOTE: Revision "B" changes inspection procedures, adds models.

Reprinted From

AVCO LYCOMING "FLYER"

Frequency of Flight And Its Effect On The Engine

We have firm evidence that engines not flown frequently may not achieve the normal expected overhaul life. Engines flown only occasionally deteriorate much more rapidly than those which fly consistently. In view of this, Lycoming accompanies its listed overhaul life in Service Instruction No. 1009 for all models with the statement that the engines must be flown at least 20 - 30 hours per month and the total time between overhauls must not exceed six years. Pilots have asked — What really happens to an engine when it's flown only one or two times per month? An aircraft engine flown this infrequently tends to accumulate rust. Some operators are running the engines on the ground in an attempt to prevent rust between infrequent flights. This may harm rather than help the engine if the oil temperature is not brought up to approximately 165°F, because water from combustion will accumulate in the engine oil. The one best way to get oil temperature to 165°F is fly the aircraft, for during flight the oil gets hot enough to vaporize the water and eliminate it from the oil. If the engine is merely ground run, the water accumulated in the oil will gradually turn to acid, which is also undesirable. Prolonged ground running in an attempt to bring oil temperature up is not recommended because of inadequate cooling which may result in hot spots in the cylinders, or baked and deteriorated ignition harness, and brittle oil seals causing oil leaks. If the engine can't be flown, then merely pull it through by hand or briefly turn the engine with the starter to coat the critical parts with oil. If the engine is flown infrequently, the oil should be changed at least every 25 hours to eliminate the water and acids.

THINK SAFETY

By Sam Burgess

While practicing for the contest, it was noted that the ailerons were mushy on an 8 point slow roll. Upon completing the maneuver, it was noted that it was necessary to position the control stick about one half left of center to maintain level flight. Although the ailerons were still responsive, a precautionary landing was accomplished.

Upon inspection it was discovered that the torque tube in the fuselage was cracked ¾ around its circumference between the control stick housing and the aileron push rod bracket. The crack was welded and the torque tube installed with no further complications.

N333N has a total of 585 hard aerobatic hours logged with an undetermined high number of rolls to the left. (Direction of the crack on the torque tube.)

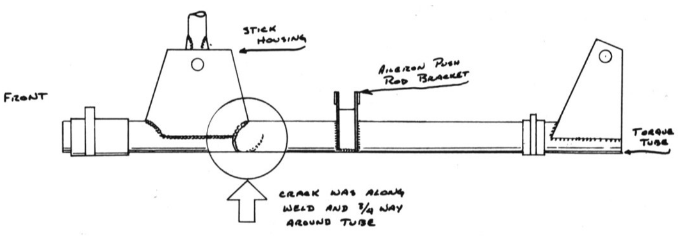
The crack was not discernible on previous inspections through the belly inspection plates. However, it would have been obvious from the cockpit except that the rear floor boards around the wobble pump and fuel filter obstructed the torque tube view.

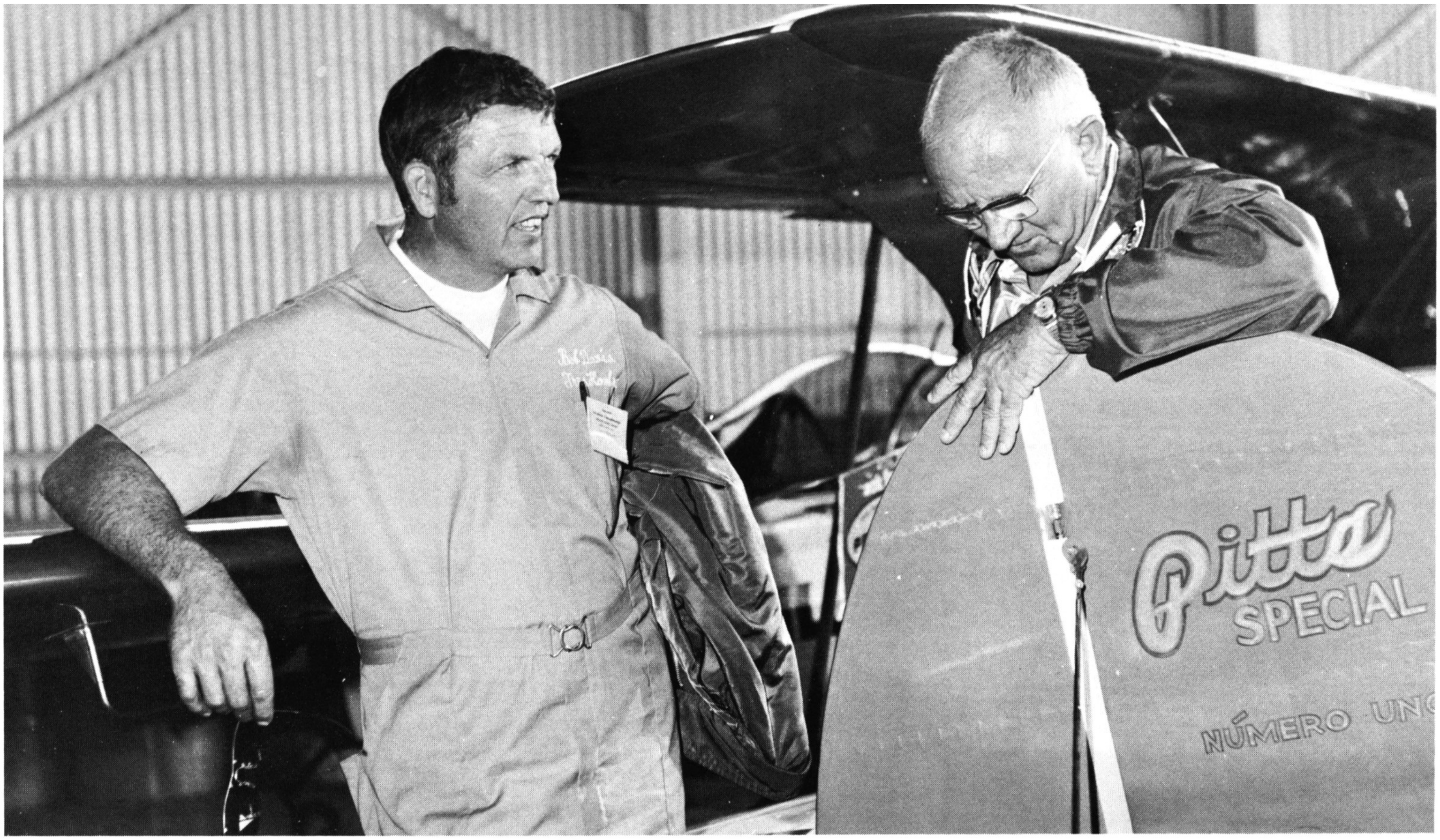
In the event of complete failure of the torque tube and subsequent loss of aileron control, it is doubtful if a wings level condition could be accomplished with use of rudder alone. In addition, the torque tube would probably slide through the rear bearing, rendering the elevators useless.

It is recommended that all Pitts pilots thoroughly inspect their torque tube for cracks and either remove the rear floor boards permanently or have them easily accessible for inspection of the control column.

Pilots with Pitts under construction should consider using only heel runners, ala Bucker Jungmeister, Stearman, etc., or floorboards, making the entire section of torque tube, fuel lines, brake lines readily available for inspection, not to mention, the window for competition framing that may be installed.

It is further recommended that the section of the torque tube between the control stick housing and the aileron bracket be beefed up with welded straps or collars before installation. It may eliminate a similar nasty situation.





Bob Davis and Curtiss Pitts discuss the problems of overweight operation of aircraft. (Photo by Verne Jobst)

Overload Plus Overweight Can Equal Tragedy

By Bob Davis (IAC 103)

A Pitts pilot has always taken much comfort and peace of mind from the universal conclusion, "you can't pull a Pitts apart". A few examples of this thinking: "I did a head on snap-roll at 170 mph in an airshow" or "Don't worry about overstressing a Pitts in a pullup. You will blackout before you damage the structure". Unfortunately, this pleasant feeling of security has been abruptly dispelled. A recent incident and tragic fatal accident have proven beyond any doubt that a Pitts, strong as it is, can be flown to the point where the structure will fail.

The Incident: This aircraft's engine was changed from a 180 hp Lycoming with fixed pitch prop to the 200 hp Lycoming "Aerobatic" with constant speed prop. A large heavy oil tank was installed behind the seat with aeroquip lines to the engine. These modifications along with additional accessories and the 230 pound pilot brought the gross weight to approximately 1250 pounds. The design limits for the Pitts are 6 positive and 3 negative at 1050 pounds. Result: After one season, the fabric was removed from the wings. All of the ribs but three were found broken with some ribs falling to the floor when the fabric was removed. The top, left rear spar was cracked on both sides. Lower wing, front spar fitting holes used for the spar to fuselage attachment fitting were severely elongated. G loading range experienced was plus 8 to minus 6. Obviously this aircraft was flown out of the design envelope and was in the process of disintegrating.

The Accident: This Pitts was flown almost entirely in airshow work. It was subjected to repeated 6-7 turn snap-rolls with entry speeds as high as 170 knots, resulting in loads of 10 to 12 Gs. The pilot sincerely felt that the Pitts design was more than adequate for these maneuvers. The morning of the accident the pilot was practicing for an airshow later in the day. An eye witness stated that after a tailslide, a pull-up to vertical was started and at this point, the upper right wing separated. The right wing "I" strut fell to the ground in front of the observer, then the upper right wing. The aircraft started a roll to the right as the lower right wing folded back along the fuselage, contacting the ground approximately 2500 feet from the initial pull-up. Examination of the wreckage disclosed separation of the top right wing at the inboard rib adjacent to the center section. All flying wires were intact and still attached to the main body of the wreckage. The flying wires attached to the top right wing had been pulled out of the wing along with a 3 inch section of both front and rear spars. All the available evidence indicates that the failure was caused by repeated high "G" load applications resulting in progressive damage and eventual failure. The first incident described damage to the top, left rear spar. It is interesting to note that the wing failure of this accident occurred at the same spot, i.e., inboard rib next to the center section. This would appear to be an excellent area to check closely on pre-flight. There are many lessons to be learned from these accounts and every aerobatic pilot should evaluate his flying habits with these examples in mind.

One lesson is very obvious: When any aircraft is flown out of its design limits, whatever the reason, overweight, overstressing or combination thereof, can only result in damage with highly probable fatal consequences.

Lacey and Tubb Speak On HOW FAST DOES IT GO?

In order to intelligently answer that question (truthfully) first, we must know the answer ourselves.

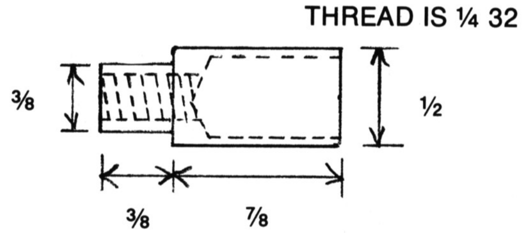
The heart of a good airspeed-pitot system is the type of pitot-static tube used. We have here a detailed tube that has worked well in the past and is also available commercially.

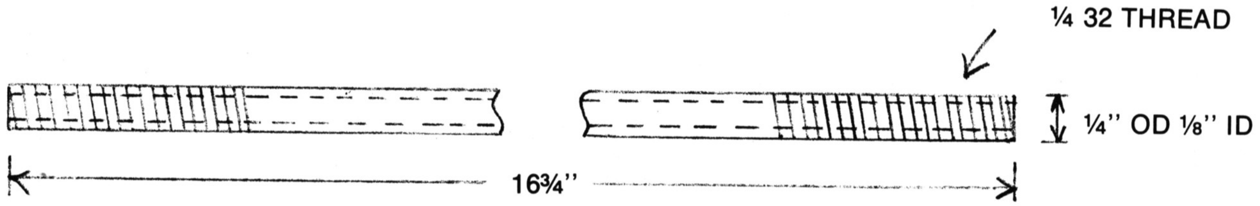
First the static ports must be in an area of undisturbed air with no bubbles present. Then, the pitot source must be as closely parallel to the airstream as is possible.

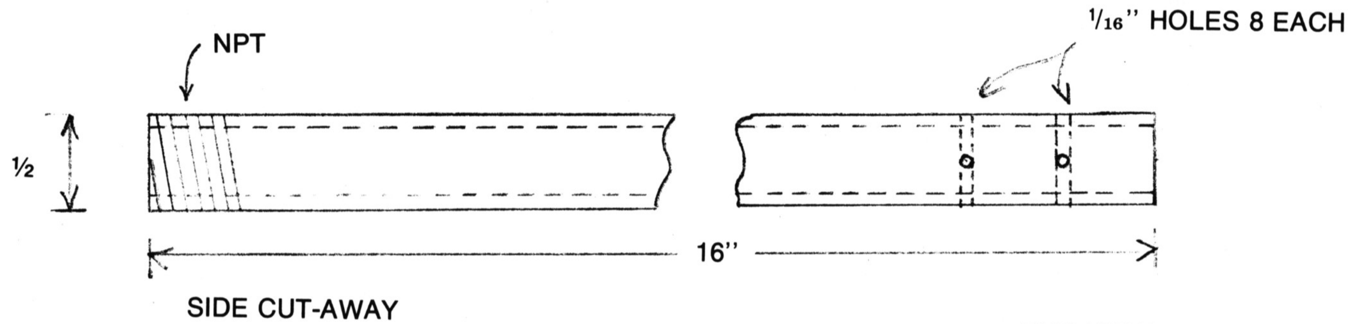
Material we have used is all aluminum except for the pitot portion which is a steel tube.

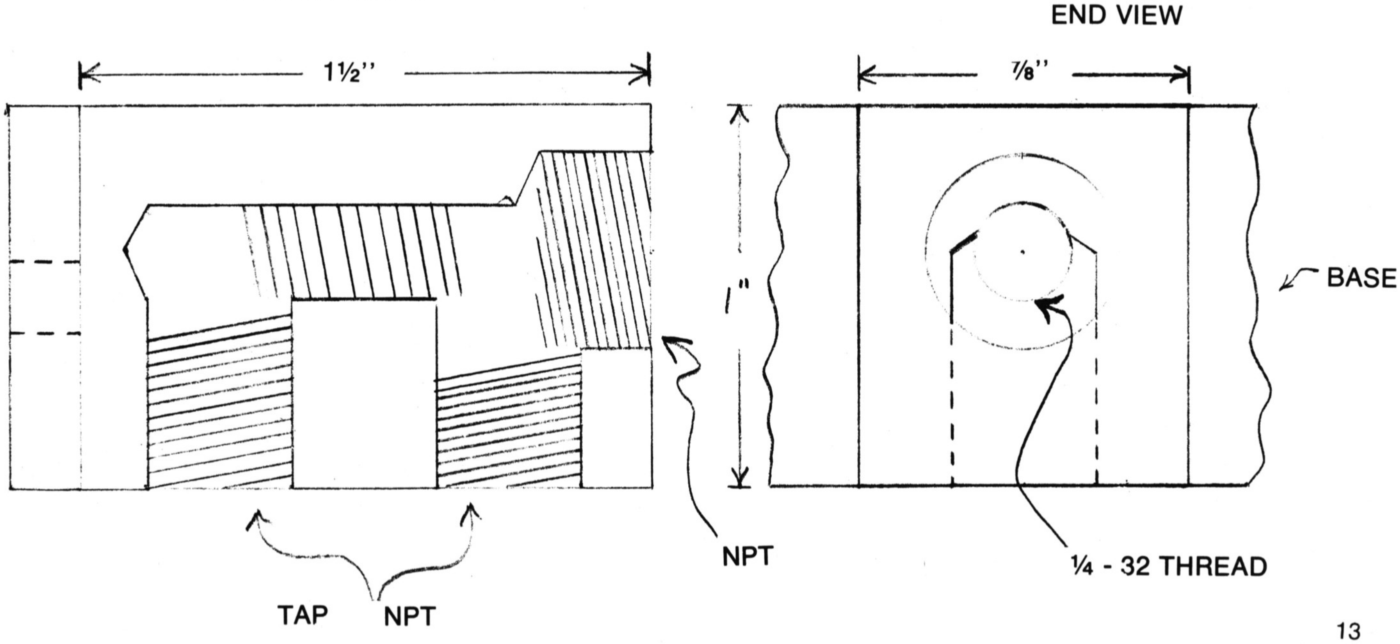
Some installations use a tube connected to the airspeed indicator that lays out in the wing for a static source. In this system we have a more accurate method of determining the ambient pressure as it is sensed in an unclosed area. The tube as drawn is pretty much self explanatory, however, care must be taken to insure a good airtight plumbing system from the mounting area to the air speed indicator. I would recommend a pressure test of the system before hooking to the indicator. It would almost be worth the money to have the FAA pitot-static check performed, that is required for IFR flight, by your local operator. This may be carrying a good thing too far, but at least you would know for sure.

This pitot-static tube should be mounted to the wing spar with the appropriate hole drilled in the leading edge material. With this system you would be able to say with no reservations how fast and how high it goes. Whether or not you divulge this information to your friends is strictly up to you.









GENTLEMEN, OIL YOUR ENGINES

By Sam Burgess

Casey Kay came to me at the beginning of last years aerobatic season and told of gritting his teeth while he watched the oil pressure slowly come up after engine start. It was still within the prescribed limits but nevertheless SLOW, slow, slow.

With all the inverted lines, air/oil separators, extra oil coolers, etc. on our acro mounts there may be a longer delay than normal in realizing a reading after start.

The thought that it just takes a while to get the pressure to the gauge on the panel is ostrich thinking. There are probably areas in your engine just as far away from the oil pump as the gauge that are not getting instant pressure.

A case history was recalled and related to Casey that may add hours to your small engine — PRE-OILING seemed to be the answer. On the 4360 P&W used on our USAF C-97s we were changing engines every 50 hours for thrust bearing failures. A tech rep established a procedure of counting 12 blades of the prop before turning on the switch. With a reduction ratio of 3.83 to one and a four bladed prop the engine turned over approximately a dozen times before it was subjected to a higher rpm. The oil pressure gauge could be seen to actually fluctuate just before starting. This cured our thrust bearing problem. Even though this procedure applied to an engine developing more than 3200 hp it could be well applied to any engine.

So, if you have just installed a new engine in your homebuilt try swinging the prop for 20 blades prior to turning on the switch and you will have instant oil pressure. This is a procedure not too late for an engine with some time on it. The initial start on dry bearings adds many hours to the wear and tear on an engine and it is a small effort on your part. It may preclude a future engine failure and prolong the life of the mill that you abuse in other ways.

Gentlemen, oil your engines.

SAFETY ADVISORIES

The following safety advisories have been sent to all Pitts Special, Model S-1 owners who have registered their aircraft with the IAC aircraft inventory. Please send any further information, comments or suggestions to:

Bob Davis
910 Woodland Drive
Woodstock, Illinois 60098

NO. 1

TO: All Pitts S-1 Operators
SUBJECT: Lower Wing Front Spar Attachment Holes.

Two instances have occurred of severe elongation of attachment holes in the lower front spar on Pitts S-1 aircraft. The cause has not been accurately determined but improperly drilled holes, loose drag wires and repeated high "G" load applications are some of the possibilities.

RECOMMENDATION: An immediate inspection of the spar attachment holes with a continuing inspection at each annual licensing.

NO. 2

TO: All Pitts S-1 Operators
SUBJECT: Cracking of Elevator Torque Tube Assembly.

Three cases have been reported of cracks in the torque tube assembly near the control stick attach point. Two of these cases began on the side approximately 3" below the stick attachment point, progressing radially around the tube. One case was caused by a small ear on each side contacting the floor board due to aileron stops not being installed.

RECOMMENDATION: An immediate inspection of the elevator torque tube assembly with a continuing inspection at each annual licensing.

NO. 3

TO: All Pitts S-1 Operators.
SUBJECT: Cracking of lower diagonal fuselage longeron.

This longeron is part of the lower rear seat attachment point cluster with the crack occurring 1"-2" aft of this cluster on the diagonal longeron. Two cases have been reported. Maneuvers such as multiple snap rolls, torque rolls and Lomcevaks which create a twisting force on the tail assembly may have caused these cracks.

RECOMMENDATION: An immediate inspection of this longeron with a continuing inspection at each annual licensing.

NO. 4

TO: All Pitts S-1 Operators.
SUBJECT: Cracking of Lycoming O-360-A-4A Crankshaft Propeller Flange.

Two instances have occurred of cracking between the lightening holes of this propeller flange. An investigation has been started to accurately determine the cause. One failure was at 442 engine hours, the other at 560 engine hours.

RECOMMENDATION: An immediate inspection of the propeller flange using dye penetrant. If this is not available, use at least a 10 power magnifying glass. This inspection should be repeated at least every 50 hours.

Service Bulletin

AVCO LYCOMING DIVISION

WILLIAMSPORT, PENNSYLVANIA 17701

DATE: January 19, 1973

Service Bulletin No. 327C
(Supersedes Service Bulletin No. 327B)
Engineering Aspects are
FAA (DEER) Approved

SUBJECT: Inspection of Center Main Bearing

MODELS AFFECTED: All IO-360-A and -C series engines and IGSO-540 series except the following which were built with straight bearing dowels as described in Service Bulletin 326.

IO-360-A, -C . . . . . S/N 7100-51A and up
IGSO-540-A . . . . . . S/N 2537-50 and up
IGSO-540-B . . . . . . S/N 2541-50 and up

All remanufactured engines shipped after January 26, 1970 are not applicable to the requirements of this bulletin except for the following which were built with the superceded stepped dowel.

IO-360-A, -C Series . . . S/N 354-51, 1049-51A, 3003-51A, 3281-51A, 6526-51A

IGSO-540 Series . . . . S/N 747-50, 844-50, 852-50, 947-50, 1184-50, 1240-50, 1361-50, 1402-50, 1453-50, 1544-50, 1767-50, 1773-50, 1794-50, 1799-50, 1933-50

TIME OF COMPLIANCE: Within next 50 hours on engines that have accumulated 500 hours or more. Within next 10 hours on engines that have accumulated more than 600 hours, or any time metal contamination is evident in the lubrication suction screens.

I. Bearing and bearing dowel failures on these engines can be attributed to movement of the mating surfaces of the crankcase halves at the bearing supports. This condition is caused by gradual loosening of the crankcase thru-studs and shifting of the bearing inserts. In extreme cases the tendency of the bearing to turn causes failure of the crankcase dowels and subsequent engine damage.

II. The following inspection is required:

NOTE

The following inspection procedure is applicable to both IO-360 and IGSO-540 engines except that no. 2 cylinder is removed and the center main bearing is inspected on IO-360 engines; on IGSO-540, no. 4 cylinder is removed and no. 3 main bearing is inspected. (On these engines no. 2 and 4 cylinders are located on the left, as viewed from the rear, no. 2 is nearest the front of the engine. See figures 1 and 2 for sequence to retighten cylinder base nuts.

Examine the exposed portion of the main bearing that is visable between the crankshaft cheeks and the crankcase bearing supporting web. Look to see if the halves of the bearing shells have shifted. If the bearings are retained properly they will appear to be flush, or nearly flush at the ends of the parting line of the two halves; any noticable step of 1/32 inch or more is indicative of a worn bearing bore in the crankcase or a worn dowel; perhaps both. If either condition is found it must be corrected. See figures 3, 4 and 5.

III. Dowel failure is evidenced by a bearing shell rubbing on a crankshaft cheek. This can be corrected by replacement of the dowel as described in Service Bulletin 326. Dowel replacement, in compliance with Bulletin 326, removes inspection requirements herein described.

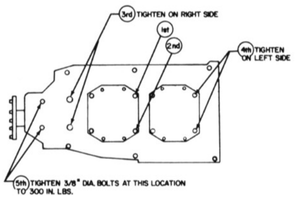


Figure 1. Diagram of Left Side of 4 Cylinder Engine Showing Sequance of Tightening

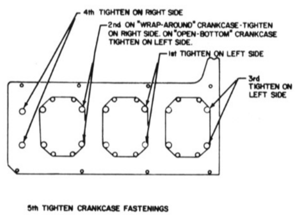


Figure 2. Diagram of Left Side of 6 Cylinder Engine Showing Sequance of Tightening

Member of GAMA
General Aviation Manufacturers Association

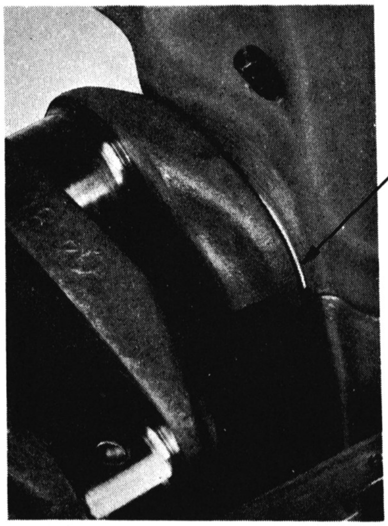


Figure 3. Area of Center Main Bearing as seen from Front of Engine (Abnormal Condition)

NOTE

The photographs for figures 3, 4, and 5 were taken of parts from an O-360 engine which had a center main bearing shift, due to dowel wear; they are intended only as a guide for inspection of the main bearing area.

Figure 4. Area of Center Main Bearing as seen from Front of Engine (Normal Condition)

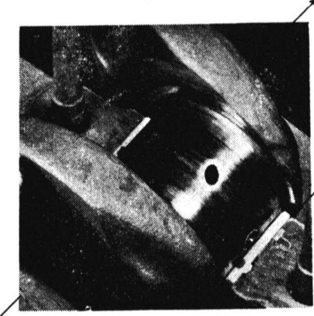


Figure 5. Left Half of Crankcase and Bearing Shell Removed to Show Position of Center Main Bearing (Abnormal Condition)

NOTE: Revision "C" adds section numbers, figure references and figures 3, 4 and 5; adds references to bearing dowel installation.

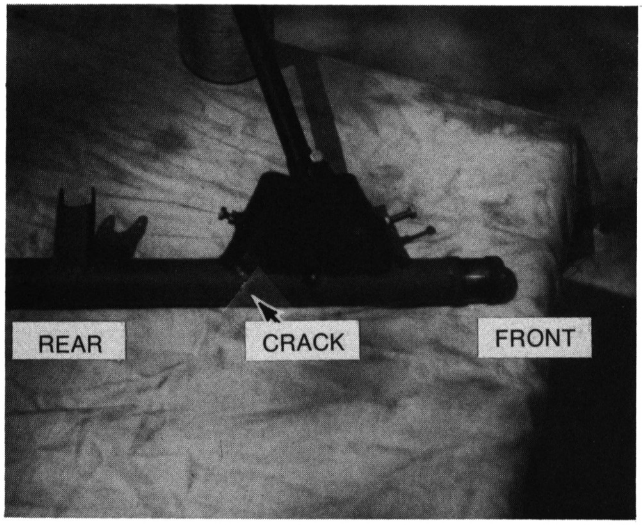
PITTS ELEVATOR TORQUE TUBE ASSEMBLY

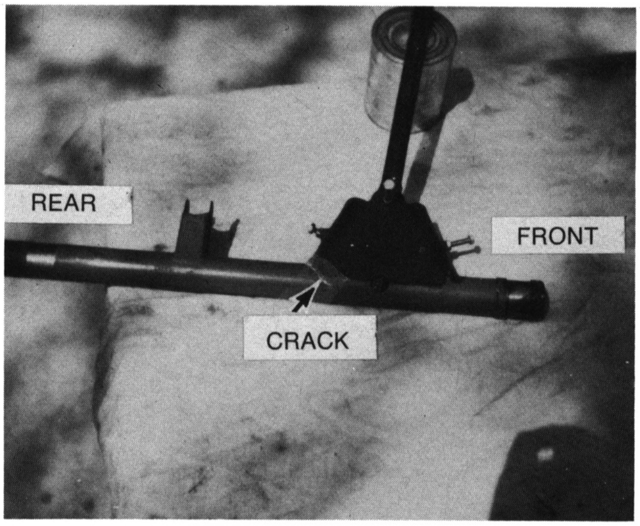
By Bob Davis

The fourth failure of an elevator torque tube assembly has occurred with an airplane with 420 hours total aircraft time. It has been reported previously about this problem, however the serious consequences demand the latest information to be made available. It appears that the outside type of maneuver stick forces are causing this recurring problem. It is highly recommended that all owners of Pitts Specials remove the elevator torque tube assembly and repair it as per the advisory by Curtis Pitts' article in the March, 1973, issue of *Sport Aerobatics*. Note the diagram and photos below.

If your airplane has ever been used or is anticipated to be used in outside work, then this modification now is a MUST on all pitts Specials as a *Precautionary Safety Measure.*

(Photos by Bob Davis)





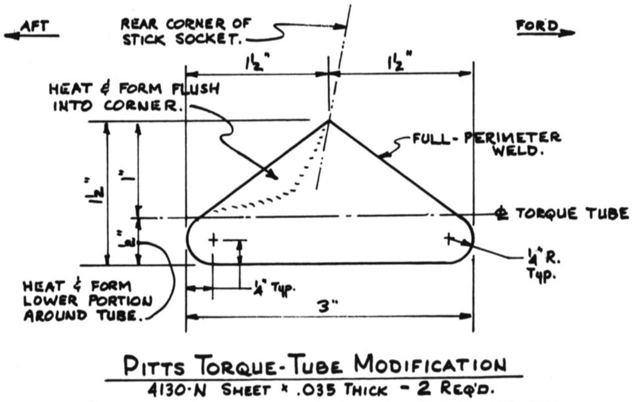
NOTICE TO PITTS OWNERS

Inspect the control torque tube at the weld attaching the control stick bracket for cracks. If cracks are found replace the torque tube assembly using a 1½ x .035 x 4130N main torque tube. Assure that weld areas are not overheated and have good penetration.

In regard to torque tube failures, I would like more information on these failures and the failed part when possible. We can have metallurgy tests run to help find the cause of failure and have more information to design a better fix.

Originally we used 1½ x .028 tubing for this part. This has been changed to 1½ x .035 x 4130N tube. I have checked Sam Burgess' tube which was 1½ x .028 with indication of overheating of the weld and tube in the area where the failure started.

Sincerely,
C. H. Pitts, President
PITTS AVIATION ENTERPRISES, INC.



PITTS TORQUE-TUBE MODIFICATION
4130-N SHEET × .035 THICK – 2 REQ'D.
(ONE EACH SIDE; LEFT-REAR AND RIGHT-REAR, AT AFT JUNCTURE OF STICK SOCKET AND TORQUE TUBE.)

Pre-Flight Check List

The following pre-flight checklist has been compiled for aerobatic aircraft prior to flight. The basic sources were malfunction and defect reports and maintenance inspection experience gathered over the years. The most important requirement for any inspection is to really *see*, what you are inspecting. Remember, a check list is not a substitute for good judgment. If something does not appear quite "right", this is the time to investigate further. Send any additions or suggestions on to me for inclusion.

Bob Davis
Chairman, Malfunction and Defect

Begin your pre-flight inspection by standing 20'-30' in front of the aircraft and observe the overall general condition. This is your best opportunity to notice items such as: low tires, sagging shock cords, bent struts, etc. Now move to the rear of the aircraft at about a 45° angle and look closely at the top of the wings and tail assembly. This is the best angle to notice bent or warped spars or ribs. A convenient place to start the check list is at the propeller. Our check list starts at this point and continues below.

PROPELLER
CHECK
Spinner — Condition, Loose or Missing Screws ( )
Propeller — Condition, Nicks or Gouges, Security of Propeller to Crankshaft Flange. ( )

ENGINE
CHECK
Fuel Tank — Quantity and Cap Secure. ( )
Cowling — Cracks, Loose or Missing Screws. ( )
Engine Compartment — Oil Level, Dip Stick Secure. ( ) General Condition of Cylinders, Baffling, Spark Plug Leads, Lines and Fittings. ( ) Loose or Leaking Rocker Box Covers. ( ) Condition of Exhaust Stacks and Smoke Oil Fittings. ( ) Chaffing of Hoses or Wires. ( ) Magnetos for Security and Ground Wire Attached. ( ) Engine mount for condition and Cracks. ( ) All Fuel and Oil Lines for Condition, Chaffing and Leaks. ( ) Brake Fluid Level. ( ) Drain Gascolator. ( )

LANDING GEAR
CHECK
Condition of Fabric or Metal. ( )
Fairings — Secure, Loose or Missing Screws. ( )
Bungee Cord — Condition, Tight, Safety Cables Installed. ( )
Springs or Oleo Shock Struts — Condition, Security, Leaks. ( )
Brakes — Condition, Lines for Security and Leaks. ( ) Condition of Pucks and Assembly. ( )
Wheel Pants — Condition, Security. ( )
Tires — Condition, Proper Inflation. ( )

RIGHT WING AREA
CHECK
Fuel Tank — Quantity and Cap Secure. ( )
Fairings — Secure, Loose or Missing Screws. ( )
Leading Edge — Condition.
Flying and Landing Wires — Secure, Proper Tension. ( )
I-Struts — Condition, Loose Bolts. ( )
Lift Strut — Condition, Security, Loose Bolts. ( )
Ailerons — Condition of Fabric or Metal, Hinge Pins for Looseness and Safetied. Minimum Play Between Ailerons if Slave Strut Installed. ( )
Entire Wing Area, Top and Bottom — Cracked or Warped Ribs, Bent or Warped Spars, Fabric Condition. ( )
Pitot Tube — Security, Opening Clear. ( )

RIGHT FUSELAGE AREA
CHECK
Windshield and Windows — Condition and Security. ( )
Fabric — Condition, Top, Sides and Belly. ( )
Longerons and Formers — Cracked or Broken. ( )
Stabilizer, Elevator and Rudder.
Fabric — Condition. ( )
Fairings — Secure, Loose or Missing Screws. ( )
Stabilizer Bolts — Secure.
Elevator and Rudder Hinge Pins — Tight and Safetied. ( )
Tail Wires — Secure, Proper Tension. ( )
Rudder Cables — Cable Condition and Security. ( )
Tail Wheel — Tire Condition and Inflation.
Bearing — Condition, Security. ( )

LEFT FUSELAGE AREA
CHECK
Same as Right Side.

LEFT WING AREA
CHECK
Same as Right Side.

COCKPIT
CHECK
Seat Belts, Shoulder Harness and Crotch Strap — Condition and Security. ( )
Parachute — Condition and Current Packing. ( )
Engine Instruments — Condition, Zero or Normal Static Readings. ( )
Fuel Gauge — Proper Quantity. ( )
Controls — Free and Full Travel, Also Check Visually. ( )
Aircraft Papers — Airworthiness, Registration, Weight and Balance, Operating Limitations and Radio License — On Board. ( )
Cockpit Area — Loose Objects and Clean. ( )
Fabric — Condition. ( )
Elevator Torque Tube — Security, Cracks. ( )
Rudder Cables — Condition, Security. ( )
Rudder Pedals — Security, Cracks. ( )
Fuel Tank — Security and Leaks. ( )
Seat Back and Bottom — Condition and Security. ( )
Canopy — Secure, Cracks, Ease of Movement. ( )
Cockpit Door — Condition and Positive Latch. ( )

INSPECTION OF LUSCOMBE 8A & 8E AIRPLANES WITH METAL WINGS, SINGLE LIFT STRUT MODEL, WITH METAL WING TANKS AND METAL FUSELAGE TANK

By Bill Bokodi
IAC 362

Most of the following inspection can be used for all Luscombe 8 series models except fabric wings.

First:

1. Buy Luscombe Silvaire Master Parts List Book Model 8.
2. Get a good magnifying glass.
3. A dull pocket knife.
4. An adjustable inspection mirror.
5. A gooseneck inspection flashlight.
6. A good friend who has an A & P license.

AIRPLANE

If you have a Luscombe or intend on buying one, the first thing to check are stress marks on the top of the wings. These stress marks will run from the rear spar towards the leading edge of the wing at approximately a 45^0 angle. If they are barely raised it is OK, but if they are real high, the wings have been greatly overstressed. You should get other wings before attempting the Sportsman Class aerobatic sequence.

Next, disassemble your Luscombe, remove the wings, vertical fin, stabilizer, elevators and rudder.

EMPENNAGE (TAIL GROUP)

1. Be sure that the A. D. note pertaining to Rear Spar Attachment Fitting 18419 has been complied with and the heavier one has been installed.
2. Check vertical fin and stabilizer for corrosion and especially check inside of bolt holes, also bolt holes on attachment fittings in fuselage.
3. Check between bulkhead 1 & 8 for corrosion, cracks and loose rivets.
4. Before assembly, clean everything — metal prep & zinc-chromate.
5. Clean all bolt holes with fine paper 600 — Lightly to remove any slight corrosion.
6. When assembling, get all new hinges and single pins.

FUSELAGE

1. Inspect complete fuselage for corrosion, cracks, loose rivets. Clean with steel wool, metal prep, rinse, air dry and then zinc-chromate.
2. Remove all 4 wing Hinge Fittings on cabin carry through spars.
3. Take a shotgun cleaning rod with brass brush — wrap steel wool around brush and clean out cabin carry through spars, blow out with air, metal prep, rinse, air dry, then put a rag on end of shotgun rod — soak in zinc-chromate and paint inside of cabin carry through spars.
4. Inspect and clean wing hinge fittings, clean, zinc-chromate and install with the right size bolts.
5. Change all landing gear bolts and bushings.
6. Inspect gear box and door past bulkheads for cracks.

WINGS

1. Inspect life struts for corrosion, in and out rivets, elongated holes. Clean in and out metal prep inside — flow thinned out zinc-chromate inside of lift struts.
2. Ailerons — Check horns, change bolts. Inspect all aileron bearing and holes.
3. Inspect — Inter-spar Wing Strut Fitting Assembly for loose rivets, cracks and corrosion. Remove wing tips, inspect everything. Clean out inside of wing, use self-etching pre-wash treatment zinc-chromate on the inside. This will self-etch itself and bar any further corrosion.
4. Inspect 2 lower end lift strut fittings and install with new bolts.
5. Be sure no wing attachment holes are elongated, spar holes, lift strut attachment holes.

ENGINE MOUNT & PROPELLER

1. Inspect for cracked mount, worn rubber bushings. Prop, track, balance bad nicks.

CONTROLS

1. Change all pulleys to ball sealed bearing type. Use all new bolts to make sure cable keepers and cotter keys are installed right.
2. Change cables if rusty or worn badly.
3. Change all control bolts. The ones under the seat in the elevator bell crank and all the stick and rudder bolts and pins.

WINDSHIELD

1. In the 2 lower corners, drill 2 holes each side, about 10-32 scres, install with washers and lock nuts. This will keep the windshield in place in snap maneuvers, otherwise it might leave the plane. This works on mine. It is better to drill and bolt the whole lower edge of the windshield, about 2 inches apart to make sure it doesn't come out.

ASSEMBLING AIRPLANE

1. Use all new A & N bolts or NAS bolts throughout.
2. All new stainless steel sheet metal and machine screws.
3. Torque all bolts up right.
4. Make sure Trim Tab cables are good and tight — it is possible to get trim tab flutter at high speeds with a loose trim tab.
5. Install a G-meter right in the middle of the panel under the gas selector valve.

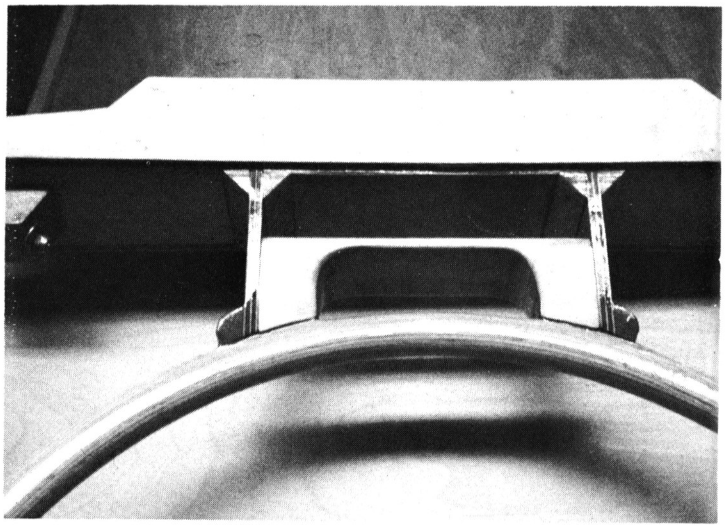
If you feel that the foregoing is going to take too much time and money — then don't do aerobatics in your Luscombe. Take up Russian Roulette, you'll get just as big a bang out of it!!!

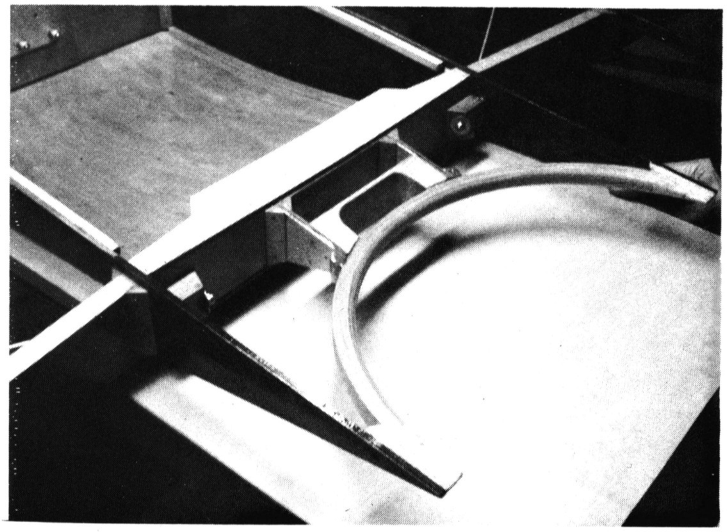
My friend Bill (Rocky) Raksangi, EAA member is building a Pazmany PL-1 and is using NAS bolts throughout. They cost more but he states it's like his butt that is going to be hanging from those bolts.

In conclusion, a Luscombe is at least 24 years old or older. Except for the ones made in 1958, 1959 and 1960. It is a well-built airplane. It is an old airplane. Metal gets tired, but if you do everything you can mechanically to keep it in good shape, it is good for the Sportsman Class.

It took me 3 months to do all of the above. $650.00 - $170.00 for bolts, screws, pulleys, etc. The rest was paint, upholstery, etc. When you are done working your Luscombe over you will have peace of mind when you are practicing up there.

If you have never done any aerobatics, don't try and teach yourself in a Luscombe. Get an aerobatic instructor and get a few hours of dual.





(Photos by Champe Pool)

Hand Hold Modification For Pitts (And Other Types)

(Photos by Champe Pool)

This modification suggested by Champe Pool is of the upper wing of the Pitts. I have always felt that a good hand hold was necessary in case an emergency exit needed to be made from the airplane. This was first brought to my attention by Frank Price, and after having a Bucker Jungmeister with the handhold, I believe that it is an excellent safety modification. Charles Vogelsong again, made this modification, and it is a light weight pine block of wood that has been carved and fitted against the bow, and uses the bow as a handhold. I think that this should work quite well.

IF YOUR PS5C COULD SPEAK IT WOULD SAY "SOAK IT TO ME"

By Sam Burgess

Just about every competition and air show aerobatic aircraft not equipped with fuel injection employs the well known PS5C pressure carburetor. Although reliable beyond reproach it requires TLC like any other faithful component of your mount. Here is a tip picked up from a carburetor expert with experience in PS5C's since their inception.

After pulling the mixture control to shut off the engine — push it back in, especially if the aircraft will not be flown for days or weeks. In other words leave the mixture ON to keep the seals and diaphrams ($71 per set) wet to prevent their drying out and cracking causing no end of mysterious malfunctions in your engine. A cracked or brittle seal or diaphram will cause sporadic roughness, surging idle rpm or momentary loss of power in flight.

Accordingly, dirt and dried out seals are about the only hazards a PS5C has to live with and these can be avoided with proper air filters and leaving the carburetor in the ON position when not in use. The expert has been chief of the carburetor shop at Hickam AFB for 30 years.

DETECTING DIRT IN THE FUEL INJECTION ENGINE

Pilots and mechanics can trouble-shoot fuel injected powerplants more efficiently if they are able to recognize the principal cause of trouble — dirt in the system. Fuel injection cannot tolerate any kind of dirt or contaminates. If dirt is present in the system the fuel flow reading will tend to be higher than normal for a particular power setting, if the system has a fuel flow gauge. The nozzles are vulnerable to dirt as are the small fuel lines and also the flow divider.

In order to locate the dirt and eliminate it, maintenance can attach identical size small bottles (i.e., coke bottle) to the individual lines at the intake port location (TIO-541 and TIGO-541 are exceptions). Take the proper fire precautions. Put mixture in full rich and booster pump on and run fuel into the bottles until a sufficient amount has accumulated for comparative purposes. If any of the bottle levels are noticeablely lower than the others, it calls for cleaning of the nozzle, line, or flow divider. Also observe the flow pattern of each nozzle. Any irregular flow should be investigated. Sometimes lint and dirt are not easily seen by the human eye without magnification. Clean the parts with a solvent and air pressure. Never use wire or any hard object to clean a nozzle. Start with the nozzle first in the investigation and cleaning.

"PITTS SPECIAL" PROPELLER ATTACHMENT FLANGE FAILURE

Dear Sir:

We have now completed our examination of the propeller attachment flange that broke away from the crankshaft of the above aircraft after 445 flying hours.

The flange, fractured through the six spokes formed by six lightning holes of approximately 1.05 inches diameter. These holes extended diametrically well into the crankshaft/flange fillet radius. All the fractures were symmetrical, indicating uniform crack growth all round the flange, but the crack faces were badly damaged by rubbing which had removed the finer features of fracture. The remaining features were characteristic of fatigue and indicated that crack initiation had occurred in several positions on both the fore and aft faces, with growth mainly from the aft face. Initiation had been influenced by the unradiused edges of the holes and also by the rather coarse machining marks.

Metallographic examination of a radial section through one fracture revealed microfatigue cracks close to the fracture on both fore and aft faces. The hardened and tempered structure of this steel appeared acceptable and grain flow was satisfactory. Micro hardness tests on the polished face did not reveal any significant decarburisation at the surface and full scale (20 Kg load) tests gave a bulk hardness of 321-327 HD, equivalent to 67-69 psi.

We have found no evidence to suggest that this failure resulted from metallurgical factors and consider that the significant features were:

a. the fact that the lightning holes extended well into the crankshaft/flange fillet radius,

b. the absence of a radius to the edges of the lightning holes and

c. the poor machining finish.

The position of the lightning holes was probably the most important factor, as it would be expected to have caused an increase in the stress concentration usually associated with a change of section and which the fillet radius is designed to minimise, and thus exploited the other two features.

Yours faithfully,
A. Jones
for Head of Materials Department

SPARK PLUGS AND IGNITION

Spark plugs for aircraft come in two basic types, the massive electrode and the thin wire electrode. There are other features that vary such as reach and heat range in both basic types.

The massive electrode, most of us are familiar with. It may have two, three or four ground electrodes. In this type the gap is originally machined in a circle around the center electrode. The theory being that the spark will jump to the closest point of the circle and consequently the wear will be even. The spark will also jump to the hottest point so the wear theory doesn't always hold true.

The thin wire plug may have platinum points or points made from iridium. The advantage of these plugs is that they don't foul so easily and they supposedly last longer. The platinum point plugs cost about double the massive electrode plug and the iridium point plug three to four times as much. The life expectancy is supposedly in line with the price.

The hot plug has a greater air space around the porcelain and the space is deeper than the cold plug. This makes the hot plug less subject to fouling. It also doesn't transfer the heat to the shell as readily, causing it to retain heat in the ceramic insulator which helps to burn away materials which cause fouling.

Lead carbon and oil are the agents which cause fouling. Running too rich will cause carbon fouling. This is usually the result of idling too long with a rich mixture. Lead will also separate from the fuel and air in the induction system at low power settings. Sudden application of higher power will cause fouling. Power should therefore always be applied slowly to give the plugs a chance to burn off the lead.

Ignition leads are a very large factor in the length of spark plug life. The larger the shielding on plug leads, the longer the plugs will last. The new five millimeter shielded leads can cut plug life in half.

Wear on the cam, or the cam follower in the magneto may contribute to misfiring and plug failure. A wear of only three thousandths of an inch can cut voltage to the leads in half.

BELLANCA DECATHLON 8KCAB

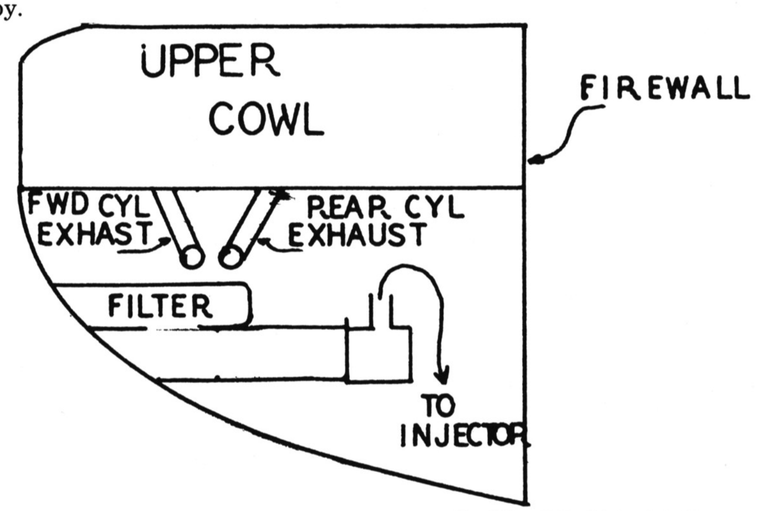
Quoting Mr. Ruehrmund's M & D report text.

The 8KCAB has a moulded fiber-glass upper and lower cowling. The lower cowl contains the air filter and intake to the fuel injector. The air intake/fiber ducts are moulded fiber-glass. The engine forward and rear cylinder crossover stacks are at 90° to the axis of the air inlet. The bottom of the crossover stacks is approximately 5" above the top of the air inlet. At the 200 hour inspection it was noted that the after cross over stack had burned a 1" x 6" hole in the top of the air inlet. The forward crossover stack had charred a 1" x 6" area, deformed the air filter retainer and the filter material. The hole burned by the after cross over stack had burned all of the epoxy and the fiber-glass remaining was brittle.

Exhaust cross over stacks too close to the top of the air intake plus high ambient temperature (95°F) and possibly lack of cooling after shutdown caused the problem.

Damage to duct reduces air available to the injector and a loss of power. Upon shutdown the hot crossover stacks could ignite air filter.

Mr. Paul L. Ruehrmund has experienced a problem with his decathlon. He was thoughtful enough to forward a copy of his FAA malfunction and defect report in hopes of preventing someone from having difficulty due to this problem. In his accompanying letter he mentions that 100% of the Decathlon and Citabria owners on his field have experienced the same problem. We all should thank Mr. Ruehrmund for taking the extra time to send us this copy.

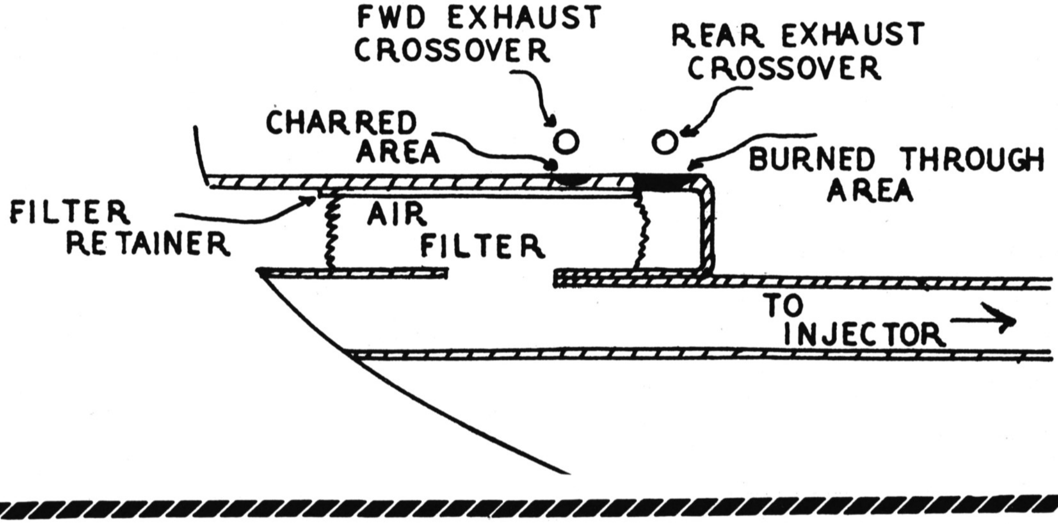


Rear cylinder cross over exhaust stack burned a 1½" wide by 6" hole in top of injector air inlet. Fiber-glass was destroyed in this area.

Forward cylinder crossover exhaust stack charred area 1½" by 6" in top of air inlet. This area not burned through but charring shows on underside of Fiber-glass.

Air inlet filter retainer deformed.

Air filter overheated.



AEROBATIC SAFETY CHECKLIST

By
Mike Leveillard
Route 1
Brooks, Ga.

Now that many people are flying solo aerobatics, after those initial dual rides, I would like to suggest the following aerobatic checklist:

1. Review government regulations regarding aerobatic flying and parachutes.
2. Remember that the 1500 feet and 3 miles visibility as specified by regulations are only legal minimums for VFR flight. Watch out for hazy days and the absence of the natural horizon. For training and practice purposes, never fly with less than 5 miles visibility. Plan your entry so that the maneuvers will never be completed at less than 3000 feet above the surface during those first several solo flights.
3. Keep plenty of distance between you and clouds. You never know when somebody might pop out of one and you are especially blind when concentrating on your maneuvers.
4. Make sure you are in top physical condition. A small head cold can turn into real misery during rapid altitude changes.
5. If you are not current or haven't flown aerobatics for a while, ask an instructor to go along with you. Do not attempt any new maneuvers on your own. (Unless, of course, you have a single-place airplane. Then, some instruction in a similar two-place is desirable beforehand.)
6. Check your parachute carefully. Make sure it is adjusted properly and check its currency. Most chutes are good for 90 days. Security chutes are good for 120 days. Do not leave the chute in the airplane.
7. Practice how you would abandon the airplane should the occasion arise. Sit in the airplane with the chute, safety belt, and shoulder harness buckled, then try it. You would be surprised how many of us have unbuckled the parachute by mistake during this practice dry run. Be familiar with the door quick-release handle, if your aircraft has one.
8. Preflight the airplane very carefully. Watch out for loose objects in the cockpit. Always set the altimeter on zero. Reset the G meter before flight but do not reset in flight. Wait until after landing for this. Have the airplane gone over thoroughly if you have exceeded the maximum G loads. Perform a postflight inspection as well.
9. Plan your maneuvers and practice session before take-off. Stick to it once airborne.
10. On the way to altitude, use every minute of your time to perfect your basic flying techniques. Concentrate on smoothness, coordination, airspeed control, and watch for traffic.
11. Do not perform any maneuvers in sequence until you have achieved a high level of proficiency in each maneuver. Then start putting two or three maneuvers together. The Basic Achievement Award sequence is a good start. One-turn spin, loop and aileron roll. Watch your framing and remember the lines. Pretend that each practice session is a contest.
12. Finally, don't show off and stay plenty high. Always watch for other aircraft.

During those first solo aerobatic flights it is especially important to be careful. You will find, however, that solo aerobatics cannot be excelled in satisfaction, enjoyment, feeling the true freedom of flight.

ELONGATION IN PITTS WING FITTINGS A CONTINUING PROBLEM

Once again it has come to our attention here at Headquarters that another Pitts owner discovered elongated lower front spar fittings in his aircraft during rebuilding. IAC Director Sam Burgess of Honolulu, Hawaii, owner of Pitts N3333N, writes that the drag wires were also quite loose. In addition, the upper left rear spar "I" strut hole was elongated. As can be expected, this problem occurs in Pitts aircraft used extensively in hard aerobatic flying. Sam's Pitts had 720 hours at the time of the teardown. We recommend that all Pitts owners who fly extensive aerobatics with their aircraft keep a close eye on this area

SAFETY NOTE

Numerous individuals have had problems with the nose ribs on the top wing of their Pitts S-1S's. Right now, there has been three known failures of several of the nose ribs on aircraft that have flown Unlimited. Pitts Aviation Enterprises has issued a Service Bulletin, No. 8, to cover these failures. It applies to Pitts S-1S airplanes from Serial Number 1-0001 through 1-0025. It has also been mailed to all known owners of S-1S aircraft. The Service Bulletin outlines the inspection procedure and the repair. Contact Pitts Aviation Enterprises, Inc., P. O. Box 548, Homestead, FL 33030 for more information.

WELCOME NEWS TO CITABRIA OWNERS

For United States Citabria owners, good news has again emanated from Washington. We have received clearance from Mr. Charlie Schuck, FAA Flight Standards Service, to install a second safety belt in Citabrias without a lengthy Supplemental Type Certificate process. According to the new 1974 IAC Contest Rules, second belts will be required in all aircraft to compete. To help out the owners of Standard category aircraft in this regard, IAC has been working closely with FAA over the past several months to make this process easier. The method that is approved requires a TSO'd metal-to-metal buckle type seat belt and a placard installed in the aircraft that the belt must be properly stowed while not in use. In addition, replacement of the lower bolt that holds the rear seat support to the air frame with "AN" bolts of sufficient length to accommodate the seat belt hardware will be necessary. This is a simple, easy to install operation and will increase the aerobatic safety of this aircraft. We are presently working on the Cessna 150 Aerobat and hope to have it approved shortly..

INTERNATIONAL AEROBATIC CLUB
I. A. C.
MEMBER

IN THE INTEREST OF *Safety*

April 25, 1974

Gentlemen:

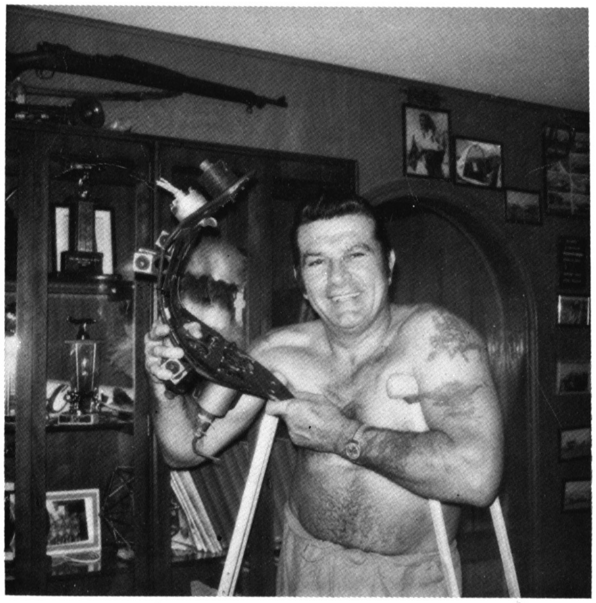
Enclosed are some pictures of my Zlin. I was practicing aerobatics in contemplation of going to the Nationals last September. I was using an old wooden prop from a Jungmann (105 hp) on this 160 hp Walter Minor engine. I don't know if this contributed to the accident but the prop seemed OK and within limits on run-up, etc. After a period of practicing, I decided to do a Lomcevak which I entered into at 2200 feet. The late Ed Fitch, who had extensive time in his Zlin, had warned me against outside snaps and Lomcevaks below at least 3500 feet. At any rate, I ignored this advice and in the last portion of this maneuver, the prop broke and I went into an inverted spin. I believe the engine twisted the mount before I could reduce the throttle as something hit the windscreen immediately which I think was a part of the cowling. I ended up in about 8 feet of water and was saved by a quick thinking shrimper named Don Phillips, assisted by two other boys. I sustained serious injuries to my back, leg, head, ribs, etc.

The main reason I am sending you these pictures is to show you the force with which I hit and to show you how the shoulder harness saved my life. I hit with such force that the straps ripped loose a welded cluster of ⅝" and ¾" tubing. Even with the harness stopping me I bent the instrument panel almost double. If I hadn't used this harness I would have eaten the back of the engine and never would have survived. The message I would like to convey is three-fold: (1) Always wear your shoulder harness, (2) Make sure your prop is in first rate condition and suitable for the powerplant, and (3) Listen to more experienced pilots that are experienced in the type of equipment you are flying. Had I listened to Ed Fitch I would have had that little extra altitude to allow me to bailout.

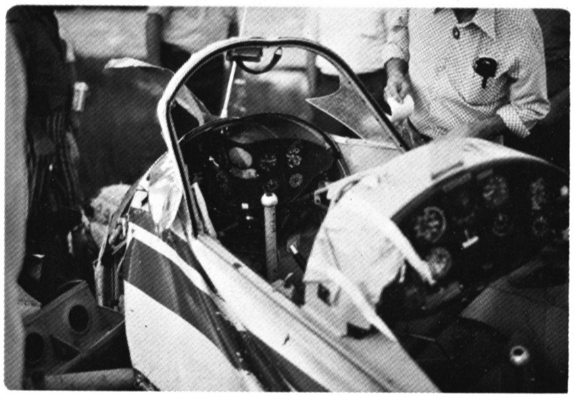
All I can hope now is that my experience will save someone's life and/or a lot of pain and suffering.

Sincerely,
George Sage, IAC 1072
Box 732
Galveston, Texas 77550

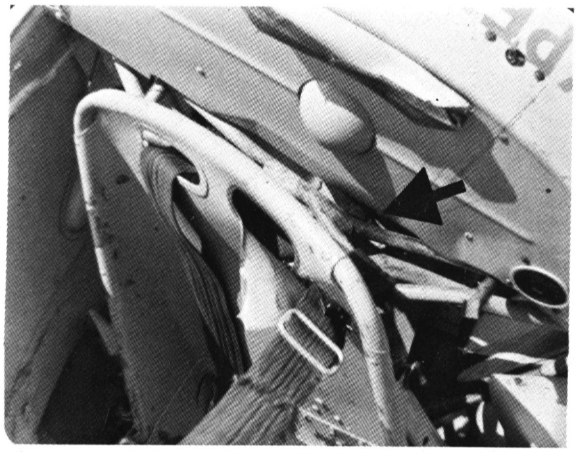
This is the instrument panel I stuck my head through. Originally it was straight.



The wreckage of the Zlin up on shore.



The cockpit I was in. Note the instrument panel.



A close-up of the welded cluster that was bent by the force of the crash. The shoulder harness saved my life.

KNOWING YOUR EQUIPMENT (PART ONE)

TYPES OF PARACHUTES

by
Bob Stroud
Stroud Parachuting Industries
Box 241
Edmond, Oklahoma

The main purpose of a parachute is to save a life, possibly your life. It has evolved into a number of things not directly connected with life saving, but the basic function is still that of a life saver.

Skydivers use two parachutes, the primary one is (in most cases) actually a non-rigid glider. The secondary parachute is just like the one you probably wear. It is meant as a life saver. Jumpers have made the sport of parachuting extremely safe and enjoyable by experimenting with new ideas, and finding better answers to old questions. The progress has been phenomenal. However, when it comes to emergency parachutes, we find the simplest approach the best. You, as pilots, are using it now. It is the best there is. There are new ideas in the mill, but until they are proven to our satisfaction, most of the equipment is the best there is available.

There are basically three types of emergency chutes: seat, back, and chest. I) The chest is the least commonly used by pilots but is the most widely used by sport parachutists. The chest type is worn on the front of a man, usually just below his chest. It is always removable as it would be in the way if it weren't. When used by pilots and crewmembers it is intended to be put in a safe place that can be reached in a hurry. The harness is always worn. You simply attach it to the harness and get out. II) The seat type is probably the most widely used by pilots, particularly those flying warbirds. This type is used when the airplane is equipped with bucket seats. One uses the parachute and a pad as a seat cushion. When you bail out, it follows you. It is not meant to be worn when a lot of moving around is to be done. III) The back type is used slightly less than the seat type. It is used in a number of different type planes. It can be worn while moving around in a plane, although you must always realize it is on and try not to damage it. It is situated on the back between the top of the shoulder and the buttocks. It is designed to be, as nearly as possible, an extension of the back. It can fit into planes that don't have the room to store a chest pack or have bucket seats installed.

The basic emergency chute is composed of four parts: 1) Harness, 2) Container, 3) Canopy with lines, 4) Pilot chute. This holds true for all emergency rigs.

The harnesses are pretty much universal (I'll talk about the Security 150, etc. later). You have two basic types: Army or Air Force (same thing), with models B-4 and B-12, and Navy (basically the NC-3). The only noticeable difference between the two Army harnesses is the color. The brown (B-4) is usually slightly older than the blue (B-12). Both are the same strength (6500# test webbing). The Navy harness is slightly different. It has a full-front chest strap, unlike the much more compact Army types. The disadvantage of the Navy harness is the slippage (or movement) the harness has when worn and the fact that most of them don't have any canopy releases. I'll explain the function of canopy releases later. I would advise you to replace the Navy harness with an Army harness if you have one. The Army harness has more positive adjustments than the Navy, and it has canopy releases. The strengths of the different types are equal, so that isn't a problem. Perhaps it's psychological, but I prefer something that I **know** isn't going to come off when I leave the plane. The Navy type always leaves me with the impression it is falling off.

The advantage of the Navy harness over the Army is that it has quick ejectors on the buckles. It is much easier to get into and out of. Only a few of the later Air Force harnesses (those available to the public, that is) have quick ejectors on them (quick ejectors, however, can be installed by a Master Rigger on B-4 or B-12 harnesses for additional cost). Again, strength is the same in all of the harnesses.

People ask me, "How strong is a harness?" Most of the load bearing webbing in a harness is 6500# tensile strength. What this means in layman's terms is that you'll come apart before the harness does. The same is true of the canopy. The parachute system is made so strong that the man underneath will come apart before the equipment does. If you have an old harness that is made of cotton or something else, get rid of it. Chances are it would come apart sooner under stress.

The ripcord holds the flaps of the container closed. The springs are trying to pull the flaps apart and the pilot chute is pushing up, all trying to spring into the air. The only thing keeping the pack closed is the ripcord. It is a long wire with a series of steel pins attached. The pins pass through a metal cone that is attached to one flap. The cone passes through a grommet on the other flap, with the ripcord pin holding them in place. By removing the pin, both sides are able to pull apart and start the parachute deploying.

The ripcord should always be on the left side (when wearing it) and facing inside. If it is anywhere else, it should be changed by a parachute rigger. The reason it should be on the left inside is that most people are right-handed and can reach across their chest easier than anywhere else. It is also protected from protruding objects by being in a protective area. On the outside of the harness, it could snag on part of the airplane when climbing out.

The container is attached to either the back or seat depending on the type of chute. Its name "container" implies its function. All it does is hold the packed canopy in place until it is needed, and getting as far out of the way of the canopy as possible when its job is finished. It also offers protection for the packed canopy, although quite limited. When the ripcord is pulled, stainless steel springs enclosed in nylon pull the flaps back exposing the pilot chute, thereby enabling the canopy to deploy and open. Once the ripcord is pulled, the function of the container is over. It can, of course, be repacked or used in a survival situation for other purposes.

The parachute canopy itself consists of the nylon canopy and the lines. They are all one piece. Anytime you buy a parachute without lines, what you have is a good car cover and the knowledge that you have been had. Don't laugh, I've seen it happen! All parachutes are made out of nylon. If you have a silk or cotton parachute, you would do well to get rid of it. They make nice decorations. The most modern parachute fabric is called rip-stop nylon. Rip-stop nylon does just that, it aids in stopping rips. The earlier nylon canopies were nylon twill and not rip-stop canopies.

The most commonly used emergency canopies is the 28 foot diameter C-9. They are the familiar orange and white although they could be any of a variety of colors. Next in line in usage is the 24 foot T-10. It is identical to the 28 foot in construction except it is smaller. The 24 foot is usually used where room is limited. It packs up about 1½ inches smaller than a 28 foot in a seat pack configuration. In a back type, it is about 1 inch thinner. The 4 foot difference in size of canopies is not that noticeable in rate of descent for emergency use. There is some, but not much. However, if you can use a 28 foot canopy, do so, because every little bit helps.

There are several other types of canopies around but they are not in a great deal of abundance. They are the Security 150 Safety Chute which has a 26 foot Conical Low Porosity Canopy, and the Strong Enterprises ultra-thin seat pack using their own 26 foot Conical Low Porosity Canopy. They are also planning to build a thin back pack, as is Pioneer, but neither is in production yet.

One thing should be pointed out here. There are two categories of speed ranges for parachutes. They are Standard and Low Speed. The Low Speed category (Security 150 Safety Chute and most skydiving reserves are in this class) is to be used in aircraft with speeds lower than 150 mph. If you go over that speed, the parachute possibly would not take the strain which could ruin a perfectly good day.

The Standard class will take as much speed as the pilot wants to bail out with. Again, the pilot will probably come apart before the parachute does. There are some high-speed parachutes around, although not many.

Some of the newer canopies have steering modifications in them. A separate article will cover modified canopies, but if you have a chance to have an "FAA Approved", or other government agency outside the United States, modification for steering put on your parachute, do so. Again, I will have separate articles on the Security 150, Strong Enterprise thin pack and any others that come out in the future.

Pilot chutes are to a parachute what an anchor is to a boat. When you pull the rip cord, you release the container exposing the parachute and also exposing the pilot chute. The canopy may or may not open without aid in getting it extracted. It would certainly take longer without help in extraction, so back in the early days a means was developed to extract the canopy from the pack. In effect, a small (36" diameter) parachute with a spring fitted inside pops up when the ripcord is pulled and jumps out into the low pressure area created by a falling body. It catches air and remains stationary while the jumper falls away from it. Once the main canopy starts inflating, the work of the pilot chute is over. There are several different types but the most common is the vane type. It is also probably the most effective. Spider type pilot chutes are the next most common in use, and are not quite as safe since they stand a greater chance of catching something while deploying. However, they do work well once they catch air. If you have a spider type pilot chute on your rig, I would recommend changing it to a vane type if possible.

Basically, the system is as simple as it is possible to make it while still retaining the basic reason for its existence in the first place — to save peoples' lives.

(EDITOR'S NOTE: This is one in a series of articles concerning the use, care, and the right way to use a parachute. This will be followed by a continuing series of articles on new parachuting equipment and techniques as they come up. Any questions you may have may be addressed to the author. Please feel free to ask any questions you may have.

The author started flying when he was 15, soloed when he was 16, and flew until he entered his first year at Oklahoma State University when he decided to make a parachute jump with the college club. From that time on, he has only jumped. It became apparent to him in recent years that there was a need for more education on this subject among pilots, so that they could more thoroughly understand the survival equipment available to them.

The author has made over 600 jumps, is a Master Parachute Rigger, a licensed Jumpmaster, licensed Instructor, and a member of the Special Forces Reserve. Obviously, he is well qualified to speak on this subject.)

LEAVING THE AIRCRAFT IN AN EMERGENCY

by
Bob Stroud
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Box 241
Edmond, OK 73034

We now know why we should use parachutes and what basic types of parachutes there are, so let's go into the usage of them.

The use varies with the problem and there are as many different ways to use a parachute as there are reasons for needing to use one. Just as there are no two airplane crashes exactly alike, there is no standardized exit procedure. They all have one thing in common, though. You had better get out right the first time, because you might not have a second chance. So what we have to do is practice on the ground as many of the circumstances we might encounter in the air, and how to get out of them. I'll try to outline the basic ways in the basic aircraft types — open cockpit and cabin type. Of course, each plane is different, so the ways I describe may not exactly fit the type plane you have, but it will probably be close enough that you can at least have something to work from. If you have trouble write or call me and I will try to help.

First, we will begin with straight and level flight with no control problems or fire or anything. Let's just suppose you can't get it down or don't want to land (fog, snow, etc.). This is probably the easiest way to exit most airplanes as they are under control — more or less. On a plane with a door on the side, you will be fighting a wind blast trying to open it. One suggestion would be to kick some rudder into the side that the door is on. This puts the plane in a flat turn taking wind pressure off the door, thus making it easier to open. On an open cockpit type, you can go over the side rather easily. Just stand up in the seat, after undoing your belt, oxygen, and mike connection (if applicable). Dive head first over the side. Now we add some problems, like fire. As soon as you open the door, or window or anything, the fire comes in like gangbusters. So obviously you have to go fast and do it right the first time. On open types you had best hurry or you will get fried. Time is of the utmost importance, whenever fire is involved. On a cabin type, make sure everything is ready to go when you are, otherwise, you might be exposed to fire longer than necessary. If the fire is going by the door, a flat turn into the door may help turn the fire away from the door a little.

From straight and level flight — with or without fire — we progress to the open cockpit planes. If you can roll it over and undo your seatbelts and fall out, good. But if you are on fire you may not have that much time. What you should do is undo your seatbelt and go over the side head first without trying to roll the airplane over. One thing to remember when your plane is burning is that nylon melts and your parachute is made out of nylon. If you wait too long to make the decision to go or stay, it may very well be made for you. Take this into account in all instances involving fire. Your container (nylon pack) will protect your canopy to some extent, but not for very long. It does not necessarily take direct flame to melt your parachute. Heat will do it just as sure as if it were an open flame.

The old adage of trying to put the plane into a loop and fall out at the top of the loop has one fault. Where does the plane go after you leave it? Keep this in mind as it is possible that it could come back at you. That could ruin a perfectly good (or bad as the case may be) day. If you are burning and try to loop, the flame will go to the inside of the loop. In a loop the tail is forced out and the top of the cockpit is exposed to the fire. All of this is as it normally should happen. Obviously, it is not always true. If you have to loop a plane to get out, make it an outside loop, and release it at the top of the loop, getting thrown, or at least helped out. The flame is also forced away from the plane. Regardless of which method you decide to use, remember two things: (1) Practice it on the ground until you can do it by instinct, (2) Do not waste time trying to decide what to do in the air. Make your decision and stick to it.

Now we progress to spins. If you get into one that you cannot get out of, make your decision to stay or leave damned fast! If you wait too long to decide, you may have no decision to make. There may be a lot of disagreement on this, but I feel that the best way out of a spin is to go over the side on the inside of the spin. If the plane were spinning to the left, then exit left, and so forth. This way the plane will be turning away from you all the time. If you are on fire, the fire will probably be coming along the side you are planning to go over, but I still feel that it is the easiest — hence fastest way out. If you are up doing aerobatics sometime, try to move against the spin. If you are going to the left, try moving to the right. In the first turn or turn and a half it may be fairly easy. Let it wrap up on you and see how hard it is. If you can get out before the first complete turn or so, go over any side you want. But again, you may not be able to.

Now we come to the problem of aircraft with only one door. You are somewhat limited in your choice of which side you go out. The only thing I can suggest is to get out as soon as you realize that it is a hopeless cause. Do not wait.

The best position for a pilot to exit a plane is head first. Dive out. Where you go your chute will follow. Besides, you can see where you go when you dive out. This business of jumping out and counting to three is stupid. If you are low (below 1000 feet AGL) pull as soon as you can see the plane you just left. By that I mean push off and look at the plane. As soon as you can see that you are more than three feet below it — pull! Normally as soon as you push off and reach for your ripcord you have cleared sufficiently. If you are above 1000 feet AGL, you can hesitate pulling ½ second if you have to. Do not wait any longer. If you are over 20,000 MSL, I would wait until I dropped to a breathable altitude — as long as you are above 1000 feet AGL. 21,000 MSL over a 20,000 MSL mountain does not leave much room to pull.

How long to wait obviously depends on how high you are. Figure that a man falls (in a spread eagle position) at 5 seconds per 1000 feet, plus 5 seconds. In other words, it takes approximately 10 seconds to fall the first 1000 feet, and 5 seconds for each 1000 feet after that.

You may ask what I mean by pushing off from a plane. I mean that you use both hands and feet in getting out of the plane. Do not grab the ripcord handle while you are still in the plane because if you accidentally pull it, the parachute may stay in the plane while you leave, and you will end up being dragged down with the plane. While you are diving out head first you should push off with both hands and feet and as you do, look at the ripcord and reach in and pull it. You will be below the plane when your parachute comes out. If you pull too soon, you could become entangled with the plane. Always try to dive out whenever possible.

Now when you go for your ripcord, do not be bashful. Grab it with both hands and pull it **all the way out of the housing**. Then throw it away. This may sound silly but it makes sure that you pulled it, and just did not take up the slack in the ripcord cable.

Now you have done all that a man can do to insure that your canopy opens correctly. Let us go back to when you push off. If your legs were flapping around, they could become entangled with your opening canopy. The best thing to do is keep them as straight as possible. If the canopy does wrap around them, do not panic. If you do not kick and scream, the canopy will unwrap itself and open clean. Just do not fight it.

Now that we are under an open canopy, look and see where the hell you are. You may be over the middle of a lake or town or something equally as nice. This is when a steerable canopy comes in nice. I strongly recommend that all pilots use a steerable parachute. It gives forward speed and control and better rate of descent. You can also miss that last tree or fence when you land. Just remember that to turn you pull the taped line (or wooden toggles on some canopies) in the direction you want to go. You can also use the rear riser for the same purpose by pulling the rear riser in the direction you want to go. Right rear riser to go right, etc. These steering methods are only good on modified canopies, so if yours is not modified, forget about trying to steer it. Always land into the wind (unless you are trying to avoid an obstacle on the ground) just as in an airplane. Those of you who do not have modified canopies will land in any direction that you happen to be in at the time. Control of a modified parachute is really quite simple, just do not panic. Control of an unmodified parachute is even simpler; there being none.

If your canopy is not a steerable type, you are SOL. One can grab the riser nearest the direction he wants to go and pull on that riser, causing the canopy to slip in that direction, but it is very ineffective. The best thing to do is prepare to land.

There are different ways to land for trees, powerlines, water, and land. On land put your legs and feet together with your knees bent and head tucked into your chest. Do not look at the ground as you will get ground rush and probably pick your legs up. That could hurt. On water, before you enter, undo your chest strap, and put your hands on your leg strap releases. As you enter the water — undo them — not before. There is no depth perception over water. You could be at 5 feet or 500 feet. The difference could hurt.

On trees and powerlines, cross your feet and keep your knees bent. Put your arms inside your risers on powerlines, and put your hands under your armpits when going into trees. The advantage to putting your hands under your armpits is that there are some main blood vessels in the armpits and on the inside of the thighs — (hence crossing your legs for a tree landing) and this helps minimize the possibility of a puncture wound and severe loss of blood. On powerlines, your best chance of surviving is to try to slip completely through without getting hung up.

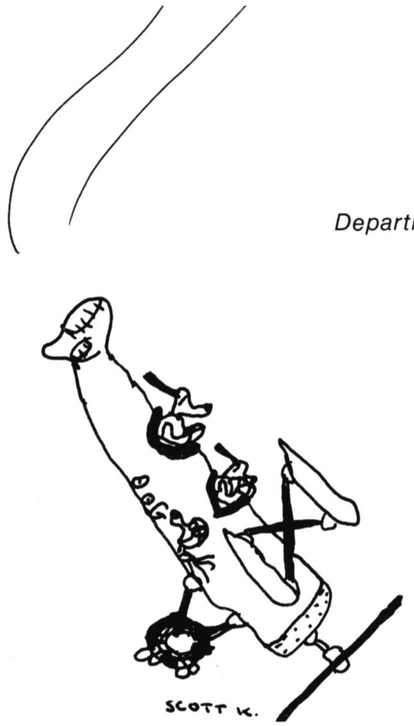
This article may sound extremely simplified, which it is, but without going into a great amount of detail (and ground training), this is about as simple as you can get. What I am trying to do is give you some idea of what to do to save your neck. I am not trying to give you a complete skydiving course. I hesitate to recommend, unless you actually intend to jump, even going through a skydiving course. It is as different as night is from day with your needs for a parachute. Do not get me wrong, I am not trying to tell you not to take a jump course. I think it should be required of all pilots. But the skydiving instructors will point out that it is for skydiving only. Do not go to a skydiving instructor just for the ground training. Most of them are not familiar with your requirements. If you do want to take a skydiving course (and jump, which I recommend completely) make sure your instructor is licensed by the United States Parachute Association as an instructor and nothing less. If he is competent, he will have all the licenses to instruct properly. If not, look for someone else to teach you to jump.

If you have any questions about anything concerning parachutes (or seat belts) feel free to write or call. I will be most happy to help.

INTERNATIONAL AEROBATIC CLUB
Experimental Aircraft Association
I.A.C.
MEMBER
TM

by
Donald A. Kennedy (IAC 1536)
Department of Aerospace Engineering Sciences
University of Colorado
Boulder, Colorado 80302

SPINS,



WILL YOUR AIRCRAFT RECOVER ?

The spinning motion of an aircraft is extremely complicated to analyze. Most theoretical studies have involved a large computer and the NASA spin tunnel at Langley Field. The reason for this is that the normal theory for most aircraft studies assumes that various aerodynamic parameters vary linearly with small changes of the aircraft's equilibrium position. This is clearly not true for the spinning motion of the aircraft. However, there are many aspects of the spin that are well understood on the basis of research and experience in the past forty years. The NACA and now NASA have been actively engaged in spin reseach for at least this period of time. Most of the results that are applicable to light aircraft are the result of experiments which have been conducted on models in the spin tunnel, radio controlled models, and full sized aircraft. After many years of data acquisition and study, several design parameters have been identified as relevant to spin recovery. The primary ones are mass (weight) distribution of the aircraft, the relative density or the weight of the aircraft compared to the weight of the displaced air, and the tail design.

The mass distribution is called the Inertia Yawing Moment Parameter. It is computed by calculating the moments of inertia of the aircraft about the rolling axis and about the pitching axis subtracting these and dividing by the mass of the aircraft times the wing span squared. For most light aircraft this number is fairly close to zero. That is, the weight is distributed almost equally along the wings and body. Weight along the wings increases the moment of inertia about the roll axis (I_x) while weight along the body increases the moment of inertia about the pitching axis (I_y). Figure 1 is a diagram of the moment balance in a developed spin. The aerodynamic moments tend to pitch the aircraft nose down while the inertia moments tend to pitch it nose up. If the aerodynamic moment is altered by power application or aileron deflection, it may also pitch the nose up resulting in a flat spin. This may or may not be recoverable depending upon the aerodynamic characteristics of the aircraft.

The relative density, u, can be computed at sea level from Figure 2. As an example the Super Acro Sport with a wing loading (W/S) of 11.24 lb./ft.^{2} and a wing span (b) of 19½ feet gives a relative density (u) of a little less than 8 as shown by the dotted lines on Figure 2.

The last, and perhaps most important, parameter is the tail design. The Tail Damping Power Ratio (TDPR) has become the design parameter to insure satisfactory recovery from a developed spin. This parameter was first suggested in 1939 by Seidman and Donlan, NACA TN 711. They based this parameter on the results of flight tests performed in a Fleet biplane in 1932 and described in NACA TN 421.

From 1939 until at least 1971 the NACA and now the NASA have used the experimental formula of Siedman and Donlan as a criterion for satisfactory spin recovery in aircraft. Hundreds of experiments have been conducted in free flight, the NASA spin tunnel, radio control models, and other wind tunnel tests. As a result of these data the spin criterion has been refined by Neihouse and is reported in NACA TN 1045 of 1946. These results have been summarized in reports by the NASA in NASA TR R-57 of 1960 and the most readable of all by J. S. Bowman, Jr., NASA TN D6575 of 1971, which can be purchased for three dollars from the National Technical Information Service, Springfield, Virginia 22151.

The remainder of this article will present the method that has been used to predict good or poor recovery from spins. Figure 3, which is used in most of the reports concerning tail design, is used to define the various letters

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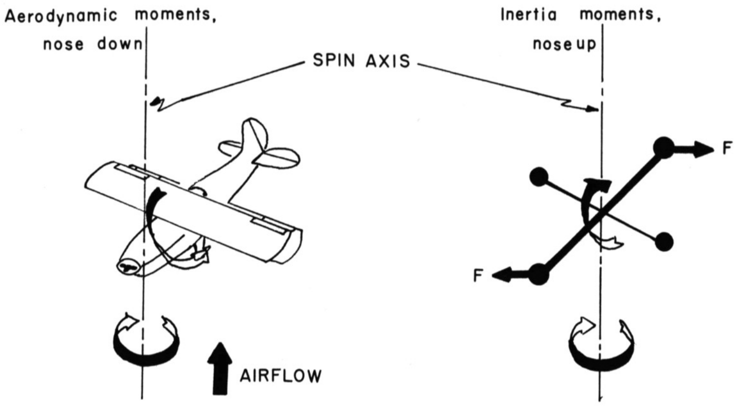


FIGURE 1. Balance of Moments in a Developed Spin

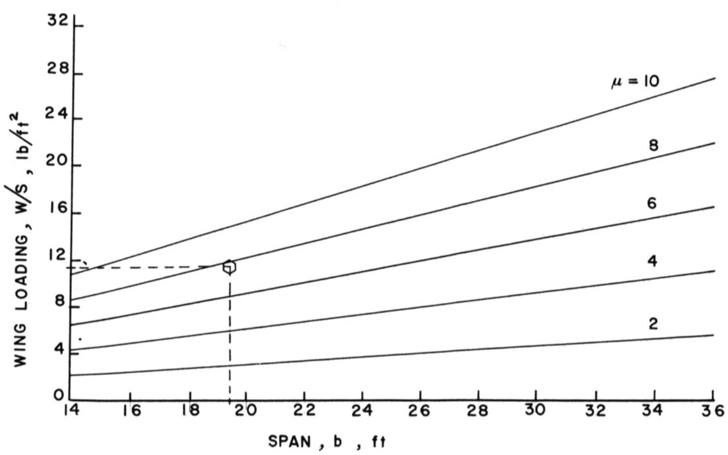
in the formula for Tail Damping Power Factor (TDPF). There are two essential parts of this expression; the Tail Damping Ratio (TDR), which is the fuselage contribution to the damping of the rotation and the Unshielded Rudder Volume Coefficient (URVC), which is the contribution from the rudder area that is not in the wake of the horizontal tail during a spin.

The Tail Damping Ratio is calculated by determining the side fuselage area **under** the horizontal tail, called S_F. This area is multiplied by the square of the distance from the center of gravity of the aircraft (usually at the rear limit) to the centroid (center of gravity) of the area S_F. This is called L. This product $S_F L^2$ is divided by the wing area S, multiplied by the wing semi span squared $(b/2)^2$. This combination

$$TDR = \frac{S_F L^2}{S(b/2)^2}$$

is called the Tail Damping Ratio. The results of many tests have shown that the spin angle of attack (flatter or steeper) depends strongly upon this number. If the TDR is less than 0.019 the spin angle of attack is taken to be 45°, if the TDR is greater than 0.019 the angle of attack is taken to be 30°. This spin angle of attack is used to determine the location of the horizontal tail wake which diminishes the rudder effectiveness. Once the angle of attack is established by the TDR, one draws a line at that angle plus fifteen degrees from the leading edge of the horizontal tail and at that angle minus fifteen degrees from the trailing edge. The spin angle of attack is shown by the dark arrow for the two cases of TDR larger than and smaller than 0.019.

FIGURE 2. Chart for Relative Density Parameter



The Unshielded Rudder Volume Coefficient (URVC) may now be calculated. The unshielded rudder is that portion of the **movable** vertical fin which is not inside the wake of the horizontal tail during a spin. The actual wake on a particular aircraft may not be just as shown, but all the data indicate that this guess of the wake location predicts the spin recovery properties of the aircraft. There are two terms to be considered, the contribution by the unshielded rudder above the horizontal tail and secondly the contribution by the rudder below the horizontal tail. The rudder area above the wake line is called SR1 and the distance between the center of gravity of the aircraft and the centroid of this area is L_1. Similarly the rudder area below the horizontal tail and outside its wake is called S_{R2} and the corresponding distance to the center of gravity is L_2. These areas and distances are combined into the URVC in the formula.

$$URVC = \frac{S_{R1}L_1 + S_{R2}L_2}{S(b/2)}$$

In this formula the distances are not squared.

The product of the Tail Damping Ratio and the Unshielded Rudder Volume Coefficient is the Tail Damping Power Ratio (TDPR). Figure 4 shows the results of the

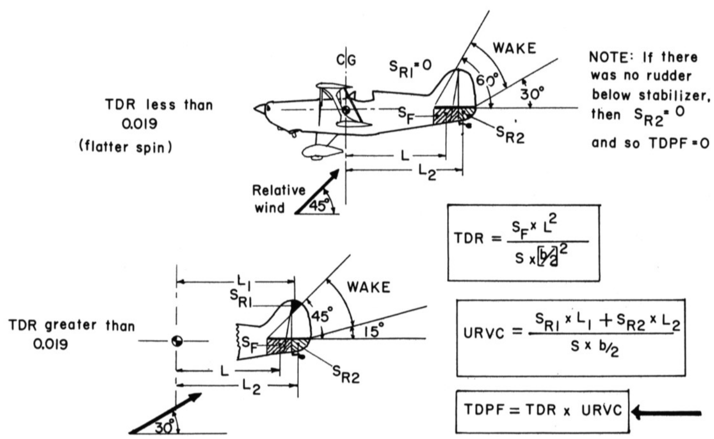


FIGURE 3. Diagram for Tail Damping Ratio and Unshielded Rudder Volume Coefficient.

many years of data correlation. If the numerical value for the TDPR is less than that indicated for satisfactory spin recovery, then it would be unwise to let a spin develop in that aircraft. If the numerical value of TDPF is greater than 0.0007 then the aircraft will recover from any spin. Since for most light aircraft $\left(\frac{I_x - I_y}{mb^2}\right)$ is close to zero, a TDPF of 0.0004 will be satisfactory. As an example, say an aircraft has a TDPF of 0.0001 and a u equals 10. The chart indicates that this aircraft will not recover from a spin with only rudder control, since the number 0.0001 is below the solid line for u equals 10. Note that since this value is above the dotted line for recovery by use of rudder and elevator, the aircraft would recover if both controls were used. If your aircraft has a TDPF of 0.00005 or less, it would be unwise to spin it intentionally. These numbers do not say that a stall with some rotation is not recoverable but that it would be unwise to let a spin progress after it started.

There are two different lines for satisfactory recovery, one with rudder alone and one with rudder and elevator. That is some aircraft will recover from a developed spin by just rudder reversal, the elevator may be left full back (Citabria, Decathlon, Pitts S-2A all fall into this category). Others must have elevator control applied to effect a spin recovery; an example is the Aerobat.

All the figures and calculations are for erect (positive g) spins. For inverted spins, one just turns the drawing upside down and determines the areas and horizontal tail wake again. For inverted spins the TDR is normally larger than 0.019 and thus only one wake is shown in Figure 5.

Flat spins normally will not occur if the Tail Damping Ratio is larger than 0.019 unless some other destabilizing element is present such as engine power and aileron deflection. In many good aerobatic aircraft, flat spins are no more dangerous than any other spin and in some may be safer than landing. If the Tail Damping Ratio is less than 0.019, it is this author's opinion that intentional flat spins may not be recoverable, and intentional flat spins should not be attempted in any aircraft that will not recover by rudder alone from a developed spin. For most aircraft the Tail Damping Ratio is much larger for inverted spins due to the presence of the fixed vertical fin. It is for this reason that one finds the inverted flat spin easier to recover from than the erect flat spin.

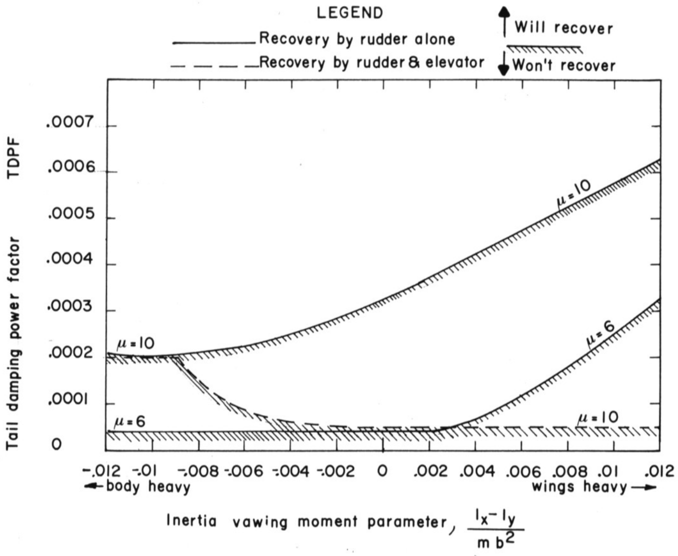
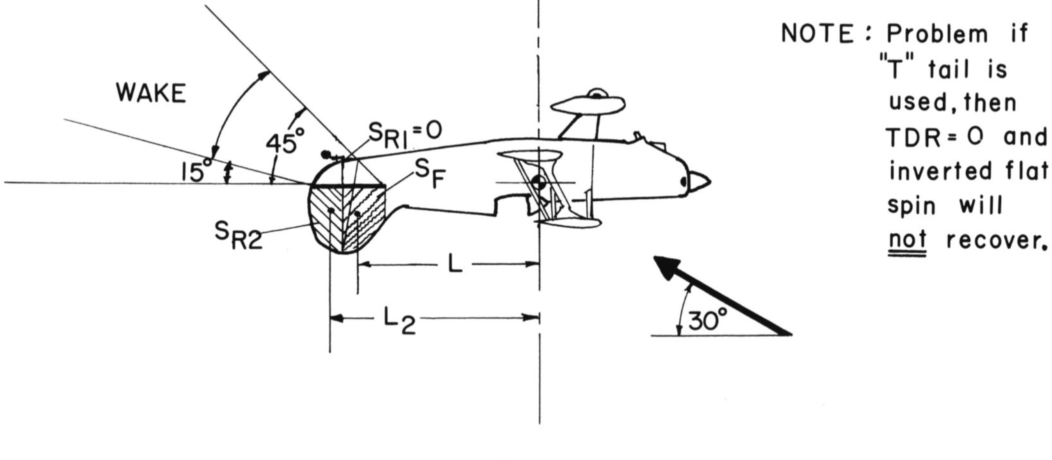


FIGURE 4. Spin Recovery Design Requirements

It is strongly recommended that you determine the spin recovery properties of your aircraft **before** attempting any aerobatics in it. Unintentional spins may be obtained under a variety of classes of mistakes while performing aerobatics, and it is for this reason that one should know the spin recovery prediction for their aircraft. As a matter of safety, one should not attempt flat spins of any kind without proper instruction from an aerobatic school that has competent instructors and quality aircraft. Like many other aerobatic maneuvers one may become disoriented and not follow the correct procedure to complete the recovery.

FIGURE 5. Diagram for Tail Damping Power Factor and Unshielded Rudder Volume Coefficient for Inverted Spins.



PARACHUTES — THEIR CARE AND USE

by
Robin King (IAC 952)
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In the last year (1973), I've been able to go to six sanctioned IAC contests. At each contest I've noticed something which, from a safety standpoint, upsets me! Most of our fellow pilots know little or nothing about a required piece of equipment that we all use to sit on. It's commonly called a parachute. Don't get me wrong — I'm no expert authority on them — but I feel some light should be shed on this subject. I might also add, at this point, that I don't use one during air shows because I don't think I am fast enough to get out of a plane at 200 feet or lower and survive. However, at contest altitudes, I feel that it could save my life.

The primary purpose of this article is to very briefly explain a little about the care and use of your parachute and answer some of the questions that have been put to me during contests about them.

Most pilots have never left a twenty thousand dollar plane with a two hundred dollar parachute. A small minority have found that contrary to all the Polish jokes that they do open before impact. Here's a fact for you — a canopy can be packed about 90 percent wrong and it will still open. I speak from experience on that subject.

First of all, use a reputable rigger. A good rigger will show you all you need to know about your particular chute and may be able to add more than what this article presents.

The best canopy on the market is probably the Security Safety Chute Model No. 150. It's harness is comfortable and the canopy has a very low rate of sink. It has a 120 day packing interval which is twice as long as other chutes. It is also steerable — more on that later. The rest of the basic emergency chutes are Uncle Sam surplus. They are good and reliable, but they are to some degree, not as efficient as the new security type chute.

CARE — It's acceptable to leave a parachute in the cockpit all the time. However, it's better to remove it after flying and store it in a dark, dry room. My hangar is wet usually, and mold and mildew doesn't do the harness, container, or canopy any good. Also, ultraviolet and infrared sun rays will cause slow deterioration of the harness and container. It is advisable to remove it at least once a month (if your hangar is dry) and hang it up to air out. I know of one Pitts driver that has removed his parachute only twice in the last year for repacking, and both times the chute appeared to me that if he had had to use it, it wouldn't have opened because it was soaking wet — which slows down openings considerably.

At the next repacking date, get your "FAA approved" rigger to show you what to look for on your particular type chute, in the way of a safety inspection. Each type is slightly different. The general things are:

1. Check the general appearance of the harness and container for signs of weather damage. Check all harness hardware. Check all screws and rivets in the hardware for security. Have your rigger examine the canopy and suspension lines for ripped seams, frayed reinforcements, and general condition. If your chute has had steering slots, he can show you where the steering lines are located and what their uses are. Your rigger will inspect your ripcord for bent pins and frayed cables, but look over his shoulder so when you inspect it between packing dates, you'll know what to look for.

HARNESS ADJUSTMENT — Your harness should fit snug at the shoulders, chest and legs. Your rigger can put it on you and adjust it for you. When he is satisfied it fits right, it will probably feel like a girdle; but if you have ever had an emergency opening with a loose leg strap that has slid up between your legs, you are going to wish it hadn't opened. The best way to illustrate the sudden pain something like this causes, is that it makes you feel like you are going to come apart where the Lord put you together — enough on that!

EMERGENCY EXITS — Let's face it, if a wing comes off at 160 mph plus at an altitude of 300 feet or less, your chances of getting out are bleak. It's best to make an emergency plan with a few **rehearsed** steps. These steps are my own, and I know from experience that they work:

1. Release all seat belts and harness equipment.
2. Clear the aircraft. If it is spinning always jump **in the direction of the spin.**
3. Pull the ripcord. Part of your rehearsal should be a habit of looking at the ripcord handle and then grabbing it. Don't count to ten and yell "Geronimo"! As soon as you have jumped, you will be far enough below to pull, so don't worry about a chute entanglement.
4. As soon as it opens, find your steering lines (if you have them) and face into the wind. By facing into the wind, your rate of horizontal movement will decrease, thus making your landing softer.

5. Parachute landing — always try to face into the wind by 200 feet AGL. Keep feet together, elbows tucked in by your sides, and legs **relaxed**. Try to hit on your feet and not on your tail end.
6. Possible hazardous landings — there are several types: (a) tree landings, (b) water landings, and (c) high tension wire landings. Your rigger can advise you on these. On tree landings, just keep your elbows by your sides, feet together, and cover your face with your hands. Water landings are a little more serious. You must know how to get out of the harness fast enough because a canopy will drag you under the water, not on top of it. The most important thing is not to panic, keep cool and you'll get out of it. By knowing where the leg and chest straps are, it shouldn't take longer than 10 seconds, so don't worry about drowning.

A word of caution on buying chutes — beware of bargain basement specials. Get someone who is qualified to inspect it and tell you what you have. Even if it comes from an FAA approved loft, have it inspected anyway. If it comes from an individual, then have it checked before buying it.

The steps and procedures I have outlined I hope may save a life someday. The best illustration of ignorance about parachutes is that today we no longer have one of our great pilots. He lost his life needlessly because he left his spinning aircraft with a chute that never opened because it hadn't ever been inspected. I am sure that in his mind he thought he would never have to use it. I sincerely hope that none of us have to, but . . .

(Editor's Note: Robin presents some of his views in this article regarding parachutes and why they are important. We hope that this has been adequately stressed over the past several issues and that all have benefitted. Next in the series will be an evaluation of the Security 150 Chute by the United States Parachute Association. Robin King is well qualified to speak on this subject. 26 years old, with 9,000 hours total time and an ag pilot for 8 years, Robin has flown Pitts', Pawnee 235's, Grumman Ag Cats, N. A. Thrush Commander, R-J Special, and a lot of antiques too numerous to mention. He is an air show pilot, an active jumpmaster with 800 plus jumps to his credit with only one injury. In his first contest season, he placed first five times and second once in six contests.)

SAFETY NOTES

John Keplinger, Ft. Lauderdale, Florida, recently pointed out an item he believes to be critical to flight safety on the Pitts S-1S. If failure occurred, it could lead to serious control problems.

On the rudder pedals in the S-1S is mounted a plate, through which the rudder cable and thimble are strung. If this plate is not chamfered, it will wear against the thimble and cable, and failure of the cable could result. John pointed out two cases he was familiar with where the cable was worn **half through**. If this cable failed, the rudder pedal would collapse to the floor and rudder control and differential braking would be impossible. Take a look at your bird and make sure this wear is not occurring.

STAMPE SV-4 SAFETY NOTE

Stampe SV-4 (Nord Stampe) owners are advised than an instance of failure of a rear rudder bar in flight has occurred.

It is recommended that before further flight, the following inspection be performed: Use dye penetrant and also visually check the rear rudder bar tube for cracks over the outboard three inches, including the foot rest attachments at each end of the tube. Pay particular attention to the cable horn area. If found defective, replace it.

SAFETY NOTE

The following safety tip was received from Jack Mayberry, IAC 1876, owner of a beautiful yellow Pitts: "The 0-360 Lycoming A4A used by most Pitts owners is one of the most reliable engines in the world. Even continuous use in the 3000 plus RPM range does not seem to phase this little tiger. However, if fuel, air, or ignition is not provided it just can't do its thing. By far, the most common cause of failure is the lack of fuel for one reason or another. One thing which can cause this is a plugged fuel tank vent. On most aircraft this vent comes out of the gear legs and is often left exposed. Consider the effect of a mud dobber or other bug building a nest in your fuel vent tube. I know of one failure from this very thing. One solution which I think works well is a pitot tube cover with an extension which slips over the fuel tank vent line. This was brought to my attention by a man who had an engine failure from this cause and I feel it is worth passing along."

Lycoming Service Bulletin No. 374 affects some of our members who operate Lycoming engines with this fuel pump installed. Subject of the Service Bulletin is a fuel pump inlet inspection on all Lycoming engines which use AC diaphragm fuel pumps, 75246 and 75247 with 9/16-18 UNF threaded inlets (not applicable to pumps with tapered pipe threaded inlet ports). The Service Bulletin should be complied with anytime fuel pressure fluctuates or deteriorates with an increase in altitude. If any of these conditions exist, the fuel pump should be removed and the inlet port and fittings inspected and new O-ring installed. A copy of the Bulletin is available through Avco Lycoming distributors or Avco Lycoming Division, Williamsport, PA 17701. Bellanca Decathlons use this fuel pump.

Technical Tips

by
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Alexandria, LA 71301

FEWER PARTS – FEWER PROBLEMS

The inverted oil system shown in the accompanying sketch has been in use on my Pitts Special since the plane first flew in March, 1972. Over 120 hours have been accumulated to date — almost all of it aerobatics — and the oil usage is one quart every twelve hours. The engine being used is a Lycoming IO-320-B1A.

The main difference between this system and others is the absence of a check valve in the air-oil separator tank, and the routing of the engine "upright" breather line. The three-way valve was purchased from Mr. Pitts. The system functions in the familiar manner while upright. In the inverted position, however, the engine oil pump picks up oil from a fitting screwed into an adapter plate and mounted on the vacuum pump drive pad at the top of the engine accessory case. Since this completely eliminates the air-oil separator from the inverted oil pick up circuit, a check valve is not required inside the air-oil separator.

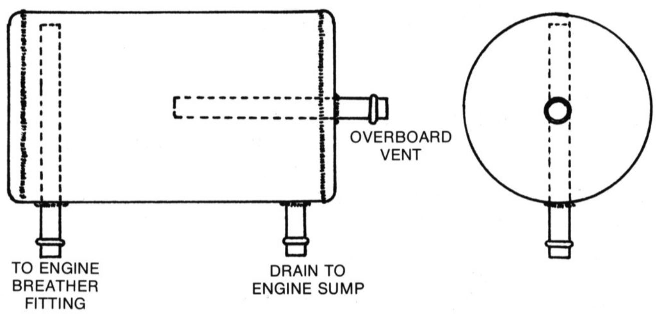
The upright or normal engine breather hose is routed so it loops down below the center line of the crankshaft and then back up to the air-oil separator tank. This loop or "sink trap", when inverted, is higher than the oil level in the engine crankcase thus oil drainage into the air-oil separator is minimized. Vertical flight and knife-edge flight are the only conditions of flight which allow the separator tank to begin to fill with oil. In each case, the duration is such that the tank never has time to fill more than half-way.

My primary reason for trying such a system was the elimination of one more moving part which could malfunction and cause loss of oil pressure.

PRE-FLIGHT — POST-FLIGHT

It is really great to arrive at the airport, give the little bird a thorough pre-flight inspection and with piece of mind in not finding anything wrong, sail off into the "wild blue" for a bit of aerobatic ballet with Count Aresti calling the tune. How often after such a session do we come in, gas up, listen to a critique of the flight, and then push the bird back in the hangar for "the next time"? Probably everyone does this most of the time. But wait! Why not again drag out that marvelous epistle called a pre-flight checklist so graciously furnished by the IAC. (Sure you used it on your pre-flight inspection?) and give your plane a **post-flight** inspection? **Now**, if something should turn up which isn't quite as it should be you have plenty of time to correct it before the next flight — you may even save some time if the "gremlin" requiring fixing necessitates ordering repair parts, etc.

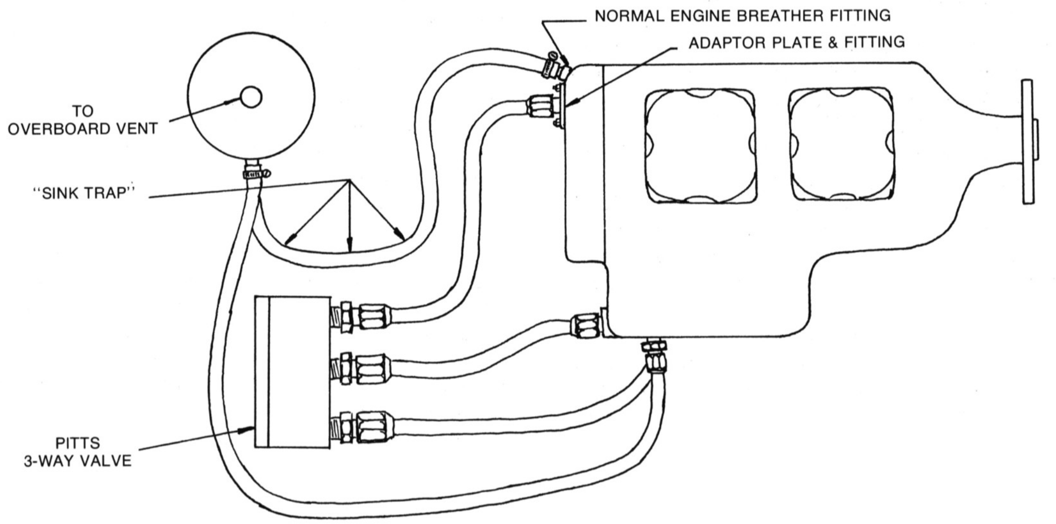
This should not lessen the diligence one normally exercises in conducting a pre-flight inspection, but it could reeuce the number of delayed or cancelled flights, resulting from some minor problem being discovered on a pre-flight inspection.



AIR-OIL SEPARATOR TANK

TANK CONSTRUCTED FROM 6061-T6 .040" TK. AL. - TIG WELDED. FITTINGS MADE FROM .035" WALL x ⅝" DIA. 6061-T6 AL. TUBING TANK SIZE 5½" DIA. x 9" LG.

AIR-OIL SEPARATOR TANK

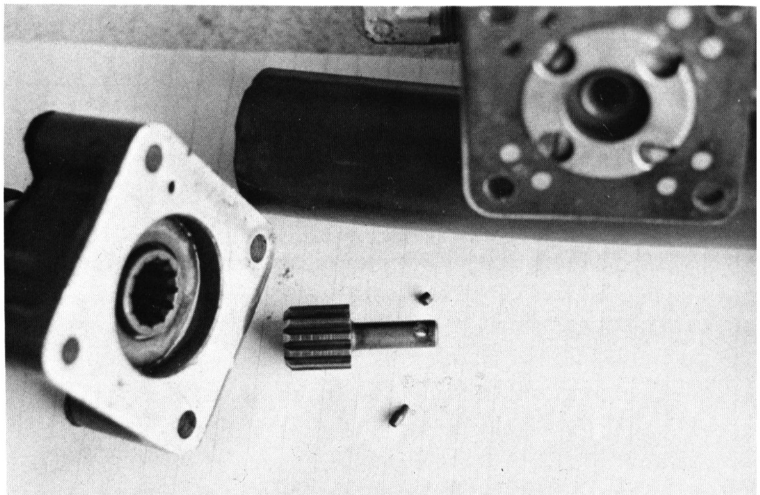


IN THE INTEREST OF

Safety

by
Jerry Spear, IAC 518
20 Crestwood Lane
Centralia, IL 62801

The result of the failure of a 25c pin in the fuel pump of Jerry Spear's Pitts.



The culprit — note the failed pin that goes through the drive shaft on the Thompson TF-1900 fuel pump.

July 28, 1974 — it was a beautiful Sunday afternoon in Fond du Lac. I was going out for some aerobatic practice. This was the last practice day before the big contest.

As I was doing my preflight, I was thinking about Mike Heuer's accident the day before — where he had a forced landing and turned over — off airport, with no one around.

I was wishing I could practice right there over the airport. However, I had had my turn in the "box" the day before and with 91 contestants each wanting a turn in the box — it was out to the boonies for me. So I wanted to be sure and tell someone where I was going and about how long I would be gone. (On takeoff, I remembered that I had forgotten to tell anyone.)

As I taxied out to the intersection where everyone was departing from, I was thinking it would be nice if I could use the whole runway. However, the 1500 feet would be plenty for take-off in a Pitts and nobody ever loses an engine on take-off — besides it's always the OTHER GUY.

Run-up was normal, the Starter signalled that it was OK for take-off — full throttle, I'm off.

Everything was beautiful, boy what a nice day, I can see for miles. I think I'll work on those rolling 360's a little more and check the altitude on those family 9's a little closer.

OH, NO!! The engine quit (altitude 100 feet) JOCKEY THE THROTTLE — NOTHING! FUEL PRESSURE **ZERO**! FUEL VALVE IS ON. HIT THE WOBBLE PUMP — IT'S DEAD, NO PRESSURE! I must have something plugging the fuel line! As this was going on, I was also yawing to try to see what was ahead. TREES LEFT — FARM HOUSE RIGHT — **MUST** GO STRAIGHT AHEAD! TIME TO LAND. SPEED SURE SEEMS FAST, looks like a creek and a mountain past this field. MUST MAKE THIS FIELD — **NOW**!

IF I CAN JUST KEEP IT FROM FLIPPING OVER. The field looks like tall clover and it's a little down hill.

LEFT SLIP — STICK BACK — tailwheel is on, mains on, mains hit pretty hard, gear is spread out, digging in, OVER IT GOES!! **FAST**.

Sliding backwards, upside down, parts are breaking, tearing, and snapping. After each snap the cockpit gets LOWER AND LOWER to the ground. I don't like this. When is it going to **STOP**?! FINALLY!! UGH!!

I've got to get out before it catches fire or something. BELTS OFF — can't find chute buckles. Hell with them. I'll get out with it on. NO ROOM, CAN'T GET OUT! STUCK? OK, I'm half out — chute must go. With the chute half on — half off, I got the rest of the way out.

NO PEOPLE — I wonder if anyone saw it go down???

The time lag from the engine failure until the airplane finally stopped sliding was about 15 seconds.

To date the damage is prop, spinner, wheel pants, vertical stabilizer, rudder, elevators, elevator push tube, left top aileron, right top wing back spar cracked near the "I" strut bolt.

Engine failure was caused from the failure of a little pin (25c) in the fuel pump drive gear. It was a Thompson pump No. TF-1900. 138 hours since overhaul. The overhaul people tell me that there is no lubrication on this gear pin. Maybe if we are using this type pump, during installation some kind of lubricant could be sealed in this area.

Personally, I am going to the diaphragm pump for fuel and use the gear type for the smoke system.

There have been several pump failures of this type and from most everyone the wobble pump has taken about 1000 feet of altitude to get the engine started, IF THEN! I was at about 100 feet. Are we all flying around thinking we have a backup pump and don't?

WHY? WHY? WHY? Are we all in such a hurry at contests to take-off that we always use the closest intersection for take-off? If we are so safety minded maybe we could make a change there. I think if I had departed from the end of the runway, I would have been able to get down on the runway. My airplane was only ¼ mile off the end of the runway. My "old" instructor was right, I couldn't use the 3500 feet or so of runway behind me.

I would like to thank all of the people who offered me their airplanes for the contest. At that time, I didn't think I wanted to fly in any contest — let alone a Pitts.

I had flown Chuck Carothers' Pitts about fifteen minutes a month earlier, so it wasn't completely strange and Chuck absolutely insisted that I fly his plane in the contest — which I did. Thanks again, Chuck.

See you all next season.

knowing your equipment (part four)

THE SECURITY 150 PARACHUTE — AN EVALUATION

By Kent J. Barnes & Terry Loboschefski
U. S. Parachute Association

So the IAC says that you must wear a parachute in that little unit on which you just squandered the family fortune. You know, that little sleek craft which will take you to unprecedented ecstasy in flight. Now we know that it wouldn't think of ever letting you down in any other mode than the "light-as-a-feather" landings you dreamed about while placing each rivet in its proper place. However, if the quality of workmanship that comes out of your shop is anything like that which has been known to fly out of mine, or if your wife is one of those ladies who would like to see you home for dinner in one piece perhaps you should read on.

What I am now going to spend a page or two rattling on about is a parachute that deserves some serious consideration by those of us who "fly those homebuilts." But first, let me establish a few ground rules. I am writing this not only as a pilot but as a parachutist who "jumps out of perfectly good airplanes" as often as one can be found. I think of parachutes not only as life saving devices which will put me down on the ground in one piece, but as a piece of equipment I expect to perform in the air much as you would expect from your newly manufactured airplane. This means that: (1) You should expect it to open in a neat and orderly fashion, natural for both the canopy and the person wearing it, and (2) Have some manner of control/forward speed so that you can get away from that set of powerlines lingering just below waiting to fry your flesh and bones.

Even though many of you have never had the glorious opportunity of floating underneath a parachute — and never hope to for that matter — these things are very important and should be seriously considered in obtaining any kind of parachutes. Again, I'm saying this as one who must trust parachutes for the fun and sport of it as well as any emergency applications.

So let us introduce you to the Security Safety-Chute Model 150. It is made by the Security Parachute Company of San Leandro, California which has been making both sport and emergency parachutes for some years now. To quote your catalog: "Model 150 Safety-Chute is the first parachute designed specifically for the sailplane pilot. Perfect also for helicopters and small power aircraft under 150 mph. Weight is under 16 pounds. Repack inspection period is 120 days (4 mos.). So light and comfortable most pilots forget they have it on. Use in any style of seat."

Now keeping in mind what a jumper would look for in a parachute, let's look at it from your standpoint as a builder and/or pilot of experimental aircraft. There are several advantages this parachute has that should really interest you. First, the weight is under 16 pounds. This means that its lack of weight will lend itself toward better performance of your aircraft.

Second, it has a repack period of 4 months as opposed to 2 months that is common in other types of parachutes. This should save you time and money. Third it's small and comfortable and has as an option a built-in air bladder in the seat that the wearer can inflate to his or her desire and that makes it an added boon to those who think little of interior seating at the time of construction.

The operation of the 150 is similar to that of most any other parachute. Just step clear of the aircraft, making sure that you have undone the seat belts, head set, and mike. Then just look at the ripcord to make what you are grabbing and pull. How quick does it open you ask? The test that the FAA requires comes under the heading of "Test Specifications N.A.S. 804" (whatever all that means). The first test is ripcord tension test. This is a test to make sure that the ripcord will take a tension of 300 pounds for 3 seconds without damage. Results: passed. Test 2: pull test — pack opening device, 22 pounds max pull. Average pull encountered was 19.5 pounds. Results: passed. Test 3: function test (normal pack)170 pounds of dummy weight. Must fully open in 3 seconds of ripcord release. 500 feet max altitude. Average airspeed of the aircraft 74.2 mph. Average altitude 458.3 feet. Average opening time 1.96 seconds. Results: passed. (It should be noted that the quickest opening time during all tests was when it was live jumped. That time was 1.1 seconds). Test 4: function test (twisted lines) dummy weight 170 pounds. Three twists near the canopy skirt. Canopy to open in 4 seconds or less, 500 feet max altitude. Results: no damage. Test 6: live drop tests. Opening: approximately 50 feet from exit. Harness: quite comfortable. Landing impact: soft and easy. Results: passed. Test 7: Rate of descent test. Average rate of descent last 100 feet not to exceed 21 feet per second at standard sea level conditions. Opening time 2.55 seconds, rate of descent 19.61 feet per second.

Test conducted by Executive Air Travel, Lincoln, California. Some tests by Security Parachute Company at Antioch Airport, Antioch, California.

Total test results are: "The back-seat type parachute part number 69B1451-1 meets or exceeds the minimum requirements of N.A.S. 804 and is acceptable under TSO C23B." — Security Parachute Company.

"So what?" you ask. Those were almost all test jumps by dummies and very few jumps by real, live people. Well at the request of the International Aerobatic Club, we at the U.S.P.A. did a few jump tests of our own at the Yoho County International Airport, California. Each drop was made by a different jumper. Experience factor was an average of 500 jumps. Each jump was made on a different day with different weather conditions. Ground wind varied from 3 to 13 mph. Jumper weight was with no gear on and deployment speed was the speed of the aircraft at the time of exit. Body position was the position of the jumper as the pilot chute emerged. Deployment time was clocked from pilot chute activation until full canopy. The comments are those of each jumper and their own opinions. The FAA rigger comments were: "Well constructed, no deterioration after fifth jump. No visible canopy oscillation. Easy to pack."

Now let's face it. This parachute, like all emergency parachutes, must meet rigid federal requirements designed to save your life and limb, and in that respect the 150 is no different from any others. That is, it will get you to the ground in relative safety. However, 99.99% of the time it will never be used and that's what the 150 is designed for — ease in comfort, mobility, and non-restrictive movement, simply because it is one of those things that we invest in hoping we never get a chance to use it. That may be somewhat of a paradox, but take it from a jumper who's hung underneath the 150 canopy — if ever the time comes to use it — it'll be there.

EVALUATION OF THE SECURITY 150 PARACHUTE
Yolo County International Airport, California
Report by Don Towner I/E 1972

Jump No.	1972 Date	No Gear Jumper Weight	Aircraft Deployment Air Speed	Ripcord Pull Body Position	Deployment Time	Estimated Deployment Altitude Loss	Estimated Canopy Descent Rate	Canopy Forward Speed	Timed Canopy Turn Rate
1	1 Jan	140	60 MPH	Face to Earth	1.8 sec.	50 ft.	stand-up	5 mph	7 sec.
2	9 Jan	175	90 MPH	Face to Earth	1.5 sec.	35 ft.	stand-up	5 mph	8 sec.
3	16 Jan	175	120 MPH	Face to Earth	1.1 sec.	20 ft.	slow	5 mph	8-10 sec.
4	13 Feb	170	90 MPH	Tumbling Backwards	1.7 sec.	45 ft.	low rate	6-8 mph	6-8 sec.
5	25 Feb	160	90 MPH	Side to Earth	1.6 sec.	40 ft.	slower than 24' ripstop	4-5 mph	slow

Each jump was made by a different jumper. Experience factor was an average of 500 jumps. Each jump was made on a different day with different weather conditions. Ground winds varied from 3 to 13 mph. Jumper weight is with no gear on. Deployment speed was the speed of the aircraft as the jumper exited. Body position was position of jumper as the pilot chute emerged. Deployment time was clocked from pilot chute activation until full canopy.

Each jumper gave his own opinion of the canopy descent rate, forward speed and canopy turn rate. See jumper comments below.

NOTES:
1. Subjective evaluation on workmanship, comfort, canopy handling and canopy oscilationwill be made. FAA Rigger — well constructed, no deterioration after 5th jump. No visible canopy oscilation. Easy to pack.
2. No statistical data will be obtained (insufficient number of jumps).
3. Jumper Comments:
   A. Jump No. 1 - Hector Aponte: positive opening, slow rate of descent.
   B. Jump No. 2 - Dwaine Cullop: Very position opening. Comfortable rig to wear.
   C. Jump No. 3 - Leon DeLise: Instantaneous opening, saw stars, ripcord jerked from hand. Soft landing.
   D. Jump No. 4 - Jerry Shaffer: Seemed to be an inherent left turn. (Ground wind was 13 mph).
   E. Jump No. 5 - Dave Goodearl: Comfortable opening and landing. Harness is easy to fit. Lines were twisted 5 turns on opening but rotated out quickly.

in the interest of *Safety*

by
Dave Hilyard, IAC 2931
13787 S. W. 66th St., No. 157-D
Miami, FL 33143

(Photos by Buck Weaver)

WHEN WAS THE LAST TIME YOU HAVE HAD YOUR INSPECTION PLATES OFF?

Fellow "stunt" pilots consider the following:

Let me set the scene for you. It's Halloween, October 31, 1974, the day before the Remuda contest in sunny Florida. The box has been marked and a few of us are trying a sequence or two. Bill Thomas and Alan Bush have flown and now in I go; strap it on; start it up and climb for the first sequence. The Known goes pretty well, so back up for the free style.

Wow!! A beautiful day! About 4:00 P.M.; the air cool with plenty of lift!

A wing wag and here we go again into the box. The first five maneuvers feel good, now up for the wind correcter . . . a vertical quarter roll . . . now lay out across the box. Now down . . . another quarter roll . . . Great . . . now the slow roll and pull for the Family Nine. The stick moves back a small amount and . . . stops as if against a control lock. It's jammed!! Pull again! Still nothing . . .

What do you do? You start testing. A little forward . . . yes . . . we have down elevator. Now back again . . . it jammed again! No up elevator. Rock the wings. The ailerons are OK. Now the rudders . . . good, they're still attached. Now back stick . . . harder this time. No luck . . . still the same. Trying popping the stick forward a few times. Push to negative G's. Back . . . still the same. Once more a sharp forward push . . . wait . . . hold it. If it jams more forward than it is I'll be in real trouble. Have to roll it over and climb inverted to get enough altitude to get out of it. Altitude is now 900 feet.

By this time I'm well out of the box and heading north across Alligator Alley and, if I remember correctly, Sebring is the next airport a few hundred miles up the road.

A slow turn puts me on a long, loose downwind for a north landing.

By experimenting I find that 2600 RPM and 105-110 mph seems like a good attitude to try a wheel landing. I can remember an insidious voice inside repeating, "Please don't bounce . . . please don't bounce."

To make a long story short . . . a long final . . . coax it down with power . . . a wheelie . . . no bounce . . . ease the power off . . . tail finally down . . . roll out and we're home free.

Unaware that I had been in difficulties Bill Thomas is called over along with Buck Weaver and Alan Bush. Be tween long exhalations on my part we discussed the whole thing. Buck had a tool kit open and is removing inspection plates in the tail. Almost before I'm unstrapped and out of the Pitts I hear Buck say, "Here's your trouble." Alan and I walk around the tail and Buck has the culprit between thumb and index.

A number 10 phillips head screw had been firmly wedged between the carry-through tube of the horizontal stabilizer and the leading edge tube of the elevator right at the control horn. The horn could not have moved further. I bent the number 10 screw!

MORAL.

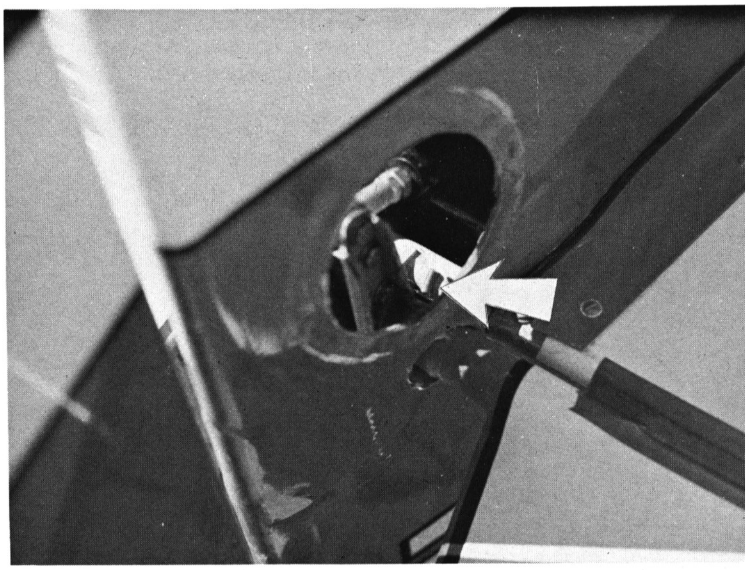
Did something just fall onto the cockpit flooring? Maybe . . . well, I guess not . . . don't see anything. A missing screw after minor work? Forget it . . . got another one here in the box. Where the hell is that little screwdriver? Probably left it over there on the tool bench.

DON'T GUESS! Find the missing screw. Find the screwdriver. Pull the inspection plates and drop a hand or strong magnet into those inaccessible sports that the eyeball cannot reach!! It sure saves wear and tear on the pucker factor.

Now let's see . . . if that last maneuver had been a low push up into a tail slide followed by a full vertical roll . . .

P.S. I know where the number 10 came from and the mechanic and I have discussed the situation.

This was all the up-elevator available, with the control jammed in the S-2.



Note the No. 10 screw jammed between the tubes.

technical tips

INSPECTING THE PITTS FOR WEAR

by
Bob Roe, EAA Designee 592
2321 Williams Place
Ft. Worth, TX 76111

Recently I inspected a friend's Pitts Special and found that the lower wing front attach fittings had been working. We took the wings off the ship and cut them open and found the fittings loose on the spars. They are attached with two 3/16" bolts and one 1/4" bolt. We called Curtis Pitts and he recommended we bush the spars with 3/8 bushings and use 1/4 bolts throughout. I cut openings in the butt rib so drilling with an angle drill could be accomplished. I then made a drill jig to match the fitting holes then bored to 3/8" and the wing attach to fuselage bolt hole, we bored to 1/2" using a 5/16" bolt in this one to attach the wings to the ship. We then made new fittings, installed bushings, and fittings and torqued the bolts. This made a fine job.

The rear fittings and bolts were replaced and attach bolt hole bored for 1/2" bushings, the same as the front fittings. We used an undersize bit and line bored the wing and fuselage fittings, then used a reamer to bring the finished hole to 5/16".

The holes in the spars were something else. The hole that was 1/4" was 5/16" on the opposite side and the 3/16" holes were at least 1/4" on the opposite side. This was about the poorest workmanship I've seen in some time. Incidentally, this ship was champ in the advanced category in a past season.

I have a Pitts in the shop now which flew Unlimited this year and placed well. The fabric was beautiful but the owner noticed nails backing out of the leading edge of the top wing. I cut the cover off the wings and found 9 broken ribs forward of the front spar on the top wing. All 4 center-section ribs and either side of the interplane strut were broken, right and left, and one rib in between on the right side of the center section.

I repaired the ribs, then reinforced all ribs, all wings at the spar's front side. The 1/4" cap strips are breaking and need to be attached to the spars better to take the load off the cap strip and transmit it to the rib plywood nose piece.

I reassembled the wings and covered the nails with epoxy cement, then put a plastic tape over that and am now recovering the plane.

Also, I replaced the front center section wing fittings, the ones which I took off were bent, and the new ones which came from the factory have flanges to keep the fittings from bending in snap rolls.

Just thought you would like to inspect your wing fittings and wing ribs and if you see any signs of working fittings or nails backing out, you had better investigate.

I also have two more Pitts to do, one flew world competition and the other one flew unlimited this year — it has nails showing. If these ships are bad I'll let you know.

(Editor's Note: These problems have occurred in nearly every Pitts S-IS flying Unlimited. Pitts Aviation publishes a Service Bulletin outlining the corrective procedure. We urge that you take a good look at your Pitts this winter.)

DO YOU HAVE A BACK-UP FUEL PUMP?

by
Larry Worrell, IAC 33
4741 Persimmon Lane
Brunswick, OH 44212

I read Jerry Spear's article in the November issue of SPORT AEROBATICS with great interest.

The part that interested me was Jerry's statement: "There has been several pump failures of this type and for most everyone the wobble pump has taken about 1000 feet of altitude to get the engine started, **if then!**"

I'm not sure but I wonder if the malfunctioning or broken pump is restricting fuel flow, causing the delay in a restart.

I have a Pitts that's flying and a Stephens Akro that is being covered and will be flying this spring.

On both aircraft the fuel lines run from the wobble pump direct to the fuel pump. In both aircraft this is per the designer's fuel system schematics.

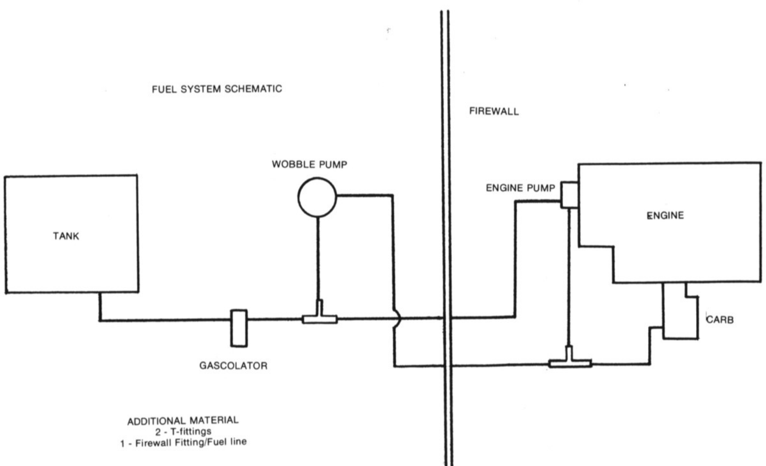
After some discussion of this problem with Dan Bookwalter, IAC 77, I find his Starduster has the wobble pump running direct to the carburetor. This way the engine driven pump is by-passed. (see schematic)

What this does, in case of an engine driven pump failure, is pump fuel direct to the carburetor. Not to, or through, a dead or malfunctioning pump.

I think this would give immediate fuel pressure, resulting in immediate restarts, in the case of engine pump failure.

Jerry questions, "Are we all flying around thinking we have a back-up fuel pump and don't?"

Maybe we do have a back-up pump, if we use the proper plumbing schematic.



BELLANCA DECATHLON RIB CRACKING

Editor's Note: IAC's Malfunction and Defects Committee, under the leadership of Buck Goodman, has been gathering information on problems encountered with aerobatic aircraft so that this information can be disseminated to the membership and corrective action taken where necessary. The program has been a very successful one and has published information on such problems as cracked crankshafts, cracks in Pitts control columns, and other areas critical to flight safety.

The most recent problems have been encountered with cracking wing ribs in Bellanca's Decathlon series. This was first reported in June at an aerobatic contest in Kokomo, Indiana. Subsequent problems were uncovered at Fond du Lac as well.

To get Bellanca's evaluation and answer to this problem, Buck Goodman wrote to Bellanca in December. The following is their reply:

January 9, 1975

Mr. W. L. Goodman
Malfunction and Defect Committee
International Aerobatic Club
Post Office Box 229
Hales Corners, WI 53130

Dear Mr. Goodman:

This is in reference to your letter of December 30, 1974.

The Bellanca model 8KCAB "Decathlon" was certified under FAA Part 23 on October 16, 1970. Since that time, 168 aircraft have been delivered.

The first aircraft reported to us with any wing problems was reported as some "loose fabric rivets". We requested the aircraft be brought back to the factory for our inspection. At the time this condition was reported to us, the aircraft had 179 hours and had been used in air show work by a relatively low-time pilot. When the aircraft was inspected at our factory, we found cracked and distorted wing ribs. The owner purchased a new set of wings and had them installed on the aircraft. The old wings were examined more closely to find a possible cause.

During the next few months several more aircraft were reported with cracked ribs; a series of tests were conducted by our Engineering Department to determine that the material in the ribs and the construction of the ribs did, in fact, meet FAA and engineering specifications.

Further studies were made regarding pilot technique, etc., since no basic pattern seemed to be developing as to which ribs were being distorted or cracking.

Many high-time aerobatic pilots were questioned, and the consensus seemed to be that the wings were being overstressed under certain maneuvers. Basically, in aerobatic competition, the Decathlon is usually flown in competition against the Pitts. This aircraft is flown through its maneuvers in a very crisp, sharp manner as the wing span is much shorter and the roll rate much higher. Most aerobatic judges look for this type of performance. The Decathlon's roll rate, being slower, requires entry speeds to be higher to enable a pilot of a Decathlon to produce this same or similar crisp, sharp maneuver.

To date, less than 8% of the total Decathlons have shown up with any type of rib distortion or cracking.

Bellanca's Engineering Department has worked closely with FAA in the problem and, as a result, developed and has received FAA approval of Kit No. 243, which consists of a set of doublers and gussets which can be installed on all Decathlons and, when installed, lifts the 25-hour inspection that is now required under AD 74-23-04.

Kit No. 243 is available on a no-charge basis from Bellanca on receipt of the name and address of current owner, along with the serial number of the aircraft. Bellanca is also requesting, for statistical purposes only, that the total hours on the airframe be included also.

Should anyone have any questions regarding cause, prevention or cure, contact the Service Department, Bellanca Aircraft Corporation, Alexandria, Minnesota 56308.

Sincerely,
BELLANCA AIRCRAFT CORP.
Norman D. Haglund
Service Manager

Additional Editor's Note: I must take exception with Mr. Haglund's analysis of the problem when he relates the problems with the Decathlon back to the type of judging and criteria for maneuvers in aerobatic competition.

IAC Judges do not consider the type of aircraft when judging maneuvers – and if they do they're wrong. For example, if one aircraft snap rolls faster and more spectacular than another, a Judge would not consider this in scoring – only how well the maneuver was performed, i.e. recovery on the point, clean break, etc.

There can be no arguing with the fact that many pilots believe that if they fly their airplane more crisply or sharply, they will receive a better score. This is a common misconception and one that has not been easy to correct. A prime example of being able to win by being **smooth** *is Fond du Lac's Unlimited winner, Clint McHenry, as Clint is one of the smoothest pilots flying today. Harold Krier was another.*

If you have had any problems with your Decathlon, we urge you to contact Bellanca as soon as possible, so they can thoroughly document the problems. Part of the problem may go back to the fact that when the airplane was introduced in 1970, it was advertised as an "unlimited" aerobatic machine. – M.R.H.

Fuel Systems RE-EXAMINED

by
Frank L. Christensen, President
Christen Industries, Inc.
Hollister, California 95023

It seems that in recent months there has been much communication among aerobatic pilots about the reliability of the prevalent series-type aircraft fuel systems and of fuel pumps in particular. There was considerable talk at the Fond du Lac aerobatic competition last year about the fuel pump failures, and I overheard many discussions about the benefits and limitations of Thompson, Romec, and AC brand engine-driven pumps as well as the various D-2, D-4 and D-11 type military surplus wobble pumps. In addition, there have been several articles and letter reprints recently in aerobatic journals such as *SPORT AEROBATICS* offering a variety of observations and suggestions relating to these fuel pumps and fuel systems in general.

I have owned several Pitts Special S1-S and S-2A aircraft over the last seven years, and I have competed in the advanced and unlimited categories in several national aerobatic contests. In addition, I have spent the past two years designing the new Christen Industries 844 Manual Fuel Pump System. These activities have caused me to make extensive studies of fuel system design and to accumulate considerable experience with the operation of these systems and their components. While this does not necessarily qualify me as an expert, perhaps my observations and suggestions here will be of interest and value to other aerobatic pilots.

Accidents related to fuel pump failures like the one experienced by Mr. Jerry Spear at Oshkosh last year (see November '74 *SPORT AEROBATICS*) certainly call for concern and perhaps action, but I am disturbed to see people drawing possibly erroneous conclusions about the causes of such accidents as a result of relatively superficial analysis and inadequate understanding of the design and function of fuel system components. For example, Larry Worrell's article (see December '74 *SPORT AEROBATICS*) suggests that the series-type fuel system being used in most aerobatic aircraft is potentially deficient and that it can be made more reliable by converting to a parallel-type system where the stand-by wobble pump by-passes the engine-driven pump and supplies fuel directly to the carburetor or fuel injector. This implies that if an engine-driven pump fails in a series-type system, fuel flow through the pump to the carburetor or injector will be restricted, so that the effectiveness of the wobble pump will be reduced. Mr. Worrell infers that Jerry Spear's accident may not have occurred with a parallel-type system. I commend Mr. Worrell's interest in improving fuel system reliability and I regret having to disagree with him; but I submit that his conclusions about fuel system components and their arrangement are incorrect, and I feel that the parallel-type system he has suggested as an alternative has serious limitations.

The Romec, the Thompson, and the AC brand engine-driven fuel pumps all have by-pass capability which assures that fuel can flow through them with little restriction regardless of the condition of the pumping impeller or diaphragm. In the Romec and Thompson impeller-type pumps, this capability is provided by a small spring-loaded by-pass valve which opens at low inlet pressure. In the AC diaphragm-type pump, through-flow is inherent in the one-way valves used for the diaphragm pumping action. Thus, failure of an engine-driven pump does not compromise the performance of the stand-by wobble pump, since fuel can be pumped easily by the wobble pump through the engine-driven pump to the carburetor or fuel injector. Further, the D-2, D-4 and D-11 wobble pumps all have more than adequate fuel volume and pressure capacity to supply a carburetor or injector with sufficient fuel for engine operation with less than three full pump strokes, if they are in good condition and are adjusted properly. In my view, Mr. Spear's accident did not occur simply because he had a fuel pump failure with a series-type fuel system in his aircraft. I suspect that the condition of his wobble pump or a lack of proper adjustment of the pump may have been the real cause. I hasten to add here that I have not talked with Mr. Spear about his accident, and I am not familiar with his particular aircraft fuel system. I am simply offering some theoretical alternative explanations for his experience based solely on his written account.

Most surplus wobble pumps have an internal pressure relief valve to control maximum output pumping pressure. This valve can be adjusted to limit output pressure across a broad range. The pressure limit should be set at 7 psi for a float-type carburetor, 15 psi for a PS-5C injection-type carburetor, or 22 psi for a fuel injector. Most pumps were set at the 7 psi maximum when they were manufactured originally, and this amount of pressure with its corresponding flow is not sufficient to supply the PS-5C carburetors or fuel injectors which are commonly used on aerobatic aircraft.

I have observed that many aerobatic pilots and homebuilders are not aware of the existence of the pressure relief valve in their wobble pumps and the importance of its correct adjustment. As a result, they install their wobble pumps with the relief valve left set at the original 7 psi maximum. If Mr. Spear's aircraft was equipped with a wobble pump which was adjusted to this 7 psi maximum pumping pressure, it is obvious why he could not restart his engine, even with many strokes of frantic pumping. Further, if his pump was not in good condition, no amount of pumping would result in adequate fuel volume and pressure output.

Wobble pumps which are not overhauled prior to use often have corroded one-way valves or relief valves. This corrosion causes the valves to leak or to stick in the open or closed position resulting in significant deterioration of pumping capacity. I have observed evidence of this condition several times when flying other people's Pitts Special aircraft. When preparing to start the engine, I have noticed that the pump will generate pressure on only one stroke; either the up-stroke or the down-stroke, but not on both strokes as is normal. In these cases, I have always commented to the owner of the aircraft that one of the valves in his wobble pump is defective, and that even though it is adequate for engine starting, it might be useless to him in the event of an engine-driven pump failure.

Contrary to what many aerobatic pilots have been hearing lately, the record of reliability for engine-driven fuel pumps is really very good. This is particularly true of the AC brand diaphragm-type. Failures do occur, of course, but they are not as common as some people are suggesting. Further, the reliability of surplus wobble pumps and the simple series-type fuel system have been well proven over the years. It is my view that the response to the recent rash of fuel system failures should not be to change the existing systems, but to thoroughly inspect the systems and their components to assure that they are functioning as intended.

I suggest that Mr. Worrell's parallel-type system does not offer any reliability advantage over the series-type system. It is true that if all system components are functioning properly, the parallel system will work well. But if there is any leakage of the one-way valves or the relief valve in the wobble pump, the engine-driven pump will simply recirculate fuel in the parallel system lines rather than forcing fuel under pressure to the carburetor or fuel injector. Such leakage of the wobble pump valves is very likely under some conditions in an aerobatic aircraft because the valves have coarse metal to metal seats and are gravity-operated. This means that when an aircraft is upside down and exposed to negative-g's, the valves may open and allow fuel recirculation which makes engine failure probable. This condition can be eliminated in the parallel system by installing a one-way check valve in the wobble pump output line, but with this addition the complexity of the system is increased and there is additional potential for failure.

While the parallel system Mr. Worrell suggests seems at first to have advantages because of the direct connection of the stand-by wobble pump to the carburetor or injector, its reliability still depends on the condition and performance of the wobble pump. The pump must have adequate volume and pressure capacity without internal valve leakage. This can be assured, of course, but with the pump in this good condition, the series-type system is equally as reliable, and without the complexity of the additional lines and check valve.

In summary, it is my opinion that fuel system failures are not very common in well maintained aircraft. Further, I feel that the series system that has been used in most light aircraft for many years is the simplest and most reliable in concept. Finally, I think that if we will all make an effort to understand our fuel systems well and to keep them properly adjusted and in good condition, we will avoid unfortunate accidents like the one experienced by Mr. Spear.

HOT STARTS ON LYCOMINGS

by
Sam Burgess, IAC 23
P. O. Box 9571
Airport Station
Honolulu, HI 96820

With a PS-5C carburetor, there are about as many procedures as there are Pitts Specials for starting your engine when it is hot.

Frustration has bred some methods that are only half way dependable but most are just hit or miss.

A survey of Lycoming reps around the country and at Oshkosh resulted in even more frustrations on a sure fire method for eliminating this balkiness at contests or at enroute stops.

While practicing with Bill Lancaster down Miami way, he came up with a procedure that has so far shown signs of reliability. We are not exactly sure how it aspirates in the intake pipes and the carb but you can't argue with success. Try it, you might like it but there are no guarantees.

STEP ONE

1. Switch off
2. Brakes set
3. Mixture rich
4. Throttle off
5. Wobble the pump for four blades

STEP TWO

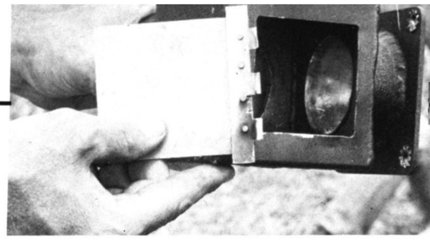
1. Throttle wide open
2. Mixture off
3. Back up prop four blades

STEP THREE

1. Throttle ½ open
2. Switch on
3. Wobble pump
4. Swing prop for start
5. Mixture rich when it fires
6. Retard throttle to idle

If the above does not work on the first try, repeat along with mutterings about what those guys can do with their ideas. If you have a better one, let's hear about it.

in the interest of safety



The culprit — this is the alternate air door which wore out and blocked off air to the engine. It lodged itself over the round intake visible through the box.

by
Mike Heuer

At last year's competition at Fond du Lac, I got the opportunity to fly the prototype Stolp Starduster Corporation Acroduster I, SA-700. Jim Osborne of California had brought the Acroduster to Fond du Lac for pilots to fly to see what they thought of the aircraft and three pilots were to fly it in competition.

It's a pretty little airplane, with some unusual design features, such as an all-aluminum monocoque fuselage, spring gear, and elliptical wings. Four ailerons were featured, as well as a 200 hp Lycoming with constant speed prop.

Several pilots got to fly it before I did on that Saturday, July 27. It was a perfect day for flying and Jim was anxious for a number of pilots to try it out.

My chance came at about 11:00 A.M. It had just landed and been topped off with fuel. Jim took me through the preflight, helped me strap in and buckle up. The cockpit was a bit on the cramped side but more than adequate. Unlike a Pitts or an Acro Sport, you sit quite upright in the Acroduster and the throttle quadrant is located high on the right and back. The instrument panel is close to your face. Prop control and mixture were also on the left.

After taxiing out and going through the run-up, I took off. The aircraft had very good power and take-off performance, even though it was a little on the heavy side due to a full electrical system and a little over 900 pounds empty weight.

Climb was made at about 120-130 mph IAS, as Jim recommended. He had mentioned that the airspeed was reading quite high, and over the fence speed should be about 120 IAS.

I climbed out to the south of Fond du Lac, up to about 4500 AGL, for some familiarization maneuvers. After a series of power-off stalls, steep turns, accelerated stalls, climbs, and glides, I rolled the airplane a couple of times and enjoyed the aircraft's one really outstanding characteristic — a tremendously high roll rate and light aileron pressures. Before I did any vertical maneuvers, however, I decided that a couple of spins should be attempted. I did one to the left and recovery was no problem — within 90° of recovery action.

I was going to do another and at this point was beginning a climbing turn, when the engine suddenly quit without warning. There was no sputter, no engine instrument indications, or anything. My early flight training came into play almost automatically, and I punched the nose down to glide speed — 120 IAS — and did everything I could to get the engine restarted. The electric boost pump was on, the mixture was rich (I cycled it a couple of times to make sure), mags on (cycled to make sure), fuel on — everything in the cockpit was in order. The engine had failed at about 4,000 AGL and I had initially pointed the airplane back toward the airport before fooling with the cockpit items. It became obvious immediately, however, that there was no way I was going to make the airport.

It now really began to dawn on me that I was really going to have to put this airplane down in a field. With the heavy weight — full tank — and the prop in full low pitch, the airplane was rapidly falling out of the sky, and I decided selection of a field must be made as soon as possible. Complicating the fact were high-power lines running east and west, and the lack of any real good field to put it down in.

Thus, I initially selected an east-west road which looked rather clear of obstructions. I turned east and set myself up on a downwind, to make it as much like a normal landing as possible. Considering the fact that this was my first approach in the airplane, I thought I was leaving myself plenty of altitude to play with to set myself up for an approach to the road. Initially, I had 2000 feet AGL on downwind. By the time I turned base, I had 1200 feet and 120 mph.

After turning base, two more factors complicated matters. First, there was a telephone line running down the north side of the road, and I would have to be careful on squeezing it in. Next, there were wires crossing it. Last but not least, I did not have the excess altitude or airspeed I would have liked.

Rather than suck it around and possibly high-speed stall the airplane trying to squeeze it onto the road I elected to put the airplane down in a field just adjacent to and south of the road. This meant that I would only have to make about a 60-70° turn to final, rather than a full 90°, and in this way, I would have enough altitude and airspeed to make it. My flight instructor (who happened to have been my Dad, too) often told me, "Once you select a field, stick with it". However, if I had done this in this case, I probably would not be writing this article.

As you may have guessed, however, the field had a crop of 3 foot high wheat in it, and right after the airplane's landing gear touched it, the airplane rapidly turned over on its back. I got out as quickly as I could, which was a bit of a problem, and got some distance between me and the airplane. The engine was cooled down and little fuel was leaking out, however, and I tried to get my heart to slow down, after I said a few choice words to myself about bending someone else's airplane. I was sick and upset that I had been responsible for this.

The police arrived shortly thereafter, and phone patched me back to Fond du Lac Airport. Jim Lacey and Don Muzzeroll arrived shortly, thereafter. Both Jim and Don were of tremendous moral support at that moment when I needed it most.

Jim, George Anderson of FAA, and Jim Osborne came out later and tore the engine down to find the cause before they removed the aircraft from the field. The alternate air box, mounted on the fuel injector, had a small spring loaded door on the side — like some Bonanzas — which would open in the event of blockage of the main air intake. What had happened is the door hinge had worn through and the door came off, blocking the air to the engine and subsequent engine stoppage. Engine suction kept it in place.

The lesson from this accident is that proper maintenance and design will keep you from having to put a little airplane in a field, when you least expect it. However, it is also true that a good 100 hour inspection might not have uncovered this problem. Good design is also essential.

My thanks go to all the IAC members who gave me their support following this accident. I really needed it.

If the engine just had some air . . .

by
Chuck Dixon, IAC 1549
508 Pine Circle
Peachtree City, GA 30269

I lost an old friend recently, my PJ-260 N2800Q. We parted company March 9, 1975 over the Gulf of Mexico while performing my airshow routine for "Aviation Days" in Venice, Florida.

I would like to reconstruct for you my feelings and thoughts of the events leading up to the loss of my PJ, as they occurred.

We were about half way through my routine doing an inside-outside Cuban Eight — I was inverted on a 45^0 down line waiting for 160 IAS in order to push up over the top. Just prior to reaching 160 IAS I noticed a slight buffet that progressively got worse. I tried to push and roll at the same time without success. There seemed to be no aileron control at all. I had plenty of altitude by now so I split-s'ed out. As the nose came up over the horizon, the aircraft was shaking so badly that I was afraid the whole plane would come apart. However, with the power off and in a nose high attitude, the PJ was slowing rapidly and it seemed as though the shaking was lessening somewhat. Just as I was beginning to think I had it made, the left aileron exploded and jettisoned itself from the plane, taking part of the left wing with it.

There is no way to explain the feeling I had when I saw the aileron and part of the left wing go.

The PJ went into an immediate left bank of about 40 degrees. Most of the buffeting was gone by now and I thought I should be able to fly the plane. It didn't take long to see I was fighting a losing battle. I had full opposite control but was still unable to make the plane respond. I tried to loosen my belts with one hand and fly with the other. That didn't work, so I had to let go of the plane and physically look for my belts to release them. When I did this, the plane nosed over and headed straight in. My only thought at that point was that I needed to hurry but had no time for mistakes.

Fortunately, I found the belts quickly, released them, and dove overboard. Remembering the advice of a friend, as soon as I was clear of the plane, I pulled the "D" ring with both hands. This same friend had also told me that I wore a parachute too loose. His point was well proven as I felt for the shoulder straps and realized the right one had fallen off. I locked the right shoulder strap in with my right elbow and grasped my wrist with my free hand. Almost immediately, the pilot chute came streaming out from under my legs. I don't recall any feeling of relief or great joy at seeing the pilot chute, but rather a feeling close to euphoria. This illusion ended abruptly as the main chute opened with such authority that I was afraid of being torn out of my harness. I caught a glimpse of the PJ going straight into the Gulf some 20 to 25 yards off to my left. It disappeared completely under the surface. Almost instantly thereafter, I hit the water totally unprepared. I quickly came to the surface and had no problem staying afloat. The shoulder straps came off easily, however, I did experience some trouble getting free of the leg straps. Had I remembered my quick releases, it would have made the job somewhat easier.

An Army helicopter arrived within minutes. Seeing that I was all right for the moment, they returned to shore to unload some men. Upon returning, Randall Richter, an Army warrant officer, jumped in the water to aid me. At this point, I needed his help because the hovering copter caused some disturbance on the water, so that I had swallowed some sea water. They lowered a rope to us but we were unable to board the helicopter this way. I noticed a fishing boat headed our direction and swam over to it. This man helped us in and then helped to pull in the parachute.

I can't remember how long I was in the water and witnesses varied in their opinions, ranging from 8 to 20 minutes. However, recalling that my wife had recently described to me a chapter from the book "Jaws," it seemed more like 2 to 3 hours.

In retrospect, I guess I could Monday morning quarterback from now on. All in all, everything worked out well with the obvious exception of the loss of my PJ. My wife hasn't said so yet, so hopefully there will be a Stephens Akro in my very near future.

I do have some suggestions for anyone caught in the same predicament:

1. Use a Security chute (I believe it saved my life).
2. Strap it on tight. I mean tight!
3. Remember the quick releases on your harness.
4. Use your chute's air bladder if it has one, for flotation.
5. Read the 3-part article in *SPORT AEROBATICS*, "Knowing Your Equipment," June, July, and August, 1974 issues.
6. Practice getting out of your machine. Phil Beale, the FAA monitor, said I was between 300 and 500 feet when I got out and that the chute opened at about 50 feet. Obviously, I was very lucky. I should have been able to get my belts off with one hand and probably could have if I had practiced it that way.

(Editor's Note: We are very happy that Chuck got out of his airplane without any harm to himself or anyone else. We are also glad that the Security Parachute worked well and the articles in SPORT AEROBATICS *were helpful. These articles are presented so that someone else may learn from an individual's experiences. As of this writing, the cause of the aileron separation from the aircraft is undetermined. We will advise you of the cause when such information becomes available.)*

(Photo by Verne Jobst)

Chuck Dixon and N2800Q . . . before the fall.

Cobras In The Cockpit — Bombs In The Bellcranks!

by
Chuck Mann
3544 Windrest Drive
Memphis, TN 38116

Have you been locked up lately? I mean really locked up tight — like, "There I was at 1500 feet on a diving inverted 45 line in an outside half-cuban and my ELEVATOR IS JAMMED! Even with both hands I can't budge it — up or down!"

As your final moments slip away, what thoughts race through your mind? Can I break it loose and recover? Can I possibly bail out and make it? How big will the splash be when I hit? Did I inspect every vital spot in my airplane before this flight? Could that screwdriver that I lost possibly be back there in the control system? Or the ballpoint pen that fell out of my pocket in that last Immelmann? Or a loose sheet metal screw — or a comb — or that map I thought blew out of the cockpit?

WHEW! Thank goodness that was a nightmare from which I awoke — or was it? Take a look at the photo. This bunch of JUNK was found in the fuselages of contestant airplanes at the Rebel Regional contest after one competitor had an inflight elevator lock during practice. Bill Thomas got us going on a tail inspection!

Could some of these be in your bellcrank now? Every contestant said, "I just had an annual". Or, "I know mine is clear as I inspected it just last week. Some of these were the most surprised to find these "bullets" in their tail.

Let's RE-READ and HEED Dave Hilyard's awesome article in the December '74 *SPORT AEROBATICS*.

Loose objects inventory (shown in photo)

Block of wood (3/8 x 1 x 6)
Rubber earcup from headset
Ball of string
2 ballpoint pens
2 ballpoint pen caps
Gob of safety wire
Plastic harness strap
2 sheet metal screws
Coke bottle cap
Pop can pull tab
Paper clip
Aircraft bolt
2 helmet straps
Gas ticket
Parachute packing card
Pair of tweezers
Piece of plexiglass
Greasy rag
Knit shirt

(Photo by Tom Carter)

THE MORE I LOOKED . . .

by Bill Oprendek

After experiencing two engine failures of unkown origin in 1974, and having the desire to update my airplane in general, I decided to completely overhaul my Pitts during the winter. The engine and airframe had 304 hours total time.

First came the engine. Believing I had a few exhaust valves hanging up, I decided to pull the jugs, and send them to be reconditioned. All the exhaust valve guides were found to be bad.

While the cylinders were off, I split the case to see how the bearings were holding up to zero oil pressure, caused by certain aerobatic maneuvers. The rod bearings, the center and rear main bearings were like new. However, the front main bearing had a few score marks on it, but after a light polishing, the crankcase was OK.

The engine was very far out of balance and as it has been on the airplane since new, I must assume that is how it came from the factory. The tappet bodies were replaced, the engine balanced and magnafluxed, and new bearings and rings were installed. The engine was carefully reassembled.

The engine has always been a little rough, and this excessive vibration caused the carburetor throttle shaft to have quite a bit of wear. Also two diaphragms in the carburetor were found cracked. I feel these carburetor problems caused the engine failures.

Next came the airframe. When the engine was pulled, I found the rear engine case was bottoming on the lower engine mount pads. The engine mount was cracked at the cross joint, just behind the sump. This could have been caused by the engine bottoming on the mount. I would like to point out that the crack would not have been found if I had not sandblasted the mount, allowing oil to seep from inside the tube to stain the cracked area. The crack was welded and a finger patch was added to the cross area.

The next item found was on the right landing gear leg. Apparently as the gear worked, a screw, which projected through the firewall, was rubbing the gear top piece, just outside the bungee cord area. The screw wore completely through the tube. This was entirely my fault, and I bring it up to point out no matter how careful you are these things can happen.

We inspected the entire airframe and the only other crack was in the horizontal stabilizer forward attach tube. The crack started at the 3/16 inch hole used to locate the stabilizer. I believe this is the same area that caused a problem in the two-place Pitts. This area must be watched very carefully.

There were cracks in the oil cooler, sections of the baffling, and other minor areas, but these are to be expected. About all that can be done on these items is keep an eye on them and repair as necessary.

Several other areas to watch carefully are the lower wing attach fittings, broken nose pieces on the leading edge of the wings, the forward upper wing attach fittings, the control system torque tube, and the crankshaft flange.

I want to point out that all of the problems I found were caused by very hard aerobatic flying during the past three years. I believe the Pitts is the finest aerobatic aircraft flying, but no matter how strong an aircraft is, things are going to break with constant high "G" loads.

I'm sure the majority of pilots flying competition aerobatics maintain their aircraft very carefully, however, I can't put enough emphasis on the need for extra caution when dealing with an airplane put through the extremely hard usage that a competition aircraft receives.

This article was written with the intent to help other pilots spot trouble before it becomes serious. The next time you inspect your aircraft, remember who will be strapped to the seat. Let's keep it safe!

(Editor's Note: Bill summarizes very well the type of problems encountered with a highly used aerobatic aircraft – and there are several lessons to be learned from his article. As always, IAC suggests that during the winter off-season, take the time to thoroughly inspect your bird and make sure that it is in top shape. It will be well worth the time.)

PITTS S-1S AND S-2A AIRWORTHINESS DIRECTIVE

On August 10, 1976, the Federal Aviation Administration issued an Airworthiness Directive applicable to all Pitts S-1S aircraft with serial number 1-0001 through 1-0043 and S-2A serial numbers 2001 through 2122.

To prevent partial loss of rudder control due to control cable slippage resulting from improper swaging of the Nicopress sleeves, accomplish the following:

A. Within 10 hours time in service after the effective date of this airworthiness directive or by September 13, 1976, whichever occurs first, inspect the 3 swaged grooves of the Nicopress part number 18-3-M sleeves in the rudder control system to assure that the major axis diameter is between .348 and .353 inches. The Nicopress "go" gage for this sleeve is part number 64-CGMP and has an opening of .353 inches. The correct opening for checking these sleeves is marked "M". The Model S-2A airplane has a total of 8 sleeves to be checked and the Model S-1S has 4. If improperly swaged sleeves are found, before further flight, reswage to the proper limits or replace as required.

B. Until compliance with paragraph A is accomplished, acrobatic flight (including but not limited to maneuvers delineated in the respective FAA Approved Airplane Flight Manuals) is prohibited and prior to further flight a placard must be installed on the instrument panel in full view of the pilot which reads: "ACROBATIC FLIGHT PROHIBITED".

C. Upon compliance with paragraph A, the placard required by paragraph B may be removed. This amendment becomes effective August 20, 1976.

The AD number is 76-16-08.

CITABRIA AND DECATHLON

Recommendations based on a review of International Aerobatic Club Malfunction & Defect Reports by IAC Chapter 1.

There are nine problem areas each reported by two or more IAC members, that are not covered by Bellanca/Champion service letters or FAA A.D.s. These are as follows:

Malfunction or Defect	Cause	Corrective Action
1. Fuel line chaffing on windshield attach screws		Bend line away from screws
2. Aileron bending or warping	Excessive aileron deflection at high speeds	Install 1974 or later ailerons — (extra diagonal brace was added in aileron in 1974)
3. Maule and Scott tailwheel chattering	(Probable) loose "U" bolt which holds tailwheel springs	(1) Tighten "U" bolt (2) Or replace rubber pad between frame & tailwheel springs with new aluminum pad.
4. 2nd thru 4th ribs from wing root distorted, fractured and separated from spar attach point. On 1968 and earlier models.	1968 and earlier models had .020 ribs. 1969 and later had .032 ribs.	On early models install doubler kit — available from Bellanca
5. Seat belt attach bracket broken at weld.		1974 and later models used heavier bracket in a different location — modify earlier models accordingly. Also, use **two** seat belts.
6. Cowling doors blown open and torn off on 1973 and earlier models.		Cowling redesigned on 1974 and later models. Install extra Dzus fasteners (one or two more per door) on early models.
7. Throttle cables broken at attach point in throttle quadrant.		Install 1974 or later throttle cable. (Bellanca changed suppliers of throttle cables in 1974 and there are no reports of breakage since then.)
8. Starter drive end wearing into cowling on 1973 and earlier models	Lack of cowling-to-starter clearance and cowling deflection under air loads.	Cowling and exhaust system was changed in 1974.
9. Emergency door release inoperative	Rust on door quick release hinge pins.	Basic maintenance and preflight inspection.

(Thanks to Mr. Norman Haglund of Bellanca Aircraft for his help and suggestions pertaining to the above problems.)

FUEL STARVATION

Many of the IAC Malfunction & Defect reports that have been submitted concern fuel system problems. One of the latest reports received involved a homebuilt Pitts S-1 equipped with an O-360 Lycoming. Below are quoted some of the pertinent passages from this M & D report.

"Fuel tank was slightly less than half full. I had just rolled from an inverted position to upright and directly into a hammerhead. The flop tube apparently ingested an air bubble and the fuel pump lost its prime. As soon as the engine quit I applied full left rudder but without power was unable to accomplish a full hammerhead and the aircraft backslid before assuming a nose down position resulting in an excessive loss of altitude, also allowing the propeller to stop turning. Recovery was made at approximately 800 feet AGL . . . had to accept a small clearing . . . and the aircraft went over on its back upon landing. The total distance traveled after ground contact was 33 feet. I came out without a scratch and there is no structural damage to the aircraft outside of the landing gear, some broken ribs, leading edge skin on the top wing, some belly skin damage — the spinner, cowling, and airscroops were damaged. The engine, carburetor, air cleaner, and engine mount were undamaged and the propeller was not scratched.

"The obvious answer to the problem is of course to keep the tank topped off while doing aerobatics.

"Another thought I might inject is that I use a Thompson pump for the fuel pump and a diaphragm pump for the smoke. I think that the other way around might be better as the diaphragm pump is self-priming and the gear pump is not."

Since this M & D reads very similarly to other reports received we thought it might be pertinent to get Curtis Pitts' comments on the problem. After a qualifying statement to the effect that there was really not enough information submitted to make a **positive** statement, Curtis made these remarks:

"There is a possibility that this machine was operating on the border line of having a fuel vapor lock and when the pressure was reduced on the inlet side of the pump, which occurred in the vertical climb due to the necessity to actually lift the fuel from the tank to the pump, vapor lock actually did occur. This is only one possibility.

"To cure the situation, move all fuel carrying auxiliary pumps, fuel filters, sediment bowls to a cool zone aft of the firewall. Excessive lengths of fuel hoses forward of the firewall should be eliminated. Eliminate any vane or gear type fuel pump since they have very poor performance under vapor lock conditions and are not as reliable as the diaphragm pump.

"There should be no problem of fuel pick up with three or more gallons of fuel in the tank."

After a cursory check of the IAC M & D files it is easy to understand why Curtis jumped on the possibility of an incipient vapor lock. The IAC M & Ds show at least six in-flight fuel problems that were contributed directly to vapor lock. To quote from two of these: "Moved boost pump, fuel lines, sediment bowl, fuel valve behind firewall in cool area. Definitely corrected problem." And, "Relocate fuel wobble pump, fuel strainer behind firewall" was listed as corrective action.

It is also easy to understand how the pilot who submitted the M & D surmised the problem might be an ingestion of an "air bubble". Contemplating the gyrations performed by several gallons of gasoline in a large container that is rolled, looped, and snapped while being subjected to a wide range of "G" forces sure brings to mind the possibility of aerated fuel, i.e. "suds", and the possibility of a flop tube not being always submersed in "solid fuel".

Whatever the primary cause of this fuel starvation problem was (vapor lock or air bubble), both the gentleman submitting the report and Curtis Pitts believe that a diaphragm type fuel pump would be the best choice.

Whenever problems such as the above fuel delivery problem arise they also bring with them a raft of questions — e.g., what is the "best" type of fuel pump, what is the optimum fuel line diameter, what about fuel filters and what is the pressure drop across the filter, flop tube size and material, cooling air blast tubes, etc. The original problem and all the subsequent "questions" are always subject to a whole bunch of conjecture and hangar flying when indeed they should be subjected to a whole bunch of testing. Carburetion/injection and fuel systems are all complete sciences in themselves. It would be great to do some A-B-A type testing, where "A" is your baseline, a test run with your original setup, and "B" is the same test but with a component or adjustment change. The second A in A-B-A is a rerun of the first test to check the validity of your test — a check of repeatability. This type of testing, while being super good, is time consuming and costly — and perhaps questionable if you consider setting up inflight engine failures for the sake of repeatability.

Another approach, and one at which IAC could excel, is to pool **everyone's** experience on the subject, and then draw conclusions as to what works and what doesn't work. The above-mentioned vapor lock reports tell you that keeping fuel system components cool is not only good theory but works in actual practice. This is a good example of pooling of information.

With complete disregard for redundancy we will mention for the third time that IAC reports show that fuel delivery systems continue to be problems. Therefore, we are asking **all** IAC members to send in a complete description of their fuel system and comment as to the operation of the system. Please include as much technical data as possible — pump models, line sizes, etc. We would like as many reports as possible, both positive and negative. Possibly through pooling **everyone's** experience we can make some recommendations for a "bullet-proof" fuel system.

Please send your fuel system comments to:

Fred L. Cailey, Chairman
IAC Technical Safety Committee
1004 Woodland Avenue
Batavia, Illinois 60510

If we police ourselves, i.e., find workable solutions to common problems, we will insure ourselves continued freedom in our sport and make sport aerobatics safer and more fun. And really that's what IAC is all about.

ONLY AN INCH AND A HALF BEHIND

by Bill Walsh

A good bet right now is that half of our readers will not finish this article when they determine the subject is about the importance of the center of gravity. To those who "know it all" and do stop here, we may someday send condolences to the next of kin.

Most of our airplanes are very forgiving of loading and occasionally a sloppy or faulty technique. The experimental aircraft builder is usually a superb craftsman. Generally a competent pilot. He has lovingly constructed a beautiful machine, frequently capable of any known aerobatic maneuver. His first flights are all very conservative; then, one day he watched a buddy rolling, snapping, and otherwise performing all manners of flying feats. Our hero's palms begin to itch, he looks at **his** sleek bird, his heart pounds as the excitement of participation mounts — a borrowed parachute and the roar of the engine and the little beauty leaves the runway and claws for altitude.

Our pilot is mildly bugged that he must hold a little more forward pressure on the stick than he had noticed on the previous flights. He shrugs it off and makes a mental note to add a few more washers to raise the leading edge of the horizontal stabilizer.

The first few slow rolls leave something to be desired. The bird feels sloppy in the inverted position. Oh, well, a little more practice. Now to try an easy one — nice dive, back on the stick for a half loop, hold her inverted at the top — GOOD GRIEF! What happened? The little bird snaps, does an octoflugeron (an unidentifiable maneuver), and now she is spinning flat and inverted. All recovery attempts are ineffective, thank heaven, he remembered to get a chute. Punch out.

A few moments later, he sadly contemplates the remains of his pride and joy which dove straight into the terra firma, having recovered from the spin right after he left it — darn (or expletive deleted). After sorrowfully hauling home the remains of his broken bird, he searches his mind to find out WHY? THEN someone suggests that maybe he had a weight and balance problem.

Now to the figures — here we are — our empty weight was 703 pounds. We computed our EWCG to be −3" datum, leading edge lower wing. We used our formula

$$CG = \left(\frac{R \times L}{W}\right)$$

where D = the horizontal distance from the datum to the main wheel weighing point; L = the horizontal distance from the main wheel weighing point to tail wheel weighing point; R = the weight at the tail weighing point; and, W = the weight of the aircraft at the time of weighing.

Our hero checks the weighing figures and finds that he had 65 pounds at the tail point, which was 131.5 inches from the main wheel weighing point, thus:

$$\frac{65 \text{ pounds (R)} \times 131.5 \text{ (L)}}{703\text{" (W)}} = \frac{8547.5}{703} = 12.16 - 15 \text{ inches}$$

(D) and the result -2.84 inches datum — a small error, .16 inch off — no sweat!

Now we compute our load — in goes the oil — 15 pounds at -28.0 inches — fill her with fuel, 90 pounds at -5.0 inches. We must be accurate now so our hero does what he hasn't wanted to do for a long time — weighs himself — then the chute — can this be real! 230 pounds at station +23.0 inches, he hurriedly figures:

EMPTY WEIGHT 703 pounds X -2.84 = -1996.52
FUEL 90 pounds X -5.0 = - 450.00
OIL 15 pounds X -28.0 = - 420.00
PILOT + CHUTE 230 pounds X + 23.0 = +5290.00
GROSS WEIGHT ALLOWED - 1050 pounds - OK
GROSS WEIGHT AT TAKE-OFF - 1038 pounds - OK
ALLOWABLE C.G. LIMITS — −4 inches to +1 inch datum — Hmmm!

So let's find out —

MOMENT IS +2423.48 DIVIDED BY WEIGHT (1038) EQUALS C.G. +2.335 FUEL BURNOFF MOVES THE C.G. AFT SLIGHTLY MORE.

Was this critical — was this the reason no recovery could be made? What could have been done to prevent this situation? The answer is easy — make a precomputation to determine which variable could be changed. For this airplane, weight could be added to the nose or the cockpit placarded for a maximum weight, about 165 pounds, pilot and chute.

The moral — PREPLAN — an inch and a half could kill you.

NO CHUTE — NO ACRO

by Earl R. Allen

I know most aerobatic pilots always wear a parachute when practicing. This short story is for those of us who don't. While practicing for an upcoming contest, a friend of mine — Ed Dennis — was flying my Pitts with a borrowed Security chute. I should note that both Ed and myself have practiced many hours before without a chute. After all, we all know you can't hurt yourself in a Pitts. Getting back to my story — Ed was about 8,000 feet and entered an outside loop. He got a little slow on top so tried a half snap to the inside position so as to complete the second half of an inside loop but he was already too slow and ended up in a flat inverted spin. To make the best of it he decided to go three turns and recover. After all, two other Pitts were flying with him and he didn't want them to think he blew a maneuver — especially since it's impossible to do in a Pitts. Well, anyway, after three fast turns, he tried to recover and the aircraft didn't seem to respond so after what seemed an hour but was actually about 20 seconds and approaching 2,000 feet AGL, he decided to punch out and explain to me later what happened to my airplane. As soon as he let go of the controls and reached for the belts, the aircraft came out of the spin and was flying again before he had a chance to get out. Now baffled and a little shook up, he climbed up to 10,000 feet and tried about five more outside spins all of which the aircraft had no problem recovering from. Now, then, the only thing we could figure out about the incident was that Ed was aggravating the spin the whole time rather than taking time to use the normal recovery process. The point I am trying to make is even though Ed didn't use the chute, it did in a sense save his life and my aircraft. If he hadn't been wearing it, he may have well aggravated the aircraft into the ground.

I now have a placard in my Pitts, **No Chute — No Acro.**

TAIL SLIDES AND FORCED LANDINGS

by Sam Burgess

While progressing in one's aerobatic career, you will eventually be doing tailslides and the intent of this article is to offer a word of caution — specifically, always have a landing strip under you. This is a good idea for any aerobatics.

As you ease into the vertical climb, the throttle is closed and the possibility of having the engine die is perhaps greater than in any other figure known to Count Aresti.

When the aircraft slides backwards, the ram air to the carburetor is nil and the reverse flow of air over the prop tends to slow it to a speed where a flat four sounds like an old radial at idle. Things can get real quiet.

A well-known aerobatic pilot once dove the Pitts to well over 200 mph when the engine quit in a tailslide before the prop started turning again. This is not a well-recommended procedure. If the engine fails to start, you have wasted precious altitude and what do you do for an encore?

It has been experienced that if a four cylinder Lycoming 0-360 is set to idle at a minimum of 700 rpm on the ground, the engine will slow to about 500 rpm in a tail slide. Other engines can be set accordingly.

Now, this means that with an increased flow of air over the elevators, you will probably have to slide farther prior to going stick backward/forward. This is what the judges are looking for and you have less chance of losing the engine.

Some may find that their mount then taxies too fast at 700 rpm. So, let some air out of the tires until they bulge a little to compensate and you will realize a bonus in that a Pitts Special becomes a much more docile aircraft on touchdown.

It is therefore recommended that any Chapter seeking establishment of an FAA-approved permanent aerobatic box in your area should insist on locating it over a suitable emergency landing site.

AEROBATICS AND CLOUDS

by Anymouse

Just about every aerobatic pilot has graduated from the "I Learned About Flying From That" experience and finds himself much more exposed to boo-boos while doing aerobatics which could have more serious consequences. I committed one of those boo-boos.

How often have you practiced near a cloud base and actually penetrated the murk for a second or two? This is not only illegal but can have unexpected results. Most maneuvers can be flown momentarily through some cloud but the one you don't want to fool with is a hammerhead.

While in the practice area one day, I was flying like a demon. Everything was going great and I was drawing lines in the sky for nothing less than nines and tens. A lone cumulus had moved across the box and when I pulled up to vertical there it was. It was obvious that before this machine was ready to hammerhead, I would be in it. No sweat, I thought, I'll just go through the motions mechanically by timing and exercising the usual precise and unmatched flying acumen, I will burst out with the ground directly below. Not so, not so.

I came out of the side of that cloud in an inverted spin and it's a good thing I was at competition altitude. Boy, did I zero that one. Even a pigeon can't fly when blindfolded.

So, stay visual at all times when doing aerobatics and you won't be making inadvertent spin recoveries.

THE FORCE OF HABIT

by Ken Larson

The drum type altimeters used by the airlines have two windows on the face of the instrument in which the pilot records the altimeter setting. The left one is in "millibars" and the right one is in "inches of mercury". Pilots flying international routes are used to receiving the altimeter setting in either mb. or in. Hg. depending upon what country they are in, and setting it in the appropriate window.

Pilots flying at jet levels — above 17,500 feet in the United States — must set their altimeters at standard sea level pressure, which is 29.92 inches of mercury. Pilots flying under the United States FAR must call, out loud, this altimeter setting when passing the transition altitude and it is more often than not shortened to an audible "nine nine two", at which time both the captain and the co-pilot set 29.92 in the right window. This becomes a habit, every trip you hear 992 and set it in the right window.

Recently, one of our major airlines had an accident that killed all on board, the official report has not been published yet, but preliminary findings indicate the crew was given, in a foreign country, an altimeter setting of 992, which was in millibars. The force of habit of associating 992 with the right window caused both pilots to dial it in the right window instead of the left without giving it a second thought. The airplane hit short of the runway with the altimeter showing they were still 600 feet high.

Animals are trained by setting up habit patterns and repeating them over and over. If your puppy soils your carpeting and you immediately pick him up and throw him out the window every time, he will learn this pattern and you will have him trained. He will soil your carpet and jump out the window. Not necessarily desirable but the end result of a habit pattern.

Recently, I watched a friend of mine taxi up in his Pitts, he shut the engine down and had his egress pattern down to a science. He was unsnapped and out of the cockpit in seconds. He started at the top, unsnapped the chest buckle of the chute first, then the seat belts and finally the leg straps. Think about that as a habit pattern — if you really get in a hurry someday, do you want your chute unsnapped first?

Rigging Tool For Swept Wing Biplane

(Courtesy of Pitts Aviation)

John Livingston devised this tool to make it easier for his friends to rig their swept wing biplanes. Pitts Aviation Enterprises, Inc. worked out the details to make it useable on both the Pitts S-1S and S-2A.

Refer to the upper right hand portion of drawing no. 41574. When block -4 is in the position shown on the rib profile the tools are used to rig the S-2A.

When movable block -4 is turned to the down position so that it contacts the leading edge of the wing the tool is used to rig the S-1S. When properly used on either the S-1S or S-2A the top edge of the tool is parallel to the wing chord line.

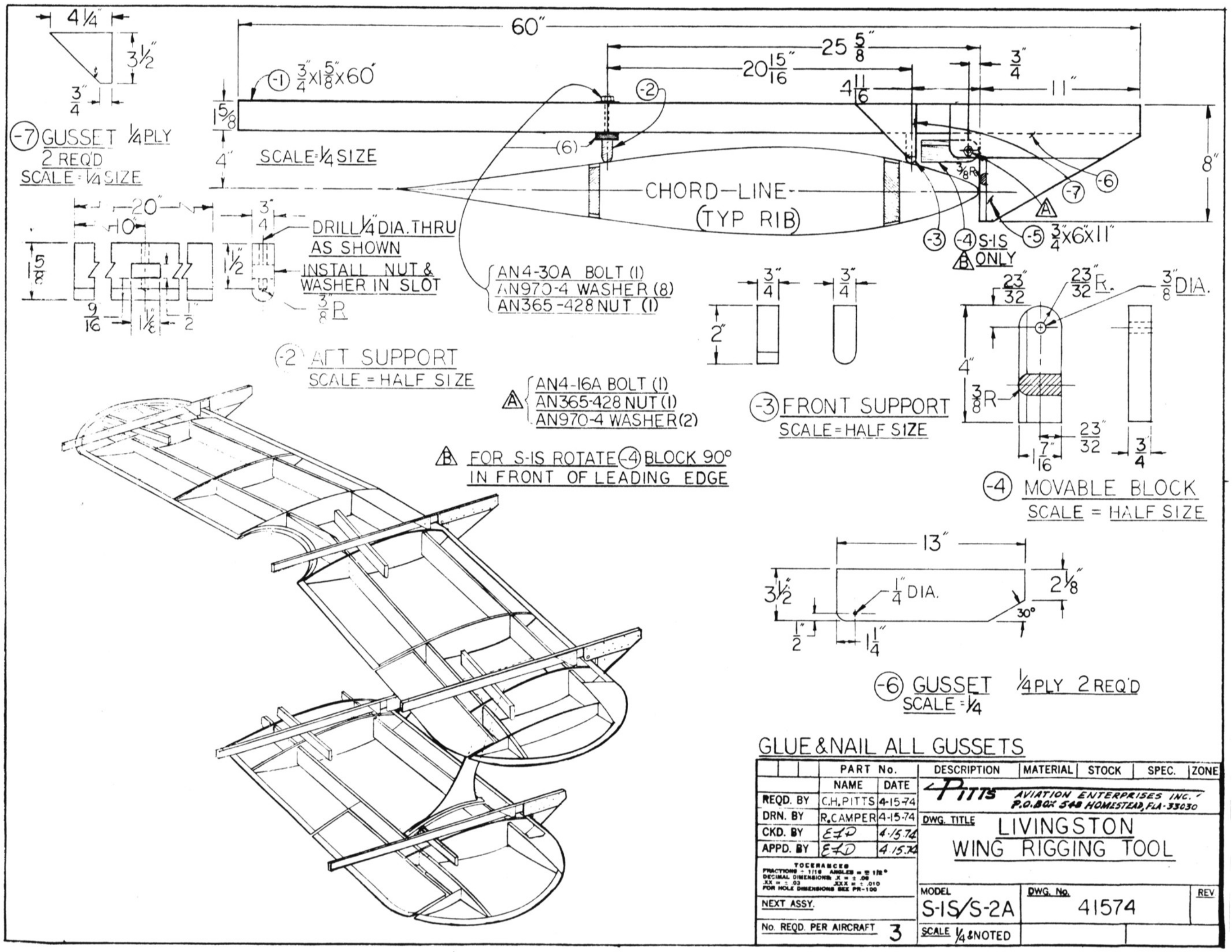
To check the rig of the upper wing proceed as follows. (We assume the wing to be level across the fuselage.) This being the case it is not necessary to level the airplane.

1. Place three rigging tools on the upper wing as shown on drawing 41574.
2. Make sure the tool is parallel to the ribs.
3. Make sure the -2 member is parallel to the rear spar and rests on at least two ribs.
4. Make sure the tool is in proper contact with the wing leading edge.
5. Sight spanwise across the top of the three tools with your eye approximately aligned with the center point of the two outboard tools.
6. If the top of all three tools are in spanwise alignment there is no dihedral in the wing.
7. If the top edge of all three tools are parallel there is no twist in the wing. For this check, all three tools top edge must be exactly parallel. Be very accurate with the adjustment of the wing tip wash in or wash out to accomplish this. Here is where accuracy pays off.

To check the rig of the lower wings place two tools on each lower wing as shown. Follow steps one through five and step seven as outlined above.

Dihedral is fixed by the strut length, therefore, if the upper wing has zero dihedral the lower wing dihedral will be correct.

We will not answer individual correspondence on this subject.



A CLASSIC EXAMPLE

A couple of months ago an IAC Malfunction & Defect Report was submitted which read in part as follows:

"450 HP Stearman. Upper left rear tailbrace wire broke at and in the thread area near the top at the vertical fin during aerobatic demonstrations — (I believe entering a square loop). The part is being mailed to you for examination — pictures enclosed — one showing accelerometer reading pos. 7Gs, neg. 2½Gs, and the other picture is of the tail brace wire position on A/C. Probable cause — high G load and possible defect in wire."

Shortly after the above report was received, the same fellow advised he had a "grapevine report" of another 450 HP Stearman which had suffered a tail brace wire failure in the same location.

A little digging through the IAC M & D files came up with this info on a Ryan PT-22A:

"Broken lower stabilizer wire, rt. side. Break was in the threaded end at the fuselage. Broke in flight. Majority of these wires are from WW II vintage, rust, pitting and fatigue are setting in."

Now there were three reports of broken "tail brace wires" — more correctly "streamline tie rods". The cause? The hangar B.S. sessions came up with several theories. The most common one being that the threads are **rolled** on the streamline tie rods and since the tie rods in question were pretty dated, perhaps some time or other someone chased the threaded portion with a die which cut a sharp "V" at the bottom of the thread, creating a stress riser and fatigue point. This sounded pretty good until checking an old (March 1969) **Sport Aviation** article entitled "All About Streamline Tie Rods" revealed that the tie rod threads are **not** made by the rolling process but are **chased** — i.e., cut, similarly as done with a die. Another good "hangar solution" said that the round tie rods are stronger than the streamline tie rods. Further checking revealed that this is not always true and in fact on the size used on the Stearman first in question, the streamline rod is stronger (higher tensile strength) than the round tie rod.

After getting through the "amateur hour", the "pros" (i.e., a tie rod manufacturer, Macwhyte Company, Kenosha, Wisconsin) were contacted. Since the IAC member who submitted the Stearman M & D Report had enclosed the broken tie rod — we were in "fat city" — the Macwhyte people agreed to look over the broken rod. Below are the pertinent passages from Macwhyte Company's report:

"The tie rod in question has been referred to our metallurgical department and the following are their conclusions:

1. Failure of the tie rod occurred by Transverse (plane-strain) cracking that originated in the thread, approximately ⅝" from the shank.
2. At failure, the tie rod showed both shear of the thread and necking-down at the bolt end of the thread. Diameter of the threaded section near shoulder of the tie rod measured .191", whereas diameter at fracture measured .187".
3. Failure occurred at the thread root which is normal for a threaded section being the weakest point in any threaded configuration.

Conclusion:

This is a classic overload fracture. The microscopic evidence of necking, together with the dimpled fracture zone, suggests that the basic problem is one of under design — that is, inadequate load-carrying capacity and insufficient consideration of stress concentration at the threads."

Skipping one paragraph which is rather inconsequential, the Macwhyte letter goes on:

"Concerning other questions raised in your letter, this is to confirm our phone conversation in which we stated that we know of no "air worthiness directive" applying to tie rods; however, all of the causes you have mentioned such as vibration, rod being too loose or too tight, etc., could set up stress risers which could cause the rod to break."

As soon as the Macwhyte Company's analysis was received, a copy of it was forwarded to the IAC member who got this whole ball rolling — the 450 Stearman owner. Armed with this professional advice he can: (1) cut back on the "G" loads, (2) install bigger tail brace wires, or (3) do both.

Classic example? — Definitely so. The Macwhyte metallurgists thought it was a classic example of overload fracture, but also it was a classic example of super good reporting by an IAC member — a complete description, pictures, and even the broken part. It also was a classic example of sincere but erroneous "hangar information" and how professional advice from knowledgeable people in the aviation industry can help make our sport safer and therefore more enjoyable. But best of all it was a classic example of how belonging to the "IAC Brotherhood" can "bring it all together". Now, as with any good example, all everybody has to do is follow it.

(NOTE: A special thanks is due Mr. Ray Stukel of the Macwhyte Company, Kenosha, Wisconsin. Thanks, Ray.)

COLD WEATHER AND INVERTED OIL SYSTEMS

Last winter a Lycoming powered Bellanca Decathlon equipped with a Christen 801 series inverted oil system encountered a loss of oil pressure while it was being flown in sub-freezing temperatures. The engine was removed and returned to AVCO/Lycoming for examination. When the sump was drained, more than one point of water was found in the oil and therefore there is some speculation that the oil pressure loss may have been due to ice formation/blockage in the oil lines or in the inverted oil system components.

First we asked Frank Christensen of Christen Industries for his opinion and help. Frank stated he was generally familiar with the incident but had not had the opportunity to examine the engine or the inverted oil system, and since the information he had received was somewhat vague and lacking in detail he was unable to draw any positive conclusions. Frank then went on to state:

> "Certainly it is possible for ice to form in inverted oil system lines, and in some cases to prevent proper function of inverted oil system valves. This is particularly true if weather conditions are conducive to substantial moisture condensation, and if the aircraft is not equipped for cold weather operation or is not warmed up properly prior to use.
>
> "Our product manual for the inverted oil system indicates that operation in cold weather requires a thorough engine warm-up and that the aircraft should be alternately flown upright and inverted for brief periods to circulate warm oil through inverted oil system lines and components until they reach normal operating temperature. The manual also indicates that the aircraft oil cooler may require modification for cold weather operation to assure that oil can reach and retain normal operating temperatures.
>
> "In summary, we recommend that users of the Christen inverted oil system read thoroughly the product manual provided with the system. They should be completely familiar with the function of the system and the proper operating procedures. Under cold weather conditions, proper engine warm-up is absolutely essential. Once warm-up has been accomplished, the performance of the inverted oil system should be tested with brief periods of inverted flight to verify normal function prior to the commencement of aerobatic maneuvers. Modification of the engine oil cooling system may be required to assure normal performance under cold weather conditions."

Next we asked AVCO/Lycoming for their comments and ideas regarding this problem and forwarded to them a copy of Frank Christensen's letter. Chief Engineer S. T. Jedrziewski replied as follows:

> " . . . We are very much in agreement with the comments and recommendations made by Frank Christensen in his letter to you, Reference 2, and also feel this information will aid a great deal in eliminating this problem."

So, next time you get airborne and the temperature is such that the water is getting kind of solid, keep the above incident and recommendations in mind — it may make life a little easier for you and your equipment.

(NOTE: All IAC members owe Frank Christensen of Christen Industries and S. T. Jedrziewski of AVCO/Lycoming a special thanks for their interest and concern. All Decathlon owners should check the type of inverted system that you have in your aircraft as not all are equipped with the Christen system. Earlier models had a "flapper door" system and this is the one described in the Owner's Manual. If your aircraft is equipped with the Christen system, you should obtain a Christen Manual and familiarize yourself with the system and its operation. Bellanca is presently in the process of updating the Decathlon Owner's Manual.)

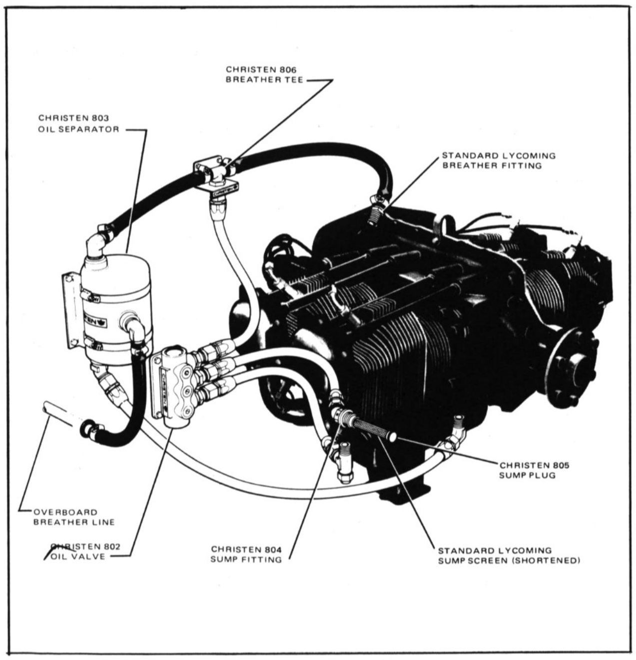


Figure 1-1. Christen 801 Inverted Oil System Component Identification.

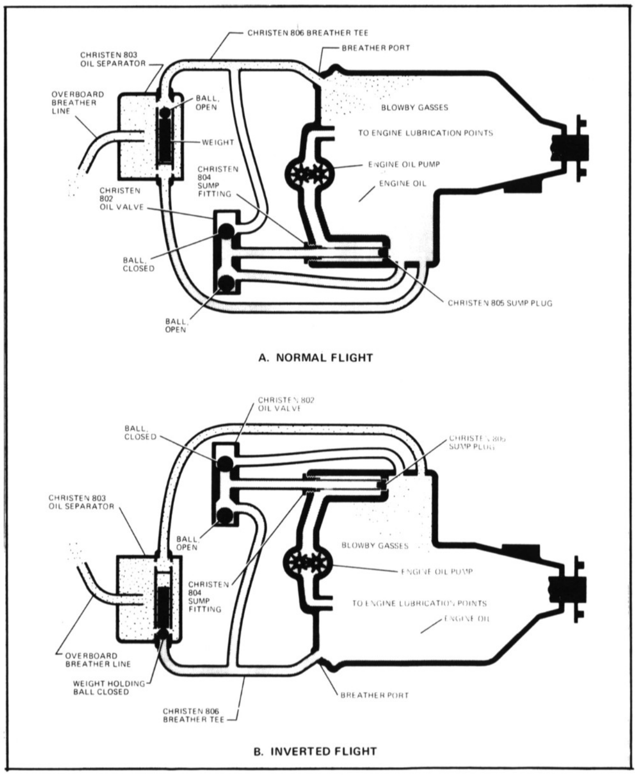


Figure 1-4. Oil Circulation Using the Christen 801 Inverted System.

" . . . MOST NEGLECTED . . . "

" . . . The two most neglected items of all: YOU and your PARACHUTE." Verne Jobst made this statement in the President's Forum column in the April 1976 issue of **Sport Aerobatics**. Verne was reminding all of us to check over the equipment before going out and enjoying our favorite sport — aerobatics.

Let's pick up on one of those items — your **PARACHUTE**, and in particular, Security 150 Parachutes. At a recent IAC meeting a comment was made that when repacking a Security 150, a rigger had noticed that the chute had been previously repacked incorrectly and possibly would not have opened. While checking this out several very interesting things came to light.

First, the original problem. The parachute in question had accidentally opened at an IAC aerobatic contest but was repacked immediately at the contest site by a certified rigger who was supposedly familiar with the Security 150 parachute. There was no Security 150 Parachute manual available. At a later date when this chute was again being repacked the master rigger noticed that the knots on the locking cord, which should be on **top** of the "S" hooks, had slipped under the "S" hooks and beneath the grommets on the back flap. Although these grommets have radiused edges, it might have been possible for the knot in the locking cord to be trapped beneath the grommet thereby holding the rear flap of the parachute closed.

Interesting, no? Well, the beat goes on. While checking with Dan Abbott of Security Parachute Company regarding this incident, Dan related this story: A Security 150 Parachute had been returned to the Security Parachute Company for some work and a repack. When the Security Parachute people pulled the ripcord to open the chute — nothing happened. And as a matter of fact, even when they started "digging" into the chute they had a hard time getting it apart. Some **certified parachute rigger** had modified the Security chute by installing a "kicker plate" — but the installation was such that it was impossible for the parachute to open. Dan said they found this same fellow had "modified" five other Security 150 Parachutes in the same manner — and "repacked" them twice since the installation of the kicker plates. Obviously, the "repacks" were just "pencil packs".

While relating some of the above information to one of the IAC Gurus, another scarey parachute story came out. Recall the first parachute problem mentioned above really started when the chute "accidentally" came open. Well, one of our foremost pilots had a Security 150 Parachute "open up" inside his open cockpit Pitts while he was flying aerobatics. Fortunately, the parachute stayed inside the cockpit but it doesn't take imagination to see that you would be in "deep serious" if you were flying in an open cockpit aircraft and the parachute canopy got out of the cockpit and deployed.

Please note that we are not "putting down" Security 150 Parachutes. Since I am **not** a parachute person, I talked to **several** riggers about the above problems and Security 150 chutes. **All** of the riggers I talked to said that Security Parachute Company products were high quality items and all felt that the Security 150 Parachute was a very good chute. But, **any** piece of equipment needs inspections and proper maintenance — parachutes included.

Below are a couple of **positive** things we can do to see that our parachutes are maintained in good working order.

(1) Just as you pre-flight your plane, you should pre-flight your parachute. On Security 150 chutes first open the flap on the outside of the back and check to see that the knots in the locking cord are on **top** of the "S" hooks — or at least see that they have not slipped beneath the grommets. Secondly, open the flaps on the inside back of the chute and check to see that the ripcord pins are through the other end of the locking cord. (If you have the parachute in front of you, the above description will make a lot more sense.) Also check for any wear/abrasion on the harness, pack, etc.

(2) When you have your chute repacked, bring it to a reliable rigger and **bring your Security 150 Parachute Service and Maintenance Manual with you**. Your rigger may not have this manual readily available and — if any questions arise you can't beat having the manufacturer's manual handy.

(3) When you bring your parachute in for a repack, ask the rigger if you can pull the ripcord and open the chute right then. This tells you something about how the chute was packed last time and definitely precludes any "pencil packing". If your rigger hedges on this point for any reason, you may want to find somebody else to pack your parachute.

(4) Do not have your parachute modified with the latest "trick of the week". Security 150 Parachutes work just fine the way they are. In the latest Security 150 service and maintenance manuals a special note has been added warning against making modifications to the chute.

(5) While working on the above problems, a couple of other related items came up:

  (a) **Practice** (mentally or physically) getting out of your aircraft in an emergency. (It takes longer than you think.)

  (b) Use rubber bands to hold down the loose ends of your parachute harness and seat belts. This keeps the seat belt/shoulder harness buckles from getting "buried" under the loose ends making it a problem to find and release them in an emergency.

  (c) Check the quick release door mechanism on Citabrias and Decathlons. Rust, paint, dirt, etc. cause these mechanisms to stick.

Ever notice how much **better** you fly when in the back of your mind you know all your equipment has been checked and is in good condition?

As a reminder, please submit any problems or "tune-up tips" you have to the IAC Technical Safety Committee. This way maybe we can all get our equipment "together" and concentrate on improving our flying.

Some Citabria Problems Revisited

A recently received IAC Malfunction and Defect Report begins:

"Start, taxi, and takeoff were normal, however, right after takeoff, the right engine cowling door came loose and started to 'flap in the breeze'. I immediately slowed to minimum flying speed (60 IAS) and decided to go around and land (abort was too late; not enough runway). I informed the tower of my dilemma but did not declare an emergency."

The report then goes on to describe a series of minor problems which rapidly compounded themselves into something more than the pilot (who was pretty highly experienced) could handle. The end result was that upon landing, the plane flipped over on its back.

Back to the first problem — that cowl door blowing open. This is a common problem with early (pre 1974) Citabrias and was mentioned in the March 1976 issue of *Sport Aerobatics*. The cure of this problem is simply to **add additional fasteners** to the cowl doors.

There are several brands of fasteners to choose from, but Dzus fasteners are probably the most readily available. The standard Citabria cowl door fasteners are Dzus AJW wing-type fasteners and, of the Dzus line, these may be the most "uncommon" type.

A more common Dzus is the "oval head" design. The parts needed to install oval head Dzus on early Citabria cowl doors are:

AJ5-50 Fasteners
GA5-375 Grommets
S5A-200 Springs

While having a cowling door come open may seem to be a minor problem, an IAC member who had the right cowl door latches open during a snap roll and the entire right door blow off pointed out: "There was no further damage to the aircraft but during some maneuvers this could be a threat to the windshield." Think about it.

* * * * *

Another early Citabria (again pre-1974) problem that was noted in the March 1976 issue of *Sport Aerobatics* was that of throttle cable breakage. That report was based on two IAC reported problems and a discussion with Bellanca factory personnel. Since that time the IAC Technical Safety Committee has obtained an FAA computer printout listing service difficulties for a five-year period on Series 7 and 8 Bellancas (Citabrias and Decathlons). This computer printout listed several more throttle cable failured. These and the IAC cable M & Ds are listed below:

MODEL	IAC REPORTS DESCRIPTION	T.T.
7KCAB	Failed near throttle lever	300
7KCAB	Cable broke at front throttle quadrant	500
	FAA REPORTS	
7ECA	Broken front throttle arm	450
7GCBC	Broken cockpit end	387
7KCAB	Broken at carb arm attach	300
7KCAB	Broke at lock not in cabin	120
7KCAB	Broken at attach point in carb	2161

The "cure" for this problem, again as was noted in the March 1976 *Sport Aerobatics*, is to replace the early throttle cable with the newer 1974 or later Gerdes throttle cable. The "newer" type cable is not a direct replacement for the earlier cable but will necessitate making brackets for both the throttle quadrant end and the carburetor end of the cable. To eliminate any welding on the engine mount or fuselage members, brackets can be constructed using a tube clamp and stand-off arrangement. Suitable material for making tube clamps that will fit both the engine mount and forward fuselage members on Citabrias is:

4130 tubing ⅞" (.875) O.D.: 17 gauge (.058 wall); .759 I.D.

Low carbon steel bushing stock 5/16" O.D.: 3/16" I.D.

And stand-off type brackets can be fabricated from .063 4130 sheet steel and welded to the tube clamps.

The Chicago FAA GADO Office advised that the above modification would just be considered an "updating" of equipment and therefore only a logbook entry is required to keep the plane "FAA legal".

If you should choose not to replace the early throttle cable with the later type, it would be judicious to make the early cable a **time change item.** Based on the above-listed throttle cable failures, a good time to change cables might be every **100** hours.

Note there is no FAA Airworthiness Directive or manufacturers bulletin covering this throttle cable problem.

These are only two problems that can easily be corrected. All IAC members are urged to send in similar "tune-up tips" to the IAC Technical Safety Committee so "the word" can be put out to **all** members thereby making our sport safer and more enjoyable. Let's take care of our own.

More Fuel Problems

Another recently submitted IAC M & D Report concerns a refueling/fire problem on an S-2A Pitts. So nothing will be lost (or added) during "translation" we will quote directly from the report.

"A S-2A . . . caught fire on the ground after starting up after refueling. The fire was put out with only bottom fabric problems, but it could have burned the entire plane. It could have been particularly tragic if the pilot had been alone, not noticed the fire, and been caught under the bubble canopy . . . this particular plane did not have a canopy.

"The fuel cap should not be put on after refueling until the system has had a chance to really vent. If this is not done, a siphon effect seems to start with some fuel discharge. In this case, the system was vented, plane moved, and this started venting and fuel discharge again happened. When the plane was started, a backfire occurred, fire, put out, and the line boy even noticed fuel discharge while he was putting out the fire."

A check with other Pitts owners revealed they also had noted a fuel siphon/discharge effect. The key is to take normal care, and, as stated in the first sentence of the second paragraph of the report, after refueling permit the system to completely vent before reinstalling the fuel cap.

We checked with Curtis Pitts concerning this problem and he concurred with the above venting procedure. Pitts' owners, please exercise care.

MORE COLD WEATHER TIPS

The July/August 1976 issue of *Sport Aerobatics* had an article entitled "Cold Weather and Inverted Oil Systems" which dealt with the operation of the Christen Industries 801 Series inverted oil system in sub-freezing temperatures. The following is really a sequel to that article.

The IAC Technical Safety Committee has received three reports of ice forming in and obstructing crankcase breather lines. In each case the resulting increased crankcase pressure caused failure of the crankshaft oil seal and accompanying loss of engine oil and, naturally, loss of oil pressure. Also, in each case the aircraft were equipped with long extended crankcase breather tubes. The aircraft experiencing this difficulty were: a 7KCAB Citabria, an S-2A Pitts and a Clipped wing Piper J-3 Cub.

A brief review of "cause and effect" is as follows:

The fuel we burn in our engines is a hydrocarbon — which is a compound consisting of a complex combination of hydrogen and carbon. When this fuel is burned, i.e., united with the oxygen in the air in a fierce process called deflagration, a gaseous mixture results with a portion of this mixture being water vapor. As a matter of fact, for each gallon of gasoline that is burned, approximately a gallon of water is produced. This burning process takes place in the engine's cylinders above the pistons and piston rings and peak pressures can reach (and exceed) 1000 PSI. Below the pistons and rings, in the engine's crankcase, the pressure is approximately atmospheric pressure. The job of the piston rings is to seal the high pressures in the cylinders above the pistons so this force can be transmitted into turning the crankshaft. However, because of the high pressure differentials involved and the mechanical considerations, the "sealing" of the gases in the upper portion of the cylinders is not perfect. There is "blowby". Blowby means that some of the high pressure gaseous mixture in the upper portion of the cylinder is forced past the piston rings into the engine's crankcase area. The main reason for having a crankcase breather line is to prevent pressure build-up in the crankcase by providing an "escape route" for this "blowby" from the crankcase area to the outside atmosphere.

Remember that a portion of this gaseous "blowby" mixture is water vapor. When an aircraft is equipped with a long extended breather tube and is flown in cool temperatures the breather line acts as a condenser. That is, heat is transferred from the hot blowby gases (which contain water vapor) that are traveling down the breather line to the walls of the breather tube until the temperature of the vapor falls to the condensing temperature (the temperature at which gaseous water vapor changes to the state of liquid water) and condensation starts. Water, in its liquid state, is formed inside the breather tube. When an aircraft is flown in colder temperatures, this liquid water changes its state of being to become ice. If enough ice builds up, the breather line becomes obstructed and effectively seals the crankcase area. Continuing blowby past the piston rings will cause the crankcase pressure to continue to rise until either the pistons stop moving up and down or something "blows" to relieve the crankcase pressure. Long before piston movement stops, oil seals and gaskets will fail. As previously noted, in each IAC M & D Report, the crankshaft (nose) oil seal failed. When this seal fails the crankcase pressure problem is immediately resolved but the resulting problem of loss of engine oil is just as immediate. And this is really the great concern of having an obstructed crankcase breather line. Obviously, there is no need of detailing out the results of running an engine without oil.

Remedial action would simply consist of using a "standard cowl length" breather tube rather than an extended breather line when flying in sub-freezing temperatures to reduce the "condenser effect" of the breather line. Also, make certain your crankcase breather line has an auxiliary opening or vent. This auxiliary opening usually takes the form of a small hole or louver located approximately 8"-10" from the open end of the breather tube. The purpose of the auxiliary opening is just as a safeguard against breather line blockage.

INSPECTION AIDS

(From Service Difficulty Daily Summaries compiled by The Federal Aviation Administration)

Bellanca BL8KCAB

Section of butt rib adjacent to front spar (top and bottom) found cracked on both forward and aft side of spar. This particular airplane used for aerobatic instructions.

Bellanca BL8KCAB

Pilot had difficulty controlling the aircraft laterally after doing a series of maneuvers. He was unable to maintain flight and landed in field. Pilot reported a maximum of plus 3 and minus 1G during his flying. Investigation revealed that ribs from fuel tank, outboard to next to last rib at tip had fabric attach rivets pulled loose on top side. A total of 12 ribs was effected. Doublers installed in accordance with AD 74-23-4 and Bellanca Kit u243 were found cracked. The AD was complied with on February 3, 1975. Doublers were also broken on the right wing.

Bellanca BL7KCAB

As pilot entered snap roll, adjustable seat broke $3\frac{3}{8}$ inches forward on frame, both sides. Top of seat then jammed aft control stick. Pilot relaxed stick pressure and regained control of aircraft. Strap attachments for back of seat broken at upper and lower right side and upper and center of left side. Forward right mounting lug for seat attachment welded upside down.

Engine, Lycoming 0320E2D

During engine run-up after modification of oil pump, oil pump driven impeller failed. It broke approximately in half.

Engine, Lycoming 0320E2D

During engine repair, left magneto idler shaft was found loose. Investigation revealed that shaft pilot had worn into pilot hole in rear of engine case. Bolt, STD-1926, was found loose and threads were badly worn. Three corners were worn off bolt head due to chaffing against lock plate. Nut on stud was also loose.

Engine, Lycoming 0320E3D

During engine overhaul, found oil pump shaft Woodruff key and keyway badly worn (excessive wear pattern). NOTE: This engine is not included in serial numbers of AD 75-08-09.

Engine, Lycoming IO360A1B6

Engine lost power and seized shortly after take-off. Forced landing was made without further damage. Investigation revealed that oil pump driving impeller had broken, breaking hole in oil pump housing, and causing loss of lubrication. Gear was type that had Woodruff key installed and it was not marked with an X. Engine had no overhaul history and AD-75-8-9 and Lycoming S/B 385C did not apply.

Engine, Continental 0200A

Number two cylinder separated at barrel to head attachment during flight in the cruise configuration. Pilot made emergency landing without further incident. Compression check was made 60 hours prior to incident (74 over 80 lbs. compression).

Carburetor, Marvelschebler

Throttle arm found loose and slipping on throttle shaft during inspection. AD 73-23-6 is not applicable to this carburetor. Engine: Lycoming 0320E2C.

Magneto, Bendix S4LN20

During cruise, engine became slightly rough and pilot returned to airport. After removal of right magneto, found excessive wear in the distributor block bushing and the finger on the distributor gear was found loose. The finger struck the distributor block electrodes eroding them away, filling area with small particles of the electrode material. These particles were also found in the bearing area. Engine: Lycoming 0320A2B.

Powerplant, Lycoming 0320A2B

Pilot heard a thud from the engine, followed by complete engine stoppage. Investigation revealed that locking pawl had separated from left magneto impulse coupling. Approximately $\frac{1}{2}$" to $\frac{3}{4}$" of pawl was found jammed in gear teeth between engine magneto gear. This stripped three teeth from engine magneto drive gear. This gear also drives cam shaft.

Bellanca BL8KCAB

Elevator controls locked during the performance of an outside loop. They could not be freed and the pilot bailed out. Moveable stop was found to have traveled past the fixed stop on the fuselage.

Bellanca BL8KCAB

During annual inspection, left and right front wing spars were found cracked span wise approximately four feet. Cracks appear to start at the seventh rib, outboard from the wing attach to the 12th rib. Cracks are approximately $\frac{1}{3}$ up from bottom of the spars. Aircraft is used for aerobatic training.

Bellanca BL7ECA

Right wing rear spar cracked at both ends of lift strut attach plate.

"WALK-AROUND"

Last fall IAC Vice-President Carl Bury asked the IAC Technical Safety Committee to review and possibly update the standard IAC Contest Technical Inspection form which is used by contest technical committees. As many of you know, this form is really kind of a glorified "walk-around" — more formally known as a preflight inspection. And within the bounds of reality, the function of a contest technical committee is to conduct a good and thorough preflight inspection.

One of the tricks of performing a good inspection is knowing where to look. With this thought in mind the IAC T.S. Committee reviewed the IAC Malfunction and Defect Reports and selected from these reports items which could, in most cases, easily be checked during a preflight inspection. A list of these "preflight checkable" problem areas has been sent to Carl and will be added to the standard IAC inspection form to assist contest technical committees in the performance of their duties. However, the items noted on this list should not be limited to being checked only by contest technical committees or only being checked on contest days — they should be part of everyone's preflight walk-around.

Below are listed some of the problem areas that are noted on the "IAC Technical Inspection Checklist, 1977 Supplement". Please note that no distinction is made between models (e.g., Decathlons and Citabrias are lumped together, as are S-1 and S-2 Pitts — with no difference made between homebuilt and factory built), nor is there any distinction made between model years (some problems noted apply only to the earlier model aircraft). The justification for this is: (1) just for simplicity; and (2) problem areas occurring in certain models or years may well be worth looking at on related A/C or other model year A/C. Also, note the IAC Malfunction and Defect files do not, as yet, have enough depth to make it possible to pinpoint specific "problem areas" on any but the most popular aerobatic aircraft.

PARACHUTES

(A) Open ripcord protector flap and check the pins for proper seating and see if the parachute rigger's seal is intact.

(B) Check to see if the ripcord handle is a snug fit in the ripcord pocket.

(C) On Security 150 parachutes, open the flap on the back of the chute and check to see if the knots in the locking cord are on **top** of the "S" hooks — at least **not below** the grommets. (See the July/August 1976 issue of *Sport Aerobatics* for more details.)

CITABRIAS & DECATHLONS

(A) Check operation of the emergency quick release on the door. Be sure and make this check with the door in the **full closed** position as hinge and hinge pin alignment may change from the door being partially open to the door being fully closed. Be sure and have someone on the outside of the aircraft to support the door as the hinge pins are withdrawn to prevent damage to the door and/or door window.

(B) Check condition of engine mount bushings and area between the exhaust crossover pipe and the fiber-glass cowling. These items **may** be related. Deteriorated engine mount bushings allow the engine to "sag" on the mount reducing the clearance between the exhaust crossover pipe and the lower portion of the nose cowling. The exhaust pipe may then burn the fiber-glass cowling.

(C) Check rear side windows for looseness. At extreme rear edge of rear side windows push gently inward and note if window is held firmly by the aluminum retaining bulkhead. If aircraft's window retaining bulkhead is fastened to fuselage with three (3) upholstery clips, check to see if each upholstery clip is fully seated by pushing firmly on each clip. (Also, if A/C is using the upholstery clip retention method, recommend to A/C owner to change clips to AN526 screws and lock nuts.)

(D) Inspect the wing area (behind the fuel tanks) from root rib to the fourth rib outboard for cracked ribs at the rib to rear wing spar attach point. Gently try to move the wing trailing edge upward and downward while observing the area at the junction of the ribs in question and the rearward face of the rear spar. Excessive movement and/or a metallic "clicking" noise may be indicative of cracked or failed ribs.

(E) Check for failed wing nose ribs. Grasp leading edge with hands spread reasonably far apart and apply an up-down twisting motion to the leading edge. Any "clicking" noises of metal-to-metal contact may be an indication of failed nose ribs.

(F) Check to see that fuel lines are not chaffing on inside of windshield mounting screws.

(G) Inspect landing gear "U" bolts for cracks at the inside radius of the bends. This "U" bolt is located where the landing gear leg "enters" the fuselage and the area to be inspected is readily visible from outside the aircraft. (Also advise the aircraft owner that the landing gear **through** bolts are considered a "time change item" and should be replaced every 500 hours.)

(H) On 1973 and earlier aircraft check the seat belt mounting brackets where they are welded to the seat frame for cracks in the area of the weld.

PITTS S-1 & S-2

(A) Inspect upper wing leading edge for failed leading edge ribs. Check at each upper wing leading edge rib station by trying to move the aluminum leading edge up and down and at the same time try to squeeze the leading edge closed with your fingers. Any relative motion or sponginess underneath the aluminum leading edge may be an indication of broken ribs.

(B) Check area where leading edge of horizontal stabilizer attaches to fuselage. Inspect for cracks near bolt that joins fuselage and stabilizer.

(C) Check diagonal brace in bottom of fuselage just aft of (rear) seat. Inspect closely the area of this tube within 2-3 inches from the forward most cluster for any cracks.

(D) Using flashlights and mirrors inspect area in tail cone of fuselage for debris and foreign material. (FOD)

(E) Check aileron hinges/brackets for tightness. Check for movement vertically (up and down), longitudinally (back and forth), and **laterally** (sideways).

(F) Check for cracks in the control torque tube in area where bracket which holds control stick is welded to the torque tube.

We recommend, where applicable, if any of the above items are not on your walk-around check list, that you add them to your list. Also, if you have any "goodies" that you feel would help IAC contest technical committees — items that could be checked during their preflight inspection — please write or call the IAC Technical Safety Committee. Remember, the more input — the more output, and the net result is a better IAC and safer sport flying.

"THE ONE YOU SAVE MAY BE YOUR OWN"

ATTEN-SHUN!

"I don't have the P/N of the front seat, but it's the new adjustable seat Bellanca introduced on all their 1976 Citabrias, Decathlons and Scouts. The seat failed while one of our students was doing a snap roll from the front seat solo. Failure occurred at 4,000 feet and his recovery was made at 1,000 feet. The seat failure allowed the seat back to bend backward pushing the rear control stick to the full rear position. The pilot's head ended up resting on the rear seat. Needless to say, the student found himself in an awkward position, but he managed to pull himself into a sitting position again and by forcing the control stick forward with his weight off the seat back he was able to regain control of the aircraft."

The above quoted IAC M&D report pertains to a 1976 8KCAB Bellanca Decathlon. While this report is from a "second person", we did talk to the pilot who was flying the Decathlon and his description of the event is basically the same, although less clinical and more colorful.

This is the kind of "story" that will be told in "hangar sessions" for many years.

As you know, hangar story sessions always lead to a kind of one upmanship brand of tale telling where each successive speaker tries to do a "can you top this" story. Just in case you're at a hangar flying meeting and the subject is aircraft seats, the IAC M&D files can give you plenty of "good" material. Below is another example.

"A good friend of mine was flying the aircraft (Pitts S-1C) at around 2500 feet while I observed him. He was doing inside and outside consecutive snap rolls and spins. Suddenly he entered a spin and didn't recover for around 2,000 feet. When he landed he explained what had happened. The plywood **seat back** had slipped under the baggage compartment and left (name deleted) back in the fuselage sitting on the torque tube jamming the elevator and aileron and the seat back had jammed the rudder cables. He removed his harness and literally tore the plywood seat loose and safely landed the aircraft. The importance of a good sturdy back for your seat can't be stressed highly enough. We installed a much heavier piece of plywood and mounted it properly."

The following is another Pitts S-1 story you might want to remember.

"Description of Malfunction or Defect:

* Split seat bottom (twice broken) ¼ inch plywood, padded and upholstered. Replaced with ½ inch plywood bottom. This one split doing 45 degree nosedown snap roll.

Cause:

* Too many positive G's for a plywood seat.

Corrective Action:

* Presently replacing seat bottom with aluminum structure riveted to primary structure."

How about another Decathlon — this time a 1974 8KCAB:

"I know of two complete instantaneous failures of seat backs on Decathlons here. The seat back is attached to the seat bottom by one bolt (about an AN3) on each side per seat. The bolt merely goes through the metal tube that makes up a part of the seat back, and apparently G loadings cause the force of the pilot's weight on the back to elongate the hole for the bolt in the tube until the bolts tear all the way through the metal tube and the seat back separates free. On my aircraft, the seat back failed during the pull-up for an inside loop at about 30°-40° nose up. The pilot in the front seat fell back against the aft stick and the pilot in the back seat. Fortunately, there were two aboard and both pilots were capable. The man in back pushed the one in front back into place and helped control to be maintained. If this had been a solo flight at low altitude, it could have been a bit hairy."

How about a Clipped Wing Cub story:

"Since the weight of the pilot and parachute may frequently exceed 1,000 lbs. during aerobatic routines, the original canvas-sling rear seat is usually unsatisfactory. I have personally had the misfortunte of discovering this half way through a competition flight. It should be emphasized, that this can potentially lead to very grave consequences since tearing the canvas seat could cause a seatpack to jam the elevator bellcrank located directly behind the seat. Hence I would recommend that the canvas seat be replaced by a suitable metal seat, constructed to provide the proper elevation with a seat pack or Security parachute."

While maybe not as readable, the FAA Service Difficulty Computer Printout also has some stories to tell, e.g.:

"1971 - 7ECA Citabria - Tubing broken back attach hole.

1974 - 7KCAB Citabria - Aerobatic maneuver broke top of front seat off.

1976 - 7KCAB Citabria - Entered snap roll adjustable seat broke 3⅜ inches forward on frame — both sides. Seat back then jammed controls.

1971 - 8KCAB Decathlon - Pilot's seat failed during snap roll, forward members broke allowing seat back and pilot to fall against rear control stick.

1973 - 8KCAB Decathlon - Cable broken rear seat back. Small cable used to restrain rear seat back to keep back from tipping forward.

1973 - 8KCAB Decathlon - Rear seat backrest broke where it bolts to seat bottom."

Note that all Decathlons and Citabrias equipped with adjustable front seats (the type noted in the first paragraph of this article) are subject to FAA Airworthiness Directive A.D. 76-22-01 and Bellanca Service Letter #C-125 (5/19/76). This A.D. applicable to the following A/C:

Model	Serial Number
7ECA Citabria	1126-76 thru 1173-76
7KCAB Citabria	551-76 thru 584-76
8KCAB Decathlon	219-76 thru 265-76

And all previous serial numbered airplanes in which the adjustable front seat has been installed per Bellanca Kit #252.

No need to belabor a point.

That should be enough "seat stories" to take care of any hangar flying session and impress on **all** of us the importance of proper construction and close inspection of all aircraft seats. Let's all try to make the above-listed seat failures the **last** ones. And hopefully the next round of hangar stories will exemplify the good design and construction of new aircraft seats — and the well thought-out modifications that have been applied to strengthen old seat designs.

GENTLEMEN — SEATS!
'nuff said.

THE OVER THE HILL 0-360

By
Sam Burgess (IAC 23)

The four banger Lycoming was removed from Pitts Special N3333N on 1 November, 1976 with 915 hours total time, which is probably the highest time ever to be accumulated on a Pitts S-1 steadily engaged in flying aerobatic maneuvers.

Will Teft originally built this little trickster in 1968 in Homestead, Florida at Curtis Pitts place and used the same jigs, etc. as the production Pitts. A factory new 180 hp Lycoming was installed at this time. It flew without an inverted system for several hours before one was installed. It was then sold to Bill Thomas and I acquired it at 325 hours in 1972.

When the 1,000 hour mark was looming as a real possibility a note was penned to Lycoming with the offer of swapping this engine, with its obvious valuable analysis at overhaul, for a new one — I received a "Dear John" letter in reply. The 0-360 was performing beautifully, however, to facilitate a timely removal between contest and air show seasons it was pulled at 915 hours.

Compression was averaging 75 cold, oil consumption was normal and during its entire period no cylinders had to be removed for any reason. Only the usual preventative maintenance items were performed such as timing the mags, new plugs, oil changes, pulling the oil screen, PS5C carburetor overhaul, new engine mount pucks, oil line replacements and the usual minor items usually accomplished on any aircraft but nothing major in nature was experienced.

The engine was major overhauled locally in San Antonio, Texas and the following was discovered: very little carbon on the piston heads, no excessive cylinder wear, the crankshaft main bearing showed signs of wear at the forward extremities, oil pump gears were O.K., the propeller flange was not cracked (sigh), and the main case was like new. The only item of any significance that required replacement was the cam shaft as the lobes were wore beyond allowable tolerances. Some cracks around the spark plug holes were discovered but easily weldable. No new cylinders were required. Mr. Lycoming would have been proud.

Essentially, the entire engine was in very good condition considering the type of flying it was involved in. Although the 0-360 is touted to be a 2,000 hour machine, this particular one had been exposed to many, many overspeeds in performing the Unlimited category maneuvers. There is no way of tabulating the actual number of over revs, however, I would guess that more than 600 hours of the 915 were flown in aerobatics, the remaining were in cross country flying from one contest to another. Therefore, it would not be difficult for any aerobatic pilot to compute the number of times this engine was subjected to the high rpm's necessary to perform some of the vertical maneuvers.

Many inquiries have been fielded as to how this rather high number of aerobatic hours were accumulated with success. Aside from complying with the Lycoming bulletins, changing oil every 25 hours (mineral oil was used throughout), performing the usual preflight items, there was only one item that could have been primarily responsible for the success of this particular engine — I pulled the propeller through twenty blades before engine start. (Instant oil pressure for your perkolator.)

This procedure was outlined in a previous IAC *Sport Aerobatics* magazine article which applied experience gained on military aircraft engines when the front thrust bearing was burning out at fifty hours. As this was the last item to receive oil from the pump, a system of counting twenty blades prior to engine firing was established and this cured the problem. Simply pre-oiling the bearing surfaces before they were subjected to any loads seemed to add hours to the P&W 4360's twenty eight cylinders. There was sound reason to believe that this procedure could be applied to smaller engines with the same results and more especially with an inverted system installed or when the aircraft has not been flown regularly. There is probably more wear on bearing surfaces at the first few seconds of engine start than during the entire flight.

Perhaps another procedure was avoiding fast cooling of the cylinders. After flying a hard sequence it will prevent a rapid drop in cylinder temperature if one flies around for a short period at cruise rpm and gradually retards the throttle in the pattern before landing. This one item can perhaps cause more damage to the cylinders than any other form of abuse.

Of course, all engines will vary in the manufacturers "care and feeding" procedures and should be followed to the letter. The only thing in addition was pulling the prop through twenty blades prior to engine start (with the mixture and switch off). Besides, this is good exercise and may prove beneficial to both you and your engine.

AN A.D. NOTICE

The IAC M&D files contain four reports of problems with Hartzell "Compact" Propellers. This series Hartzell propeller is used on Pitts S-2A's, Decathlons, and Great Lakes Aircraft. There have been several FAA Airworthiness Directives issued on this prop and today (2/24/77) the IAC Technical Safety Committee received word of another upcoming A.D. This A.D. will deal with reworking the blade shanks in the area of the blade retention bearings. This area of the blade has been subject to cracking — and indeed this was the case in the above-mentioned IAC M&D reports.

To get as much advanced information as is now available, the IAC T.S. Committee checked with Hartzell Service Manager Bob Long. Bob advised the following:

The A.D. in question has not yet been issued, but is expected to be made effective during the first part of March — possibly on or about March 5. The A.D. will probably closely follow Hartzell Service Bulletin 118A which was effective on February 15. (Note the IAC T.S. Committee checked with two propeller repair stations on 2/24/77 and as yet they had not received S.B. 118A.) The A.D. will require the propeller to be disassembled and the blade shanks reworked. This will entail "removing" the shot-peened area on the shank and then "cold-rolling" this area in a "rolling machine". Bob said shot-peening, the process previously used to strengthen this critical area on the blades, gives a rough finish, while the newer method of "cold rolling" gives a smooth finish. He said that "cold rolling" gives a great improvement in strength over "shot-peening".

The propellers affected by this A.D. will fall into three categories:

(a) If A.D. 75-07-05 has been accomplished and the engine (IO-360) is a "dampened" engine — the compliance time will be within 500 hrs.;
(b) If A.D. 75-07-05 has not been accomplished — the compliance time will be within 100 hrs.;
(c) If prop is used on an "undampened" engine (IO-360) — compliance time will be within 100 hrs.

(NOTE: It appears as if this A.D. will be initially for props on Lycoming IO-360 engines, e.g., Pitts S-2A, Great Lakes, etc. But if past history means anything, do not be surprised to see this A.D. grow to cover other engine/prop combinations.)

We asked Bob about the "rolling machines" and he advised that presently there are two machines — one at the Hartzell factory in Piqua, Ohio, and one in England. He said Hartzell is working on more machines and these will be made available to Hartzell distributors first. (Note: One Hartzell distributor that we later talked to advised they had a rolling machine on order — approximate cost $2,000.00.)

Then we asked Bob what he guessed would be the approximate cost for an aircraft owner to comply with this A.D. Bob said for the job to be done by Hartzell at their Piqua, Ohio facilities it would be about $150.00 plus an additional $33.00 charge for removing and reinstalling the prop. He also said that they often find the propellers need the leading edges reconditioned and the blades repainted — the charge for this is $40.00. (To save everybody some time, $150.00 + $33.00 + $40.00 = $223.00.)

While talking about this upcoming A.D. and of past problems of blade shanks cracking, Bob said that engine red-line speeds must be observed. This red-line is usually around 2700 rpm. He said a graph of the blade shank stress takes the form of a "J" curve and at about 2850-2900 this curve makes almost a "right angle" showing the stresses on the shank rise greatly at and above that rpm. He said Hartzell is pushing hard to have all A/C owners have their tachometers checked. Hartzell has a new digital read-out strobotach for checking tachometers in the field. Bob said Hartzell would be glad to check anybody's tach (at the Hartzell factory) — if they called in advance. Hartzell is going to require that all their distributors have a strobotach. Bob went on to say they have found many tachs in error — some as much as 250 rpm. And sometimes the cause is not the instrument itself, but the drive gears or drive cable. This "tach checking advice" should be heeded by all IAC'ers.

As noted before, the A.D. under discussion has not, as of this writing, been issued, but most probably will be in effect by the time this article is read. Bear in mind some of the above "facts" may have changed. However, the purpose of putting out this **premature** article is to alert IAC members, at the earliest possible date, of a safety-related item.

(IAC thanks to Bob Long of Hartzell Propeller Co.)

CONCERNING YOUR SECURITY PARACHUTE

1. The Model 150 Parachute will function normally at 200 mph. It is, however, approaching its absolute strength limitation. Tests were conducted by the German Air Ministry and damage started to occur at 226 mph. Two lines separated from the canopy.
2. The question of opening time difference of the Model 150 vs. the Model 250? There is no difference whatsoever. Both parachutes are dimensionally identical, both have the same area, drag coefficient, etc. Both canopies will react the same to a given deployment/opening situation with regard to opening time. There will be a difference in snatch force because of the difference in strength and elongation of the suspension lines. There is also a slight difference in rate of descent between the two canopies. The bias canopy tends to distort in the lateral (bias) direction, whereas the Model 150 is more rigid and uniform. The convolutions are deeper on the bias version. The Model 250 is considerably stronger than the Model 150.

	Required Strength	**No. Of Lines**	**Rated Strength**	**Actual Strength**
Model 150	3,000 lbs.	24	400 lbs.	9,600 lbs.
Model 250	5,000 lbs.	24	550 lbs.	13,200 lbs.

The "after manufacturing strength" is conservatively valued at 65% of the actual strength. This is strength loss due to sewing, etc.

Model 150 $9600 \times .65 = 6240$ lbs.

$$\text{Safety Factor} = \frac{6240}{3000} - 1 = +1.08$$

Model 250 $13200 \times .65 = 8580$ lbs.

$$\text{Safety Factor} = \frac{8580}{5000} - 1 = +.72$$

Rated Airspeed

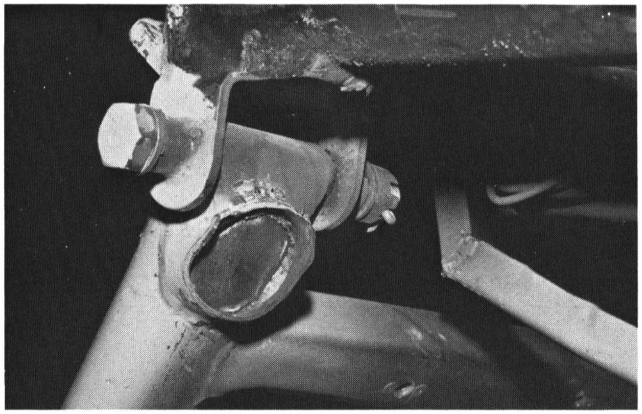
Model 150 200 lbs. at 235 mph at 500 ft./ASL
Model 250 200 lbs. at 300 mph at 500 ft./ASL

This information was prepared by and is printed through the courtesy of Mr. Dan S. Abbott, Vice-President of Security Parachute Company.

TUBES

Lately, the IAC Technical Safety Committee has received a rash of reports concerning problems with or related to 4130 chromemoly tubing. Below is a brief summary of these reports.

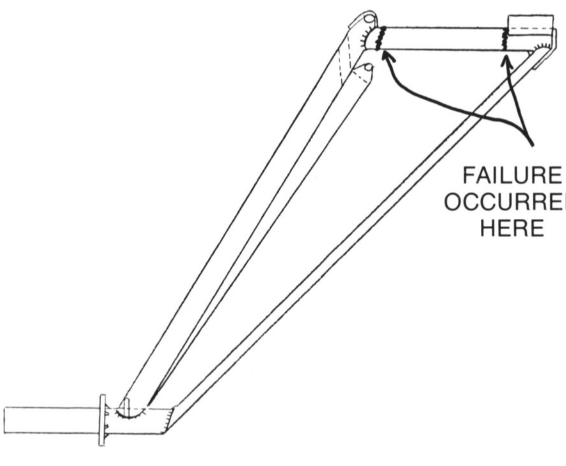
First, is the problem of cracked streamline tubing. An IAC member reported that while working on the fuselage of his homebuilt Pitts he discovered a crack in the trailing edge of the .049 streamline tubing on a cabane strut. He said, "It is so difficult to see the tiny hairline cracks in the trailing edge of the .049 streamline tubing that I'm not sure I would have detected it if I had not been working at night and apparently the light just hit it right for me to see. At first I thought there wasn't actually a crack but after using the magnifying glass under good light I could clearly see that the crack was through the entire tubing. I then inspected



A close-up of the front top of the right MLG showing the point of failure. Note the weld is completely intact and the break occurred next to the welded area.

every piece on the airframe as well as the unused part of my shipment and all of the streamline tubing was defective." This gentleman had over $1,000 (American) and **six months** of labor (cutting, jigging, and welding) invested when the first crack was detected. This problem was fully covered by Mike Heuer in the February 1977 issue of *SPORT AVIATION* (page 7, Hotline From Headquarters) and is noted here again so as to assure that "the word gets out" to all IAC members.

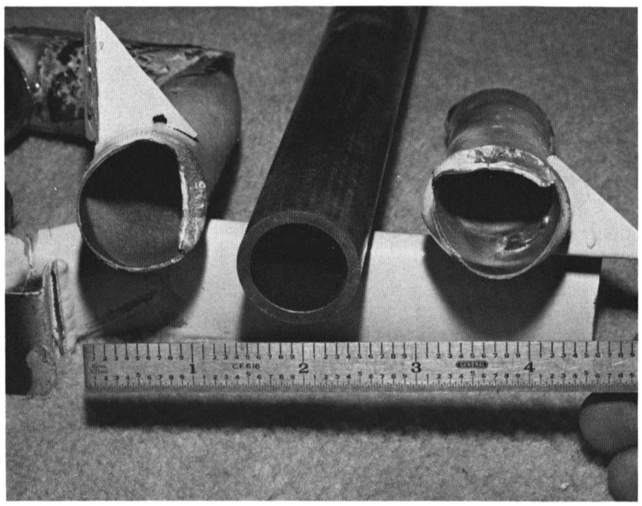
Another tubing problem that was also covered in *SPORT AVIATION* (January 1977, page 7, Hotline From Headquarters) that is of concern to some IAC members is that of a tubing size change in the landing gear of the EAA Acrosport. The tubing change was from a 1.25" x .049 4130 tube to a 1.25" x .120 tube. (Please see the



The relationship of the sections of failed tubing on the right gear leg.

above-mentioned issue of *SPORT AVIATION* for more details.)

Pitts S-1 aircraft plans have also undergone **several** changes in tubing sizes. **One** of these changes is related to landing gear structure and is similar to the above-noted EAA Acrosport gear tubing change. The Pitts landing gear tubing has been changed from 1.125" x .049 to 1.250" x .120. An unsuspecting IAC member unfortunately made this discovery the hard way when he had the main gear (constructed of the small diameter thinner wall tubing) collapse on the initial landing of his 180 hp homebuilt Pitts. This gentleman had spent five years, four months and seventeen days and a considerable sum of money on his Pitts. (On the brighter side, we recently talked to this IAC'er and he almost has his Pitts ready to fly again — with the later tubing size changes incorporated. This Pitts has many innovations and features outstanding workmanship. Hopefully there will be a *Sport Aerobatics* article on this plane in the near future.)



Dramatic illustration of the difference between the **early** 1.125" x .049 tubing (showing both ends of the failed section) and the **later** 1.250" x .120 tubing which replaces the same gear member.

The Acro "Never Again"

Hayden Harris
IAC 88, Southeast Michigan

I was doing some basic maneuvers in my Great Lakes over Miller Field in Brighton, Michigan at an IAC Chapter 88 meeting. I completed a loop and decided to enter an inside spin. The entry was normal and I initiated the standard recovery routine — opposite rudder, then pop in forward stick for a nice verticle down line; after all, there was a judging school below grading these maneuvers.

I was shocked to discover that I only had approximately one-half of the forward stick in when it jammed against something. I thought I was going to spiral down into the center of the field. I then tried back stick and discovered that I had enough space to pull out of the spiral dive I had entered. I cautiously tested the stick movement and found that I could maintain more or less level flight moving only about half of the stick. I headed straight for the grass strip and made an uneventful landing except that I didn't have enough forward stick to do a standard Great Lakes two-wheel landing.

At the line I waved over Dennis Houdek, chapter president. My pulse rate was slowly returning to normal. I demonstrated the stick movement to him. He inspected the front cockpit and discovered the villian.

The front cockpit has a glove compartment with an aluminum door which hinges from the bottom. When down, it extends far enough so that the front stick jams against it at about mid-point of the door preventing forward travel. The latch, which was a twist type now had worked loose and released the door.

I have now installed a key lock on the door which will not allow removal of the key without being positively locked. The key is on the same ring with the ignition key so that the plane cannot be started without removing the glove box key. This winter I plan to hinge the door from the top.

Another check-point for preflight inspection: check your aircraft very carefully for anything that could possibly work loose and interfere with the controls.

The October 1976 issue of *SPORT AVIATION* called attention to another Pitts tubing size change — cabane struts going from an .035 wall to a .049 wall.

The IAC Technical Safety Committee checked with Curtis Pitts regarding these problems and Curtis helped clear things up with the following information:

The S-1C series Pitts were originally built around the C-85 Continental engine. This plane had an empty weight of 615 lbs. and a gross weight of 975 lbs.

In 1967 a **number** of structural changes were incorporated into Pitts drawings so that Lycoming 180 hp engines could be used. The average empty weight of this version of the S-1C was 715 lbs. and the gross weight was 1050 lbs. (This was without starter, generator, or battery.)

In 1973 the current drawings for the S-1D and S-1E were released. Again there were a **number** of structural modifications to provide for the installation of the 180 hp Lycoming engine with starter, generator, and battery. The average empty weight of this version is 815 lbs. and gross weight is 1150 lbs.

Curtis said it has been a problem to keep homebuilders from exceeding the gross weight recommendations and continued, "The gross weights for each individual model must be used in the interest of safety." Also, note that Pitts Aviation can **not** supply drawings or information to update the older models and they do **not** have a drawing exchange program. Again to quote Curtis, "The changes have been too numerous between the various models."

To add just a little more confusion to the matter of tubing sizes and different versions of the S-1 Pitts, the IAC has received reports of at least two aircraft supply houses which are currently selling "Pitts Tubing Kits" with tubing dimensions taken from **early** Pitts plans. CAVEAT EMPTOR.

One more "tubing problem" that is related to Pitts aircraft should be mentioned — that of breakage of the diagonal member between the fuselage lower longerons in the bay located behind the pilot. There are reports of four such broken members and in each case the tube fractured next to the cluster located to the pilot's right rear side near the area where the seat belts attach. There has been some conjecture as to the cause of this breakage and the IAC T.S. Committee has checked out some ideas ranging from snap rolls, to welding "chill lines" (areas subject to "thermal shock"), to welding methods (heliarc vs. "gas"), and to methods of normalizing. A couple of very knowledgeable persons, including Curtis Pitts, believe vibration to be the primary cause of the problem. The particular section of tubing in question is the longest of its size and wall thickness in the aircraft and this longer length will lower the natural vibrating frequency. This frequency is believed to be in a range that can be excited by engine vibrations. These vibrations then cause the tube to fail at its weakest point — the area adjacent to the weld. (Note, the area next to a weld is a "weak" area due to being subject to thermal shock when the welding process is being performed. This is true regardless of the welding method used. Normalizing relieves this area somewhat, but it is still the "weakest point".) Curtis recommends as a fix that a small brace should be clamped to the center of the tube and to another part of the airframe to dampen the vibrations.

(Thanks are due to the many persons who contributed information contained in the above article — especially noted should be Curtis Pitts who always freely lends his time and knowledge. From all IAC members, Thank You.)

INTERNATIONAL AEROBATIC CLUB
I.A.C.
MEMBER

CITABRIA & DECATHLON

"SEE-THROUGHS"

Rear Side Windows: The IAC Technical Safety Committee has received several reports of problems with rear side windows on both Citabrias and Decathlons. The reports cover windows blowing out, shattering inward, cracking, being loose, and deflecting inward (but not breaking). Bellanca Aircraft Corp. has also received reports of rear side window failures. They investigated this problem and felt that the three upholstery clips on each side, which hold the aluminum bulkhead that retains the rear edge of the window, may be pulled loose from their mountings under heavy inboard pressures, thus permitting the windows to flex and pop loose. In August of 1976 Bellanca changed from using the aforementioned upholstery clips to using AN526 screws and lock nuts. This is a relatively simple change that all IAC members who drive earlier Decathlons and Citabrias should make. AN526-10-32 screws and AN365-10-32 elastic stop nuts fit just fine in the holes that originally held the upholstery clips. Another beef-up that may be considered is to joggle two small pieces of aluminum (e.g., .032 x ¾ x 1¼") to act as retaining clips at the front edge of rear window. These small clips can be fastened to the aluminum box section that is exposed when the window front edge cover plates are removed. The clips can be attached with small P-K screws and when the cover plates are reinstalled they will not be visable. They definitely will prevent the rear window from possibly sliding forward and slipping from under the rear hold-down plates into which you just installed the AN526 screws. One more rear window "fix" to consider would be that of a small stand-off, i.e., rubber-tipped stop or bumper, near the center of the window. This would prevent the window from flexing inboard. These stand-offs could be attached to the fuselage tube members (monkey-bars), that are inside of the rear window, with tube clamps. To reiterate, we definitely recommend the replacement of the upholstery clips with AN526 screws and feel the front retaining clips and stand-offs should be considered.

Side Door Window: The IAC Technical Safety Committee has received three reports of door windows flexing inboard. There have been **no** reported door window failures. One IAC member suggested fastening, either gluing or riveting, a two-inch wide strip of Plexiglas to the door window to act as a stiffener. Another thought would again be some kind of stand-off but this would entail some type of horizontal or vertical brace across the window. To our knowledge, neither of these ideas has been tried. Anybody have some constructive thoughts on the subject?

Side Swing-out Window: There have been no problems with the left side "swing out" window reported. Note this window should be placarded "Do Not Open Over 130 mph". Also note that late model Citabrias and Decathlons have this window placarded as an emergency exit. Bellanca Service Letter #122, January 5, 1976, deals with placarding earlier aircraft which utilize the left hinged openable pilot's window as an alternate emergency exit. These aircraft are up to and including the following Serial Numbers:

Model	S/N
7ECA	1152-76
7GCAA	328-76
7GCBC	912-76
7KCAB	567-76
8KCAB	236-76

Of these aircraft, those which have a **limited** opening left-side window may install red placard P/N 1-10550· which reads "Alternate Emergency Exit Unlatch-Force Forward Portion Past Stop" and those with a full opening side window may affix a red placard which reads "Alternate Emergency Exist Unlatch-Push out".

Front Windshield: Last June an IAC member was killed in a Citabria and at first blush it seemed to be due to a windshield failure. Subsequent checking with NTSB investigators and others has seemed to preclude the windshield failure idea and, in fact, evidence now seems to point to medical problems as the reason for the accident. Anyway, our investigating at that time revealed several interesting facts that should be made known to IAC members. The FAA Service Difficulty Computer Print-out lists two 7KCAB windshield problems. One listed "Condition" as "came out"; the other was listed as "shattered" — no other information is given. Bellanca Aircraft Corp. advised they know of **no** windshield problems and then gave the following information: The windshield on the Citabria is ⅛" + .020 thick (V_{ne} 162 MPH); the windshield on Decathlon is 5/32" + .020 thick (V_{ne} 180 MPH). When the Decathlon was being developed it was designed for a redline of 200 MPH — with no windshield problems. Toward the end of the certification testing program, while the FAA was flying the plane, they encountered a windshield problem at 200 MPH. This surprised the people at Bellanca since they had already tested the plane to higher speeds. The Feds then wanted many more tests run — but since this was almost at the completion of the planned testing program and Bellanca wanted to start production, it was decided to increase the windshield thickness by 1/32" (making it a 5/32" windshield), add a center stand-off/brace, and lower the redline to 180 MPH. The above background material is presented because we feel the more one knows about the equipment he is operating, the more intelligently he can use and maintain that equipment. It should be noted that the Decathlon windshield will **not** fit in Citabrias for the cut-out section around the wing leading edge is different.

Also, before putting down the windshield subject, several IAC Citabria pilots have advised of windshield deflection at high speeds and, because of concern to them, have added Decathlon center windshield braces to their aircraft. They advised these braces fit with very little modification and have the additional benefit of making good reference lines for point rolls.

(IAC members should be aware that Bellanca Aircraft Corp. has given much time and help to the IAC Technical Safety Program. And, in fact, they have supplied the IAC T.S. Committee with copies of service manuals, parts manuals, owner's manuals, and Service Letters for their Citabria, Decathlon, and Scout models. These manuals will no doubt help IAC to "take care of its own". We all owe a thank you to Bellanca.)

ET CETERA

Two Technical Safety articles that appeared in the July/August 1976 issue of *Sport Aerobatics* have brought some interesting comments from IAC members.

First, regarding the article entitled ". . . Most Neglected . . .", which concerned itself with parachutes, and in particular the Security 150 parachute, an IAC member gave the following input. He said that he (a "retired" sport parachute jumper with 660 jumps) and a friend, who is a parachute rigger, were concerned over the lack of mesh over the modification (Tee shaped hole in the rear of the parachute canopy). They felt since most aerobatic pilots had probably never made a parachute jump, that if they ever had to jump they would probably leave the aircraft with an improper body position for good chute opening and the pilot chute or possibly a section of the main canopy could pass partially through the modification (hole) and cause a malfunction. He further advised that next time he was having his Security 150 repacked, he planned on having mesh put in over the modification.

We checked with our local parachute authority who also thought the mesh idea was a good one, except that it was illegal.

Next, we checked with Dan Abbott, Vice President of Security Parachute Company, to see if he felt the "mesh idea" had merit, and if so, how to make such a change "FAA legal".

Dan replied to the IAC Technical Safety Committee with a six-page letter which included some first class sketches of parachute deployment. Below is a capsulized version of what Dan stated. First it should be understood that modifications or "holes" are put into parachute canopies to give the parachute forward drive and therefore provide some directional control. Security installs a gride net of 1" wide nylon tape in lieu of marquisette mesh over the Tee modification on all their Model 150 and 250 canopies. The maximum size opening of this grid is 11.5" x 9.0" and Security feels this size opening is too small for any portion of the canopy to pass thru and possibly cause a tangled chute. Dan says they are not aware of any malfunctions whatsoever where the canopy passed thru the grid net modification. Dan further states the marquisette mesh is of sufficient density (permeability) as to reduce the thrust of the parachute markedly. The mesh would for all intent and purpose eliminate forward speed and turn control whether in a Tee Thruster arrangement like Security chutes or a Tri-Vent Thruster. Dan says "this is said from practical knowledge".

That should pretty much exclude thoughts of altering a Security 150 parachute.

Also, Dan has a pretty long dissertation on parachute malfunctions with these highlights:

1. The canopy deployment form (conventional form) of the Security chute allows for the fastest deployment and filling time.
2. The conventional form (system of canopy deployment) is least affected during inflation by a bad body position of the jumper.
3. In personal investigations of malfunction reports, Dan found that 90% were caused by misassembled equipment or bad packing techniques.

(Also of note is that the low porosity 26 ft. diameter canopy employed on the Security Model 150 stems from a Skydiving Reserve Canopy designed in 1964 and is the standard reserve canopy of sport parachuting throughout the world.)

One last note — Dan gave full approval to the six (6) "suggestions" listed in the *Sport Aerobatics* "Most Neglected" article and placed special emphasis on item number (3). (We won't repeat these suggestions here — you'll just have to dig out your old *Sport Aerobatics* and re-read that article. Better do it **now** or it will "bug" you forever.)

IAC kudos go to Dan Abbott.

* * * * *

Another IAC member made reference to the article "A Classic Example" which dealt with an example of overload fracture of a streamline tie-rod — a tail brace wire on a 450 hp Stearman. He noted **another** point concerning streamline tie-rods of which we should all be aware — that of alignment. This gentleman operates a crop dusting service and has much experience with 450 Stearmans and states that he personally broke about five (5) upper front tail brace wires on Stearmans and between replacing his own and loaning out this particular wire to his competitors, he has depleted all his spares out of six (6) sets. He said that three (3) of these wires broke in the streamline area just inboard of the flares — and further notes that he had had front Stearman flying wires break in the same area on wings that were hurriedly installed to get the plane back to work and did **not** have the javelins put in place. All these failures were blamed on twisted or off aligned wires that "sang unnoticed occasionally". Our crop duster friend advises that since he started getting fussy on wire alignment, he hasn't had any more trouble. He says he has become so wire alignment conscious that when he has to work a strange airplane, one of the first things he checks is the wires.

To further emphasize his concern about flying wires, this IAC member continued that he had a "faintly singing" wire on the tail of his Pitts S1C that he could **feel** but **not hear** during abrupt maneuvers. When he could not run down the exact source of the problem he bought a new set of round tail brace wires and this eliminated the vibration completely.

* * * * *

In many IAC T.S. articles we personally thank companies and professional people for their help — and this is truly a heartfelt thanks. However, for various reasons it is the policy of the IAC Technical Safety Program to maintain "author anonymity" of M & D reports submitted by IAC members. Just because we do not thank these contributing members by publishing their names in "black & white", none of us should forget it is these nameless persons who really deserve the most thanks, for without their input and ideas there would be no IAC T.S. Program and no (possibly) lifesaving tips. To the above two contributing IAC people and all others — **THANKS.**

TECHNICAL SAFETY 1

(Editor's Note: The following was sent to Fred Cailey and forewarded by Fred for publication to acknowledge that Chapter Reporters and Technical Safety Reporters are responding beautifully to the need for communication!)

Dear Fred:

Thank you for expediting the safety reports to us. You are doing an outstanding job, keep getting the word out.

Chapter 17 in Imperial Valley recently invited this old Crop Duster to join in their activities. One home built S-1S Pitts is getting very strenuous airtime, from Intermediate to Unlimited.

They were having a great time, even taking top honors at a recent contest in the aforementioned categories. Now, one of the reasons I am still here after pushing dusters for twenty-two years is that I look, so the Pitts got some looking.

First, the engine shaft and prop flange got a dye check. Nothing shows, but these folks are starting to get interested, so I asked if the leading edge stabilizer carry through tube had been inspected for cracks, the lower wing attach fittings for wear and hole elongation.

The interest in looking is starting to build, just slopped out bolt holes and bearings, improperly keyed pins and nuts so far, but they are looking and finding.

Now I throw them the kicker. This plane has been lomceracked and snapped a lot, one log entry by the previous owner showed triple snaps at 170. Suppose the center section attach fittings are bent. I looked and the front fitting is bent back from the spar at least 3^0 and the rear plate at that point is twisted. The attach holes to the cabane in these fittings are elongated to the right a sixteenth of an inch.

This revelation really spurs the membership to an activity of detection. Someone tells me that on a practice flight some months ago, the lower right cabane bolt snapped. The noise of it breaking clearly audible to the pilot. Whether or not that contributed to the center section fitting problem is hard to say.

The search is on now, the top wing is taken off and opened up. One of the first finds is a loose drag wire in the right inboard bay, like a quarter of an inch with all nuts still jammed tight.

One antidrag wire anchor block had pulled loose at the rear spar left inboard bay in the top wing and all bays had to be retrammed in all panels.

Much to the credit of Chapter 17 members, with the realization that important contests might be missed, out came the fabric cutting knives and the whole airplane is stripped.

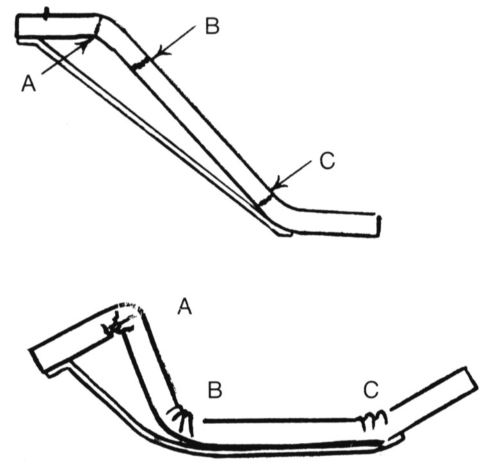
We have some good flying and building talent in this chapter, and all the things that must be done for safety are getting done, however long it takes.

As so many have said before, the off season should be tear down and inspection time, with plenty of that time to do a thorough and meticulous job.

Making the bird go just one more contest might be one too many.

Dick Bailey
Tech Reporter
Chapter 17

Pitts Gear Showing Welds



TECHNICAL SAFETY 2

Check those welds in the Pitts landing gear. Especially the ones that are located near the shock cords.

I had a gear failure recently on landing. Really it was uneventful and no great danger occurred. As the Pitts touched down on the sod strip, the landing was somewhat harder than intended. I felt a slight give-way and I thought the shock cords had broken. Continuing to roll, the Pitts slowly turned left and stopped on the side of the runway with the wing tip about six inches from the ground. On inspection of the damage, I was greatly relieved that nothing more than a bent gear-strut occurred. The weld at the top of the gear which is gripped by the shock cords, marked "A", gave way and the tubing appeared to be telescoped into the joining piece.

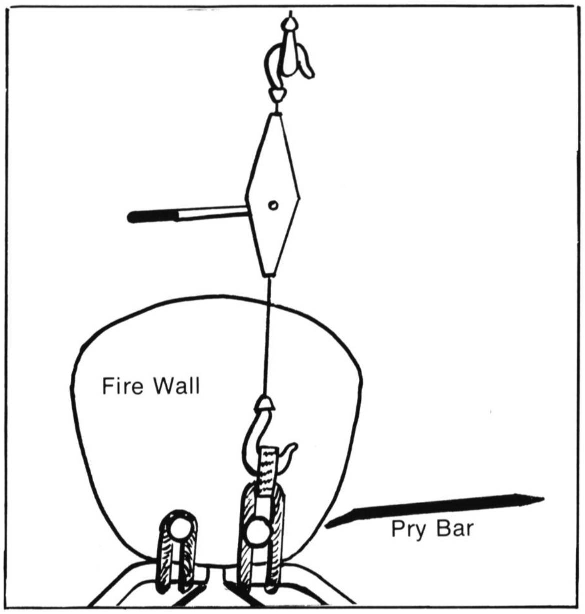
A designated inspector said that the weakened tubing problem appeared to have been caused by constant bouncing on take-offs rather by hard landings.

The welding instructor at Le Tourneau College of Auronantics did a fabulous job of rebuilding with sleeves in the bent strut. By heating the metal red hot, he was able to pull the bend and ripples out of the lower end of the strut. Replacing the gear on the Pitts was easy, a perfect fit. Naturally, the hard part was yet to come as we replaced the shock cords, but an idea in an empty head can have a field day.

I have seen others fight, cuss and sweat trying to replace shock cords, but this idea worked so easy and we were finished in about fifteen minutes. The cowling was removed and I left the engine mounted. I dropped a cable line and hook from a come-a-long which was attached to a second come-a-long connected to a steel rafter. Using a Navy web belt, like we used to hold up our pants in the Navy, I attached it to the shock cord and the hook. By cranking a notch at the time, the 1380 shock stretched nicely. Using the weight of the plane with engine intact, the process of slipping the loop of the shock cord over the collar was simple.

I backed off the wench and let the cord set in. By uncoupling the hook and yanking a couple of times, the web belt disengaged and we returned for the second shock. It was just as easy as the first one.

Dr. Carroll V. Guice
Longview, Texas



TECHNICAL SAFETY 3
More Etcetera

The following is taken from a letter received by the IAC Technical Safety Committee:

"The aircraft is a '75 Citabria 7KCAB with the Christen Industries 801 series inverted system. I did normal run-up, outside temp. was about 15°, engine temperatures and pressures were normal. On take-off oil pressure went slightly past red line (on the high side). While returning to the field I noticed oil blowing on the right lower wing strut from below the engine.

"After shutdown I removed the cowling to see what caused this problem. Engine seals and gaskets were normal and all the oil had blownout of the breather. I removed the oil lines from the oil valve of the Christen 801 (P/N LW13750), upon doing this I poured approximately a cup of water from the two lower lines, which was ice at the time of the flight. This caused the oil to be pushed past the ball check in the oil valve, forcing oil into the breather line and into the oil separator, which caused the oil separator to fill and blow excess overboard. This amount of water had accumulated in 2 months and only 11 hrs. of operation.

"I think the only remedy here is either to change the oil more frequently and draining all oil lines of any water accumulation, or at least warm engine long enough to melt any ice that may have formed in the lower lines."

The key sentence in this report may be the last line "warm engine long enough to melt any ice that may have formed . . ." This sounds a lot like the information Frank Christensen (Christen Industries) put out in the July/August 1976 issue of *Sport Aerobatics* (see article entitled "Cold Weather and Inverted Oil Systems") when he said "under cold weather conditions, proper engine warm-up is absolutely essential." While on the subject of cold weather operation, perhaps we all should also re-read the article in the January 1977 issue of *Sport Aerobatics* entitled, "More Cold Weather Tips."

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In the February 1977 *Sport Aerobatics* an article concerning aerobatic aircraft seat breakage concluded by saying, "Let's all try to make the above-listed seat failures the **last** ones." Shortly thereafter the IAC Technical Safety Committee received both a phone call and a letter regarding another seat failure. Both gentlemen were a little concerned (to say the least) for this was the **second** seat failure for this particular aircraft. The plane, a 1976 8KCAB Decathlon equipped with the adjustable front seat, previously had both side members of the seat frame break. (Re-read the first paragraph of "The One You Save May Be Your Own," February 1977 — refers to the same 8KCAB). This breakage was **before** A.D. 76-22-01 was issued on the Decathlon and Citabria seats. The seat was repaired and the additional bracing as per A.D. 76-22-01 and Bellanca Service Letter C-125 was added. The second seat problem occurred while doing snap rolls, as did the first breakage. But this time the seat back failed — on the right side. The hinge bolt tore through the mounting fork. (See picture below.) Again referring back to "The One You Save May Be Your Own" article, please note several other Citabria/Decathlon seats that broke in the same location. All IAC members flying Citabrias or Decathlons with folding seat backs should very closely inspect the hinge bolt area.

***** ***** *****

Another IAC member reports that he had his Security 150 Parachute repacked just recently and when he picked it up at the parachute loft he thought he would give it his usual "pre-flight" check. When he opened the back flap, much to his surprise he discovered the knots in the locking cord were **beneath** the grommets. (Note: This problem was fully covered in the July/August 1976 issue of *Sport Aerobatics* in the article ". . . Most Neglected . . ."). He pointed out the potential problem to the rigger who had packed the chute and this rigger and a fellow helper "worked" the locking cord around until the knots were correctly positioned above the grommets and on top of the "S" hooks. The IAC member goes on to say that **the rigger** was a little "put out" about all this and remarked that the knots "probably won't stay above the grommets for long." As they say, "You pays your money and you takes your choice." There is an IAC brother who says next time he is choosing a different parachute loft and different parachute rigger.

***** ***** *****

Part of the learning process is "review". The above three incidents make good review for all of us. The old cliche, "We **have** to learn from others' problems because we probably won't live long enough to make them all ourselves," is quite appropos for aerobatic enthusiasts. Thanks go to the IAC members who took time and made the effort to send in the above reports so others could benefit. This is what the IAC Brotherhood is all about.

It Quickens The Pulse

By Dennis E. Houdek

There is something to be said about doing acro over an airstrip in an approved practice box. Today while giving acrobatic dual to one of our chapter members, Bob Barnes, a top wing fairing came loose during a snap to the left. We were flying a Decathlon rented from Livingston Aviation of Howell, Michigan and flying over Miller Field where our practice box is located.

The fairing let go as we passed the inverted attitude. Bob Barnes finished the snap and then I took over the controls and found a speed and power setting at which the fairing would not slap around. Fabric and one stringer in the fuselage above my head were damaged. We made a safe landing at Miller Field and removed the loose fairing and got some furnace tape to make the ferry trip back to Howell.

The right wing had previously been off for repair and this fairing was a little looser but not noticeably so. There are three screws at the rear and a tension screw at the front holding this fairing. In my opinion the old J-3 Cub with lots of screws in it is a much more substantial installation.

After returning to Howell we were discussing the fairing and found out that they had questioned the tightness of the fairing after the repair but the mechanic had said it was airworthy. It would be my opinion that this fairing could use more screws in it than it is designed with. The fairing tightness is obviously critical and should be looked at with an eye of suspicion particularly after work has been performed. In this case several months of flying was done before it let go.

Stick Grip Stickum

By Sam Burgess IAC 23

We have all experienced that rubber knob on the end of the control stick on an aerobatic aircraft coming loose or completely disengaging itself from its mooring.

It is disconcerting and could be dangerous at the appropriate moment. How many maneuvers have been blown by your stick grip coming loose or sliding off the end? This is more apt to happen to Advanced and Unlimited category pilots when pushing outside.

Motorcyclists have developed a procedure to end this dilemma and many aerobatic mounts will be seen sporting some sort of motorcycle grip. The type with the vanes is not recommended as these vanes will collapse when pressure is applied as in a snap roll with a resultant loss of feel for the control surface activated. This type is designed for the twisting action of a cycle throttle. The solid rubber type with the large flare on the end is more suited for aircraft installation.

Tape the stick with old fashioned black cloth friction tape (do not use plastic or rubber) to a thickness slightly wider than the inside diameter of your grip. Soak the tape with NAPTHA and slide the grip on the stick with the flare on top to prevent your hand from sliding off when the stick is extended forward. Allow the naptha to dry overnight, and you will find that your new grip is welded to the tape and can only be cut off.

Glide Ratio

By T. J. Brown

I suppose most people have heard by now that I had an engine failure in my new S1. I was in an inverted spin at the time (maneuver #2 in the Unlimited sequence) and didn't have a great deal of altitude when I recovered. The engine apparently had a rod fail (it was sticking through the case). I'll give you a complete story later with pictures. My purpose in writing (this) now is to convey my experience about a Pitts with a dead engine in hopes that others may benefit.

First of all let me say that I had "dead sticked" jet fighters, which have a glide ratio just better than a sewer lid. In spite of that, the glide ratio (or lack of it) in a dead engine Pitts is startling. When I pulled out of the spin the engine was still running though I had it in idle due to the severe vibrations. In this condition the plane had a comfortable glide and it appeared that I would make the field. However, the engine quit shortly thereafter. I immediately pushed the nose down sharply but still lost about 30 mph before I could establish an 80 mph glide with a dead engine. I would say that my glide ratio was cut in half at best. I knew then that I couldn't make the field so I flew the plane, holding 80 mph, right into a dense wooded area, raising the nose to about a 25^0 dive just before hitting the trees about 75 feet above the ground.

The airplane was destroyed; I was not injured at all. There are two things to pass on immediately . . . First, if you have practiced landing a Pitts in "fake" emergencies with an idle engine, be prepared to double your practiced dive angle if the engine quits altogether. Second, regardless of where you will land, FLY the plane to the ground. Do not let it fall (stall/spin). Let the plane take the punishment by giving it a chance to slide, tumble and skip across the ground. Remember, it's the sudden stop that hurts.

By the way, after I "landed" I was lost in the woods — it just wasn't my day!

(Photo by Bill McCollough, MD)

T. J. says, "FLY it to the ground. Don't let it fall!"

"A PITTS IS A PITTS IS A PITTS"

Or is it? In the United States there are two government agencies that investigate aircraft accidents — the Federal Aviation Administration (FAA) and the National Transportation Safety Board (NTSB). Both agencies use computers to file and then distribute information. Other countries have similar bureaus that work in the same manner.

A couple of months ago we received from the NTSB a computer printout sheet entitled "Briefs of Accidents" on which was listed File Number 3-1931 with the following information:

"Aircraft Data — Pitts S1-C
Injuries — Crew one, fatal
Damage — Destroyed
Type of Accident — Airframe failure in flight
Probable Cause(s) — Pilot in command - exceeded designed stress limits of aircraft
Factors — Pilot in command - failed to follow approved procedures, directives, etc.
Miscellaneous acts, conditions — Unwarranted low flying - overload failure - separation in flight."

Now, if reading a report like that doesn't bring a Pitts driver to attention, ain't nothin' goin' to. However, the IAC Technical Safety Committee received this NTSB computer data approximately nine months after the accident and by that time we had a pretty good handle on the situation including the complete report upon which the computer printout was based, photographs of the wreckage, input from an IAC chapter president who knew the party involved and lived in the area of the accident, and information from Curtis Pitts of Pitts Aircraft (now Aerotek) and Sam Macre of Razorback Fabrics.

Presented below are excerpts of important information quoted from the sources that were contacted by the IAC T.S. Committee.

First, some info from NTSB Form 6120.4, "Factual Aircraft Accident Report - General Aviation" — (This is the full 12-page report on the accident in question.)

"Part U — Narrative Statement of Pertinent Facts, Conditions, and Circumstances.

Secton A. **Resume:** Following completion of a loop, both left wings separated from the fuselage and the aircraft crashed in the water, fatally injuring the pilot.

Section B. **History of Flight:** Mr. (deleted), a private pilot, employed by (deleted) Aviation, Inc., told me he saw the aircraft complete two loops. (Name deleted) further told me that the second loop was completed at an estimated 2000' with the aircraft in a shallow dive, and when the aircraft was at an estimated 400' to 500' altitude he saw a wing come off.

Section D. **Damage to Aircraft:** The aircraft as such was destroyed. The impact in approximately three feet of water was near vertical. The propeller showed no evidence of damage, however, the propeller's spinner was pushed straight back and had the imprint of the heads of all the propeller's attach bolts.

The aircraft's fuselage, landing gear and empennage were a completely mangled mass of steel tubing. The mangled and broken right top and bottom wing were found with the main wreckage, with the right aileron still attached to the lower right wing. The left top wing, the larger portion of which was in two parts, was found by the (deleted) County Sheriff's personnel floating in the water south of the main wreckage. Numerous small scraps of wood from the bottom left wing, and the detached shattered left aileron, were found floating in the water near the left top wing.

The left outer bay I strut, with flying and landing wires attached, remained attached to the main wreckage.

The two largest portions of the left bottom wing that was retrieved were two portions of the rear spar, each approximately 18 inches in length, with one of the two aileron hinge brackets attached to each piece.

Most of the wooden pieces of the left aileron remained in its envelope covering. The left aileron spar was broken into (sic) at the points where the two 3/16 inch bolts that attached the aileron to each of its two hinges were bolted through the aileron spar.

The bolts were not pulled through the aileron spar prior to its breaking into. (sic)

Section G. **Aircraft Information:** The aircraft was a modified version of the amateur built Pitts Special in that the wing span was approximately three feet longer and the fuselage two feet longer.

Also, the aileron ribs were made from ¼ inch mahogany plywood with no reinforcement at their trailing edges. Each rib was attached to the aluminum V trailing edge with two 4/32 metal screws ⅜ of an inch long, with one screwed into the plywood rib from the top and one from the bottom.

The ailerons also had aluminum fixed trim tabs approximately 6 inches long and one inch wide attached to their trailing edge. The left tab was found bent up and the right down on an approximate 30 degree angle.

(Name deleted) an Airframe and Powerplant Mechanic holding an Inspection Authorization, told me that he sold the aircraft to (name deleted). He further told me that during the time he owned the aircraft, he had experienced considerable aileron control problems but this was corrected by further crimping the aileron's aluminum V trailing edges and adding the fixed trim tabs. He also stated the trim tabs were only slightly bent when he owned the aircraft.

Section N. **Wreckage:** In addition to that as described under Item D of this report, the following was noted: the left aileron, in addition to having its spar broken into at its hinge points, had a considerable amount of the finish missing from its razorback fabric covering. Also, the fabric tape along the trailing edge of the left aileron was pulled loose from the fabric and extended up along most of the top of its trailing edge."

In Part O — Instrument Readings — airspeed indicator impacted at 208 mph.

After going through the NTSB report we contacted Curtis Pitts for his comments. Below is what Curtis had to say:

"After reading and analyzing the contents of the report we have come up with a Sherlock Holmes type deduction of the sequence of events leading up to the failure.

1. Excessive loads were imposed on rear spar of lower wing by aileron, (probably by flutter developing in the left lower aileron).
   a. Flutter could have been excited by the loose tape at the trailing edge of the aileron.
2. Rear spar of lower wing failed due to excess aileron loads. We note that two sections 18 in. long with aileron hinge bracket attached were found, apparently ripped right out of the wing. Also note that one hinge bracket was inboard of the "I"

strut and one outboard. The section in between was still attached to "I" strut and aircraft.

3. The damaged lower wing folded rearward due to drag loads plus torsion loads from the upper wing induced by lift and drag. This torsion load was transmitted to the lower wing in a rearward direction by the "I" strut causing the upper and remaining portion of the lower wing on this side, to be twisted from the aircraft.

   Since the wings on this aircraft were of longer span than the standard wings the natural frequency of the wing would be somewhat lower. This would probably make flutter possible at considerably lower airspeed than the standard wing.

   Since we do not know the actual natural frequency of the longer wings or ailerons we can not make a very good guess as to what speed would be critical."

Following up the loose tape-aileron flutter idea, the IAC T.S. Committee called Sam Macre of Razorback Fabrics in Manilla, Arkansas. Sam advised that he had never heard of **Razorback tapes** pulling loose from **Razorback fabric** but hastened to add that he has seen many unapproved covering jobs that used Razorback fabric and either Dacron or Grade A tapes. He said that using either Dacron or Grade A in conjunction with Razorback may give a less than satisfactory bond and is **not** the recommended Razorback process.

By the time we had gotten this far the accident investigation was all over but the shouting and there was not much chance of determining anything further about the tapes or the covering job.

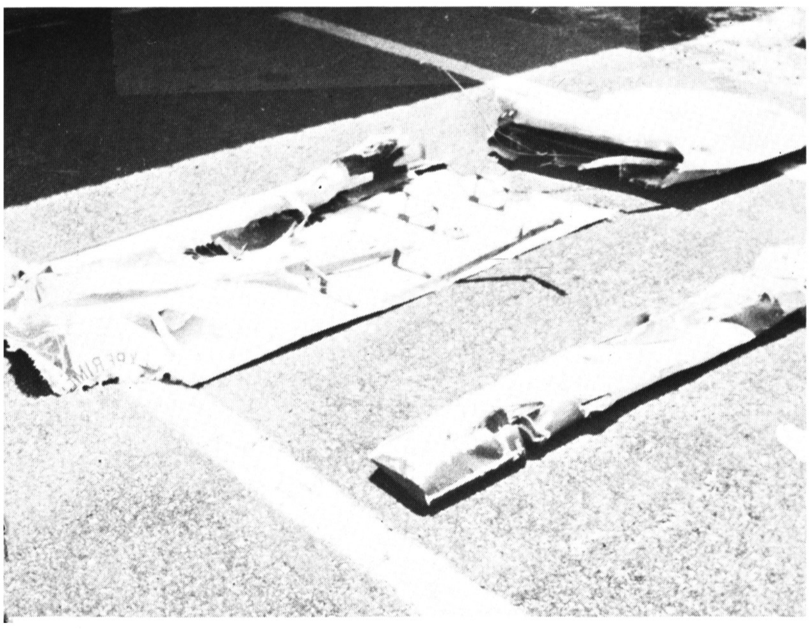
Now that we have read the computer printout data and the pertinent background information, this brings us full circle to the significance of the title of this article, "A Pitts is a Pitts is a Pitts". The NTSB computer has this accident on file as a Pitts aircraft, airframe failure in flight, aerobatics, etc., and any future request for computer information sorts on Pitts a/c, or aerobatic accidents, etc. will have the computer spitting out File Number 3-1931 as noted in the beginning of this article. Is this good data? Do you think that an aircraft, in this case a Pitts, that has been modified both in construction details and basic design — three foot longer wing span and two foot longer fuselage — should be in the same classification as an "unmodified" version? Was this aircraft a Pitts S1-C? What about the computer printout listing for probable cause(s) of the accident — "Pilot in command exceeded design stress limits of aircraft"? It is highly probable that no one has ever figured the design stress limits of a Pitts that has a two-foot longer fuselage and a three-foot longer wing span. And does in fact the idea of exceeding "stress limits" fit in with the actual observed data and probable cause of the accident?

The purpose of this article is not to second guess the accident investigators or to belittle the NTSB or any other government agency but only to do the following:

(One) — To point out the shortcomings of some types of computer information. Everyone knows that water is composed of oxygen and hydrogen and when water is broken down into its basic elements, neither of these elements bears any resemblance to the original substance — water. This "corruption by division and classification" (or whatever you would like to call it) holds true for all complicated information (such as aircraft accidents) that has to be broken down and classified to fit into certain slots in a computer. IAC members should bear this in mind when dealing with computer information, or studies based on computer information, that deals with aerobatic aircraft, or aerobatic accidents.

(Two) — To present background information for those IAC members who had already read the NTSB "Briefs of Accidents" File Number 3-1931 computer printout and had had questions regarding this particular accident.

(Three) — As is the case with all IAC T.S. articles, to disseminate as widely as possible, any information of a technical/safety nature that may help to make flying sport aerobatics safer and more enjoyable. The above article has some good pointers by Sam Macre of Razorback Fabrics and by Curtis Pitts of Pitts Aircraft (now Aerotek). To these two gentlemen and the others who contributed, IAC thanks.



Left top wing and left lower aileron.

GEL/CELL

Pitts Aerobatics of Afton, Wyoming, has recently generously donated to the IAC Technical Safety Committee a complete set of Pitts Manuals including S-1 and S-2 owner's and maintenance manuals, S-1 and S-2 parts catalogs, and S-1 and S-2 Service Letters and Service Bulletins. The wealth of information contained in this literature will help IAC take care of its own and benefit many in the aerobatic community.

To start making use of this material, below is a copy of Pitts Aerobatics latest Service Bulletin, S.B. #12, June 1, 1977, on Gel/Cell Battery Installation.

MODELS AFFECTED: S-1S 1-0001 to 1-0054
S-2A 2001 to 2145

The use of lead acid batteries with liquid electrolyte has resulted in continuing problems with acid spills in the aft fuselage interiors of Pitts S-1S and S-2A aircraft, with resultant field service problems. In order to correct this problem, the use of Gel/Cell batteries in these aircraft has recently been approved by the FAA. Two Gel/Cell 6V 20A batteries are used in series in place of the AN3153-1A or Rebat S-25 previously approved. With the Gel/Cell batteries installed it is no longer necessary nor desirable to turn the alternator field switch off during aerobatics since the Gel/Cell battery vent system will vent properly in an inverted position.

The following items are necessary in order to make the conversion.

1. 2 ea. Gel/Cell batteries
2. 1 ea. 1-241-15/2-2125-13 adapter plate
3. 1 ea. 1-241-19/2-7602-37 connector strap
4. 1 ea. 1-101-25/2-2125-17 hold down bar

Install the Gel/Cell batteries in the following manner:

A. Disconnect the leads from the original battery installation.
B. Remove the original battery from the battery rack.
C. Check the tubular structure in the aft fuselage area and neutralize any acid spills with bicarbonate of soda and touch-up with primer where necessary.
D. Install adapter plate in battery rack.
E. Shorten existing threaded rods so they project approximately ¾" above hold down bar.
F. Set batteries on adapter plate with positive terminals on outboard side, one at the left front corner and one at the right rear. Install hold down bar with pads on bottom side against the battery cases and tighten wing nuts on hold down bar until bar begins to bow slightly. (Do not over-tighten.)
G. Safety the wing nuts with safety wire.
H. Install connector strap between negative pole of one battery to positive pole of the other (at aft end of batteries).
I. Connect ground strap to negative pole at right forward corner of batteries and the positive lead to the positive pole at the left front corner of the batteries. Use AN 960-416L washers on each side of terminal lugs.
J. Recalculate weight and balance using the following information.

	Weight	Arm	Moment
(1) S-2A			
Old Battery Installation	30 lbs.	154.8	4644
New Gel/Cell Installation	20 lbs.	154.8	2864
(2) S-1S			
Old Battery Installation	30 lbs.	108.0	3240
New Gel/Cell Installation	20 lbs.	108.0	2160

K. Complete installation by making log book entry covering battery change in accordance with Pitts Aerobatics Service Bulletin No. 12.

SEVERING OF RIB STITCHING ON PITTS S-1 UPPER WING

In order to present the information that has been received by the IAC Technical Safety Committee in the least disfigured form, many IAC T.S. articles are mainly a conglomeration of quotations from various sources. This IAC T.S. article will follow this familiar format.

About a month ago the T.S. Committee received the following report:

"In October '76 it was noted that the three ribs in the upper right wing between the center section and aileron of . . . had separated at the trailing edge and the ensuing sawing action, as the ribs vibrated back and forth, had severed the rib stitching from the trailing edge to half way between the spars.

The rivets securing the rib trailing edge had split the wood and with no chinking blocks at the spar the rib was allowed to "saw" the stitches. This was assumed to be an isolated case and repaired as necessary, however, in April '77 it was noted that the same condition appeared to be prevalent on the upper left wing. When the fabric was pealed back it was noted that the ribs were secure at the trailing edge but the stitching was again severed from the trailing edge to in between the spars. Again no chinking blocks were found where the ribs attach at the spar. The only way the ribs were retained was by one small nail driven through the inside cap strip upright to the spar which had worked loose. Glue had been applied at this position but the fit was not snug enough to be effective and had broken loose allowing the rib to move at the rear spar.

In both cases angular chinking blocks were glued to all four corners of the rib/spar joint and no further problems are anticipated.

This particular aircraft is a homebuilt but manufactured at Homestead, Florida using the same wing jigs and perhaps techniques as the factory wings.

The method of nailing the rib to the spar was evidently used to save weight. Even a small block glued to each side of the rib at the top and bottom of the spar would be insignificant in weight and would probably have secured the rib in place.

It is difficult to say what particular aerobatic maneuver would cause this rib separation but constant vibration is suspect."

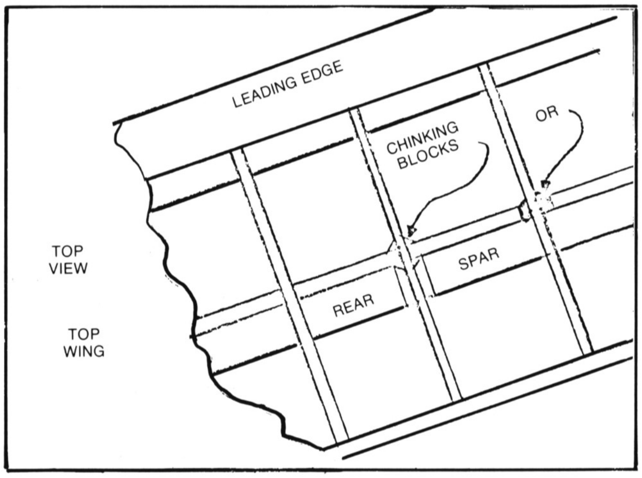
The section of the above report suggesting that perhaps "factory-built" wings used the same construction techniques prompted the IAC T.S. Committee to check with Herb Andersen of Pitts Aerobatics in Afton, Wyoming. Herb's reply read in part as follows:

"We have never used any so-called "chinking" blocks where the ribs cross the spar on the factory built Pitts wing. The wings are truss type construction and the vertical uprights are always glued to the spars and, to the best of my knowledge, we have never had any situation where these ever worked loose. I would be surprised if such a thing as a so-called "chinking" block was used on a truss type rib as it is usually only used when a rib is made out of a plywood web."

Herb then went on talking about manufacturing techniques stating, "A lot of them are using wings that are manufactured by individuals where the gluing is not necessarily always done as it should." And then reiterated, "I can certainly assure you that we have never had this problem, to the best of my knowledge, with any of the factory built Pitts aircraft or factory built Pitts wings."

We have noted that oftentimes when trying to trail down problems the trail turns "cold" and no definite "cause-effect" or "do this and don't do that" conclusions are reached. This does not mean, however, that meaningful information has not come to light. The foregoing input from one IAC member and from Pitts Aerobatics verified that last statement. And it should not be necessary to dissect the foregoing information delving into the ifs, the ands, and the probabilities — each interested IAC member can apply his own logic. However, it should be noted that the second largest single problem area for IAC members, as reflected by the IAC M & D files, concerns wing problems — broken ribs, cracked and broken spars, cracked leading edge wrap-arounds, elongated wing attach bolt holes, bent wing attach plates, drag and anti-drag wires pulled loose, etc. Therefore, it behooves us all to take special note of this article and double check those wings.

To continue our "standard" format, IAC thanks the member submitting the wing report and Pitts Aerobatics for their comments on the subject.



INTERNATIONAL AEROBATIC CLUB

I.A.C. MEMBER ™

PRE-FLIGHT CHECK LIST

In the April 1977 issue of *Sport Aerobatics* IAC members were offered free Decathlon and Citabria 100 hr./annual inspection checklists. Several of the members responding to this asked if there was also available a pre-flight checklist. For these people and others, below is a reprint of the Bellanca Operating Check List for Citabrias, Decathlons, and Scouts. One side of the Operating Check List is "Pre-Flight" and the other side is "Pre-Flight Ground Check". Citabria and Decathlon owners can use this checklist as a basis for building their own personal check list. Hopefully, some of the Technical Safety information put out in *Sport Aerobatics* will work its way into individual members' check lists. A detailed pre-flight inspection check, pertaining to all aerobatic a/c in general, was authored by Bob Davis and was published in the May 1973 issue of *Sport Aerobatics*. Remember, a good pre-flight inspection, using a good pre-flight check list, is the first line of maintenance defense.

PRE-FLIGHT GROUND CHECK

Check aircraft for general condition. Check its systems and components for condition, excessive wear, security, fluid leaks, etc. Check control system for normal movement and security.

1) a. Release Control Lock
   b. Ignition Switch "OFF"
   c. Fuel Quantity on Fuel Gauge
   d. Fuel Valve "ON"
   e. Seat Belts
   f. Secure Rear Seat Belt and Harness if not in use
   g. Before Aerobatic, Remove all Loose Articles

2) a. Wing Root Cover
   b. Flap and Aileron

3) a. Right Main Landing Gear and Brake
   b. Fuel Quantity, Filler Cap Security
   c. Pitot—Static Tube for Stoppage

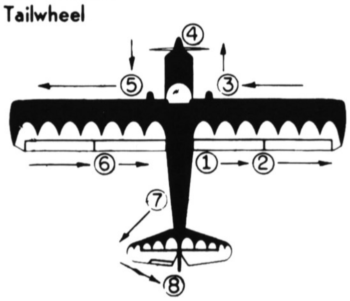
4) a. Oil Level and Secure Dip Stick
   b. Engine Compartment—General Condition
   c. Gascolator Drain
   d. Windshield for Cleanness
   e. Prop and Prop Spinner
   f. Air Filter for Cleanliness and Security

5) a. Left Main Landing Gear and Brake
   b. Left Fuel Quantity, Filler Cap Security
   c. Inspect Stall Warning Switch

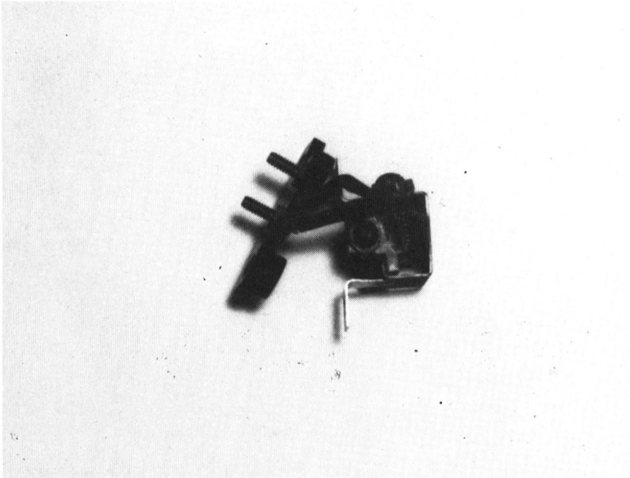
6) a. Aileron and Flap
   b. Wing Root Cover

7) a. Gas Drain Aft Fuselage
   b. Bottom of Aircraft

8) a. Tail Surfaces
   b. Tailwheel



ALTERNATOR BRUSH HOLDERS



An IAC member recently encountered an alternator malfunction due to a broken alternator brush holder. A little research revealed several other broken alternator brush holders, namely:

Year	Make & Model	Total Time
1973	Citabria 7ECA	20 hrs.
1973	Citabria 7GCBC	———
1972	Decathlon 8KCAB	135 hrs.
1969	Citabria 7ECA	308 hrs.

Since all the alternators involved were Prestolites and the IAC member first mentioned had sent in the broken brush holder, the IAC Technical Safety Committee forwarded the holder to Prestolite's Technical Service Section and asked for their help.

Prestolite supplied the following information:

(1) The brush holder that was sent to them (and apparently the other broken holders) was of an old design and is no longer being manufactured.

(2) The brush holder design was changed in May 1971 but there was no A.D. or Service Bulletin issued. The factory considered this a "running change" and therefore even the brush holder part number (P.N. ALU-1045BS) remained the same. This same holder is used on all 5-inch frame Prestolite alternators.

(3) The old style brush holder and the new style holder (called a "captive design") are easily physically identifiable. The older style had the wire leads from the brushes coming through the side of the holder and attaching to a terminal stud — if the pin used to hold the brushes retracted in the housing for assembly purposes is removed, the brushes will not fall out. The new captive design style does not have the leads attached directly to the brushes — removal of the assembly pin will allow the brushes to fall out of the holder.

(4) Due to purchasing of, and shipping of alternators in large quantities, it is possible for later model A/C to be equipped with alternators with older style brush holders. (Note that three of the four A/C listed above were manufactured after 1971 — the year of the brush holder redesign.)

Although all of the aircraft reporting broken brush holders were Bellancas, remember that the same style 5-inch Prestolite alternators, possibly with the older brush holders, are used on many A/C — e.g., Pitts, Great Lakes, etc. IAC members with A/C over several years old that have problems with Prestolite alternators should make an inspection of the brush holder as the first thing on their troubleshooting checklist. Since the older brush holder has been phased out this should not be a recurring problem.

Thanks to the IAC member who supplied the M&D Report **and** the broken brush holder and thanks to Prestolite for the technical information and background.

FUEL CAP GASKETS

When your aircraft is inverted the fuel caps see a completely different set of circumstances than when the plane is in a normal flight attitude. In inverted flight your fuel filler cap is on the "bottom" of the tank and obviously if the cap gasket is in poor condition or has a poor fit, a fuel leak will result. As an extreme example of poor fuel cap gasket sealing, one IAC member reported **two** (2) "off airport" landings in an 8KCAB Decathlon due to fuel starvation which he attributed to loss of fuel out of the fuel caps while flying inverted. Open cockpit drivers also have to contend with another problem if they have a poor fuel cap fit — and that is the possibility of fuel being thrown into the pilot's eyes. (Naturally, sunglasses are a no-no and goggles are a must.)

Citabria and Decathlon owners encountering leaking fuel caps may find the answer to this problem by using the latest Bellanca fuel cap gaskets. The early Citabrias used just a common gasket material (paper) gasket in the fuel caps. Later Citabrias and Decathlons came equipped with neoprene gaskets. Unfortunately, in time the neoprene tended to swell and crack when exposed to gasoline. The new Bellancas come with BUNA N gaskets which should solve the problem. These gaskets (P/N 1-10408) fit all the earlier models. Any other aircraft which have the same type filler caps as do the Citabrias and Decathlons may also benefit from using the new Bellanca BUNA N gaskets. And for IAC members who have a "different than Bellanca" type fuel filler — well, at least you know what type of material to hunt for.

One more point. The best gaskets in the world aren't worth a darn if the fuel cap is left off or **not tightened completely**. How many IAC members have an alignment mark painted on their fuel caps which aligns with a mark painted on the fuselage or wing next to the cap which gives a visual indication of when the fuel cap is secure? We know of one IAC member who just got a new aerobatic mount and immediately "penciled" on alignment marks until he had time to paint them on. How about the rest of us?

(Thanks to Bellanca Aircraft Corp. for the fuel cap gasket material information.)

"U-BOLTS & THRU-BOLTS"

Below is a list of Citabria and Decathlon MLG U-bolt and thru-bolt failures that has been compiled by the IAC Technical Safety Committee.

Thru-Bolt	U-Bolt	A/C Model	Year	TT	Remarks
1		7ECA	1973	620	Sheared
1		7ECA	1972	2500	AN-7 broken
1		7GCAA	1972	—	Gear let go; hit rt. wing strut
1		7GCAA	(SN 165)	—	Broken
1		7GCAA	(SN 108)	504	Broken
1		7GCBC	(SN 147)	—	Broken
1		7GCBC	1974	43	A/C flipped over
1		7GCBC	(SN 94)	1423	Broken
1		7GCBC	(SN 150)	—	AN7-25A bent & corroded
1		7KCAB	(SN 182)	—	Broken
1		7KCAB	1973	791	Broken
	1	7KCAB	1974	314	Broken fwd. radius
	1	7KCAB	1970	875	Broken)
	1	7KCAB	1970	—	Second report this) Same A/C; both RH) A/C
1		7ECA	(SN 102)	—	Broken
	1	7ECA	(SN 598)	650	Broken
	1	7ECA	(SN 639)	854	Broken)
	1	7ECA	(SN 639)	200	Broken)
	1	7ECA	(SN 639)	1900	Broken off under) Same each nut when) A/C removed for) inspection)
	1	7ECA	(SN 637)	619	Broken base of threads
1		7ECA	—	1320	AN7-25
	1	7ECA	(SN 625)	786	Broken
	1	7GCAA	(SN 143)	561	Broken
1		7GCBC	—	—	Broken
	1	7GCBC	1972	—	Broken
	1	7KCAB	1972	112	Broken radius) Same
	1	7KCAB	1972	50	Cracked radius) A/C
	1	8GCBC	1974	320	Broken
1		8GCBC	1974	—	Broken
	1	8GCBC	1974	635	Broken bend radius
	1	8KCAB	1974	250	Cracked
	1	7KCAB	—	900	Broken
	1	7KCAB	1973	428	Broken
—	—				
15	18				

INTERNATIONAL AEROBATIC CLUB

I.A.C.

MEMBER

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Rather than just state that there have been 18 landing gear U-bolt failures and 15 landing gear thru-bolt failures, we have chosen to print the entire list of failures for pure dramatic impact. Now that everybody is "psyched-up" let's dig into the problems.

First the U-bolts. The MLG U-bolts have been a Citabria and Decathlon problem for some time. Bellanca has made three or four changes in their U-bolts — including material changes (different grades of steel) and processes (shotpeening, etc.) — and still the problem persists. The latest, and best U-bolt available, is the heavy duty U-bolt used on the Bellanca Scouts (restricted category operation). The H.D. U-bolt is P/N 2-2132. It is available for replacement on Citabria and Decathlon aircraft. Bellanca is presently working on a forged production U-bolt but as yet it is not in manufacture. When this forged bolt becomes available, a Service Letter will be issued and the information passed on to IAC members. For the present it is recommended that the H.D. Scout U-bolt be used and that it be removed, stripped, and inspected (Magnafluxed or dye-penetrant checked) at a specific time interval — perhaps every 100 hrs. or every annual inspection — or after any extra hard landings. When installing the U-bolts note that **torque requirements are critical**. Follow information and procedures given in the Bellanca Service Manuals ("Torque U-bolt to 450-500 inch pounds with gear off the ground.")

The thru-bolts — Older Bellanca aircraft with AN-7 bolts as the landing gear thru-bolts. It is recommended that these bolts be changed immediately to the newer high strength MS20007 Allen head bolts. The MS20007 bolts which came standard on later model Bellanca A/C are considered a time change item and should be replaced every 500 hours.

This is noted in the Bellanca Service Manuals both in the section on landing gear and in the inspection checklist. Note that MS20007 bolts have a radius under the bolt head that requires the use of a special washer (P/N MS20002C7). The nuts used in conjunction with these bolts are high strength nuts P/N ZEB 1845-070. Note that of the 15 thru-bolt failures listed, only one occurred under the recommended 500 hour time change period — and that failure occurred at 43 hours. This tends to make one think that perhaps this one particular bolt was defective to begin with or improperly installed. Also note that one failure occurred at 2500 hours — that is five (5) times the recommended service life of the bolt. The MLG thru-bolt problem is mainly that of **maintenance neglect**. A word of caution when installing new thru-bolts: The Bellanca Service Manual calls for a torque of 650-700 inch pounds and this has reference to the **nut** not the bolt. Getting to the nut to torque it isn't easy and may require making an adaptor. (Torque values that compensate for torque wrench adaptors may be computed as per FAA Advisory Circular 43.13-1).

IAC members should note that this article was prompted by **one** IAC member who called the IAC T.S. Committee several months ago to advise of a broken U-bolt on his 7KCAB. This member also went to the effort to submit five (5) separate IAC M&D Reports. We all owe him thanks and thanks to Bellanca Aircraft for supplying pertinent data.

By Fred L. Cailey
Chairman
Technical Safety Committee

BELLANCA SERVICE LETTERS

The Bellanca Aircraft Corporation has generously donated to the IAC a complete set of Bellanca Service Letters. In order to disseminate this valuable information as broadly as possible, the IAC Technical Safety Committee has gone through the entire set of Service Letters and has made a brief index of the Letters which would be most applicable to IAC members, i.e., the Service Letters pertaining to 7ECA and 7KCAB Citabrias, and 8KCAB Decathlons.

It is highly recommended that each IAC member subscribe to (and comply with) all manufacturer's service letters. However, Citabria and Decathlon owners who presently do not receive Bellanca S.L. may check the list printed below and ferret out those S.L. that apply to their particular A/C. Local Bellanca dealers — F.B.O.s should have on hand, or at least be able to obtain, copies of the individual Service Letters that are of concern to each Citabria/Decathlon owner. Those IAC members who cannot, for some particular reason, obtain copies of the Bellanca S.L. from local sources or Bellanca Aircraft, may contact the IAC Technical Safety Committee for help.

Bellanca Service Letters

For Bellanca 7ECA & 7KCAB
Citabrias & 8KCAB Decathlons

Number	Date	Subject	Models Affected 7ECA	7KCAB	8KCAB
77	5/22/67	Battery Acid Leakage - Caps	X	X	
78	5/22/67	Replacement of Nylon Brake Lines	X		
79	2/12/68	Operation of Seat Belts	X	X	
80	11/15/67	Throttle Knob Attachment	X	X	
81	11/15/67	Brake Fluid Leakage	X	X	
82	11/15/67	Top Windshield Retainer on A/C With Greenhouse Roof	X	X	
84	1/15/68	Revised Wheel Pant Brackets	X	X	
85	2/5/68	Fabric Replacement - Pop Riveted Wings	X	X	
86	1/15/68	Front Rudder Pedal Return Springs Rubbing on Fuselage Tubes	X	X	
87	2/1/68	Revised 1/4/71 Service Publications Index			
88	2/1/68	Revised 1/4/71 Service Kit Index			
89	2/1/68	Revised 19.5 Gal. Fuel Tanks	X	X	
91	8/19/68	Aux. Upper Door Latch	X	X	
92	8/19/68	Vented, Sealed Manifold for Rebat Batteries		X	
93	2/13/69	Propeller & Spinner Ass'y. Component	X		
94	5/5/69	Throttle Arm Knob Replacement	X	X	
95	6/9/69	Inspection, Repair & Modification of Aileron Bay Ribs (A/C mfg. prior to 2/9/67)	X		
96	8/1/69	Reinforcement of Fuselage Longeron at Landing Gear (A/C built 2/1/67 thru 10/5/67)	X	X	
98	11/2/70	Prevention of Loosening of Fuselage Belly Fabric (A/C built prior to 8/28/69)	X	X	
101	9/10/71	Replacement of Aluminum Pulleys in Elevator & Rudder Controls (A/C built prior to 5/1/71)	X	X	
102	9/1/72	Fuel Ventline Blockage By Ice or Snow (39 Gal. Tanks, Underwing Vent Built Prior to 8/28/72)	X	X	
103	6/1/72	Battery Venting		X	
104	9/12/72	Control Cable Replacement 7ECA S.N. 840-72 thru 871-72 7KCAB S.N. 304-72 thru 310-72, 312-72 thru 320-72, and 332-72 8KCAB S.N. 13-72, 15-72 thru 37-72	X	X	X
105	9/19/72	Battery Box 7KCAB S.N. 1 thru 208, 209-70, 210 thru 226, 227-70 thru 257-70, 258-71 thru 265-71, 265-70 thru 269-70, 270, 271, 272-70 thru 287-70, 288-71 thru 290-71, 291-72 thru 330-72 8KCAB S.N. 4-71, 5-72, 6-71, 7-72 thru 49-72		X	X
106	9/25/72	Fuel Lines (S.N. 4-72 thru 49-72)			X
107	9/25/72	Firewall & Cowling Cooling Modifications S.N. 4-71 thru 49-72			X
108	9/22/72	Installation Flexible Brake Lines 7ECA S.N. up to & including 883-72 7KCAB S.N. up to & including 330-72 8KCAB S.N. up to & including 49-72	X	X	X
109	5/5/73	Folding Back Seat Frame (All A/C built prior to 5/1/73)	X	X	X
110	5/30/73	Cowling Maintenance on 1973 A/C with Two-Piece Cowl having an Oil Access Door Only	X	X	
111	7/27/73	Inspection of Left Wing Overboard Fuel Vent Assembly 7ECA S.N. 905-73, 950-73, 951-73 7KCAB S.N. 344-73, 378-73, 381-73	X	X	
113	10/74	Inspection and Repair of Wing Ribs			X
116	3/6/75	Wing Leading Edge Inspection (A/C S.N. 4-71 thru 159-74)			X
117	3/6/75	Installation Butt Rib Support (A/C S.N. 4-71 thru 174-75)			X
118A	7/10/75	Replacement of Carburetor Air Box Alternate Air Valve 7ECA S.N. 985-74 thru 1108-75 7CKAB S.N. 405-74 thru 532-75 8KCAB S.N. 120-74 thru 204-75	X	X	X
119	4/8/75	Aileron Clearance			X
122	1/5/76	Alternate Emergency Exit Placard 7ECA S.N. up to and including 1152-76 7KCAB S.N. up to and including 567-76 8KCAB S.N. up to and including 236-76	X	X	X
123	12/19/75	Ammeter Needle Fluctuation (All A/C)	X	X	X
C124	4/15/76	Engine Overrich Operations (S.N. 405-74 and up)		X	
C125	5/19/76	Reinforcement of Front Adjustable Seat 7ECA S.N. 1126-76 thru 1173-76 7KCAB S.N. 551-76 thru 584-76 8KCAB S.N. 219-76 thru 265-76 (and all previous serial numbered A/C in which seat P.N. 7-1498 is installed as retrofit per Kit #252)	X	X	X

1977 FOND DU LAC TECH INSPECTION

Please remit correspondence to:
FRED L. CAILEY, CHAIRMAN
INTERNATIONAL AEROBATIC CLUB
TECHNICAL SAFETY COMMITTEE
1004 WOODLAND AVENUE
BATAVIA, ILLINOIS 60510

The nitty-gritty of an inspection is the actual inspection itself. Below is a list of items found during the technical inspection at the 1977 IAC Fond du Lac contest.

*Bolts too short on elevator trim tab cable attach point (3)
*Cracked aluminum elevator trim tab (1)
*Bent brake pad (1)
*Chaffed brake lines (many)
*Fuel tank vent lines on gear leg facing forward (many)
*Corroded propellers (many)
*Short propeller bolts (1)
*Old-style throttle cable (2)
*Bent Pitts upper wing front attach plate (old-style) (many)
*Nails backing out of L.E. wraparounds (3)
*Broken javelins (2)
*Loose aileron hinge fittings (Pitts) (many)
*Short bolt on engine mount to firewall (1)
*Deteriorated engine mount bushings (Lycoming type) (many)
*Loose wing trailing edge (1)
*Loose tail brace wires (many)
*Short bolt on tailwheel assembly to tailwheel spring (1)
*Worn tailwheel inner connect springs (very many)
*Worn tailwheel inner connect spring clips (very many)
*Loose stabilizer trim jackscrew (1)
*Looseness between elevator halves (many)
*Loose tailbrace strut (1)
*Loose elevator attach (carry thru) bolts (2)
*Water in elevator (no drain holes) (1)
*Dry (no lubrication) elevator hinges (elevator would stick in any position it was placed (1)
*Oil soaked belly fabric (several)
*Worn rudder horn cable attach points (many)
*Dry (no lubrication) rudder hinges (took about twenty lbs. pressure to move rudder) (1)
*Aileron interference with aerobatic sight (1)
*Aileron gap kit bracket broken — interfering with aileron movement (1)
*Aileron interference with aileron well (1)
*Broken rear seat folding back retainer strap (Decathlon) (1)
*Old-style (factory recommended immediate replacement) MLG thru bolts (Citabria) (1)
*Friction type (metal to fabric) seat belts (several)
*Dual seat belts attached to same mounting bolt (1)
*Loose Nicropress thimble (1)
*Incorrectly routed shoulder harness (Decathlon) (1)
*Foreign objects in tailcone (several) including: receipt book, two pennies, one quarter, top of pen, parachute packing card, ear plugs (2), comb, 12 foot tape measure
*Cracked Pitts control torque tubes (3)
*Cracked Pitts fuselage member (1)

Several parachute "discrepancies" including:
*Incorrect locking cord
*Rip cord handles incorrectly positioned in handle pocket
*Several probable "pencil-packs"
*Several out-of-date/unsigned parachute logs
*Missing packer's seal

Some of the above-noted deficiencies are self-explanatory; however, some may require further brief comments.

Any type of control surface looseness or improper balance, e.g., worn hinges, broken trim tabs, entrapped water, looseness between elevator halves, etc. could induce flutter. How much is too loose or too far out of balance? Last year an IAC member was killed in a flutter-related accident.

The IAC M&D files contain many landing gear/brake problems — broken tailwheel springs, broken MLG bolts, sticking brakes, brake failure, etc. The usual report is a ground loop with damage to wing tips, wheel fairings, gear attach points, etc. There are at least two reports of aircraft completely flipping over.

One of the favorite tricks of Pitts builders is to run the fuel tank vent line down a gear leg and then face the end of the vent line forward — at a height of about 2"-3" above the ground. In this position it is a prime candidate for blockage with mud or some other foreign object. Fuel systems constitute the number one problem area for IAC members.

An article by Sensenich Propeller Company that was in the October 1974 issue of **Aviation Mechanics Journal** states: "The types of service-damage which may render a fixed-pitch metal propeller unairworthy mainly consist of mechanical injuries such as cuts, nicks, and dents, caused by the impact of flying stones, gravel, sand, etc. Usually a displacement of the metal is involved and the void is roughly V-shaped in cross-section with the sharp point of the "V" pointing inward, away from the surface of the metal. There is also a type of chemical damage which involves corrosion at the interfaces of the grain structure of the metal. It is called corrosion pitting. The mechanical effect of this on the strength of the metal is the same as that of a "V" notch with the sharpest possible edge." Judging from the number of planes with corroded propellers at the FDL contest, apparently many pilots are not aware of this incipient problem. The corrosion can usually be removed by having the prop reconditioned which involves grinding a thin layer of metal off the propeller's surface. Propeller reconditioning, besides removing the corrosion also have another benefit. To quote from Sensenich Service Bulletin R-14. "Recent research has shown that metal specimens, which have been fatigue-cycled to 50% of their endurance life, can be restored to original condition by the removal of a thin layer of surface metal."

In 1974 Bellanca Aircraft changed from the old style (choke cable wire) to the new style Gerdes throttle cable. The IAC M&D files reflect about 4-5 failures with the old style cables and no reported failures with the new style. (Note that one of the A/C at FDL equipped with the "choke wire" throttle cable was a homebuilt Pitts.)

We have been advised that Pitts bent upper wing front attach plates (old style - flat plate) do not in themselves present a serious problem but should be changed to the new style (flanged edges) when recovering or rebuilding the wings. Note that Pitts Service Letter No. 3 advises checking area above AN5 bolt in attach plate for cracks.

Wing leading edges are a highly critical and highly stressed area. Many IAC reports note broken nose ribs and cracked L.E. wraparounds. We know of two L.E. failures — both were fatalities. One was an IAC member.

IAC files list broken flying wires, landing wires, and tail brace wires. Some of the failures have been attributed to vibration due to broken or missing javelins or excessive looseness.

Many IAC members have reported from 100 to 300 hours service life on Lycoming-type engine mount bushings. Since Lycoming has been supplying these in different heights (same part number), Citabria and Decathlon owners may want to ignore the torque dimension figure noted in the Bellanca service manuals.

An article on Decathlon/Citabria MLG U-bolts and thru bolts was printed in the September issue of *Sport Aerobatics*. All Bellanca owners should check this article.

Friction type (fabric to metal) seat belts have been reported to (1) slip or break during high stress, i.e., in an accident, or (2) jam up so tight that they cannot be released. Either way, metal to metal type seat belt buckles are the way to go.

On Decathlons and Citabrias in order to avoid possible interference with the rear control stick, front seat shoulder harnesses should be routed in **front** of the seat back — i.e., between the parachute back and the seat back. Routing the harness behind the seat back could cause it to become entangled with the rear control stick.

F.O.D. has been a steady problem for IAC members and Fond du Lac proved to be no exception. In spite of the best efforts of the Fond du Lac Technical Inspection team, one FDL contestant had to break off his sequence and land when he encountered partial control blockage due to a foreign object jammed in the elevator controls. For those of you who keep count, this is the 500,000th time it has been said that checking in the A/C tailcone for foreign objects should be part of **every** pre-flight inspection. (Please re-read the list of items found in tailcones during the FDL tech inspection and note again that at least one item was missed.)

Cracked Pitts lower fuselage members were covered in the March 1977 issue of *Sport Aerobatics* in an article entitled "Tubes". Perhaps Pitts drivers should review this article.

Cracked Pitts control torque tubes is a problem that has been around for a while. As of this writing, a special article covering the torque tube problem has already been forwarded to *Sport Aerobatics* Editor Steve Morris and should soon be appearing in **THE** magazine.

Though not problems per se, each Citabria and Decathlon at the FDL contest had the emergency quick-release door mechanism "exercised" and lubricated. One Decathlon driver admitted this was the **first** time he had tried the door quick-release mechanism. Every quick-release mechanism checked was in operating order. Also, when time permitted, each pilot was asked if he had an emergency escape plan in mind — that is, if his plane was in an uncontrolled situation, what altitude had he decided was to be the minimum before he would leave the aircraft. Most contestants answered either 1500' or 1000' AGL. What is **your** pre-programmed altitude?

Remember the above problems were noted on August 7 and 10 at Fond du Lac, Wisconsin. They are not the figment of some bureaucrat's imagination or the printout of some misguided computer. They are real problems — **here** and **now**. Therefore it behooves all of us to check the above noted areas on our own aircraft very closely — before the next flight.

One other item should be mentioned. The FDL Technical Inspection Committee "checked" **seventy** (70) aircraft on Sunday alone. To look over that many planes in that short a period of time almost requires that a person be wearing roller skates. The point being that the "inspections" could hardly be considered as thorough inspections — but merely a common pre-flight walk-around check. The number of discrepancies found tell us that we could and should make better inspections of our A/C. Remember whose donkey is on the line when you're up there working through a sequence.

My personal thanks and, on behalf of IAC, IAC thanks to the following individuals:

Nancy Cailey and Marquita Dulin — These two gals took care of all the paperwork. If the sordid details were published it would be seen that they were the "heroes" of the program and really saved the day.

Jim Dulin — Jim got stuck with double duty — he inspected **all** of the parachutes and also some of the A/C.

Scott Hellem — Scotty also did the double duty routine as photographer and inspector. (Unfortunately, one of the rolls of film, the one with "all the good pictures" was lost in developing.)

Dick Johnson — Dick was the Bellanca Aircraft Corp. representative on the FDL Tech team. He hit it full bore helping inspect **all** of the aircraft with **special** help on Bellanca products. (Note that this is the first time an aircraft manufacturer has sent a representative to help inspect aircraft at an IAC contest and Bellanca is to be commended on their interest and initiative.)

Charlie Wells — Charlie was the "Guru" on the Tech team. He not only worked on the two scheduled inspection days, Sunday and Wednesday, but took over by himself for two **unscheduled** days — Monday and Tuesday.

Bob Buffington and Dan Stewart — Both of these fellows deserve "special mention" for their assistance.

Again, thanks to all the above for their hard work and dedication.

PITTS SERVICE LETTERS AND THINGS

At the 1977 IAC Fond du Lac, Wisconsin, Aerobatic Contest, three (3) Pitts aircraft with cracked control torque tubes were discovered. This is **not** a new problem and has been covered in past issues of both *SPORT AVIATION* and *Sport Aerobatics* and in Pitts Aircraft Service Letters. In a recent phone conversation with Pitts Aerobatics General Manager, Herb Andersen, the problem of the fractured torque tubes found at Fond du Lac was discussed. Herb said he had also just learned of a couple of cracked control torque tubes on Model S-2 Pitts and he was concerned. Since the inspection method and modiation accorded to this problem have been long in existence, it was agreed that perhaps the present "rash" of occurrences has been somehow due to lack of information — i.e., the aircraft owners and operators not being aware of the problem or not knowing the proper fix. Herb suggested that IAC might want to reprint the Pitts Service Letters covering the torque tube problem in *Sport Aerobatics*. Herb's concern was deep enough that several days after the first phone conversation, Herb called and again urged the IAC Technical Safety Committee to "help get the word out" through the pages of *Sport Aerobatics*. Bob Abernathy, who heads the ACA's technical program has also been asked to help. Below are copies of Pitts' Service Letters 1 covering S-1 Pitts and 5 covering the S-2A models. Please note the dates on these service letters. We have not been playing "heads up" ball. **This should not be a reoccurring problem.**

* * * * * * *

Pitts Service Letter 12, regarding Gel-Cell battery installations, that was printed in the August issue of Sport Aerobatics had one slight error. The weight, arm, and moment given for an S-2A installation was:

Weight	Arm	Moment
20 lbs.	154.8	2864 (incorrect)

Obviously, the moment (weight x arm) should read 3096.

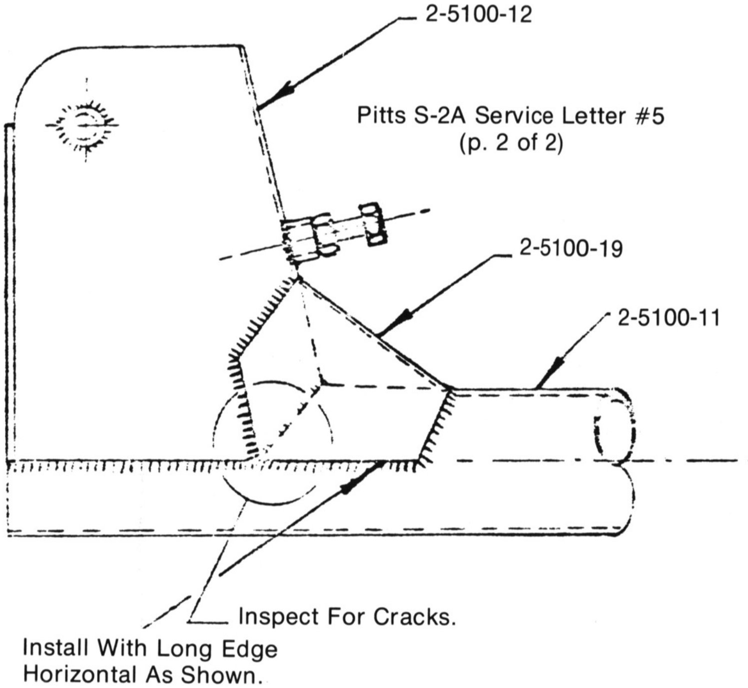
SERVICE LETTER NO. 5 — **PITTS MODEL S-2A AIRPLANE**
May 1, 1975 Revision A — Page 1 of 2

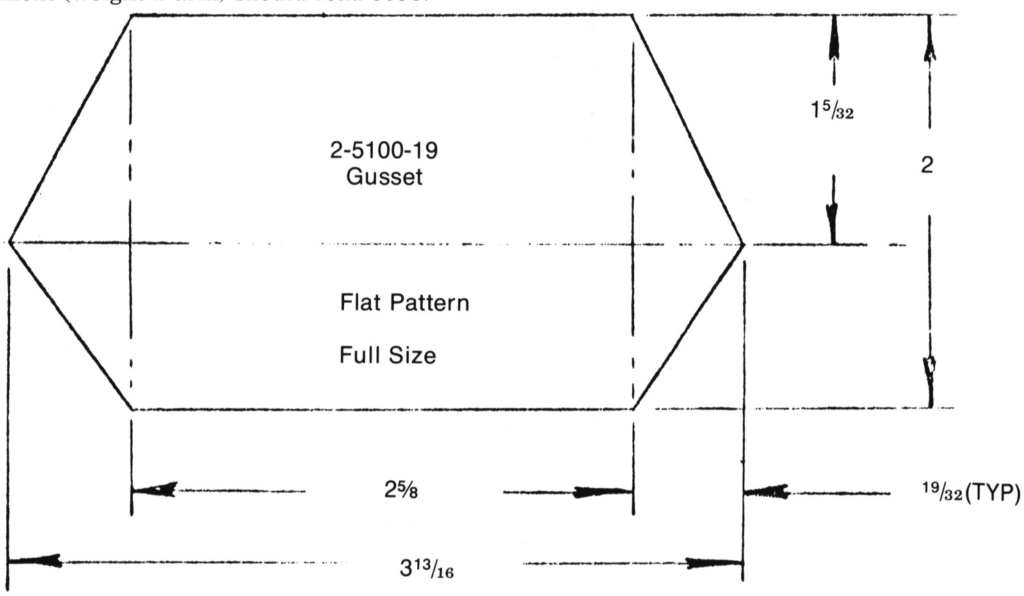
APPLICABILITY: (Applies to Model S-2A aircraft serial number 2001 thru 2105)

PURPOSE: To check for cracks in the P/N 2-5100 control tube assembly.

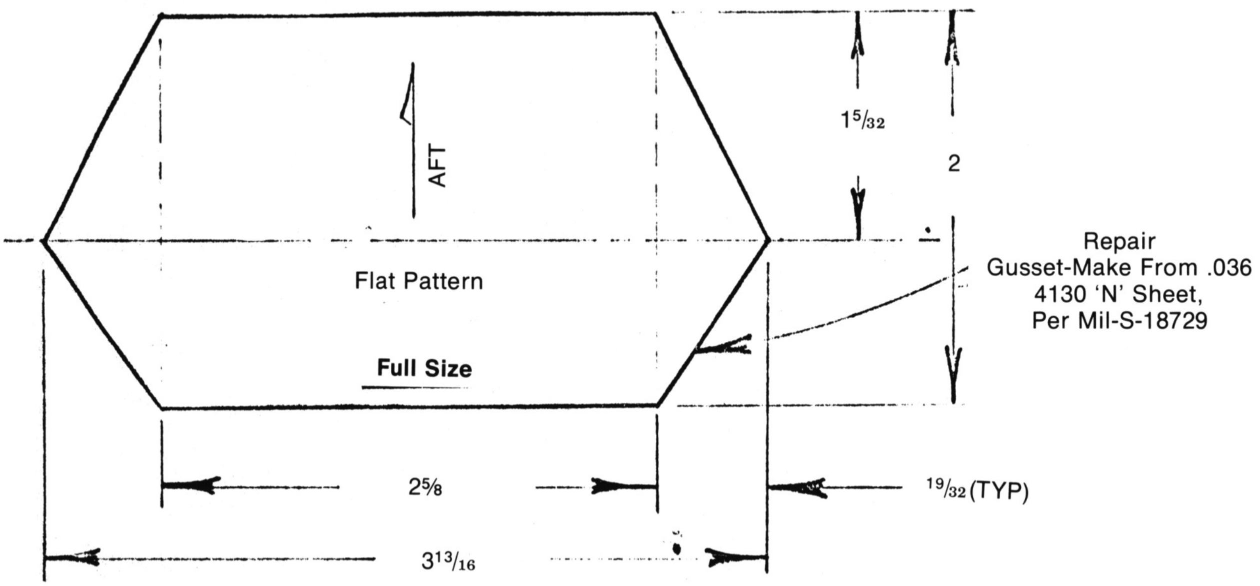
DISCUSSION: We have had a few reports involving airplane subject to frequent and vigorous aerobatics concerning cracks initiating at the junction of the aft 2-5100-12 stick housing, where it is welded to the 2-5100-11 tube. (The 2-5100 control tube assembly connects the front and rear control sticks.) It is reported that having started, the cracks progress slowly.

ACCOMPLISH THE FOLLOWING: This area is easily inspectable without removal or disassembly of parts. Strip paint from the suspect region and inspect for cracks using a ten-power magnifier. If no cracks are noted repaint the stripped area and repeat this inspection each 100 flight hours. If cracks are noted, remove the 2-5100 control tube assembly from the airplane, weld shut the cracks, and weld on reinforcing gusset, P/N 2-5100-19, per repair sketch enclosed with this letter. Note that both ends of the 2-5100 control tube should be inspected, although no cracks have been reported at the forward junction betwen 2-5100-12 housing and 2-5100-11 tube. After repair, the reworked areas should be repainted. All welding and priming/painting to be in accordance with good aircraft practice, per FAA AC 43.13.1. Please advise Pitts Aviation Enterprises, Inc., P.O. Box 548, Homestead, Florida 33030, of the results of your inspection, and the total airframe time on your airplane. Part no. 2-5100-19 gussets are available from Aerotek, Inc., P.O. Box 547, Afton, Wyoming, 83110.



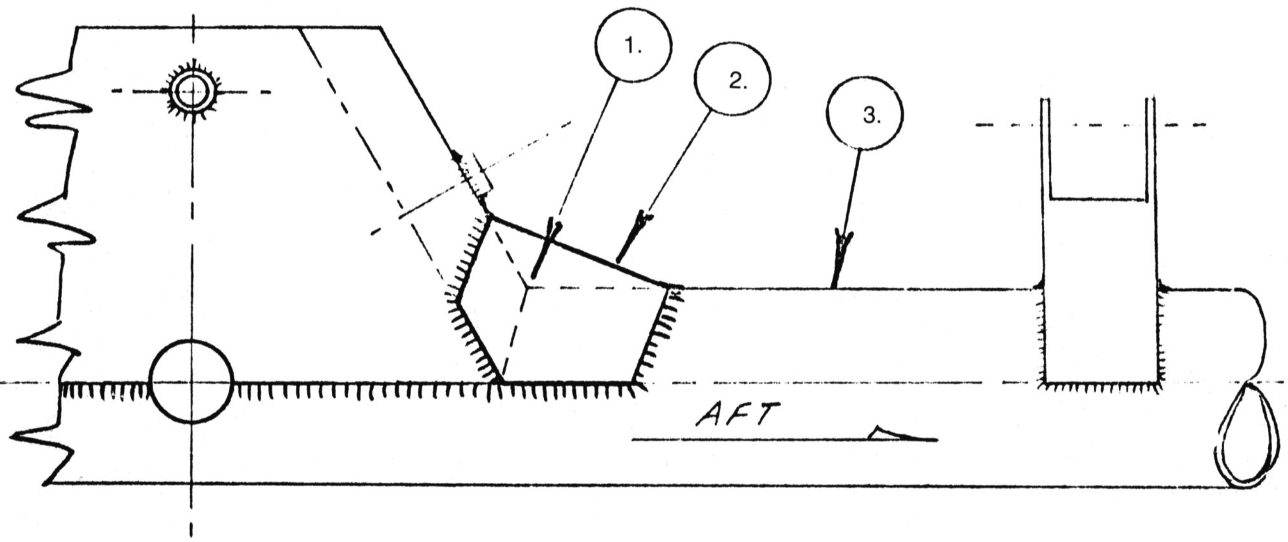


(Make From .036 4130 'N' Sheet Per Mil-S-18729)



Pitts Aviation Enterprises, Inc.
Service Letter No. 1.
Torque Tube Reinforcement.

Homebuilts - Only
Model S-1 Series



AFT
NOTES:
1. Inspect For Cracks Originating Here. If Any; Weld Closed.
2. Repair Gusset. Form To Fit Torque Tube and Weld All Around As Shown.
3. Torque Tube Assembly.
4. Welding To Be Heliarc or Gas. Clean and Zinc Chromate Repair Area After Welding.

New Citabria & Decathlon Service Letters

Bellanca Aircraft Corporation has just (10/14/77) issued three very important Service Letters. All Citabria and Decathlon owners should obtain the following Service Letters if they have not already received them from Bellanca:

- Service Letter #C-126
  Subject: Engine Mount and/or Engine Mount Rubber Bushing Replacement
  AFFECTED AIRCRAFT:
  Model 7ECA — S/N 1 and up (Lycoming engines only)
  Model 7GCAA — S/N 1 and up
  Model 7GCBC — S/N 1 and up
  Model 7KCAB — S/N 1 thru 610-77
  Model 8KCAB — S/N 3-70 thru 298-77
  Model 8GCBC — S/N 1-74 and up
- Service Letter #C-127
  Subject: Airspeed Restriction/Front Strut Replacement
  AFFECTED AIRCRAFT:
  Model 7ECA — S/Nos. 1 thru 722, 725, 723-70 thru 1238-78
  Model 7GC — S/Nos. All
  Model 7GCA — S/Nos. All
  Model 7GCAA — S/Nos. 1 thru 198, 200 thru 204, 276, 205-70 thru 355-78
  Model 7GCB — S/Nos. All
  Model 7GCBA — S/Nos. 1 thru 201, 205, 207, 202-70 thru 1024-78
  Model 7HC — S/Nos. All
  Model 7KCAB — S/Nos. 1 thru 208, 210 thru 226, 270, 271, 209-70 thru 617-77
- Service Letter #C-128
  Subject: Aerobatic Maneuvers Placard/Accelerometer Markings/Operating Limitations Card Change
  AFFECTED AIRCRAFT:
  Model 7ECA — S/Nos. 1 thru 722, 725, 723-70 thru 1238-78
  Model 7GCAA — S/Nos. 1 thru 198, 200 thru 204, 276, 205-70 thru 355-78
  Model 7GCBC — S/Nos. 1 thru 201, 205, 207, 202-70 thru 1024-78
  Model 7GBC — Aircraft approved in acrobatic category only.
  Model 7KCAB — S/Nos. 1 thru 208, 210 thru 226, 270, 271, 209-70 thru 617-77

PITTS FUEL LINES

Fuel system problems continue to plague IAC members seemingly something like Hydra — we stop one problem and 329 more jump up and bite us. One of the latest difficulties encountered concerns factory-built Pitts S-1 fuel lines.

One IAC member reported the following:

"While doing the Unlimited Known and after a prolonged series of inverted maneuvers, the aircraft had loss of power on going vertical. Gasoline fumes were detected in the cockpit on landing and close inspection revealed the main gas line was damaged by crushing and had a small rupture. This occurred just in front of the right rudder pedal and occurred when full right rudder **and** full right brake was applied, trapping the tube against the firewall. If the tube had been ½" higher or lower it would not have occurred."

The IAC Technical Safety Committee relayed this information to Herb Andersen, General Manager of Pitts Aerobatics. Herb replied that he has a letter out to the people in the final assembly at Pitts advising them of the problem and requesting that extra care be taken in the routing of this fuel line.

Several days after receiving Herb's letter the IAC T.S. Committee received a letter from Bob Abernathy, who is Technical Committee Chairman for the Aerobatic Club of America, which also dealt with fuel line/rudder pedal interference on Pitts S1S. Bob advised that he has recently found two cases of the right rudder pedal striking the fuel line on S-1's and had been informed of two other Pitts with the same problem. Bob further noted that one of the lines he inspected was worn completely through and leaking fuel and the other line was well on its way to a failure.

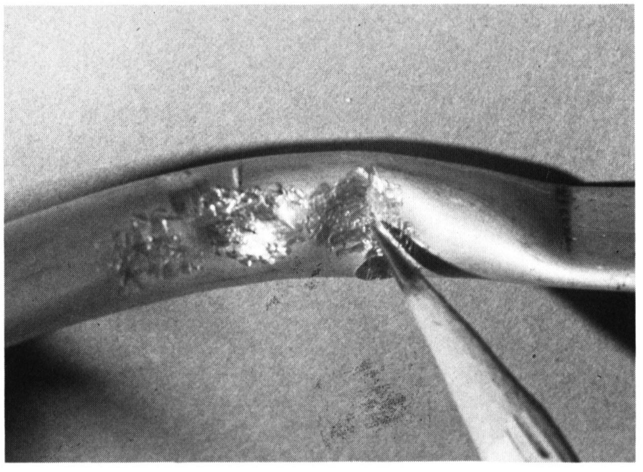
As far as an inspection goes, below is a quote from Bob's letter:

"To check for this condition, remove the right side panel aft of the firewall, have an assistant use full right rudder, and check to see if any contact occurs between the rudder and main fuel line. If any contact is made, replace the fuel line and reposition it during installation to maintain sufficient clearance."

Note that Bob also copied Herb Andersen at Pitts Aerobatics about this problem. Now that the factory is well aware of this problem and corrective action has been taken, if all Pitts owners will go ahead and check their aircraft ASAP, we should be able to lop off this head of the fuel-system-dragon.

IAC thanks to Herb Anderson at Pitts, Bob Abernathy, ACA Technical Committee Chairman, and to the IAC member whose report was first quoted. The IAC member to whom we have reference wrote a **five** page letter describing the fuel line problem and it is kind of exasperating that we must refrain from making a public thank you by not printing his name. However, past events have shown that anonymity must be the policy of the IAC T.S. Program. But a deep heartfelt thanks is due this member and all other IAC members who have shown their concern for the sport of aerobatics and their IAC brothers by contributing to the IAC T.S. Program

Fred L. Cailey
Chairman
Technical Safety Committee



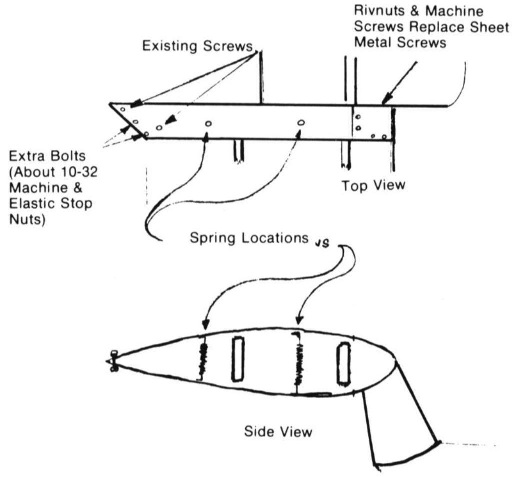
Citabria & Decathlon Fairings

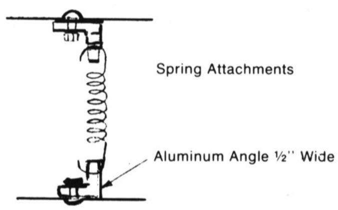
Wing root fairing problems have been reported by several Citabria and Decathlon owners. (Remember Dennis Houdek's article "It Quickens the Pulse" in June 1977 *Sport Aerobatics*). One IAC member sent in the following comments and shop sketch on how he remedied the situation.

"I have managed to eliminate about 95% of my fairing problems with a few simple changes and am dropping this info to you in case you may wish to pass it on. The biggest help on the fairing problem is the adding of two springs on each fairing from top to bottom which are in tension. These springs can be made from a spring used to close a storm door or a similar type. The sheet metal screws holding the fairings around the windshield have been replaced with rivnuts and machine screws except the two top screws that attach to the root fairing. The spar did not leave room for rivnuts so I kept sheet metal screws but added Tinnerman nuts in this area. Two extra bolts were added to the rear of the root fairing by drilling straight through and installing machine screws and elastic stop nuts. One of these bolts replaces a sheet metal screw which fastened to the wing trailing edge and will require drilling through it. The second was added to hold top and bottom fairings together securely at the back and allow the tension adjusting screws at the front to be brought up extra tight. Hope this may be of some help to anyone having the same problems."

The IAC Technical Safety Committee sent the above info (naturally with all personal information, names, addresses, etc. deleted) to Bellanca Aircraft Corp. with the hopes of encouraging a factory "fix". Bellanca replied as follows:

"Thank you for forwarding the information from your IAC member concerning the Decathlon gap cover problem. We have a production fix for this problem coming out in our 1978 model which I am sure will please everyone. We are now in the process of developing a service kit for field retrofit. I have passed your suggestion onto our Osceola Engineering Staff. Our Service Department will send you a copy of this kit when it is available."





And, of course, as soon as the IAC T.S. Committee receives information on the new wing root fairing service kit from Bellanca, it will be reported in the pages of *Sport Aerobatics*.

Much thanks to the IACer who sent in the above suggestions. It is this kind of help and interest that makes the sport of aerobatics safe and fun.

Dear Fred:

TORQUEING PROPELLERS ON AEROBATIC AIRCRAFT

Homebuilders and aerobatic pilots alike are probably more familiar and in compliance with the various torqueing values of bolts on their aircraft than any other type.

If one follows the manufacturers recommendations and utilizes a calibrated torque wrench your mount will then be at the proper degree of strain over all its components which can give you some comfort during that tripple snap, however, there is one place where the torque value will decrease rapidly and that is in the propeller bolts. Why? Simple. It is due to the soft aluminum face and back plates for the prop spinner most commonly found on fixed pitch propellers.

As the prop is exposed to the gyroscopic loads imposed during aerobatic flight it will tend to "bite" into the soft aluminum spinner plates and lower the torque value. It has been experienced that just normal usage of the prop will also require increased torque checks.

Torque values are carefully printed on the hub of all new propellers to insure that the prop will not "work loose" or over strain the crankshaft flange. These values are useless if a softer metal than the alloy prop and prop flange is inserted.

It is therefore recommended that the IAC Technical Safety Committee investigate this latent problem area and make a recommendation. The only answer would seem to be to install steel spinner plates which are presently not in quantity in our suppliers catalogues.

It is also recommended that more frequent torque checks on the propeller bolts be accomplished to insure that your prop is still "up tight".

Sam Burgess

AIDS

The key to any type of inspection — preflight, annual, etc. — is to know **what** to look for. With this in mind, the IAC Technical Safety Committee has "candled through" bunches of "U.S. Federal Aviation Administration Inspection AIDS" and culled out some of them that would be of particular interest to IAC members. Below, listed by aircraft manufacturer and by date published, are these "special interest" FAA Inspection AIDS. Note that some of the problems listed have been corrected by manufacturers in later aircraft or have been covered by Service Letters or Airworthiness Directives — in general are problem areas that at this date should no longer be significant. Other problems noted, e.g., areas subject to corrosion in older aircraft, may be even more significant today than the date of publication. IAC members should also bear in mind that problems attributed to specific model aircraft may oftentimes be applicable to other aircraft. The FAA Inspection AID covering intergranular corrosion in Waco spar crush bushings notes that this condition may exist in "other aircraft of similar design". Other examples such as battery acid spillage should also be obvious.

Many of the problems listed can be checked **during pre-flight inspections**. Therefore, each IAC member should immediately incorporate into his pre-flight inspection checklist any problem area noted below that may be applicable to the aircraft he is now flying. Other problem areas noted in the FAA Inspection AIDS can only be checked during more thorough inspections, i.e., during annual or 100 hour inspections. Therefore, each IAC aircraft **owner, flying-club member,** or **renter** should make a list of the problem areas pertaining to the aircraft they are now using and present this list to the mechanic who is doing the maintenance on that aircraft. It is totally unrealistic to believe that aircraft mechanics can be aware of all the specific/potential trouble spots on all the various types of aircraft they are called upon to inspect. And, therefore, by supplying them with valuable inspection information, as noted in this IAC Technical Safety article and in **other IAC Technical Safety articles**, you can help insure that your aerobatic mount is maintained to the highest standards. A good A&P mechanic will appreciate the help and straight-thinking IAC members will supply it.

BELLANCA AND CHAMPION AIRCRAFT
1968

Champion Models 7ECA, 7GCAA, and 7GCBC
Cabin Throttle Control Assembly

Reports have been received that the pilot's throttle control knob is breaking off at the attachment to the throttle control arm. In some cases these failures may be due to replacement of the standard throttle knob with an unapproved knob that has a longer extension.

This practice of replacing the throttle knob with an unapproved part should be discontinued because the greater overhang of the throttle extension can result in failure of the attachment bolt. In addition, all throttle control knobs should periodically be visually inspected for cracks at the weldment of the knob bolt to the throttle arm. If cracks are not found, the throttle knob should be turned on far enough to cover all threads. This procedure will provide additional strength to the throttle knob. Champion Service Letter No. 80 covers this subject.

Champion Aircraft Models 7ECA, 7GCAA, and 7GCBC
Wing Rib Failures

Wing rib failures occurring aft of the front spar have been found on models manufactured prior to February 9, 1967. These failures, in the form of cracks, appear to be confined to the ribs located forward of the aileron bays. The cracks emanate from the upper rib flange in the area adjacent to the upper spar-cutout doubler, and extend all or part way to the rib lightening hole.

It is suggested these ribs be inspected periodically and checked frequently if the aircraft is engaged in aerobatic operation. Repairs may be accomplished in accordance with Champion Service Letter No. 76 or acceptable methods, techniques, and practices per AC 43.13-1. Repair kits are available from Champion Aircraft's parts department.

Champion 7 Series (Aerobatic Models)
Battery Installation

Battery acid spillage is reported to be damaging the fabric, fuselage structure, and control system cable.

The battery originally installed by the manufacturer had military type nonspill vent caps. It is essential that this type of cap be used if acid spillage is to be avoided. It is suggested that when a battery replacement is made with a battery from a source other than Champion, be certain the caps are of the same military type. If necessary, remove the caps from the original battery and install them on the replacement battery.

Champion Service Letter No. 77 covers this subject.

Champion Model 7 Series
Wing Fabric Attach Screws

It is suggested the wing surfaces (top and bottom sides) be checked periodically to determine that the fabric attaching screws are secure, and the fabric has not pulled away from the screws and washers.

Champion Model 7 Series
Wing Lift Struts

Internal corrosion is reported to be occurring at the lower inboard end of the lift struts. Indications of this condition may not be evident on the exterior of the strut. This condition is believed to be more prevalent on aircraft used in dispensing agricultural materials.

Champion Model 7 Series
Landing Gear Shock Strut Upper Attach Fitting P/N 1-2547

Upper attach fitting separated from the outer case of the shock strut. Also, reports of the AN5-22A bolts shearing and/or the outer case bolt holes pulling out. It is suggested this area be given a close examination periodically.

Champion Model 7EC and Subsequent Models
Exhaust System

Reports indicate service difficulties are being experienced with many portions of the exhaust system. In several instances, parts of the exhaust system assembly have been found chafing on engine components and/or the mount structure.

Champion Models 7ECA, 7GCAA, 7GCBC and 7KCAB
Rudder Lower Drain Grommets

Reports indicate some aircraft do not have drain grommets located in the lower surface of the rudder. The manufacturer advises that, in lieu of this grommet, a No. 15 hole was drilled in the bottom rudder channel, at a point aft of the hinge line.

If this hole is found to be plugged or obstructed by the fabric which covers the rudder, it is suggested the lower portion of the rudder structure be examined for evidence of corrosion. This is especially important if the aircraft has accumulated an appreciable number of hours of operation. This check should be made each time the inspections required by FAR 91 are accomplished.

1969

Champion Model 7KCAB (Aerobatic)
Battery Installation

A number of reports have indicated that in the performance of aerobatic maneuvers, acid spillage causes substantial damage in the area of the battery. In some instances it appears that the battery filler caps were not of the non-spill type, such as that installed on the Rebat battery obtainable from Champion.

Champion Service Letter No. 77 provides information for filling battery cells to an acceptable level that will prevent cell cap leakage during inverted flight. Service Letter No. 67 covers the use of sealant material at the battery vent manifold.

Champion Model 7 Series With Cleveland Hydraulic Brakes
Forward Brake Pedal Rod Assembly P/N 1-9922

Inspection following hard braking action disclosed the aft adjustment end of the pedal rod was bent in the threaded section forward of the locking jam nut.

It is suggested these rod adjustment ends be examined for the above condition at periods prescribed by FAR-91, and any time excessive braking action is suspected.

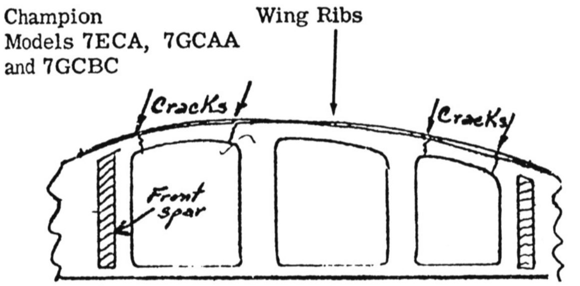
Champion Model 7KCAB (Aerobatic)
Battery Security

There is a report that a battery became dislodged and damaged a control cable while the aircraft was engaged in aerobatic maneuvers. The terminals on the battery contacted the cable and arced. Investigation disclosed the battery hold down had deteriorated as a result of battery acid spillage.

Champion Models 7ECA, 7GCAA and 7GCBC
Wing Ribs

With reference to the Champion wing rib failure item which was published on page 41 of the 1968 General Aviation Inspection Aids Summary, it is now reported that there have been additional occurrences.

Champion Service Letter No. 93 contains detailed information on this problem and prescribes Champion Service Kit No. 232 be used if cracks are found.

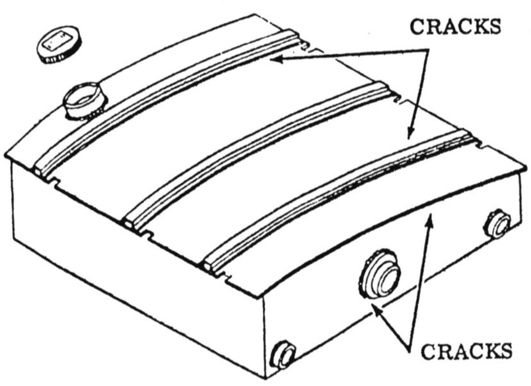


1970

Champion Model 7 Aerobatic Series
Wing Fuel Tanks, 19.5 Gallon Capacity

There are numerous reports that fuel tanks are leaking at the welded seams, baffle spot welds, and adjacent to the fuel gauge. The leaks are evidenced by stains or seepage at the wing trailing edge.

A tank designed to withstand the loads imposed by aerobatic maneuvers is available from Champion. Their Service Letter No. 89 identifies applicable models and describes ordering procedures.



Champion Models 7ECA and Up
Elevator Cable P/N 3-1072

Inspections have disclosed the elevator cables are fraying in the area of the pulleys in the belly of the aircraft. These pulleys are located aft of the rear seat.

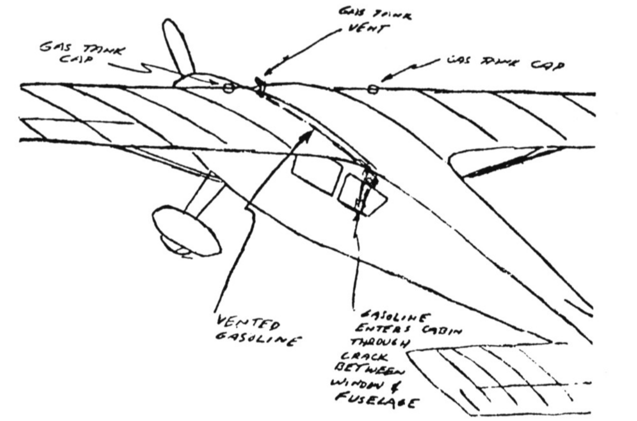
Champion Service Letter No. 70 contains suggestions covering cable and pulley maintenance. Examination of these cables and other control system components is one of the inspection functions required by FAR 91.

Champion Model 7ECA
Fuel Tank Vent

The possibility exists that expanding fuel in a tank filled to capacity may be discharged from the fuel tank vent and enter the fuselage and cabin area. Champion Service Kit No. 226 was developed and is available for field installation to prevent this potentially hazardous condition.

Champion Models 7ECA, 7GCBC, and 7KCAB
Spring Steel Type Landing Gear

The fuselage lower longerons are reported to fail in the area



adjacent to the landing gear attach point. Indications of this condition may be fabric wrinkling or a noise when the aircraft is moved.

This type of failure is believed to be attributable to rough field operation, hard landing, and/or severe ski operating conditions. To properly inspect for this condition may require the use of a mirror and removal of a small section of the fabric where the landing gear enters the fuselage.

Champion Model 7KCAB (Aerobatic)
Battery Installation

A number of reports have indicated that in the performance of aerobatic maneuvers, acid spillage causes substantial damage in the area of the battery. In some instances it appears that the battery filler caps were not of the non-spill type, such as that installed on the Rebat battery obtainable from Champion.

Champion Service Letter No. 77 provides information for filling battery cells to an acceptable level that will prevent cell cap leakage during inverted flight. Service Letter No. 67 covers the use of sealant material at the battery vent manifold.

Champion Model 7KCAB
Cabin Heat Control Wire Installation

A recent inspection disclosed that the cabin heat control wire was chafing the main fuel line at a point adjacent to the header fuel tank.

1971

Bellanca (Champion) Models 7ECA and 7KCAB
Fuel System

Fuel line damage has occurred at several locations between the fuel tank and the fuel strainer. Lines have been found chafing on the aircraft structure or being chafed by other parts and components. Reports have also indicated the lines are being pierced by the screws used to secure upholstery, clamps, and engine controls in the fuselage cabin area.

Champion Model 7KCAB
Cabin Heat Control Wire Installation

A recent inspection disclosed that the cabin heat control wire was chafing the main fuel line at a point adjacent to the header fuel tank.

It is suggested that this location be inspected to determine that a minimum ½-inch clearance exists between the heater control wire and the fuel line.

Champion Model 7 Series Aircraft
Control Cables and Pulleys

Wear of the aluminum pulleys and steel cables in the rudder, elevator, flap, and trim systems can be prevented or greatly reduced by periodic inspection and lubrication.

Champion Service Letter No. 79 (revised 4 January 1971) provides information as to specific problem locations and the recommended lubricants.

Champion Model 7 Series
Carburetor Air Intake Heat Box Assembly

Cracks are reported to develop at several locations in the carburetor heat box assembly. In performing inspections, particular attention should be given to the riser position, the valve shaft bushing area, and the attachment of the valve to the shaft.

Champion Models 7ECA and Up
Elevator Cable P/N 3-1072

Inspections have disclosed the elevator cables are fraying in the area of the pulleys in the belly of the aircraft. These pulleys are located aft of the rear seat.

Champion Service Letter No. 70 contains suggestions covering cable and pulley maintenance.

Inspection Aids

1972

Bellanca (Champion) Models 7ECA, 7GCAA, 7GCBC
Wheel Fairing and Bracket

There have been reports which indicate that cracks are occurring in the P/N 7-1323 wheel fairings and the P/N 2-1944 brackets.

The P/N 2-1944 aluminum brackets should be replaced with brackets made of steel (P/N 2-1961). The P/N 7-1323 fairings can either be repaired using recognized fiber-glass repair techniques or replaced by P/N 7-1301 fairings. The P/N 7-1301 fairing is 41.5 inches long, while the P/N 7-1323 fairing is 52.88 inches long.

1973

Champion Model 8KCAB
Fuselage Fabric (Ceconite)

On walk around inspection, it was observed that an 18" split had developed over the center of the forward left stringer in the fuselage belly. Inspection revealed that there is no surface tape over the stringers on this fuselage.

Champion Model 8KCAB
Left Rudder Cable

The left rudder cable separated during a slow roll maneuver. The inspection revealed that the cable broke about two feet forward of the rudder attach point. Corrosion was also noticed at four points along the cable as the result of the battery acid dripping from the vent line which was hanging loose inside the fuselage.

1975

Bellanca (Champion) Model 7KCAB
Exit Doors

The right wing collapsed during aerobatic maneuvers. The wing spars and wing brace struts failed at several locations and the inboard portion of the wing containing the fuel tank rotated against and blocked the single entry/exit door. Although this blockage might have effectively precluded his exit through the doorway, the pilot seated in front nonetheless attempted to jettison the door using the quick-release mechanism. He pulled the safety locking pin and pushed down on the release handle according to the emergency instructions, but he could not release the door because an accumulation of rust between the forward door hinges and pins prevented extraction of the hinge pins.

Since the windshield had loosened and separated from the airplane during the sequence of structural failure, the pilot was able to evacuate through this forward open area and parachute to the ground.

It is recommended that emergency or quick-release doors on aerobatic airplanes be inspected and actuated to assure proper operation at each 100 hour inspection. Any significant restraint at the hinges due to rust, foreign matter, or material deformation is critical since, as evidenced in the above case, such a condition could render the release mechanism ineffective. This maintenance item is applicable not only to the Champion Citabria, but to all aerobatic airplanes.

Bellanca (Champion) Model 8KCAB
Wings

During a special inspection, the following damage was found. Both wing leading edge skins were wrinkled in the area of the jury struts and were in a permanent set. "Pop" rivets attaching the fabric to the upper surface of the wings were loose.

The right wing ribs, one inboard and two outboard of the lift strut, were cracked along the top cap in the area of the front spar. The left wing ribs, three inboard and five outboard of the lift strut, were cracked along the top cap in the area of the front spar.

"Pop" rivets attaching the fabric to the lower surface of the fuselage were also loose. Inspection holes had to be opened in the lower surface of the wings to identify the extent of the damage.

Total aircraft time — 384 hours.

An Emergency Airworthiness Directive was issued August 21, 1974, relating to inspection and repair of the areas described in this Inspection Aid.

Bellanca Model 7GCBC
Wing Spar

During inspection, the right wing rear spar was found broken. The break extended inboard from the bottom of the spar below the compression member located inboard of the outboard flap bracket, to the top of the spar in the vicinity of the first rib inboard of the compression member. Aircraft total time — 454 hours.

Bellanca Models 7KC and 7KCAB
Carburetor Heat Valve, P/N 1-9155

Reports continue to be received that the carburetor heat control valve in the air box separated from the shaft and fell into the carburetor induction air intake, restricting air flow, which affected the engine power.

Bellanca Model 7KCAB
Heat Valve, P/N 1-9155

The engine stopped during take-off. Investigation revealed that the heat valve had failed at the attachment screw holes. One-half of the valve had blocked the airflow to the injector.

Bellanca Model 8KCAB
Engine Cowling

There is a report that the engine lower cowling was found burned around the air intake screen. The fiber-glass lower cowl when installed is close to the engine exhaust crossover pipe. In addition, the insulation on the alternator main lead which is routed along the right side of the engine was burned.

Champion Model 8KCAB
Ailerons

While performing aerobatics, the ailerons jammed; however, they were freed by using force. Investigation revealed that the leading edge of the "up" aileron would jam in the wing cutout for the aileron.

Bellanca Model 7GCAA (Australian Registry)
Carburetor Air Box Valve

The carburetor air box valve was found cracked around the attachment screw area. Total time in service — 149 hours.

1976

Bellanca Model 7 and 8 Series
Elevator Bellcrank Stop

The elevator down stop has been found deformed, bent downward and concave, as shown in photo No. 1. The correct condition of the stop, perpendicular to the vertical stabilizer tube and flat, is shown in photo No. 2. The optional bolt, installed in the bellcrank is to adjust for proper elevator travel, and should not be filed flat.

Bellanca Model 7GCAA
Landing Gear "U" Bolt, P/N 1-9805

During take-off, the right main landing gear "U" bolt failed at the bend radius. Total time in service — 65 hours.

Bellanca Model 8KCAB
Seat Frame, P/N 7-1454-16

The front seat frame broke during aerobatic maneuvers. The break occurred in the lower portion of the frame just forward of the bend at the aft attachment to the floor.

1977

Bellanca Model 7ECA
Elevator Cable

The elevator (up) cable broke during aerobatic maneuvers. Investigation revealed that the cable failed at the pulley immediately aft of the aft cabin upholstery panel due to rust and fraying. The elevator (down) cable was found to be severely rusted and frayed. Total time in service — 3100 hours.

Bellanca Model 7ECA
Brake and Rudder Pedal

The left brake and rudder pedal was found to be cracked and bent during inspection. Total time in service — 979 hours.

Bellanca (Champion) Model 8KCAB
Engine Mount Washer, P/N STD-619

The engine starter ring gear cut through the top cowling during inverted flight. Investigation revealed that the engine was sagging in its mounts and could be moved approximately 4 inches at the propeller hub. Further checks disclosed that one washer was missing from the aft side of each mount. Aircraft total time in service — 47 hours.

BOEING
1968

Boeing Model 75 Series
Engine Mount Upper Attach Bolts At Firewall

As a result of agricultural and aerobatic operational requirements, many of these aircraft have heavier engines with higher horsepower installed. Reports now indicate the two upper bolts securing the engine mount to the fuselage at the firewall are failing. Investigation has disclosed this condition is attributable to the fact that the original 7/16-inch-diameter bolts are still being used.

It is recommended that these bolts either be magnetic-particle inspected or replaced with new bolts at each 100 hours of operating time. Operators who desire to modify the engine mount to accommodate ½-inch bolts should obtain engineering assistance.

Boeing Model 75 Series
Landing Gear to Fuselage Attach Knuckle, P/N 75-2619

Extensive cracking and complete breakage of the landing gear attach knuckle have been occurring where the knuckle angle changes from the horizontal to downward for the gear leg attachment.

It is recommended these knuckles be examined frequently and also whenever excessive loads have been imposed. A four-power magnifying glass or dye-penetrant inspection methods should be used for detecting minute cracks before they progress extensively.

Boeing Model 75 Series
Lower Wing Spar Attach Fittings

Both the right and left lower inboard spar attach fittings have been found to be excessively corroded. In some cases, this corrosion can only be seen by removing the fitting from the spar. This condition appears to prevail only on aircraft used for dispensing agricultural materials.

1971

Boeing Model 75 Series
Lower Wing Attach Fitting

Severe corrosion was found on the spar attach fittings of the lower wings. This condition has been attributed to the corrosive effects of the materials dispensed for agricultural purposes. Corrosion on these aircraft is now, however, limited to the wing attach fittings alone. It can also exist in all metal parts and assemblies which are not periodically inspected, cleaned, and given protective coatings.

It is suggested all aircraft used for dispensing agricultural chemicals be inspected at intervals commensurate with their degree of usage. Procedures for the treatment of corrosion are contained in FAA Advisory Circular AC 43.13-1, Chapter 6. This advisory circular, entitled "Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair", is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $3.00 ($3.75 foreign).

LUSCOMBE
1968

Larsen Luscombe Model 8 Series
Aileron Hinge Brackets and Control Horns

Reports have been received that aileron hinge brackets and control horns are failing. These difficulties are believed to be attributable to wind damage because adequate control locks were not used when the aircraft were tied down outside.

It is suggested the hinges and control horns be carefully examined periodically for evidence of cracks, distortion, security of attachment, etc. Particular attention should be given to the bend radius of the hinge and the area of the control horn hinge pin hole. It is also recommended that a check be made to determine that the correct bolts and shim washers are installed to prevent stresses on the control fork ends.

Larsen Luscombe Model 8 Series
Elevator Trim Tab Cable

Reports disclose corrosion and fraying of the elevator trim tab cable forward of the tab and extending into the stabilizer area.

Larsen Luscombe Model 8 Series
Landing Gear Main Leg, P/N's 48378 and 58379

The bolt hole in the main landing gear leg attachment casting is reported to wear excessively on late model aircraft. On earlier aircraft, the landing gear leg is developing cracks at the attach point wraparound reinforcing gusset.

Larsen Luscombe
Throttle Control Assembly

Throttle control flexible housings are reported to separate at the carburetor and/or the instrument panel end. In one recent instance, this type of failure necessitated a forced landing.

To alleviate the possibility of further incidents that could be attributed to this problem, it is suggested the condition and security of the entire throttle control assembly be closely examined periodically.

1970

Larsen Luscombe Model 8A
Landing Gear Main Leg

Several reports of severely corroded landing gear struts have been received. In one instance, the corrosion progressed to the point where complete failure of the gear occurred adjacent to the axle.

1972

Luscombe Model 8 Series
Main Landing Gear Strut

Severe internal corrosion has been reported in the main landing gear strut in the vicinity of axle attachment. Indication of this condition may not be evident on the exterior of the strut, however, the strut can be removed and visually inspected with the aid of a light by looking down the strut tube.

1975

Luscombe Model 8A
Firewall, P/N 581020

The firewall was cracked behind the steel doubler plate for the lower left engine mount attachment. This crack went unnoticed until it progressed beyond the doubler plate and was also covered by the upholstery inside the aircraft. In addition, an upper and center engine mount attachment bolts were also broken. Due to the tubular construction of the engine mount both halves of the broken bolts remained in place and these failures were also undetected. Time in service — 1172 hours.

Luscombe Model 8E
Spar Web

A report has been received that corrosion was found penetrating 90 percent through the web of the wing rear spar at the upper cap strip. This inspection was made with the wing disassembled for other repairs.

Luscombe Model 8A
Exhaust Pipe, P/N 086275

Exhaust fumes were detected in the cabin during engine run. Inspection disclosed that the exhaust pipe, inside the cabin heater shroud, was rusted and burned through.

Luscombe Model 8A
Vertical Stabilizer Attach Fitting, P/N 28453

The vertical stabilizer forward attach fitting failed resulting in loss of rudder and elevator control.

MONOCOUPE
1968

Monocoupe All Models
Vertical Stabilizer Leading Edge

Fatigue cracks involving approximately 75 percent of the tube are reported to be developing at the top of the weld joining the tube to the horizontal stabilizer.

Monocoupe Model 90A
Vertical Stabilizer Leading Edge

The vertical stabilizer leading edge tube was found to be extensively cracked in the area of the weld attaching it to the horizontal stabilizer.

PITTS
1970

Pitts Special
Tail Brace
The right lower tail brace fitting was found broken at the fuselage longeron attach point (weld).
It is suggested these fittings be periodically examined for evidence of impending failure.

PIPER
1969

Piper Model J3C
Propeller Hub
Investigation of elongated mounting holes in the propeller hub disclosed the propeller had not been installed in accordance with existing McCauley propeller instructions and all six attach bolts had loosened.

1970

Piper Model J3C Series
Landing Gear Cabane Strut
There is a report the fuselage "U" fitting for the landing gear cabane "Vee" strut failed in the fuselage attachment area. Examination disclosed evidence that progressive failure had occurred over a period of time. This fitting is welded to the lower fuselage longeron and is difficult to inspect due to the fabric covering.

1971

Piper Model J3-C65
Aileron Cables, P/N J3-A408
The aileron cables were found worn flat where they pass through the wing lift strut fairleads.

1973

Piper Model J3C-65
Landing Gear Vee
The left landing gear collapsed during landing. An examination revealed the forward tube had failed immediately adjacent to the reinforcing gusset. The aft tube failed in the weld joint between the forward tube and the axle. Indications of an old crack was present and hidden by the fabric covering. Both tubes were found to have heavy corrosion at the lower ends.

TAYLORCRAFT
1971

Taylorcraft Model BC-12D
Landing Gear Cabane Strut
Complete failure of the landing gear right cabane strut was recently reported. The failure occurred adjacent to the strut lower attach point. In another instance, a 4-inch crack was found in the strut leading edge midway between the landing gear and fuselage attach points.
It is suggested that a sharp-pointed probe be used to inspect the low points of the tube members on those aircraft which have been in service for several years. Testing in this manner will usually reveal the existence of a severely rusted-out tube section that is not readily visible.

Taylorcraft Model BC12-D
Control Yoke
There is a report that the left control wheel yoke cracked. The fault extended from the pin hole to a point approximately ¾ around the circumference of the stub area. This condition may be difficult to detect due to the thick coating of rubber material covering the failure area.

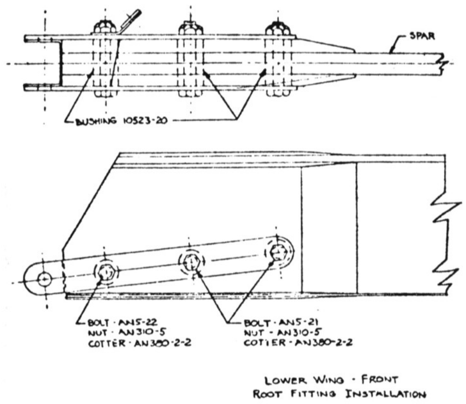
Taylorcraft Model BC12-D
Flexible Fuel Line
A recent instance of fuel starvation was attributed to deterioration of the internal lining material in the flex line routed between the firewall and the fuel strainer. Portion of the internal lining came loose and partially restricted fuel flow to the carburetor.

Taylorcraft Model BC12-D
Fuel Transfer Placard, P/N B12-307
Some of these aircraft were originally equipped with a six gallon auxiliary wing tank and had the following placard installed adjacent to the wing tank shut-off valve. "Refill main tank in level flight only." Should this placard be missing, a replacement may be obtained from the Taylorcraft Aviation Corporation, P.O. Box 243, Alliance, Ohio 44601.

Taylorcraft Model BC12-D
Wing Spars
There are reports of wing spar lamination separation in the area of the fuel tank. Spar root end butt plates are also being found loose.
Detection of these conditions requires that holes be cut in the root ends of the wings. It may be necessary to pry the butt plates slightly with a knife to determine whether they are loose. The visual appearance of the plates is no assurance they are secure.

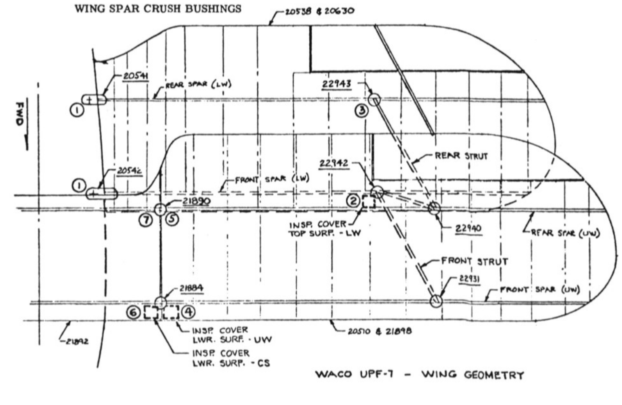
WACO AIRCRAFT
1975

Waco Aircraft
Corrosion Inspection
Intergranular corrosion was found in the spar crush bushings in all wing fittings of a Waco Model UPF-7 aircraft during overhaul. The corrosion was most prevalent in the lower wing at the root and "N" strut fittings. It is recommended that these areas be examined very closely during inspections. The bushings are a close press fit and can be removed by using a wooden dowel and a hammer. If they are seized, this is a good indication of expansion caused by intergranular corrosion. When this occurs, the spar holes should be checked for elongation caused by expansion of the bushing. It may be necessary to remove the reinforcing plates to accomplish this inspection. If the spar holes are elongated it may be necessary to replace the entire spar.
These conditions may exist in other models of Waco aircraft or other aircraft of similar design.



TYPICAL BUSHING INSTALLATION
AT N-STRUT & BUTT-END FITTINGS

WING SPAR CRUSH BUSHINGS



WACO UPF-7 - WING GEOMETRY

SOMETHING IS BETTER THAN NOTHING

Often IAC members are operating aircraft near V_{ne} (Velocity, never exceed).

When considering this point and things like FAA Airworthiness Directive 77-22-05, which in part states that Citabria owners must either replace the old front lift strut (P/N 5-144) with a new front strut (P/N 5-392) or reduce V_{ne} from 162 CAS to 153 CAS (this is a reduction of approximately 6%), and also noting that many new aircraft (not necessarily Citabrias) are only tested to V_{ne} + 10%, one appreciates the need for accurate and reliable airspeed numbers.

How accurate is your airspeed indicator?

Below is a "quick and dirty" test that can be used to test the pitot system of almost every aircraft. While it obviously is not as accurate as more sophisticated tests, and does **not** give a complete 100% answer to the question of airspeed indicator accuracy being that it only checks the pitot system for leaks, it does have the redeeming virtues of being simple and cheap.

Here's how the test goes. Locate a short length of flexible tubing that will fit over the end of the pitot tube of your aircraft — surgical tubing works great. Slip one end of the tubing over the pitot tube and **very slowly** roll up the other end to apply pressure to the system. See Photo 1. The rule of thumb says you roll up the tubing, increasing the pressure, until the airspeed indicator reads normal cruise speed and then "pinch off" the tubing to hold that pressure. If the airspeed shown on the ASI (airspeed indicator) falls more than 10 mph in a minute, this indicates the system has a leak — and perhaps your airspeed readings are not as accurate as they should be. (NOTE: The amount of "wrap-up" of the tubing shown in Photo 1 is just for illustration purposes and is probably more than will be required to pressurize the pitot system up to "cruise speed".)

While you have your flexible tubing handy, and if you have a static system something like the Citabria that is illustrated, you can sort of use the reverse procedure to test the static system for leaks. Roll up several "coils" on one end of your flexible tubing and slip the other end over the static port. Now, **very slowly** unroll the tubing applying a low pressure to the static system. See Photo 2. Initially set your altimeter to zero and unroll the tubing until the altimeter reads 1000 feet and pinch off the tube to hold that pressure. If the altimeter drops more than 150 feet in one minute, this is

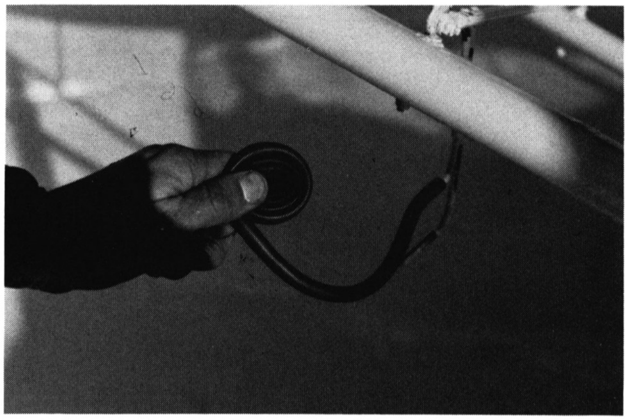


PHOTO 1

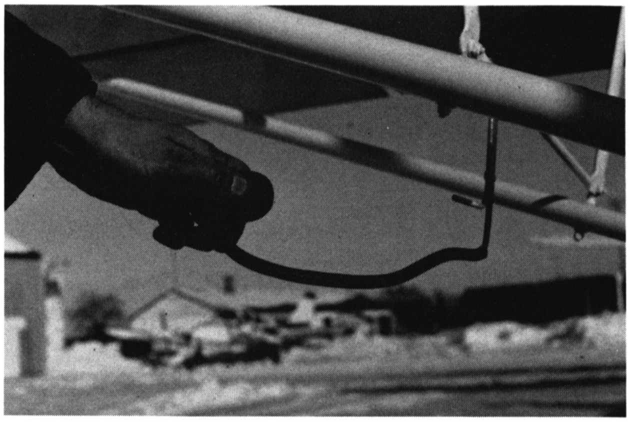


PHOTO 2

an indication of a possible leak in the system. (Naturally, if any systems have drain holes, alternate pick-up points, etc., these items must be taken into account and blocked off and/or tested separately.)

To reiterate: This test should **not** be taken as an **absolute** indication as to the condition of your pitot system (or static system), and therefore should not be considered to attest to the **absolute** accuracy of your airspeed indicator.

We have all read of highly accurate and super-sophisticated test methods. However, for most of us such methods, because of the time, money and equipment involved, make only interesting reading. The "old flexible tubing routine" is simple and inexpensive — and, therefore, will most probably see **actual** application. This fulfills the old axiom that is close to the hearts of all of us, "something is better than nothing". And perhaps this little something can keep an IAC member from unwittingly exceeding the design limitations of his aircraft.

INDIGESTION & OPEN FRACTURES

An IAC member's homebuilt Pitts recently suffered a case of Lycoming O-360 indigestion. On a cross country flight a brass exhaust manifold nut backed off, fell, and was sucked up through the intake tract and deposited inside of one of the cylinders. The nut bounced around in the cylinder for a while knocking the electrodes off of both spark plugs, which shut the cylinder down, and then it bounced back into the intake pipe. The pilot made an uneventful three cylinder landing at the nearest airport and there the necessary repairs were accomplished. A little checking came up with grapevine stories of two other homebuilt Pitts which also ingested foreign objects in flight that caused immediate cylinder shut down and substantial damage. One of the objects reportedly was a P-K screw.

Pitts Aerobatics General Manager, Herb Andersen, advised that sucking foreign objects into the engine on homebuilt Pitts aircraft has been a problem because many of these planes do not have the intake tract sealed to the outside of the cowling. Herb further advised that when the Pitts aircraft were undergoing certification tests by the U.S. Federal Aviation Administration, the FAA required the induction systems air intake be completely sealed to the outside of the cowling. All factory-built Pitts meet this requirement.

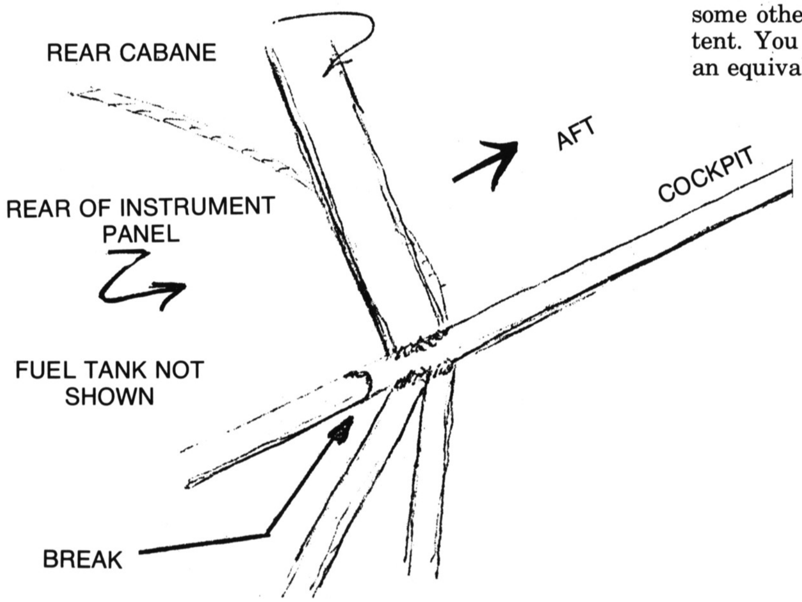
Although we have been talking about Pitts aircraft, it is obvious the above lesson should be applied to all makes of aircraft. When inspecting aircraft engine compartments, one often finds missing/loose screws, Tinnermans, nuts, washers, etc., and if the engine's intake is not sealed to the outside of the cowling or does not have an effective air filter, the engine's intake system becomes a vacuum cleaner trying to suck up any loose objects.

*****

Another IAC member recently reported finding a fractured upper longeron on a homebuilt S-1S Pitts. The break was on the upper left longeron just in front of the rear cabane strut attach point. (See Sketch) The break was discovered when the fuel tank was being removed to repair a leak. The IAC member making the report advised the area in which the break occurred could be checked with an inspection mirror held under and behind the instrument panel. Note that this particular aircraft had accumulated approximately 1100 hours total time and much of this time had been flying unlimited competition maneuvers.

This is the only report in the IAC M&D files of a broken Pitts longeron. In the past we have observed that quite often reports of certain problems seem to come in bunches. We feel this may be due to the broken areas accumulating the same number of fatigue cycles at about the same time and/or IAC members becoming aware of a problem area and hence making close and thorough inspections of the area. Therefore, we urge all Pitts drivers to closely inspect the upper longerons in the area noted above and if any cracks are found, please make a report to the IAC Technical Safety Committee.

IAC thanks to the IAC members and to Pitts Aerobatics whose input is responsible for the above article.



CONCERNING SMOKE SYSTEMS

IAC Technical Safety Chairman, Fred Cailey, received correspondence from Jacques David of France requesting information concerning the installation of a "smoke system" in his CAP 20. He asked about the availability of kits or plans for building such a device and about the composition of the mixture or mixtures used in the tank. This editor found Fred's reply very informative and, as perhaps some of you have been wondering the same things, elected to publish that information which follows.

"We know of no company that manufactures 'smoke system' kits — everyone's smoke system being rather a custom-made unit. However, we are enclosing a copy of an article on making a smoke system that was written by Jim Lacey. The system described should be applicable to your CAP 20. You will note the system discussed used an engine-driven pump. However, some IAC members, usually with lower powered aircraft such as Clipped Cubs, are using air pressurized smoke-oil tanks and some IAC members with larger aircraft, such as 450 hp Stearmans, have used a wind-driven smoke-oil pump. In general, electric pumps that were originally intended for fuel pumps have not proven successful as smoke-oil pumps. I have no personal experience with smoke systems and am relating to you information I have obtained from several IAC people who use smoke systems for air show work.

"Also regarding a smoke system for your CAP 20, we contacted Jim Davis of Acra-Line Products, Route 1, Box 267A, Greentown, Indiana 46936, USA. Although Jim's company, Acra-Line, does not make smoke system kits, they have made several custom smoke systems. Jim said he would be glad to try and help if you had any further questions on smoke systems. I asked him if he would make smoke system components for your plane, and although he said this would be possible, it would probably be much less expensive for you if you had the parts made locally in France.

"The oil used to generate the smoke in smoke systems is a high paraffin-base oil that is generally used by building contractors to prevent concrete from adhering to the wooden forms. It is commonly known as 'form oil'. The oil that most U.S. pilots like to use is a Texaco Oil Company product which is marketed under the brand name of 'Corvus' oil. This is preferred over some other brands because it has a higher paraffin content. You should probably be able to get 'Corvus' oil or an equivalent in France."

"PSYCHED?"

On February 13th, 1978 the EAA hosted a Symposium on Aerobatic Aircraft Design and Maintenance. Several interesting topics were talked over at that meeting but perhaps one of the most interesting was a brief discussion between several top competition and air show pilots concerning aircraft inspections and maintenance — from a psychological standpoint.

One of the pilots present observed how difficult it is, psychologically, to cut away fabric through a "trick" polyurethane point job to inspect a critical area — **even** when one has certain clues that something is "wrong" in that area and a detailed inspection **is necessary.**

Another pilot said that occasionally one notes a different noise or vibration in his plane when he is flying and immediately resolves to "trail it down" as soon as he lands. However, oftentimes another flight comes up before there has been an opportunity to check for the strange noise or vibration, and pretty soon the idiosyncrasy just becomes something we live with. (i.e., hopefully we will live with it.)

Another party stated he felt that often people become emotionally involved with their aircraft.

The same gentleman, in another train of thought, but during the same discourse, told the following story. While riding in a friend's aircraft, the friend questioned a peculiar engine noise, asking "Is that a 'normal' noise?" After a short conversation, his friend came to the conclusion that perhaps it was "a **new** normal noise."

Another outstanding pilot said that when he arrives at an aerobatic contest he is actually kind of "numb" to anything but flying that contest. That "anything" includes inspecting-preflight his a/c. He also stated that he finds he does a better preflight inspection when his partner is going to fly, and not necessarily at a contest, than when he is going to fly and rather correspondingly finds he trusts his partner's preflight inspection more than he trusts his own preflight inspection when he is going to fly.

Several others in attendance at the Symposium made comments along similar lines.

What can we learn from the above conversation? Perhaps it is telling us that sometimes we are **not** psychologically or emotionally fit to make an objective or analytical inspection of our aircraft. Maybe?

In the November 1977 issue of *Sport Aerobatics* there was an IAC Technical Safety report on the tech inspection at the 1977 Fond du Lac contest. Several "How-could-that-have-happened?" items were mentioned. For example, one aircraft that was brought up to be inspected had an elevator full of water and another had a broken aileron gap kit bracket that was rubbing on the aileron to the extent that it was clearly audible and could even be felt in the control stick. We all know the danger of foreign objects in a/c tailcones yet almost every IAC contest tech inspection finds some loose garbage in contest a/c tail sections — and 1977 FDL was no exception with things like coins, pen tops, tape measures, etc. being found. People, some from thousands of miles away, don't come to the world's largest aerobatic contest to perform annual inspections on their aircraft. Could it be that some of the IAC contestants were so "psyched up" for the contest that they were "psyched out" for even routine preflight inspections?

Going from the macrocosm in aerobatics (the IAC FDL contest) to perhaps the microscopic in aerobatics (one's own weekend practice session) is it possible that perhaps we still sometimes encounter a psychological block to performing thorough and analytical preflight inspections? Think about the last weekend the weather was CAVU, you were feeling like a tiger, and you had a plan for a new sequence you wanted to try. On your way to the airport were you thinking about inspecting your plane or flying it?

A couple of suggestions relating to psychological-blockage of aircraft inspections that were noted at the EAA Symposium were:

(1) Have a friend help or even make a separate inspection of your aircraft.

(2) From time to time have a qualified individual fly your a/c to see if any "irregularities" have sneaked in on you.

(3) Set aside a special or separate time devoted just for inspecting your plane — and preferably **not** on the same day you intend to fly it.

This is obviously not the typical "nuts and bolts" IAC Technical Safety article but the topic of this article does relate to the maintenance of aerobatic aircraft. It is presented here to help make all of us aware of a potential problem — and often just being aware of a problem goes a long way to resolving the problem.

All IAC members owe a thank you to those IAC members who were able to attend the EAA Symposium and who shared their thoughts on the subject of psychology and maintenance.

Fred Cailey
Chairman
Technical Safety Committee

NOW YOU KNOW

By Nick D'Apuzzo
Reprinted from
EAA Chapter 78 Newsletter
Vol. 1, No. 8, Aug. 1976

How many times have you heard people who should know better refer to a BALANCE TAB as a SERVO TAB? Just so you won't make that same mistake, the following definitions should help to keep you straight.

BALANCE TAB. A balance tab decreases the force which must be exerted by the pilot to move and hold a primary surface in any given attitude. It is similar in appearance to the controllable trim tab and is hinged in approximately the same position. The essential difference between the two is that while the trim tab has an independent control mechanism, the balance tab is so connected to the airplane structure that when the primary surface is moved in any direction, the tab rotates in the opposite direction. As the air stream acts on the tab, it assists the pilot in moving the primary surface to the desired position and holding it there. When the control is released, both the control surface and the balance tab will return to the natural position because of the action of the air stream. On some airplanes, this tab may be used also to perform the function of a trim tab. Some tabs may be adjusted by controls located in the cockpit to operate as trim tabs and still carry out their balance function whenever the primary surface is moved.

SERVO TAB. A servo tab is used to assist in moving a large primary airfoil and holding it in the desired position. In appearance and location, it is similar to the balance tab, but is controlled from the cockpit by a linkage to the primary control mechanism. The tab linkage is connected parallel to the primary surface linkage, which has a spring-loaded cartridge incorporated in it. When the control in the cockpit is moved, the spring compresses, permitting the primary surface to remain stationary for a time while the servo tab moves at once. Because of the action of the air stream, this tab moves the primary surface. Thus, for ordinary operation of the primary surface, the pilot needs only to apply enough force to operate the servo tab and put a limited compression on the spring. However, if the action of the air stream on the tab does not cause the primary surface to move far enough, further movement of the control by the pilot will complete the compression of the spring and move the primary surface manually. Whenever the pilot releases the control, the entire system will return to the neutral position.

NOTE: The terms "primary surface" and "primary airfoil" are used interchangeably.

CRACKED FUEL TANK

By Ward Bryant
President IAC Chapter 35

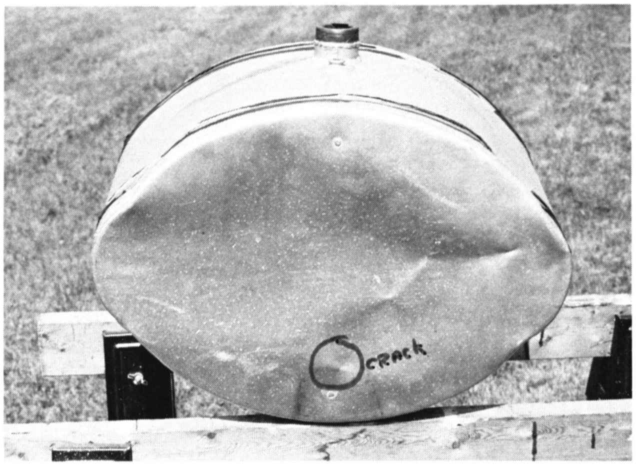
After several inside snap rolls one fine May morning, the smell of fuel filled the cockpit of one Pitts Special. Upon landing and looking around for a while it was discovered that the fuel tank had developed a hair line crack on the aft end.

The Pitts in question is a non-factory Pitts, "professionally" built and completed in 1971. It is powered by a Lycoming 160 hp engine, has never been used for dramatic or severe aerobatics, Sportsman and Intermediate style at best, and at the time had approximately 200 hrs. TT.

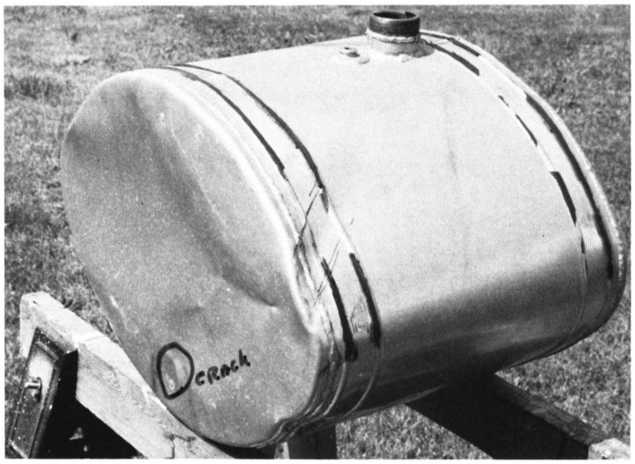
Not being the ardent Homebuilder I'd like to be, advice regarding the probable cause of the problem was solicited from those in the area who are more knowledgeable in such matters. All comments and suggestions were well received and greatly appreciated, but so many theories ranging from vent lines, to vent tubes to vent holes, flop tubes, standing pipes, vertical flight, inverted flight, to no flight at all, came to the surface that it began to feel like going outside flat.

After talking to and studying the situation with EAA Designee Jack Denison from Rochester, NH, and some of the other builders in the area, the following cofusions were reached.

1. The fuel tank was severely dented during the building stage to facilitate its clearing the aft cabane struts, which set up stress wrinkles on the aft side of the tank. (see picture) After 200 hrs. of flexing and vibrating one of these areas gave away.
2. Using the normal non vented fuel tank cap for inverted flight the only venting available is through the standard vent line along the landing gear. Now, many things frighten aerobatic pilots: 200 ft. Lomcovaks, Advanced and Unlimited Unknowns, loose women, ????? and mud dobbers. To alleviate danger from the latter we cover pitot tubes etc., and on this Pitts we even covered the fuel tank vent line with a sealed plastic tube. (see picture) Imagine the pressure build up in the tank after filling it with fuel on a 40 degree evening and then



having it sit in a 90 degree hangar the following day. These temperature ranges are not uncommon in New England or many other places during the Spring and Fall. With no venting available the pressure changes in the tank must have been substantial, and in this case caused much flexing on an already wrinkled and weakened tank surface.



Consequently the crack in this particular Pitts fuel tank is believed to be the result of the original denting of the tank combined with flexing caused by pressure changes from a non-vented fuel system. This may be an isolated cause of fuel tank cracking but hope it may shed some light on what appears to be an increasing number of fuel tank problems in aerobatic airplanes.

making smoke

By David N. Meade
IAC 4314

The article in the Feb. 78 *Sport Aerobatics* "Concerning Smoke Systems" has struck a responsive note in me and I therefore offer the following as my solution to the oil delivery problem.

The Dukes model 4140-00-1 pump is designed to deliver 35 gallons per minute at 26 psi. This is the pump I use, along with a general controls 3/8 npt solinoid valve. (12 vdc cont duty).

Since the flow rate from the pump is much too great, a method is required to reduce the flow.

I designed a set of removeable jets which are inserted into the exhaust nipples. The .052 dia. drilled hole provides the correct amount of oil to the exhaust stream as a high pressure spray. If a change is desired, the jets are easy to remove, replace or redrill.

The hook-up requires 3/8 tubing on the suction side of the pump and 1/4 tubing on the pressure side, a switch to actuate the pump and solenoid, plus a manual valve if your oil tank is located in the wing center section. (The manual valve allows service to be performed without draining the tank.)

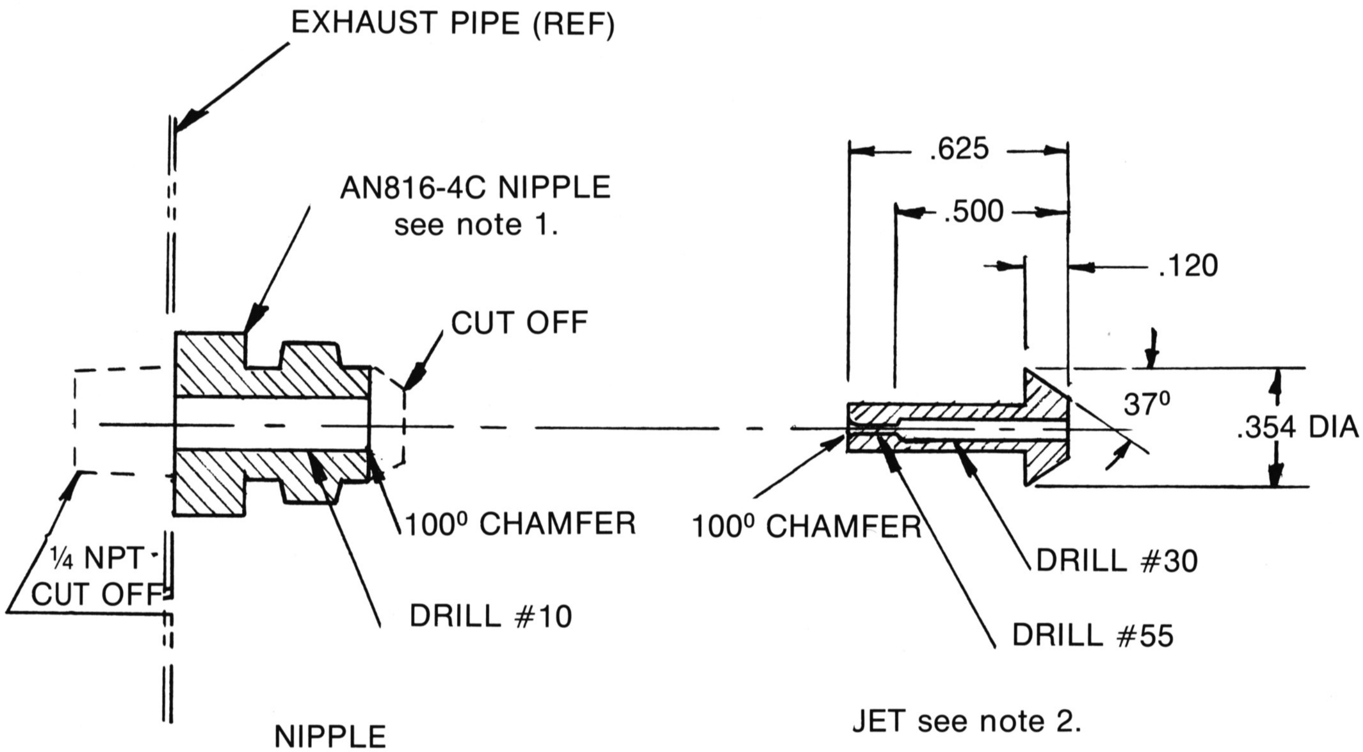
Insert jets into #10 hole in nipple and attach flex line nut which will seal against 37° flare.

If you do not have enough smoke to suit you, drill jets larger one number size at a time. — Example 55 then 56 then 57 etc. —

Note: Flow is proportional to square of diameter so it takes very little to obtain the desired result.

This system worked as desired for the "CLOUD DANCER" movie airplanes, providing dense white smoke and NO problems.

A sketch of the key parts is enclosed.



NOTES.
1. AFTER MACHINING, WELD TO EXHAUST
2. MAKE JET FROM AN3-10 BOLT.
   GRIND 37° ANGLE ON VALVE GRINDER.

4-25-78
DAVID N. MEADE
IAC 4314

SENSE LINE . . .
(Continued from Page 11)

non-techs have all sorts of resources and capabilities that the techs don't have.

I recently taught a course on digital logic for the club at my home. When one of my students hungrily eyed a flexowriter I had for years, I offered to sell it to him. His response was "Well, Gary, I don't have the thirty-five dollars right now, what will you take in trade?" I thought about it for a second and thinking that he didn't have anything I needed I jokingly said, "Yeah, a color television set." His response knocked me over. "No problem, I fix them for a living. Must have a dozen down at the shop. What kind do you want?" I have heard of people trading an automobile tune-up for all sorts of computer stuff. This is sort of interesting, isn't it?

In summary, people in your club have much to offer each other. It is the job of the officers of the club to make sure that the club members get the picture on this. When interaction between the members increases the reason for belonging to the club, the club will be that much stronger. A club will be based on the most solid bases known: A common good of all its members.

"BLOCKAGE"

Fuel systems continue to be the number one problem area for IAC members. Below are two accounts from IAC M&D files of fuel system problems due to fuel line blockage.

1. Description of problem:
   "Trash accumulation in #3 injector nozzle caused misfiring & resultant power loss."
   Cause:
   "New Aeroquip line made up in field — **not properly checked to ascertain if any rubber particles present after assembly. Proper assembly tool not available.**"
2. The second fuel line blockage problem was not a "first person" report, for sadly it resulted in a fatality. A brief account taken from the FAA Preliminary Accident Report reads, "Engine cut out. Aircraft stalled and crashed and burned. Fatal." The aircraft was equipped with a Bendix fuel injection unit and as part of the accident investigation, all the fuel system components were sent to Bendix for testing. The result of these tests showed that one section of fuel line had a piece of rubber inside of it — possibly a piece that was cut loose when the hose end fittings were installed. The fuel flow through this section of hose was only **25% of full flow.**

Obviously, no matter what brand of hose that is being used, Aeroquip, Strat-O-Flex, etc., proper assembly and inspection procedures are mandatory. In this regard below are two sections taken from Aeroquip Catalogue #110 showing Aeroquip hand assembly tools and Aeroquip inspection procedures. Sure, you can put on the hose ends **without** the proper assembly tools but you greatly increase the chances of cutting the material in the inner portion of the hose. Note the Aeroquip line, "These tools are recommended to avoid damage to the sealing surface and to properly support the inner tube, thus eliminating cut rubber flaps and inner tube bulge." Also note the second picture marked "INSPECT". Don't just whip the hose up to your eyeball and be satisfied if you see a little light at the other end of the tube. As closely as possible **examine** the inside of the hose looking through the hose from both ends.

One of the aims of the IAC Technical Safety Program is simply to eliminate aerobatic accidents. This is a very broad proposition, but we can, at least from the mechanical end of things, take a giant step in the right direction if we can eliminate fuel system problems. Let's all make a positive effort in this direction through proper design, construction, and maintenance of our aircraft's fuel system.

Hose assembly equipment

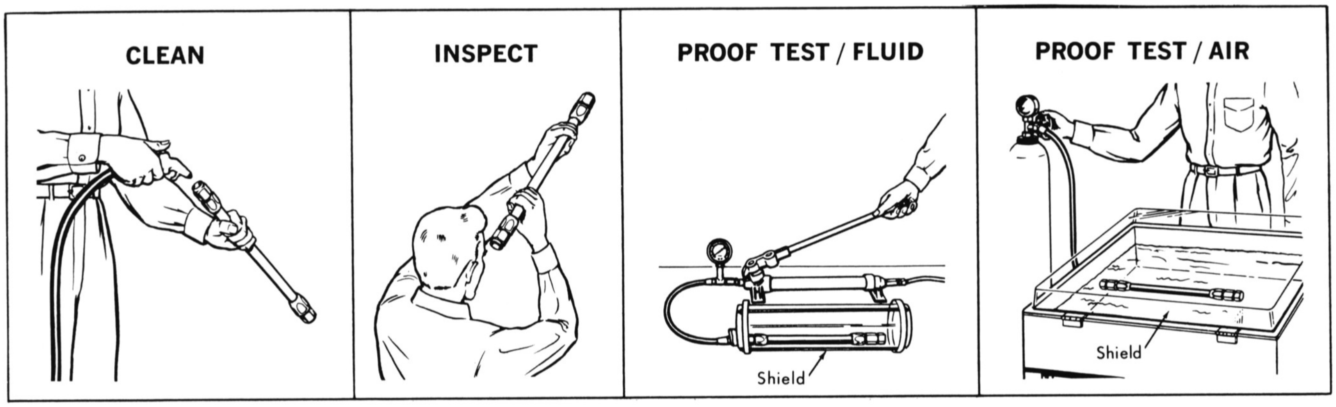
Aeroquip S1051 Hand Assembly Tools are for use with MS24587 AN flared fittings (Aeroquip 491 and 451). Tools are cadmium plated hardened steel with permanent handles and a precision cone seat driving surface. These tools are recommended to avoid damage to the sealing surface and to properly support the inner tube, thus eliminating cut rubber flaps and inner tube bulge.

Tools and bag may be ordered separately or as a kit.

S1051 Hand assembly tools

Aeroquip Part No.	Tube Size O.D.	AN Thread	Fitting used on: MS number	Fitting used on: Aeroquip Part No.
S1051-3*	3/16	3/8-24	MS24587-3	491-3
S1051-4*	1/4	7/16-20	MS24587-4	491-4
S1051-5*	5/16	1/2-20	MS24587-5	491-5
S1051-6*	3/8	9/16-18	MS24587-6	491-6
S1051-8	1/2	3/4-16	MS24587-8	491-8D
S1051-10	5/8	7/8-14	MS24587-10	491-10D
S1051-12	3/4	1 1/16-12	MS24587-12	491-12D
S1051-16	1	1 5/16-12	MS24587-16	451-16D
S1051-20	1 1/4	1 5/8-12	MS24587-20	451-20D
S1051 Kit	—	—	Sizes -3 through -20 in 1595-6 Zipper Bag	
1595-6	—	—	Canvas Zipper Bag	
1595-7	—	—	Bag with individual pockets for six tools.	

*With removable mandrel.



NEW BELLANCA SERVICE LETTERS

** Service Letter No. C-129, 6/2/78 and Service Letter No. C-129A, 1/30/78, revised 5/11/78.
Subject: Engine Oil Pressure Guage Line/Fittings
Aircraft affected:
7ECA — S/N 813-72 thru 1248-78
7KCAB — S/N 291-72 thru 617-77
8KCAB — S/N 5-72 thru 381-78

The engine oil pressure gauge line is connected to the engine on the right side directly under the upper right engine mount bushing. It is possible for this line to interfere with the engine mount under negative load conditions when the engine is deflected toward the engine mount. This interference becomes more critical when the rubber engine mount bushings are soft as a result of age and/or usage.

Aeroquip has notified Bellanca of a possible oil pressure gauge line nipple defect and has recommended that certain Aeroquip lines be replaced.

Bellanca therefore recommends that the following engine oil pressure gauge line inspection and engine fitting replacement be accomplished within the next 30 days or 10 hours of flight. (See Service Letter for particulars.)

** Service Letter No. C-130, 6/2/78.
Subject: Wing/Fuselage Gap Cover
Aircraft affected:
8KCAB — S/N 3-70 thru 357-77

An improved wing/fuselage gap cover installation has been developed and is being offered as a field retrofit. This retrofit may be accomplished at the owner's discretion.

This installation consists of improved attachment methods for both upper and lower gap covers. Bellanca Aircraft Corporation recommends that this installation be accomplished if attachment problems have been experienced with the present gap cover configuration.

** Service Letter No. C-131, 6/2/78.
Subject: Model 7KCAB Winter Kit
Aircraft affected:
7KCAB — S/N 459-74, 509-75 and up or all 7KCAB aircraft equipped with the Christen Inverted Oil System.

The Model 7KCAB aircraft equipped with the Lycoming AEIO-320 (Christen Oil System) has exhibited the following severe cold weather operational problems:

1. Low Operating Oil Temperature
2. Moisture Condensation in Oil/Breather System
3. Ice Blocked Oil/Breather Lines

In order to prevent these problems, Bellanca Aircraft Corporation recommends the following:

I. Installation of Service Kit No. 264
II. Adherence to recommended operating practices outlined in Service Letter C-131.
III. Adherence to recommended maintenace practices outlined in Service Letter C-131.

** Service Letter No. C-132, 6/2/78.
Subject: Airplane Flight Manual Corrections
Aircraft affected:
8KCAB (150 only) — S/N 338-77, 340-77, 342-77, 344-77, 346-77, 352-77 thru 355-77, and 357-77

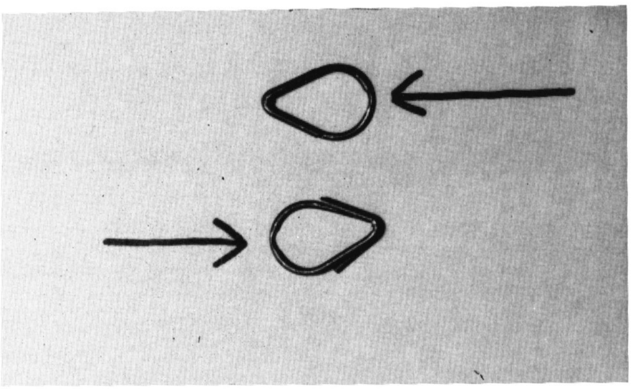
This Service Letter concerns an incorrect date and tachometer instrument markings listed in the airplane flight manual.

** Service Letter No. C-133, 6/2/78.
Subject: Repositioning of Emergency Fuel Pump Drain
Aircraft affected:
7KCAB — S/N 611-77 thru 617-77
8KCAB — S/N 219-76, 299-77 thru 378-78

"SHIMMY, BREAKAGE & OTHER TAILWHEEL WOES"

Over the last couple of years the IAC Technical Safety Committee has received several reports concerning tailwheel problems. Often the result of a severe tailwheel problem is a ground loop with accompanying damage to the MLG, wheel fairings, and wing tips. However, there have been reports of more substantial damage. In one report a broken tailwheel spring U-bolt on an EAA Biplane resulted in the a/c actually being flipped over on its back. Below are listed some specific tailwheel problem areas that should receive close inspection and some ideas concerning tailwheel problems and possible problem cures.

One IAC member sent the IAC T.S. Committee some worn tailwheel chain spring clips off of his S-1 Pitts. (See Photo #1) He advised these clips had approximately 300 hrs. of use with the large Cessna-type springs. He also suggested the following: "Always install the clip in the tailwheel actuating armhole with the twin end pieces attached to the chain — the round end (of the clip) should be inserted in the actuating arm to cause less wear," and he further commented, ". . . it is a good procedure to run a couple of lengths of safety wire around the spring and chain where they join — if the chain should wear here and break, the safety wire should hold and prevent a serious mishap."

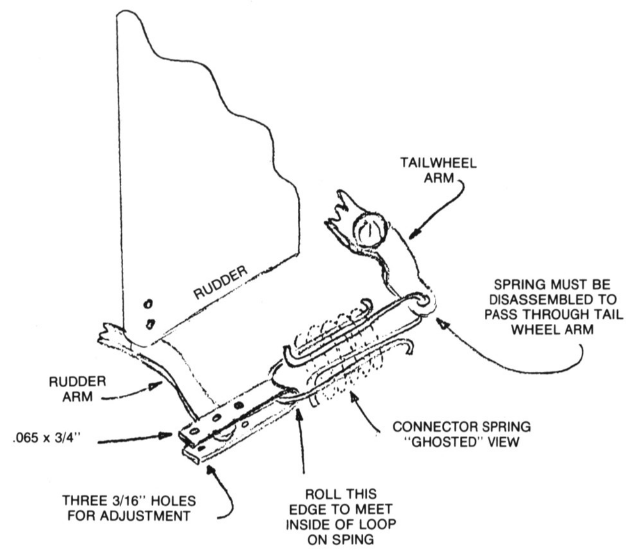


Tail wheel chain spring clips from Pitts S-1.

Another IAC member who had the above mentioned clips on his S-1 Pitts break — which resulted in wheel fairing and wing tip damage — noted that these spring clips are made of a pretty hard material and they wear only to a certain point and then **snap.** If a spring clip is worn 25% of the way through, this does **not** mean you have 75% of wear left — it may snap in half on the next landing.

IAC members may also recall the 1977 Fond Du Lac technical inspection article in the November 1977 issue of **Sport Aerobatics** and noted that **many** aircraft at the contest had worn tailwheel steering springs and spring clips.

Still another IAC member eliminated the spring clip/chain problem altogether. (See Sketch #1) He advised he has used this set-up on both of his 8KCAB Decathlons satisfactorily.



The IAC T.S. Committee recently received an article from an IAC member dealing with another tailwheel problem. Below is this article in its entirety.

"TAILWHEEL TANGO"

"The Maule tailwheel, commonly found on a Pitts, has proven to be a sturdy and dependable item, however, there exists a weak point that has caused a local Pitts S-1 to ground loop.

Under the right steering arm you will find a plate retained by three sheet metal screws which holds the pin and spring which in turn locks the tailwheel to the rudder horn when in the trail position. This pin is disengaged when the tailwheel is "kicked out" by a cam for ground handling inside the hangar.

These three PKs are screwed into the hard metal steering arm and cannot be seen visually on a walkaround inspection and in the above case had worked loose allowing the pin and spring to drop out and full swivel the tailwheel.

The screws in question can be checked by feeling under the right steering arm or by lying on the floor and checking with a slotted screwdriver. Rumor has it that the later Maule tailwheel has tapped holes to retain the plate.

It is likely that a Pitts could be controlled on a landing with rudder and brake if the pilot was aware that he did not have a locked tailwheel, but should the pin drop out and catch the pilot by surprise it is doubtful if a successful landing could be accomplished.

It is recommended that this item be made a part of the IAC Technical Inspectors' checklist at all contests and that it be brought to the attention of our members as a potentially hazardous condition."

To further comment on the above problem, it should be noted that the lock pin, spring, and channel that the pin rides in, are partially exposed. It is possible for enough mud, dirt, etc. to pack up into this area so as to prevent the pin from sliding forward and locking the tailwheel in the trail position.

Two S-2A Pitts have suffered broken fuselage lower tailpost plates. In one case (See Sketch #2) an IAC member reported, "During a slight crosswind landing, the tire started to vibrate severely enough to be felt over the entire airframe causing the lower tailpost plate to separate. Directional control was lost momentarily — pilot was proficient enough to regain control avoiding serious damage to aircraft." On the second S-2A Pitts (See Photo #2) another IAC member reported, "It was noted upon preflight that the tailwheel would wobble when the fuselage was pushed sideways. Subsequent inspection revealed the tubing was cracked ¾ of the way around with a possible small wedding band just above the crack." Please note that this second aircraft was just recently purchased and the past history was not known, however it seems very possible that tailwheel shimmy/vibrations could account for the broken tailpost plate. This area should receive close inspection on all S-2s and possible other a/c as well. Pitts Aerobatics advises that a gussett plate was installed in the tail post area to production S2A aircraft ser. #s 2126 and up — which means it was incorporated about 2 years ago.

If one checks Bellanca 7 & 8 Series a/c closely, you will notice some small but significant changes on their tailwheels. There have been several tailwheel spring U-bolt designs and the tailwheel spring pad(s) have changed from a rubber impregnated fabric material to an aluminum block. Bellanca engineers have advised that tailwheel spring **throughbolt, U-bolt,** and **tailwheel attach bolt** torque should be checked periodically. These are often overlooked items.

Again, possibly noting "looseness," another IAC member reported installing new wheel bearings in a Scott tailwheel stopped a shimmy problem he had encountered.

In trying to determine some tailwheel problem answers, the IAC T.S. Committee contacted Mr. B. D. Maule. Mr. Maule made the following comments:

- Wider tailwheel springs are usually less prone to shimmy than the narrower 1¼" wide springs.
- Shimmy problems are sometimes due to loose spring throughbolts or loose spring "U-bolts".
- Shimmy problems are sometimes related to overinflated pneumatic tailwheel tires. If a shimmy problem exists, he recommends trying tailwheel tire pressures of 15-20 PSI.

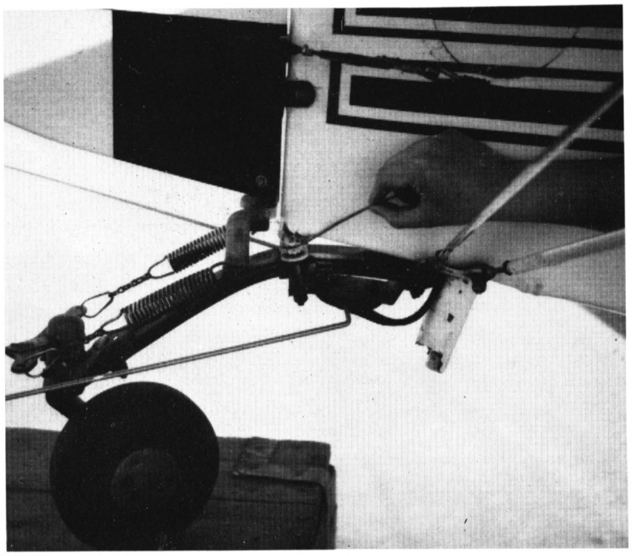


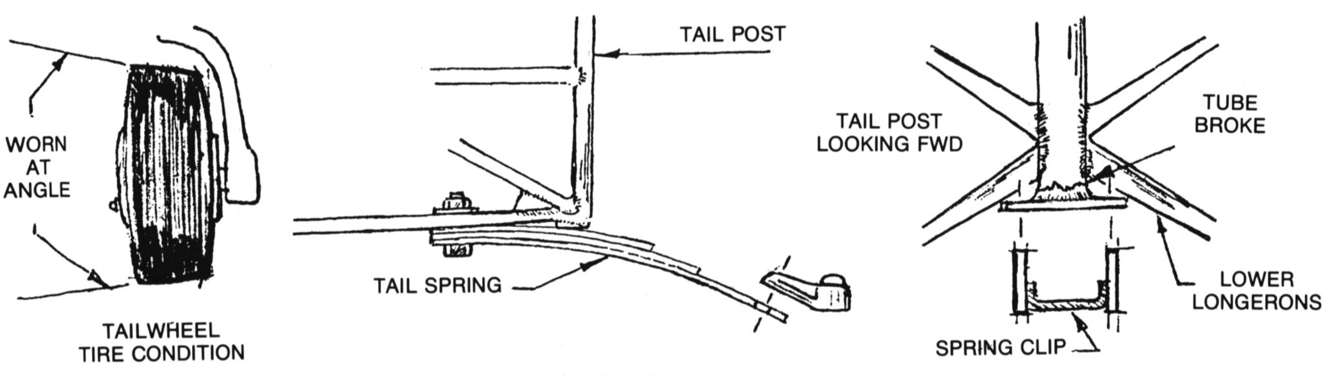
Photo #2

- Be sure and check steering arm on rudder for tightness.
- New Maule tailwheels do not incorporate shimmy dampers.
- Maule is now manufacturing a new type of tailwheel connector springs. These springs consist of one "light" spring and one "heavy" spring. It is recommended that the "heavy" spring be installed on the right side because of engine torque. These springs are intended to help eliminate tailwheel shimmy and vibrations. (It should also be noted that Mr. Maule **donated** a set of these springs to the IAC for evaluation.)

This pretty well covers the tailwheel problem input that has been received by the IAC T.S. Committee to date. IAC thanks go to all the T.S. Program contributors. Note: Because of IAC policy, T.S. contributors must remain anonymous and remember the IAC T.S. Program is no more than a "clearing house" for information and without input from people like the IAC members who contributed the above, there would be no IAC T.S. Program. Therefore, again on behalf of all IAC members, **THANKS.**

Fred L. Cailey
Chairman
Technical Safety Committee

Name of Specific Part Causing Problem	Mfg. & Part #	Part Condition	Part Total Time
Tail Post Spring Bracket		Separated From Aircraft	560 Hrs.



Sketch #2

"THE GREAT SHOULDER HARNESS ATTACH PLACEMENT POLL"

In the January 1978 issue of *SPORT AVIATION*, Dr. Dean M. Hall had an **excellent** article on shoulder harness attach placement that should be read and re-read by all IAC members.

Shortly after Dr. Hall's article appeared, an IAC member, who has a pretty good engineering background, contacted the IAC Technical Safety Committee and advised he agreed with most of Dr. Hall's article, especially the statements calling for a level with, to 30 degrees above the shoulder point for shoulder harness attachment but disagreed with the statements implying that a low-mounted shoulder harness is necessary for negative G support in competition aerobatics. He further stated he believed that the lap belts and crotch strap really supply the negative G support and he felt the only reason for low shoulder harness attach points on most a/c is that it is the most expedient place for the manufacturer/builder to mount the harness.

The IAC Technical Safety Committee responded to the concern expressed by this one member, especially the thought that new aerobatic pilots may compromise their safety by believing that a low shoulder harness is necessary, and decided that a poll of some IAC Unlimited category pilots would provide a basis to resolve the high point shoulder harness attachment/low point shoulder harness attachment controversy. The response by IAC pilots to the IAC T.S. poll was super and provided some very interesting and informative comments. Because of space and to provide anonymity, some editing of the replies has been necessary. However, to provide as much "learning material" as possible, below is a mostly "unabridged" compilation of the great shoulder harness attach placement poll.

Low shoulder harness attachment IS NOT necessary:

(1) "The low mounting is NOT necessary.

"The only reason I wear a shoulder harness is in case of a sudden stop.

"I agree with the IAC pilot mentioned in your letter who does not feel that shoulder straps are necessary for negative G support.

"I owned a Great Lakes with only two lap belts and performed outside maneuvers without difficulty, nor did I even feel the need for a shoulder harness for negative Gs, however, I did, at a later date, install a harness but only for the purpose of combating deceleration forces. I then found that the shoulder straps only served to loosen the lap belt but a crotch strap cured this.

"On my homebuilt Bücker, for practical reasons, I did not want the shoulder harness passing through the baggage compartment, as in the original Bücker, and as shown in Dr. Hall's article. So I mounted the straps on the cross member in back of the seat about 'small of the back level'. This was found to be particularly undesirable during negative Gs as my body tended to 'bunch up' and my lung capacity seemed to decrease causing a 'shortage of breath' condition.

"I don't believe a higher category competition pilot desires to put too much load on the shoulders during inverted flight but rather will fly with them 'comfortable' and then tighten them down on landing. I also find that outside snap rolls from inverted are difficult to get in full 'forward stick in the far corner' when the straps are too tight.

"I prefer the high mounted shoulder straps and agree with the 'level to 30 degree proposal'. Even in 1933 Herr Bücker recognized this desirable human factors item and designed his straps HIGH."

(2) "I, for one, do not rely on the shoulder straps for negative G maneuvers. I have found that tight shoulder straps mounted low as in the Pitts, cause me a good deal of pain in my back. I beleive this fact was also mentioned in the article of which you write. The manner in which my shoulder harness is mounted in my Pitts has concerned me for some time, as not being adequate in a crash situation, as is brought out by Dr. Hall's article.

"To sum up my feelings then:

1. I do not rely on shoulder harness for negative flight, but use the seat belt and crotch strap for this purpose. As a matter of fact, I wear the shoulder straps loose for aerobatics, then tighten for landing and take-off.
2. I am completely in favor of the high-mounted shoulder straps, and am now in the process of trying to relocate same in the new Pitts I am building. If I do stick to the present location, it will only be because of too much restructuring, but will still not like it, and realize it is a calculated risk in case of an accident . . . I certainly would not advocate this type of placement to any newcomer, however."

(3) "It is my opinion that the purpose of the shoulder harness is not to restrict vertical movement incurred during negative G maneuvers but to restrict or limit forward body movement. The seat belt and crotch strap should totally support the body during negative G maneuvers with very little pressure from the shoulder harness.

"When I first started flying outside maneuvers, I made the mistake of tightening the shoulder harness too tight. After a flight, I usually had black and blue marks on my shoulders. This meant that I was trying to support a good portion of my body weight with my shoulders. I feel that this was the cause for some minor back problems. When I loosened the shoulder harness and allowed the seat belts and crotch strap to provide all the support, the back problems went away. Ever since then, I make sure the shoulder harness is loose enough to prevent black and blue marks. And I haven't had any more back problems."

(4) "I do not use the shoulder harness as support for negative maneuvers as it puts an undue stress on my spine. I strap in with them slightly loose so they will be 'snug' in negative maneuvers. As far as I am concerned the only thing the shoulder harness is for is to prevent hitting the panel in a crash."

(5) (A letter addressed to Dr. Hall — a copy of which was sent to the IAC T.S. Committee.)

"I would like to commend you on your article on shoulder harness attach placement in the current issue of *Sport Aerobatics*. I concur completely with the finding of your research and can speak with some authority on the type of injuries produced by improper attach points. I do take issue, however, with the statement implying that aerobatic pilots need the shoulder harness tight to lend additional support during heavy outside 'G' maneuvers. This is contrary to my experience as an Unlimited competition pilot.

"In September of 1965 I experienced an unplanned premature arrival back on the ground while doing a take-off roll at an air show. The failure of an aileron to function properly was the cause, but that is not pertinent to what I want to emphasize.

"As a result of a shoulder harness that was attached at about the level of my shoulder blades and was not extremely tight, I was thrown forward in exactly the manner you describe in your article and did, in fact, suffer a compression fracture of the third and fourth lumbar vertebrae. The harness, however, probably saved my life as it stopped my head from going any farther forward than the altimeter set knob — which I broke off with my very hard head and required 36 stitches to repair. (The head, that is. The altimeter required a complete overhaul.)

"More recently, I have been flying Unlimited competition in my Pitts S-1S. Based on my observations, I would say that in this type of flying you would probably not find too many tight shoulder harness straps regardless of attach point placement, simply because the pilot must have the freedom of movement of his upper body to properly work the controls when flying a sequence. Speaking only for myself, I usually tighten my lap belts (2) **as tight as I can get them**. I then tighten the crotch strap to hold these belts in place, followed by pulling the shoulder harness straps down to where they are snug. I don't know if I am typical of all Unlimited pilots, but all of my bruises are confined to my hip and thigh area after a sequence.

"It appears your article may generate quite a bit of controversy as I have already received a letter from IAC Technical addressed to all Unlimited pilots requesting comment. In answer to this request, I am copying them on this letter to you.

"Congratulations on a well researched and thought provoking article."

(6) "From my personal experience, I depend upon the crotch strap and lap belts to hold me in the airplane during negative G maneuvers. I wear my shoulder harness snug enough to keep me from hitting the panel, but do not depend upon it to keep me in the airplane during negative G maneuvers. If I were to do this, I would be unable to push the stick forward far enough for such maneuvers as outside snaps.

"In talking with Dr. Hall, I explained my particular situation. I told him that each aerobatic pilot is different, therefore I feel this poll would be extremely informative. In fact, I am sure Dr. Hall would appreciate any information as to any response that you receive. He is an extremely capable individual."

(7) "I read Dr. Hall's article with interest and noted the statement about shoulder harness placement in aerobatic aircraft.

"It has been my experience (after several unlimited flights with **tight** shoulder harness) that the shoulder harness should be **loose** enough so as not to restrict or interfere with pilot movement while he is violently maneuvering the aircraft. A tight harness is not only restricting, it can be uncomfortable and downright painful if the seat belt is loose.

"In my opinion the shoulder harness performs only one function — that of restraining the upper torso and head from pitching forward in the event of a sudden stop. It is the function of the **seat belt** and the **crotch strap** to hold the pilot in the seat (firmly) upright or inverted.

"After an aerobatic flight most unlimited pilots will have minor bruises on the upper thighs caused by the seat belt taking the weight of the negative 'Gs', occasionally one will have them also on the shoulders but usually only when the shoulder harness is pulled too tight and rubs against the **forward** part of the shoulders.

"In short, the term 'hanging from the straps' is merely a cliche. One is really hanging from the **crotch strap** and the seat belts.

"I suggest that the harness as mounted in the Pitts and Eagle are there because of attach points to the frame and more 'importantly' to preserve the baggage compartment."

Three IAC pilots replied to the IAC T.S. poll by telephone. All three advised they rely on lap and crotch belts for negative G support and keep their shoulder harnesses loose. One of the three said he believes the crotch strap to be the most important. Two of the pilots advised they tightened their shoulder harness only for take-off and landing. One of the fellows said he needed the harness loose for "flexibility" in the cockpit. The term "only for forward restraint" popped up in several of the conversations. One of the respondents advised that on page 18 of Neil Williams book, "Aerobatics", Williams comments on safety harness. Below is taken from "Aerobatics" by Neil Williams:

"I cannot place too much emphasis on the need to be securely and tightly strapped in. Even so, all the straps will loosen off in flight but will still result in the pilot being very firmly restrained in the pelvic area, which is close to the pilots own center of gravity. The pressure of the straps across the chest will have eased off, and this is very important for inverted flight, where nearly all the weight is on the negative g strap, and the shoulder straps serve merely to stabilize the upper body. If these shoulder straps were too tight they would tend to restrict breathing during inverted flight and would cause the pilot to tend to hold his breath. This would result in an increase of blood pressure to the head, and could result in an increase in the value of negative g being experienced, so that although the accelerometer might show -2g during an inverted turn, the pilots upper body and head might well be subjected to -4g, with the attendant distress."

Low shoulder harness attach IS necessary:

(1) "Does the aerobatic pilot who will push outside G's need a low mount on the shoulder harness? Yes.

"If I leave my shoulder harness loose, and push 7 negative G's, my upper body will stretch between 1" to 2". This of course is not a situation that the aerobatic pilot wants either physically or mentally. When I tighten my lap belt and shoulder harness, I try to reach a point where 50% of my weight will be taken by each. Over-tightening of the shoulder harness will cause lower back pain, but of course outside G's cause pain all over anyway, huh!"

(2) "I am almost sure that at least part of the negative load is borne by the shoulder harness in my case. I just have it snug on the ground but am sure that I move against it while inverted."

(3) "As much as it would be nice to have shoulder harness set up high for a possible crash per Dr. Hall, I

believe the **low-mounted** harness as per Pitts S1 are necessary for hard outside maneuvers. I tried a sequence last weekend with the shoulder harness loose and didn't like it. Also, as you know, I conducted a study of Christen harnesses (Pitts S1 installation) in crash situations and I'm still here."

(4) "I do like the low mounting shoulder straps, but do not pull them as tight as the seat belt. I pull the seat belt as tight as I can get it, then the shoulder straps snug. On outside G's both seat belt and shoulder support weight."

Two of the pilots who responded to the survey suggested we get advice from some qualified doctors. One of the pilots even suggested two doctors to contact. Overall we got the opinion of three doctors — two by letter and one verbally. The doctors' comments:

(1) "Shoulder straps are upper torso restraint devices for forward motion. They should **not** be relied upon for trunk placement in negative GY maneuvers. The quoted 30^0 above the shoulder attach points are optimal for their work as GX restraining devices for the upper torso. Any other position compromises this function.

"I do not feel that more than the double lap belt should be necessary for negative GY restraint. I currently fly in the F.4C and have a totally loose upper restraint, yet have no difficulty in aerial combat maneuvers where shifting G loads are extreme in being able to utilize all controls and handle the fire control system."

(2) "Straightaway, I am in agreement with Dr. Dean Hall's article on "Shoulder Harness Attach Placement" as published in *SPORT AVIATION* (January 19, 1978). After searching what medical literature that was available to me and in talking to some of the local engineering groups, I believe we can say it is certainly correct that the shoulder harness should have the high attachment in preference to the low attachment. Dr. Hall grapically illustrated the problems with a single attachment such as in Figure 2 of the article as compared to the seat belt plus low attached shoulder harness as in Figure 3. This type of injury to the spinal column is serious in either event, but the type of fracture to the vertebral column is different in the two cases and, most likely the one illustrated by Figure 3 would be the most severe.

"Now with the medical aspect out of the way and to answer the second part of your question — whether or not the aerobatic pilot should use the high or low placement for his shoulder harness. I am in agreement with Frank Christensen's opinion noted in the question paragraph on Page 51. It is my personal opinion and personal observation that the low placed harness does give you a sense of security that I do not believe would be afforded by the high placed harness. It would seem to me that the high placed harness would allow just too much motion of the upper portion of the trunk to be comfortable. This, of course, in the final analysis, boils down to a personal opinion on the part of the pilot. This is not to say, also, that the shoulder harness is a primary retaining harness. I believe, at best, it is third in line with the two lap belts being the primary source of stability in the cockpit for the pilot. The crotch strap is secondary and then down the line as tertiary is the shoulder harness. I also would bring to your attention that a too tight shoulder harness and or the reliance of the shoulder harness for vertical stability in the cockpit in the inverted position is probably at best uncomfortable and at worse would possibly cause some prolonged discomfort due to the traction on the nerves and blood vessels exiting from what we call the thoracid outlet or in common words, the base of the neck area.

"Fred, in summary, it seems to me that the high placed shoulder harness is probably the engineered best placement and it certainly will do the best job in a rapid deceleration of a horizontal motion, but from the standpoint of aerobatic flying in which we are dealing with a vertical motion, rather than a horizontal, it is my opinion that the low attached harness is probably the best and the pilot who makes this decision will have to realize that he is making some compromise with body safety, but after all this is just one more of the many compromises that the aerobatic pilot must assume relative to his aircraft and personal safety."

The third doctor recommends the high mounted shoulder harness (level with to 30 degrees above shoulder level) and advised he felt the shoulder harness served only as a restraint to forward body motion. He also noted a concern for pressure at the base of the neck with too tight a shoulder harness. He said he flies aerobatics with a loose shoulder harness.

Not too much more can be said. The poll is in and the judge and jury is each individual IAC member — how do **you** want your shoulder harness. It should be noted that one IAC member did suggest a shoulder harness modification using a spring or a shear rivet giving kind of a high and low harness attachment. And in phone conversations with Dr. Hall, he advised he is checking into a couple of new deceleration devices that may possibly be incorporated into shoulder harnesses. These may be a subject for a future article.

IAC thanks are owed to many members for the above input, but special thanks are due Dr. Dean Hall whose effort and initiative brought this subject to the fore, and to the IAC member whose concern for clarification prompted the IAC poll.

AILERON STOP BOLTS

MODELS AFFECTED: S-1S 1-001 thru 1-0058

There has been one reported instance where the jam nuts on an aileron control system stop bolt installation in an S-1S Pitts have come loose, allowing the stop bolt to restrict the aileron travel with potential dangerous loss of aileron control.

For this reason, we are requesting that the aileron stop bolt installation be inspected on all Pitts S-1S aircraft to determine that the jam nuts are tight. If any jam nuts are found to be loose, the aileron travels should be checked, the stop bolts properly adjusted, and the jam nuts tightened. Aileron control travels are 25^0 up $\pm 2^0$ and 23^0 down $\pm 2^0$. As an added safety precaution to insure against possible future loosening of the nuts, install an AN 365-1032 stop nut against the jam nut on the outboard end of each stop bolt.

DIFFERENCES

Last April at the 2nd Annual Seminar sponsored by the State of Illinois Department of Transportation (the real honcho being IAC Board of Director member Charlie Wells) one of the guest speakers was Jerry Robinson of Cessna Aircraft Company. Jerry gave a very interesting presentation on the differences between the similar-appearing Cessna 152's and the Cessna A152 Aerobats. At that time we thought perhaps we could put Jerry's information into a Technical Safety article for *Sport Aerobatics*. But the need for such an article was greatly impressed upon us just a couple of months later when a fellow we know who had just recently obtained his U. S. Private Pilot's License told us how he was teaching himself hammerheads (stalled turns) in a straight Cessna 152.

Most probably similar incidents are what originally prompted Jerry's talk.

Thinking in the same vain, that is, aircraft that have a similar appearance but are designed to different criteria, we thought there may be some questions and "identity problems" among aerobatic pilots regarding the Bellanca Citabrias and Decathlons.

The IAC Technical Safety Committee therefore contacted both the Bellanca Aircraft Corporation and the Cessna Aircraft Company for their help. Below in its entirety is an article forwarded to the IAC T.S. Committee by Jerry Robinson entitled "152 Equals Aerobat, Right? — WRONG!!" Following Jerry's article is the reprint of a letter from Bellanca's Product Manager, Dick Johnson, to the IAC's request for Citabria/Decathlon information. (Note: Dick helped on the IAC Technical Inspection Team at Fond du Lac 1977, demonstrated the capabilities of the Super Decathlon at Oshkosh 1978, and has contributed much info to past IAC T.S. articles.)

CESSNA

"152 Equals Aerobat, Right? — WRONG!!

by

Jerry Robinson

Corporate Pilot

Cessna Aircraft Company

'Sure, you can do aerobatics in a straight 150 or 152 . . . the only difference between them and the Aerobat is paint and price.'

We've all heard someone say that. Maybe we've said it ourselves. But if we've said it, or if we believe it . . . we're wrong.

When Cessna decided to build an aerobatic airplane, it wanted to meet the market demand for a trainer with aerobatic capabilities, not create a new airplane. That's why the decision was made to design aerobatic capability into an airplane already familiar to literally thousands of people. Upgrading the world's most popular trainer would give flight schools and instructors a more versatile trainer, with the capability of introducing unusual attitudes and basic aerobatic maneuvers.

But this decision carried a certain risk . . . the risk that people would assume that, because the airplanes **look** alike, they are alike.

Let's talk about the differences, and clear the air on that point.

First, let's look at the fuselage. The most obvious point at which more strength would be needed is the front spar carry-through. This part, in effect, assures that the two wings maintain a somewhat fixed relationship with each other and the fuselage, since both wings and the fuselage bolt directly to the carry-through. Material thickness was increased from .062 in the standard aircraft to .071 in the Aerobat; a doubler of the same material was placed inside the carry-through; and the open side of that hat-shaped section was closed with a .050 cap.

Loads are transferred from fuselage to the front spar carry-through by the doorposts, and they are also strengthened by closing the open hat-shaped section with a doubler, attaching a 4130 steel angle to the upper forward face of the post, and replacing the rivets used in the standard airplane with steel bolts.

Under the fuselage floor, the loads carried by the doorposts and transmitted by the lower strut attachments come together. The bulkhead that carries these loads is reinforced with a .125 doubler which runs the entire width of the aircraft and is then braced against fore-and-aft buckling by two smaller bulkheads and stiffening gussets.

Minor, but very important additional fuselage changes include extended stringers in the tailcone, doublers around rudder cable cutouts and doublers and stiffeners on the fuselage root rib. A heavier engine mount was used on Aerobats through 1970, when the heavier mount was adopted for the 150 as well.

With the fuselage beefed up to aerobatic standards, the wing next comes in for some attention.

Stiffeners and doublers are added to both front and rear spars to carry the higher loads imposed by aerobatics. All wing ribs except the three outboard ribs are made from one gauge heavier aluminum. Rivets are increased one size, and the spacing of the rivets is halved. A reinforcing plate is placed both over and under the gasoline tanks to reduce wing twisting during higher acceleration loads. Stringers are added to the leading edge skin to stiffen it and the root rib is reinforced with a doubler and vertical stiffeners. There are some additional gussets and stiffeners in the flap track attach area and throughout the wing.

Since strut strength is necessary to prevent the airplane's becoming an ornithopter, struts are made from material approximately ¼ inch larger each dimension, and a larger lower end fitting is used. The aerobat strut is basically a shortened Cessna 182 strut.

The final area of concern is tail strength and, as you might suspect, Cessna engineers got busy here, too. The leading edge skin of both vertical and horizontal stabilizers was increased one thickness, and one additional rib was added to the vertical stabilizer.

Both front and rear spars in the horizontal stabilizer were redesigned and rivet size was increased and rivet spacing decreased.

The finishing touch was a redesigned crew restraint system and quick-release doors, topped off with a distinctive paint scheme so every student pilot could tell the difference between the 152 and the Aerobat.

And so, with 16 additional pounds of aluminum, the 152 trainer is transformed into the A152 Aerobat. Flown within the limitations of the pilots operating handbook, the airplane is one that is capable of performing the basic aerobatic maneuvers, training in unusual attitude recovery, being used for day-to-day instruction, providing transportation for two people at twice the legal highway speed and doing all these tasks in comfort and at a price 'most anyone can afford."

BELLANCA

"Dear Fred,

I have been asked to reply to your request for comparison differences in the Citabria and Decathlon aircraft.

Unlike the Cessna Aerobat, which is basically a beefed up Cessna 150, the Citabria and Decathlon are two different aircraft designed and certified independent of each other. For this reason, it would require a detailed description of both the Citabria and Decathlon fuselage and wing structure to properly describe the differences.

The fuselage of the Decathlon shares much of the same truss design of the Citabria, but structurally it is quite different.

*The material thickness of steel tubing is increased in many areas.
*The tail section has additional truss members.
*The wing attach and carry-through members are stronger.
*The fuselage is designed for 180 HP.

The wing of the Decathlon is completely different and shares very few parts with the Citabria.

*The airfoil is a NASA 1412. This, for one thing, distributes flight load differently.
*The main spar is larger (wider and deeper).
*The rib spacing is closer (more ribs per wing).
*The front and rear wing struts are larger and stronger — adding greatly to its compression strength or negative flight loads capability.

The windshield of the Decathlon is made of thicker, stronger material and is supported with a center brace.

Another big difference is in the certification and operating limitations.

The Citabria is approved for aerobatic maneuvers listed on the placard on the panel. Only those maneuvers are approved.

The Decathlon is approved for a list of maneuvers and variations or combinations of those maneuvers which does not exceed the operating limits. Only the tail slide and lomcevak are not approved.

I have enclosed a copy of the Decathlon flight manual and the Citabria owners manual as a reference for you to compare operating limits and approved maneuvers in more detail.

	Citabria	**Decathlon-150**
Gross Wt.	1650 lbs.	1800 lbs.
V_{NE}	162 mph	180 mph
V_A (at Gross Wt.)	120 mph	130 mph
Maneuvering Load Limits + and −	+5 −2	+6 −5

I hope this explanation is adequate. If not, please do not hesitate to contact me.

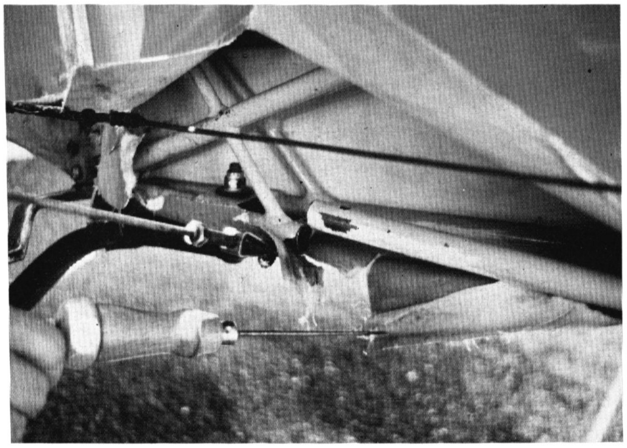
Sincerely,
BELLANCA AIRCRAFT CORPORATION
Richard M. Johnson
Product Manager"

Interested and responsive people/companies like Jerry Robinson/Cessna and Dick Johnson/Bellanca insure keeping our sport as safe and as fun as possible. IAC thanks to both of them for their time and help.

INTERNATIONAL AEROBATIC CLUB
I.A.C.
MEMBER

Clockwise from upper left: Standard Cessna 150, Cessna Aerobat, Bellanca Decathlon and (below) Bellanca Citabrias.

CLIPPED CUB BREAKAGE AND MONDAY MORNING QUARTERBACKING*



*"Monday Morning Quarterbacking" is a United States colloquialism connoting "second-guessing".

The following M&D Report was sent to the IAC Technical Safety Committee by an IAC Chapter Safety Officer.

"Please notice the enclosed photograph of the lower tail area of our IAC Chapter club aircraft, Clipped Wing Cub with a Reid conversion. As you can see, the lower right longeron has severed at the point of the intersection of the horizontal stabilizer brace wire strap, the diagonal tubing brace, and the lower right longeron.

"The broken longeron was discovered by a club member during preflight prior to an aerobatic practice session. He first noticed a wrinkling of the aluminum fairing around the leading edge of the horizontal stabilizer where it joins the fuselage, and upon closer inspection, noticed that there was a limited amount of flexing in the lower right longeron in the area of the break when the vertical stabilizer was twisted. The club member observed and I definitely concur, that the vertical stabilizer was surprisingly rigid in spite of the broken longeron. Do not let the stiffness of the vertical stabilizer deter a very thorough inspection of the tail area of the Clipped Wing Cub! Not until pressure was applied to the longeron at the point of the break, could one determine that a definite break had occurred.

"Upon removal of the fabric, the ends of the broken longeron were shiny and smooth, indicating that it had been broken for some time. The aircraft had been flown in aerobatic practice for several flights just prior to the discovery of the break.

"In my opinion, the break was brought about by the following combination of factors: 1. The penetration of the weld joining the longeron and the horizontal stabilizer brace wire strap was very deep creating in effect a dam of metal on the inside of the tubing that, in turn, held a few drops of condensation in that one spot; 2. The aircraft, prior to being bought by our chapter had been hangared in the Northeastern U.S. and had not been flown regularly; and 3. As a result of the first two conditions, the formation of rust on the tubing was accelerated thus weakening the longeron and making conditions right for the failure once the aircraft was put back into service as an aeobatic trainer.

"In summary, I would like to suggest that all Clipped Wing Cub owners thoroughly inspect, on a regular basis, the lower longerons in the tail area. Be especially alert for wrinkles in the fabric and metal. Frequently inspect the longerons from inside the fuselage by use of mirrors, lights, etc.

"Finally, if you fly aerobatics in any airplane, never fly without a parachute, and always fly at a sufficient altitude to recognize a structural failure in time to use the parachute if necessary."

The above report and analysis given by the IAC Chapter Safety Officer is super good and in the full spirit of the IAC T.S. Program, i.e., the pooling and exchanging of technical/safety information for the benefit of all IAC members and the sport of aerobatics. However, there is a good game all of us can play **everytime** we read any T.S. Report that can ADD to the report. This game is "Monday Morning Quarterbacking". The approach to M.M.Q. is strictly positive, striving for a perhaps better understanding of the problem and broader application of possible inspections and corrections. Below is an example of M.M.Q. based on the above Clipped Cub M&D Report.

(1) Rust in the lower longerons in the tail of an aircraft is a steady problem in older conventional gear aircraft of tube and fabric construction and, as pointed out, is believed to be a contributing factor in the reported Clipped Cub longeron breakage. Obviously the older the aircraft and the more adverse weather conditions it has been subjected to, the greater the possibility of rust. So not only should Cub drivers check for rusted lower longerons but perhaps also should Clipped T-Craft owners, and maybe some early Citabria owners, etc. How do you check for rusted longerons? Piper Service Bulletin #297 says: "Tubes that are suspect may be checked by using a pointed instrument like a prick punch. Grind the pointed end into a rounded end with a 1/32-in. radius. Place the modified punch with the rounded point against the outside of the tube in the area most likely to be corroded on the inside. Tap the punch with a light hammer until there is a slight indentation in the tube evenly distributed around the contact part of the punch. If severe corrosion is present, the punch will punctuate the surface or cracks are likely to form before the tube will dent slightly." IAC members may also want to consult Piper Service Bulletin #528 which relates to A.D. 77-03-08 and concerns checking steel wing-lift struts for internal corrosion using a Maule fabric tester.

(2) Early Piper Cubs were not constructed entirely out of 4130 chrome moly but also contained 1020 steel. Could this have been a contributing factor to the reported Clipped Cub breakage? A friend of ours is restoring a pre-war Aeronca Chief and has done quite a bit of digging into the history of the plane — this included talking to old Aeronca factory employees. One of the old Aeronca employees told our friend that Aeronca sometimes used 1020 in their fuselages if they were short of 4130. He further stated that when they were building these aircraft they never dreamed that people would still be flying them 35-40 years later. Think about that last statement awhile and also consider that if Piper and Aeronca sometimes used 1020 steel, would it be possible that a contemporary manufacturer of theirs, Taylorcraft (a plane still used by many IAC members), also used some 1020? M.M.Q.

(3) A check of the IAC M&D files for related Clipped Cub problems only turned up one possibly related and very criptic report:

"Problem: tail bends
Reason: rolls"

(Continued on Page 33)

(4) Tailwheel vibration/shimmy problems have plagued many IAC members. (Note the IAC T.S. Report on these problems in the August 1978 issue of *Sport Aerobatics*.) There have been reported several tailpost breakages on S-2A Pitts due to tailwheel vibrations and as previously reported in *Sport Aerobatics*, Pitts has added a gusset in the tailpost area to strengthen it. Since the break in the lower longeron in the Clipped Cub report is quite near the tailwheel spring through bolt pad, is it possible that tailwheel vibration, maybe in the aircraft's past history, was a contributing factor?

(5) Note that the Cub's lower longeron broke next to a welded area. Although the break did not actually follow a weld, we do know that areas next to welds are subject to a thermal stress during the welding process. Actually, a very small area between the molten weld and the relative cool area of the adjacent material is quenched and becomes very hard and brittle and is therefore much more subject to breakage than either the weld itself or the remainder of the material. Often this narrow, brittle area is referred to as a "chill line". Was this a contributing factor to the Clipped Cub's broken longeron? More M.M.Q.

(6) Tail brace wires and their attach points are subject to high stresses. *Sport Aerobatics* T.S. articles have reported broken tail brace wires on Stearmans and broken tail brace wire lower longeron attach points on early S-2A Pitts. A recent Service Letter on Great Lakes aircraft calls for increasing the size of the tail brace wires. PJ-260 aircraft require tail brace struts, and a fairly recent tragic accident was the result of a PJ-260 being flown without the necessary tail braces. A little investigation into that accident revealed that that particular aircraft had a history of broken tail brace struts to lower longeron attach fittings — which, although was due to poor repair techniques, does indicate a highly stressed area. Following the development of specialized aerobatic aircraft can be enlightening. We have in mind particularly the Laser 200, which very early in its development had four tail brace wires and later sprouted four more wires for a total of eight tail brace wires. All this has to tell us that tail braces and their attach points are highly stressed areas. Note the Cub lower longeron broke next to a tail brace wire attach point.

(7) ad infinitum — Left for IAC members to practice M.M.Q.

"Monday Morning Quarterbacking" often raises as many, or more, questions than it answers. But if played in a positive, intelligent manner it provides a good review, which most of us constantly need, of related problems so we can stay alert to these areas during our preflights and annual inspections and also helps us relate problem areas between similar type or similarly constructed aircraft.

The meat in this T.S. article is the report by the IAC Chapter Safety Officer alerting us all to the potential problem of rust in the lower longerons of Clipped Cubs. This gentleman was in the position to make the best possible judgment as to the cause of the broken longeron — rust. A large IAC "thank you" is due him. The remainder of this article, the M.M.Q. bit, is all pure conjecture, but hopefully it illustrates how we can learn beyond the scope of the original report. As the IAC T.S. Program grows and matures, IAC members will steadily be able to make better judgments regarding aerobatic aircraft design and maintenance, the IAC will be able to clearly demonstrate to government officials that we can take care of our own, and most importantly the sport of aerobatics will remain safe and fun.

SAY AGAIN

By Bob O'Dell and Dave Reasoner

If that awed hush from the crowd that you used to enjoy after challenging the judges in aerial combat now seems to follow you home, perhaps your ears are losing their battle with Lycoming's finest. Hearing loss due to over-exposure in high performance airplanes is a real possibility and difficult or impossible to remedy when established. Since it is easily avoided, why run the risk? Unfortunately, we see this done all too frequently.

It is well established that continued exposure to excessive noise diminishes hearing acuity with the high frequency response failing first. If the over-exposure continues, the middle frequencies that are most important in conversation are lost, too. This very real danger of hearing loss is the reason that OSHA has established times that workers can be exposed to specific levels of sound. These are based on daily exposures for long intervals.

Sound Level	115 dB	110 dB	105 dB	100 dB
Maximum Time	15 min.	30 min.	1 hr.	2 hrs.

The amount of sound is measured in decibels (dB), a unit where 5 dB means the sound is three times louder, 10 dB is ten times louder, 20 dB is 100 times louder, etc.

We have measured the sound level in three common aerobatic aircraft and found some easily predicted results. All were loud and some were very loud. The measurements were all made at full power in flight. The results were:

Cessna 152 - Aerobat (110 hp)	95 dB
Bellanca 8KCAB - Decathlon (150 hp)	100 dB
Pitts S1S - Closed Canopy (180 hp)	113 dB

The Pitts can obviously be a problem, especially if one practices a lot or goes cross country. We are all familiar with how tired one can be after even a modest cross country trip in a noisy airplane. Hearing loss is much more permanent and serious, and we should take steps to avoid it.

Fortunately, help is at hand. Earmuffs and earplugs are both very useful. A typical earmuff cuts the very low frequency sound by only about 12 dB, which brings that 113 dB snarl of the Pitts down to 101 dB, which is better, but not good enough. Earplugs vary from being almost useless, all the way to a reduction of 30 dB. A thorough test by the FAA done a few years ago showed that the E·A·R plug manufactured by the E·A·R Corporation (7911 Zionsville Road, Indianapolis, IN 46268) to be the best available. Properly inserted, that 113 dB growl becomes a very tolerable 83 dB purr.

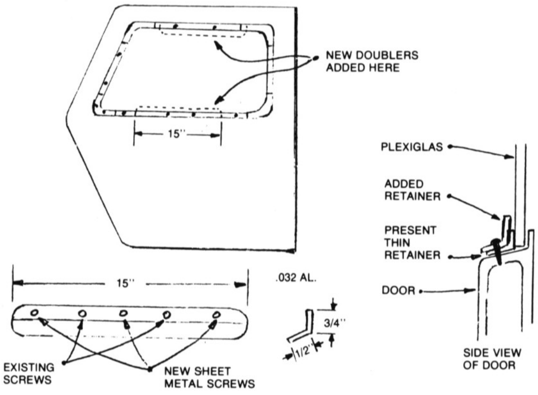
The E·A·R plugs are simple cylinders of polymer silicone foam that are compressed by rolling, then quickly inserted into the ear canal. Light pressure by a finger keeps them in place while the plug expands (60 seconds) to form a snug fit with the ear canal. The best fit is obtained by pulling up and back on the outer ear with your opposite hand while inserting the compressed earplug. They are meant to be throw-aways, but they can be used over many times, depending on how dirty your ears are,, how willing you are to wash them (the earplugs), and how cheap you are.

With protection like this available at your airport's goodies counter — why run the risk of giving yourself a permanent low score as a conversationalist?

BELLANCA WINDOWS

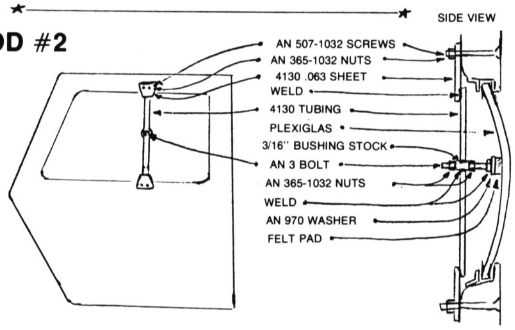
In the April 1977 issue of *Sport Aerobatics* in an article entitled "Bellanca See-Throughs", it was noted tha several Citabria and Decathlon owners had encountered flexing of the side/door window and we asked for suggestions. Since that time several other Bellanca owners have advised that they also have encountered flexing (oil-canning) of the door window and two of them have come up with possible fixes. In fact, both of the IAC members suggesting door window fixes also enclosed alternate methods (see 1977 April issue of *Sport Aerobatics* for "Bellanca method") for securing the rear side windows on Citabrias and Decathlons. IAC thanks to these people. These following shop sketches should be self-explanatory.

DOOR WINDOW MODIFICATION METHOD #1

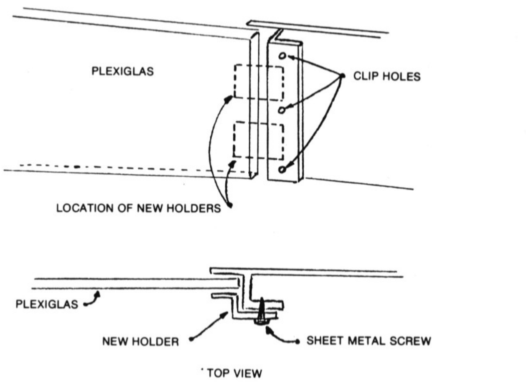


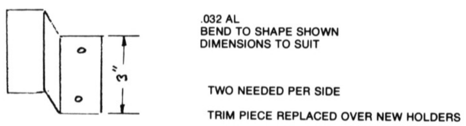
NEW DOUBLER/RETAINER

METHOD #2

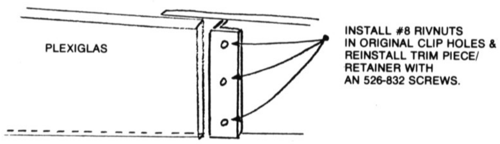


REAR SIDE WINDOW MODIFICATION METHOD #1





METHOD #2



PROPELLER SERVICE LIFE

The service life of propellers used on aerobatic aircraft seems to be a continuing and very debatable subject among aerobatic pilots. The topic has been brought to the attention of the IAC Technical Safety Committee several times and one of the last correspondents' letters was as follows:

"The subject is 'Longevity of an Aerobatic Prop'. We need some guidance on this as the only figure ever published was 500 hours which I believe someone must have picked out of a hat.

"Could you check with the manufacturers and see if they have any recommendations. This should include constant speed and wooden props as well as the fixed pitch usually found on a Pitts S-1.

"For example, I recently overhauled an O-360 Lyc. with 915 hours on it and the Sensenich propeller had the same amount. It was the original prop installed when the engine was new.

"A new prop was purchased and the old one shipped to the factory to be reconditioned or condemned. Surprisingly enough it returned with a clean bill of health as a prop that supposedly could go another 915 hours.

"The Pitts S-1 it was installed in had been flying Unlimited aerobatic maneuvers which included many Lomcevaks, triple snaps and other gyrating figures. When the engine was overhauled the prop flange was O.K. I would think that should one find a crack in this prop flange, the prop would also be suspect.

"I certainly am not advocating that anyone run a prop for nearly one thousand hours on their aerobatic machine but I do say we need some sound advice on this very important item. The loss of a prop blade will usually have disastrous results."

In order to try and simplify things and to possibly get a "handle" on the question of aerobatic propeller service life, we decided to explore the most commonly used fixed pitch aluminum propellers first and let the problems of the lesser used wooden props and the problems of the constant speed props, which are compounded by hub design, blade retention methods, pitch change mechanisms, etc., wait until a later date.

Following this idea the IAC T.S. Committee contacted the Sensenich Propeller Corporation in Lancaster, PA for their comments on aerobatic propeller service life. Below is the reply from Sensenich Executive Vice President, A. C. Wedge:

"In reply to your letter, we presume you are familiar with the FAA Publication AC No. 91-48 dated 6/29/77 on the subject of Acrobatics. Paragraph 7f (copy enclosed) refers to 'operating limitations determined at the time of manufacture', and further states that these limitations must be closely observed and all other limitations should be followed as well. Paragraph 8 under Operations emphasizes pre-flight and post-flight inspection and Paragraph 9 references maintenance.

"Thus, within this context, all of the above apply equally to the propeller. In short, if operated within the aircraft limitations and **properly maintained**, a fixed-pitch forged aluminum propeller on a Type Certificated aerobatic aircraft should give long service basically equivalent to that on Normal and Utility Categories.

"You are undoubtedly aware of these limitations shown on T.C. A-8SO for the Pitts S-1S, viz. on the engine (and propeller) 'limited to 180 hp at 2700 rpm for all operations' and the placard to 'avoid continuous operation between 2150 and 2350 rpm'.

"Much has been written in FAA and industry publications on the importance of care and maintenance of propellers. A copy of our Use and Care Instructions and FAA Aids No. 20-7N are enclosed for your reference. You will note our recommendations for complete reconditioning. Several years ago C. H. Pitts wrote us on this matter and the copy of his letter attached may be of interest to you. This is pertinent in that under FAR 23 it is the aircraft T.C. holder who determines and is responsible for meeting the airworthiness standards and specifying the operation limitations.

"In the event of operations beyond rated limits, we concur with Lycoming in that it becomes the responsibility of the owner to establish his own overhaul period.

"It is our observation that this has and is being done in view of the service history of Sensenich propellers on aerobatic aircraft."

The FAA Advisory Circular, AC 91-48, to which Mr. Wedge refers was written by Mike Heuer (past IAC Officer, former Editor of *Sport Aerobatics*, etc.) and was printed in the March 1978 issue of *Sport Aerobatics*. The Sensenich bulletin on "Metal Propeller — Instructions for Use and Care" might not be so completely circulated among IAC'ers as AC 91-48 and is therefore printed below.

"METAL PROPELLER —
INSTRUCTIONS FOR USE AND CARE

Your Sensenich propeller has been manufactured from a high-strength, heat treated forging under closely controlled conditions to the approved design in accordance with the applicable FAA Regulations. Stamped on the propeller hub face are the Model and Serial Number, Type and Production Certificate Numbers.

DO

1. Follow the instructions on the blade decal when installing your propeller and use the proper bolt torque evenly applied. Note: Every propeller is accurately balanced at the factory. If, after installation, the propeller-engine combinations feels rough in flight, remove the propeller, rotate 180 degrees on the engine crank shaft and reinstall. Should this condition persist, check the engine crankshaft flange for run out.
2. Make a complete pre-flight and post-flight inspection of blades for nicks, scratches, erosion, stone bruises and cracks — both look at and feel the surface.
3. Have any minor damage repaired at once by qualified personnel in accordance with FAA Bulletin AC:43:13-1 and the Sensenich Metal Propeller Repair Manual.
4. Clean propeller blades frequently with a non-oil base solvent (Stoddard) or equivalent. **Never use an alkaline cleaner.**
5. Protect propeller blades from moisture and corrosives, by wiping with a cloth dampened with oil or by waxing the blades with an automotive type paste wax.
6. Conform to applicable rpm placard limitations and periodically have tachometer checked for accuracy.
7. Have all major repairs and reconditioning done by an FAA Certificated propeller repair station or by the

factory. This will assure you that the correct repair procedures are followed.

8. Have your propeller completely reconditioned (including anodizing) after extensive time; (provided it has not received prior damage requiring more frequent attention). Recommended times between reconditioning are:
   76EM Series used on Lycoming O-360 engines .... 500 hours
   74 DC Series used on Continental IO-346 engines .... 500 hours
   All other propellers .... 1000 hours
9. Replace your propeller when there is any question as to its airworthiness. To avoid interruption in aircraft use, consider having a spare unit which can be installed while the other one is being inspected and/or repaired.

DO NOT

1. Use your propeller under any circumstances without a thorough inspection by qualified personnel if it has been subjected to impact.
2. Have your propeller straightened except by qualified personnel: Even partial straightening of blades for convenience of shipping to a repair station may cause hidden damage which, if not detected, could result in a non-airworthy propeller being returned to service. Be sure to report anything of this nature before repair is initiated.
3. Repair blade defects by peening or welding. This induces premature failure and is not permissible.
4. Paint over corroded or damaged blades. This hides the defect and may deter needed correction.
5. Run up your engine/prop in areas containing loose stones and gravel.
6. Push or pull on the propeller when moving the aircraft by hand.
7. Install a propeller on your aircraft unless it is the model approved under the Aircraft Type Certificate and has been obtained from a reliable source. A used propeller of unknown service history may be no bargain."

Note that Mr. Wedge makes special mention in his letter of Sensenich's recommendations for reconditioning listed in the above service bulletin.

The FAA AIDS #20-7N just notes the standard metal propeller preventive maintenance procedures of which most IAC members are aware.

The letter by Curtis Pitts to Mr. Wedge was dated 11/3/76 and mentions the Pitts S-1S propeller operation limitations noted in Mr. Wedge's letter and also has this comment:

"I suggest to people involved in aerobatics that they should, in the interest of safety, replace their propeller each 500 hours with a new one. I also caution against the use of straightened or reworked propellers. I have no documentation to support this theory however, I do believe in it."

Another service life number was given in the President's Forum column in the March 1974 issue of *Sport Aerobatics* by past IAC President Verne Jobst. The gist of Verne's 3/74 column was to remind us of all the items that should be checked over in preparation for the then-upcoming summer of 1974 aerobatic season. Among many other things Verne stated, "You look at the prop. Sure looks pretty, no nicks or . . . where did that come from? Better check and see how many hours I have on that prop. What did these guys say last year about changing props between 300 and 400 hours? That is pretty cheap insurance."

It seems as though any discussion of aerobatic propeller service life must relate to not only the type of service the propeller is subjected to i.e., aerobatic flying, but must also relate to the powerplant the propeller is used with and perhaps to a lesser degree the airframe and engine/prop combination. Many will recall that several years ago Thorp T-18 people ran into a rash of propeller failures which related to prop engine combinations and airframe in the respect that high performance T-18's were operated at higher altitudes which had a very negative effect on prop life. (An article entitled "Propeller Fatigue" by Lu Sunderland in the November 1972 issue of *SPORT AVIATION* covered this T-18 problem and basic prop fatigue problems.)

A search of IAC M&D files did not help answer the service life question. While the files do contain problems with constant speed propellers, and perhaps somehow related cracked crankshaft propeller flanges, there are no reported fixed pitch aluminum prop problems.

In the above material there are listed several "service life figures" which come from several reputable sources of unquestionable integrity and sincerity. However, it should be noted that during the limited research of the aerobatic prop service life question, the IAC T.S. Committee did not come across any reports, studies, tests, etc. that documented or substantiated any of the given service life numbers.

The last statement is not meant to be derogatory. It is intended only as a fact and to lead to the next part of this article which takes a rather different tack on the subject. One IAC member who was concerned about the aerobatic propeller service life question did a little researching/thinking several years ago and below is his report.

"I have a Citabria with a fixed pitch McCauley 72-46 prop and have had some concern as to the fatigue life of the propeller. A few years ago, after hearing 'hangar stories' of the top dog aerobatic pilots changing props after every season and reading about how the 'uneven loading of a rotating asymmetrical disc' when a plane is yawed puts heavy stress on the prop, I decided to check around a bit.

"Several things came together at one time that influenced my thinking:

(1) First, I read Sensenich Service Bulletin R-14, 3/23/70, which in part says, 'Recent research has shown that metal specimens, which have been fatigue cycled to 50% of their endurance life, can be restored to original condition by the removal of a thin layer of surface metal.' And I knew that when prop shops recondition a prop they grind a thin layer of metal off of the entire surface.
(2) Secondly, I saw some 'Goodman Curves' on metal fatigue and the one for non-ferrous metal was a J curve. I interpreted this as meaning that if a part is made from aluminum and flexed or cycled back and forth, eventually it would fail.
(3) I read that propellers flex at certain points, nodes, usually corresponding to some engine rpm/engine-induced vibration.
(4) Also read that when propellers are reconditioned — ground and thinned, the point or area at which they flex for a certain induced vibration is moved to a slightly different point. Would this new point on a reconditioned prop be fresh, back to the bottom of the Goodman J curve — showing no number of accumulated fatigue-cycles?

"Putting Items 1 through 4 together, I asked, would a reconditioned propeller be as good as a new propeller? To try to answer this question I obtained an FAA computer printout of propeller service difficulties 12/72 to 3/74 and from that printout made the following chart: (See FIGURE I).

"I was interested mainly in fixed pitch propeller problems (blade-tip failures) which meant fixed pitch McCauley and Sensenich. The chart showed many more problems/failures with new props than with reconditioned props — but I thought this might be because there were more new props in service. So I made some **guesses** and reasoned (rambled) as follows:

GUESSTIMATES

*Number of new fixed pitch props produced in 1973

(1) New aircraft with fixed pitch props produced in 1973

Cessna	5500
Piper	2500
Bellanca, etc.	1000
	9000

(2) New replacement props sold in 1973 (Approximately 10%) 1000

Total new props produced 1973 10,000

****

*Number of reconditioned fixed pitch props in 1973

(1) Number of propeller repair stations — approximately 150 of these, **50** are **active** repair stations

(2) If each of these stations average one fixed pitch reconditioned prop per day and each station has a 5-day work week —

50 (shops) x 5 (days) x 50 (weeks) = 12,500

Number of reconditioned props in 1973 12,500

****

*Total number of new propellers in service assumptions:

(1) ⅓ of the reconditioned props are props that are being reconditioned for the **first** time.

$$12{,}500 \div 3 \approx 4{,}500$$

(2) 5% of new propellers are destroyed in accidents each year.

$$10{,}000 \times .05 = 500$$

Therefore, rate, or ratio, of new propellers that are lost due to accidents or become reconditioned props is —

$$4{,}500 + 500 = 5{,}000$$

$$\frac{5{,}000}{10{,}000} = \tfrac{1}{2} = .5 = \mathbf{.5\ per\ year}$$

****

Sum of the first terms of a geometric progression —

$$S = a\,\frac{1 - R^{\eta}}{1 - R}$$

a = 1st term in progression (10,000 - number of new props per year)

R = Ratio (.5)

η = Number of terms (number of years to be considered)

$$S = 10{,}000\,\frac{1 - .5}{1 - .5}$$

Let $\eta \to \infty$

$$S = 10{,}000\,\frac{1 - 0}{.5} = 10{,}000 \times 2$$

$$S = 20{,}000$$

Therefore, total number of new fixed pitch props in use is 20,000.

****

*Total number of general aviation aircraft 100,000

*Total number of general aviation aircraft with fixed pitch props (40%) 40,000

*Number of new fixed pitch props compared to number of reconditioned fixed pitch props —

40,000 — Total
20,000 — New

20,000 — Reconditioned

Therefore, number of fixed pitch propeller failures should be equal for new and reconditioned props.

"If all my guesses were close and the number of new and reconditioned propellers in service are about the same, why were there more failures with new props than reconditioned props? Again, a couple of things came together:

(1) First, I read an article about aircraft exhaust system failures which stated, 'The frequency of exhaust system failures reached a maximum of approximately 100 to 200 hours of operating time; thereafter, the frequency of failures dropped off sharply at a generally constant rate to 1200 hours of operating time. About 94 percent of the failures occurred with 1200 hours of operating time; however, over 50% of the reported failures happened within the first 400 hours operating time.'

(2) The exhaust system article lead me to graphing

PROPELLER SERVICE DIFFICULTIES (3/72 TO 3/74)

FIGURE I

		New Propellers				Overhauled Propellers							
							Total Time			Time Since Overhaul			
Make	Total # Problems	Number	Highest Time	Lowest Time	Average Total Time	Number	Highest	Lowest	Average	Highest	Lowest	Average	Miscellaneous
Unidentified	20	12	6890	71	1802	3	2400	960	1440	1260	10	427	5
Allison	1												1
Beech	4	1	2100	2100	2100	2	5407	2048	3728	1081	349	715	1
Hamilton Standard	12	1	454	454	454	1	203	203	203	47	47	47	10
Hartzell	103	56	3259	15	798	10	3340	1735	2304	1376	59	781	37
McCauley (Fixed Pitch)	31	22	2075	39	710	1	951	951	951	71	71	71	8
McCauley (Constant Speed)	47	22	3047	517	1202	7	3558	852	2277	2008	569	974	18
Sensenich	14	9	2092	32	603	2	2230	1408	1819	126	86	106	3
Aeromatic	5	1	358	358	358								4

• Figures on chart taken from FAA Propeller Service Difficulties Computer readout

• Difficulties classified as "Miscellaneous" if "Total Time" or "Time Since Overhaul" or "Both" not given the 31 (total of McCauley and Sensenich) **new** fixed pitch prop failures. (See FIGURE 2).

And, since 'failures on fixed pitch props' could only mean blade or blade tip failures, I graphed the 24 failures listed as 'blade' or 'tip' failures for **new** McCauley and Hartzell constant speed props. (See FIGURE 3).

It seems, just like the exhaust system failures, the maximum number of prop failures occur during the first several hundred hours of service.

(3) Thirdly, I ran across an old **Scientific American** article entitled 'Dislocations in Metals' which said, 'Many important properties of metals are now understood to result from a kind of imperfection in crystal lattices that is called a dislocation.' And, referring to an old theory, said, 'For example, the theory said that a stress of some two million pounds per square inch would be required to deform pure iron plastically, that is, beyond the limit of elastic recovery. In fact, it takes only 30,000 pounds per square inch.'

"From all this, I believe, and this is pure conjecture, that when aluminum props are forged (and exhaust systems made) there are certain undetectable stresses, perhaps not crystal lattice dislocations, but nevertheless stresses set up in the material itself. In some cases where these internal 'manufacturing stresses' are in a critical location or are of a high enough degree, the prop will fail after only a relatively short time in service. In other cases where the built-in stresses may not be so great or somehow relieve themselves, the propeller has a long service life.

"I am not a logician, mathematician, statician, metallurgist, engineer, etc. and I realize the number of examples given are not very many, so all of the foregoing may be just a lot of smoke. However, until I see something to change my mind I am going to use a high-time **proven** metal prop and periodically have it reconditioned to remove the fatigued outer layer of material as per Sensenich Service Bulletin R-14. If I have heavy prop damage, such as a ground strike, I may go the new prop route, but until then I am going to run my present propeller until it gets too thin or too narrow to be 'reconditioned' again."

All of the above material is very interesting, but does it answer the basic question of propeller service life on aerobatic aircraft? Let's review.

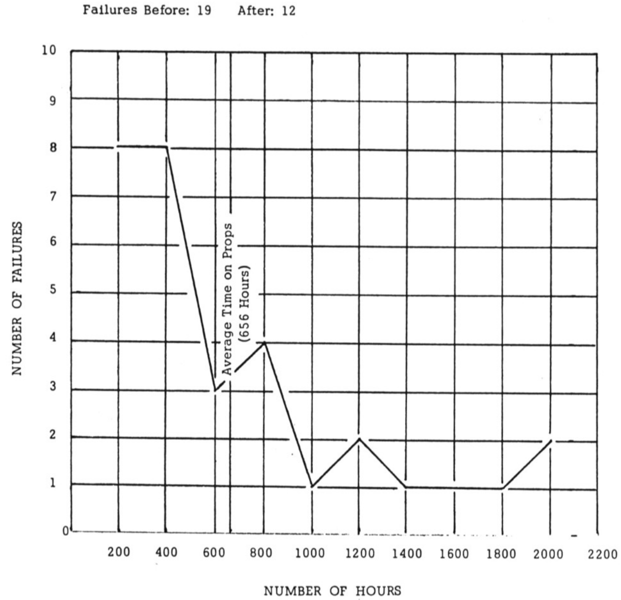
Sensenich says if propellers on aerobatic aircraft are operated within rated limits they should give service life equivalent to normal and utility category a/c. And in their propeller bulletin on care and use of metal propellers they give some recommendations. They also point out if operations are beyond rated limits it is the responsibility of the owner to establish his own overhaul periods. Regardless of what has been written, or what conversation we have heard, we believe that many fixed pitch aerobatic a/c are flown W.O.T. (wide open throttle) and the engine rpm varies with the airspeed. (If we are wrong on that last statement no doubt we will hear about it.) Therefore, perhaps for some IAC'ers, Sensenich's recommendations do not relate to reality and are irrelevant.

Several very knowledgeable IAC members believe that somewhere around 500 hours is the service life of a prop used on an aerobatic a/c. But, and as they are the first to point out, there apparently is no documentation to support this idea. Interesting also is the fact that Sensenich talks of time between **reconditioning** and the IAC'ers are talking about time between **new** propellers.

Lastly, one IAC member spelled out his thinking as to why he is going to use an "old" — "proven" propeller that has been periodically reconditioned. And he also points to the lack of documentation to fully support his thinking.

FIGURE 2

GRAPH OF 31 McCAULEY & SENSENICH
NEW FIXED PITCH PROP FAILURES



We have some very interesting input, but has the basic service life question been answered? Unfortunately, no. But here is the golden opportunity for **all** of us to make the IAC Technical Safety Program work — and in an area of great concern and little factual information.

If each IAC member who flies aerobatics in an a/c with a fixed pitch aluminum propeller would fill in the attached propeller questionnaire and mail it to the IAC T.S. Committee, we might possibly have enough aerobatic propeller service life information to set up our **own guidelines**. These would be guidelines that apparently are presently **not** available from any source (including government, propeller manufacturers, airframe manufacturers, etc.). This puts it right on the line. If we as individuals and as an organization are interested enough in the question of aerobatic prop service life, we here have the tool to do something. The number of returned questionnaires will reflect our concern. The input may not only enlighten us about propellers, but also about ourselves and our organization. Results will be published in *Sport Aerobatics*.

GRAPH OF TIP FAILURES ON
NEW McCAULEY & HARTZELL CONSTANT SPEED PROPS

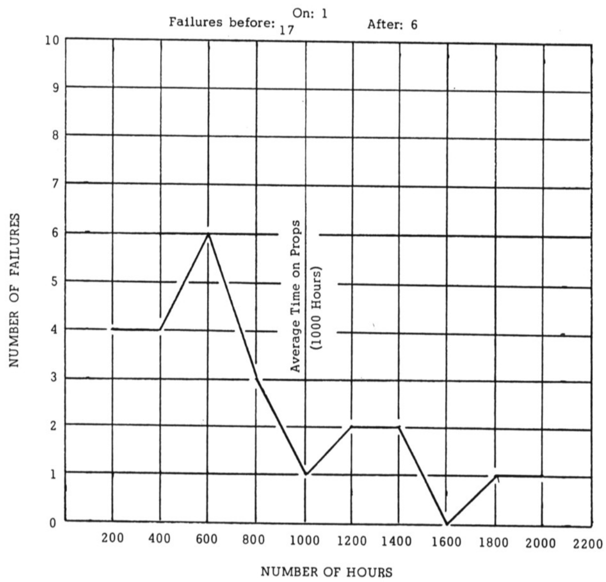


FIGURE 3

TO BE CONTINUED??

In the February 1977 issue of *Sport Aerobatics* in a Technical Safety article entitled, "Walk Around", there was a comment advising checking the condition of Citabria and Decathlon engine mount bushings — noting there may be a relation between worn mount bushings and reported incidents of the engine/exhaust system in these aircraft coming into contact with the cowling. The November 1977 *Sport Aerobatics* T.S. article, "1977 Fond du Lac Tech Inspections," again reported on the Citabria and Decathlon engine mount bushings noting that some IAC members had reported a 100 to 300 hour service life on the bushings and also commented on the torque dimensions given for the mount bushings in the Bellanca service manuals.

A.T.S. article, "New Citabria and Decathlon Service Letters," in December 1977 *Sport Aerobatics* advised of Bellanca Service Letter C-126 on the subject: engine mount and/or engine mount rubber bushing replacement.

Recently the Citabria/Decathlon engine mount bushing question came forward again with the following input from an IAC member:

"Please find enclosed one set of engine mount bushings removed from my 1974 7KCAB Citabria S/N 446-74. New engine mounts were installed per Bellanca Service Letter No. C126 using Bellanca Service Kit No. 254.

"At the time these bushings were replaced, the total time on the aircraft was 604 hours. I am the second owner of this aircraft. Both myself and the original owner used the aircraft for aerobatics including competition in the Sportsman category.

"With the cowling installed, some slight sagging of the original engine mount bushings was evident. The spinner was slightly lower than it should have been, but there had been no contact between the spinner and the cowling. The exhaust pipe had moved toward the rear of the hole through the cowling but had not yet touched the cowling. With the cowling removed, the bushings appeared to be only slightly distorted. There were no signs of serious problems, but I had the bushings changed as a precautionary measure.

The upper bushings were fine; however, the lower bushings were nearly worn out. As you can see, the lower bushings failed in the center and were nearing the point where the engine mount lugs would start to contact the engine mounting bolts. Note that the lower engine mount bolts are polished due to working of the bushings on the bolts. No such polishing was evident on the upper engine mount bolts. Metal to metal contact between engine mount lugs and the engine mounting bolts could have resulted in failure of the engine mount, the mounting bolts, or the lugs on the engine. Please note that the new engine mounts included in Bellanca Service Kit No. 254 are of an improved design.

"I thought you might want to pass the above on to other IAC members who might be tempted to keep flying with engine mounts that are 'sagging slightly' but still 'loook O.K.'."

We feel this gentleman's last comment about being tempted to fly with mount bushings that are "sagging slightly" but still "look O.K." is very important. As seen in the accompanying photos of the worn bushings, the heavy damage/wear could not be detected unless the mount bushings were removed.

IAC members may want to note that Bellanca Installation Kit #254 (engine mount lord bushings) requires the use of a drill jig, number 3-1611DJ. This jig is used to locate holes on the mount face pad. It is available from Bellanca for approximately $25.00 or most probably can be borrowed from a Bellanca dealer. If, for some reason, IAC'ers have trouble locating this drill jig, just write the IAC Technical Safety Committee and a paper tracing of Jig 3-1611DJ will be forwarded enabling members to make their own jig. Naturally, in the interest of accuracy, it will be best to use the Bellanca Jig.

Many thanks are due the above-mentioned IAC member for his thorough report — which included the worn parts. Only by such input is the IAC T.S. Program able to function. Everyone realizes that many (all?) items on aircraft have a limited service life, and rubber engine mount bushings, especially those subjected to hard aerobatic flying, are one of these items. Now that more and more IAC members are flying Bellancas with the "new mount bushings" and accruing "aerobatic service hours," the T.S. Committee should be receiving field reports and hopefully be able to help establish service life limits on these parts. Surely this engine mount bushing report will be continued.

BELLANCA AIRCRAFT CORPORATION
Municipal Airport
Alexandria, Minnesota 56308

P.O. Box 624
Phone: 612/762-1501
May 4, 1977
FAA APPROVED

SERVICE LETTER #C126

SUBJECT: Engine Mount and/or Engine Mount Rubber Bushing Replacement
MODEL(S): 7ECA, 7GCAA, 7GCBC, 7KCAB, 8KCAB and 8GCBC
EFFECTIVITY:

Model		
7ECA	S/N 1 and up	(Citabria with Lycoming Engines Only)
7GCAA	S/N 1 and up	(Pkg. A Citabria)
7GCBC	S/N 1 and up	(Pkg. C Citabria)
7KCAB	S/N 1 thru 610-77	(Pkg. B Citabria)
8KCAB	S/N 3-70 thru 298-77	(Decathlon)
8GCBC	S/N 1-74 and up	(Scout)

INSTRUCTIONS:

Service reports on Models 7KCAB and 8KCAB have indicated that the engine mounting isolator rubber bushings installed in above noted serial numbered aircraft of these models may become permanently distorted with resulting short service life and undesirable vibration characteristics.

Also, these reports indicate that engine movement during high 'G' maneuvers in Model 8KCAB may cause engine-cowl interference.

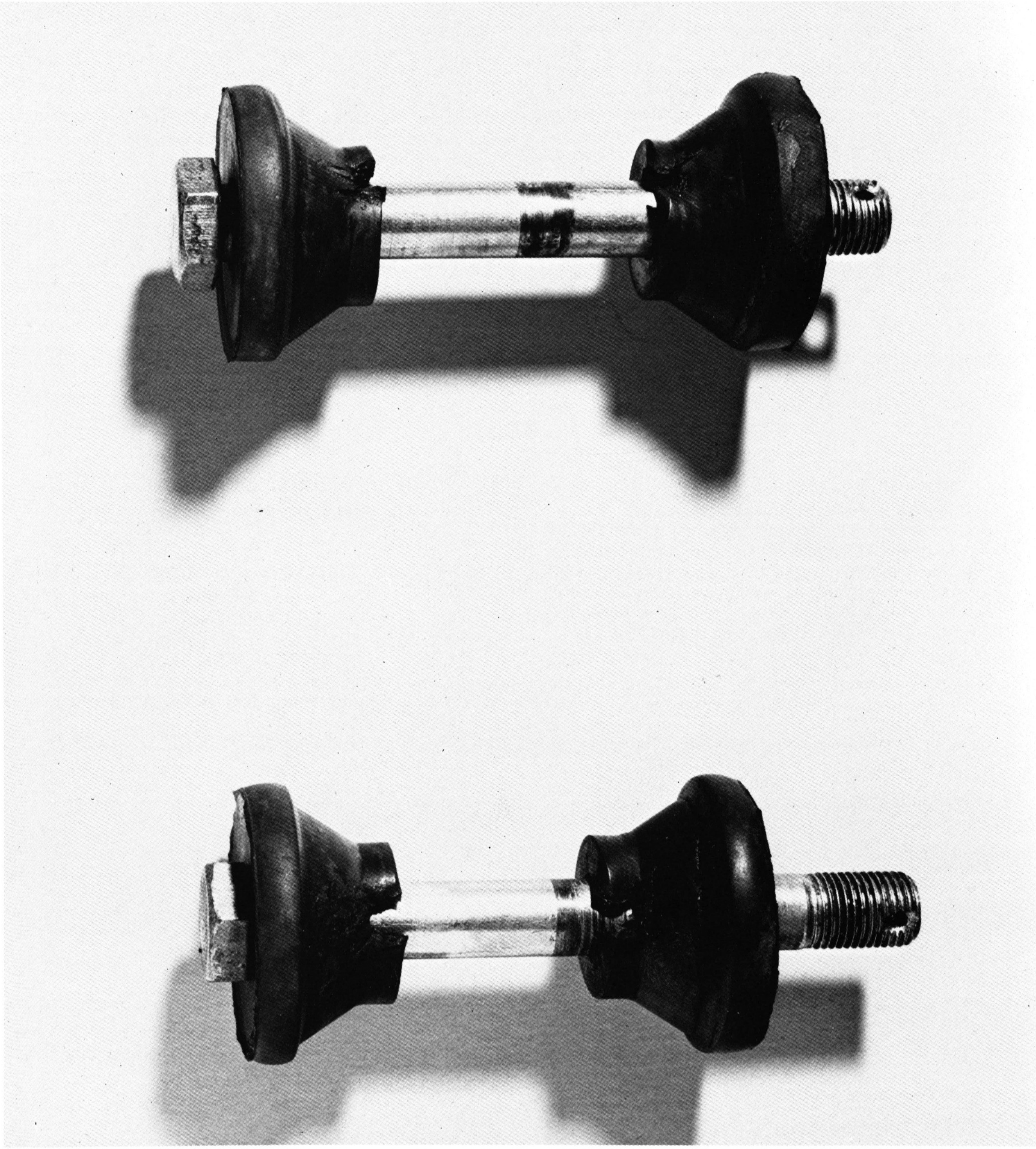
To improve the service life and vibration characteristics, it is recommended that Bellanca Kit #254 **Engine Mount Rubber Bushing Replacement** be installed on Models 7KCAB and 8KCAB with noted serial numbers. This kit consists of a redesigned isolator rubber bushing assembly with necessary installation hardware and instructions.

Kit #254 may also be installed on other models noted above. Models 7KCAB serial number 611-77 and up and 8KCAB serial number 299-77 and up are factory equipped with Kit #254.

Also, to reduce engine movement in Model 8KCAB, it is recommended that Kit #255 be installed in above noted serial numbered aircraft of this model. This kit consists of a redesigned engine mount and **includes** Kit #254 and necessary installation hardware and instructions.

Kit #255 is **not approved** for installation in Models 7ECA, 7GCAA, 7GCBC, 7KCAB and 8GCBC.

Model 8KCAB serial number 299-77 and up are factory equipped with Kit #255.



WIRE THOSE VERTICALS

by Sam Burgess

"What's this for?" You are asked at every gas stop to and from an aerobatic contest. At the contest site you can see various gimmicks attached to the wings of these aircraft. Crutches for vertical and 45 degree lines.

During the past few years, many aids have been used to set those lines a little more vertical. Vertical and 45 degree tapes on the "I" strut are O.K., but these will set the line above the horizon and, unless you have time to look both ways, you must be aware of how high above the horizon to set it plus leveling it. The wire in line with the cockpit makes it a one step operation.

Chuck Carothers once asked Bill Thomas "how to do a good vertical roll," and Bill replied; "first, you have to be vertical".

Pilots with canopys have drawn their lines on the plexiglass, however, this system is used less today probably due to the inaccuracy caused by the proximity of the lines to the eye. Anyone who has ever shot a Kentucky long rifle with its unerring accuracy can understand this logic.

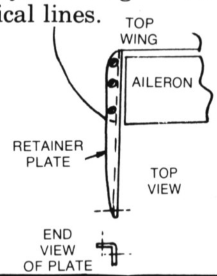
The wing tip wire seems to be the most poplular today and is particularly well adapted to the Pitts Special with its forward located cockpit. The S-2 Pitts pilots incorporate a coat hangar device attached to a strut and sighting from the rear cockpit. Monoplane pilots just attach an old TV aerial to the wings.

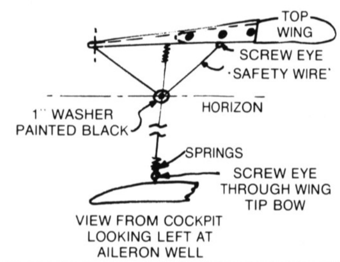
One must hang a red streamer to your leveler as hangar experts are always running into it which is usually at eye level. Some pilots have designed a detachable wire just for this precaution.

These crutches are usually made from common aircraft safety wire and are attached by coil springs to keep the wire taught. A weak spring will cause a bow in the wire at higher speeds. Insulated wire, with it's larger and more visable diameter, has been tried; but with the extra size it tends to bow even at climb speeds. By attaching a spring on each end of the safety wire you can lay them on the horizon when vertical and follow them around on a vertical roll.

Ron Cadby recommends "the vertical wire has to be tilted about three degrees forward of perpendicular on the Pitts Special fuselage longeron to assure a correct vertical. This will appear to put you on your back slightly, but believe me, you will fly a better vertical."

So, if you want a conversation piece on your aerobatic mount and to wire those verticals, go ahead — experiment around with what is best for your design and see if you don't get better scores on those 45 degree and vertical lines.





GREAT LAKES
Airworthiness Directive
Volume I

78-26-10 **GREAT LAKES:** Amendment 39-3384. Applies to Models 2T-1A-1 and 2T-1A-2 airplanes.

COMPLIANCE: Required as indicated, unless already accomplished.

To preclude contamination of cockpit heater air with carbon monoxide, accomplish the following:

A) Within the next 25 hours time-in-service after the effective date of this AD:

1. Determine if the airplane is equipped with a cockpit heater system and, if not, make an entry in the airplane's maintenance record that the airplane complies with Paragraph A)1 and that further compliance with this AD is not required. This determination and maintenance record entry may be made by the owner or holder of a valid pilot certificate.

2. If the airplane is equipped with a cockpit heater system, prior to further flight, install a revision in the walk around inspection (Section II C. 2.) of the Flight Manual adding an inspection of the exhaust system hanger (Figure 1 of this AD).

3. If the airplane is equipped with a cockpit heater system, prior to further flight, and within each 25 hours time-in-service thereafter:

a. Remove the cowl to gain access to the engine installation.

b. Disconnect the two cockpit air heater ducts from the heater shroud and remove the shroud.

c. Visually inspect the support plates of the heat exchanger at both ends for cracks between the five tube cluster.

d. If no cracks are found, return the heat exchanger to service.

e. If cracks are found, either replace the heat exchanger system with an airworthy part or, in the alternative, comply with Paragraph B) of this AD.

B) Remove the optional heat exchanger system and:

1) Install P/N 50126-1 stack assembly on all aircraft and P/N 50172-1 shield on aircraft equipped with IO-360-BIF6 and AEIO-360-BIG6 engines using QS100-M32W or equivalent clamps.

2) Block existing cockpit heat control valve in closed position by safety wiring control arm to adjacent aircraft structure.

3) Block the cockpit air supply opening in the left vertical engine cooling baffle per AC 43.13 1 and 2.

4) Remove Aircraft Flight Manual Revision specified in Paragraph A)2 of this AD (if installed).

C) Inspections specified in Paragraph A)3 of this AD may be discontinued upon removal of the cockpit heat exchanger per Paragraph B) of this AD.

D) Any equivalent method of compliance with this AD must be approved by the Chief, Engineering and Manufacturing Branch, FAA, Central Region.

Great Lakes Aircraft Company (GLAC) Service Bulletin No. 9, dated November 17, 1978, or later revisions, pertain to portions of this subject.

This amendment becomes effective on January 4, 1979.

AIRPLANE FLIGHT MANUAL REVISION

(AD 78-26-10 requires this revision to remain in the below designated airplane flight manual when the airplane is equipped with the optional cockpit heat system.

MODEL__________ N__________ S/N__________

In addition to the presently specified preflight procedures, prior to each flight:

1. Inspect the left engine exhaust tail pipe hanger for deformation or failure.
2. If found failed, the hanger must be repaired prior to further flight.

ENGINE RETENTION CABLES

A recent *Sport Aerobatics* Technical Safety article dealt with propeller service life. The following information could very well be considered as a sequel to that report.

As we are all aware, propeller failures, i.e., blade failure/separation, can often have catastrophic effects. The unbalanced condition and resulting vibration following a propeller blade failure have been known to tear engines from their mounts and even cause engines to separate from the airframe. With these thoughts in mind, and also feeling that aerobatics may not be conducive to long propeller life, several years ago we wrote IAC member George Owl, Jr. — who has been involved with Formula One air racing and some experimental propeller design — about the use of engine safety retention cables, i.e., cables which would retain the engine in the airframe in case of propeller failure and the possible results of such a failure. Below are George's comments:

"In my opinion the safety cables are a 'last resort' type of device. I would recommend that all possible preventive measures against prop blade failure be taken as well as certain precautionary measures to reduce the probability of a fatal accident resulting from a blade failure. My priority list would be somewhat as follows:

1. Use a prop that is ATC'd for aerobatics in combination with your engine.
   Lycoming IO-360 plus Sensenich 76 EM8-0-56.
2. Use a wood propeller. Wood is not subject to fatigue failure.
3. If you must use a non-certificated metal propeller (or a modified one) have a static vibration survey accomplished by a competent person and calculate the rotating resonant frequencies for all primary modes. Avoid operation at or near these resonant frequencies. Consult the manufacturer.
4. Make sure that the engine cowl and fasteners are robust. If the cowl can act as a basket and retain the engine you are simply faced with a dead stick landing. Aluminum has proven superior to fiberglass in this respect.
5. Wear a parachute and **use it if the engine separates** from the aircraft and conditions permit.
6. Rely on safety cable to permit controlled crash.
7. Dye check aluminum blades at frequent intervals.

About all we hope to accomplish with the safety cable is to prevent complete separation of the engine. The cable will not prevent the engine from destroying or breaking through the cowl; consequently you would be left with the engine hanging below the firewall if the cable served its function. Hopefully, this would keep the C.G. far enough forward to permit a controlled glide. The prospects for a 'safe' landing, with the engine hanging down below the firewall, are slim at best. This is why I recommend using the parachute if at all possible. Unfortunately it is not feasible to wear a chute in many of the Formula I racers and of course escape at racing altitudes is very unlikely unless control of the aircraft can be maintained.

Since installation of the cables was made mandatory, we have experienced two blade failures, both in high altitude cruising flight (as are the majority of our failures). In both cases the cowling retained the engine and thus the cables did not come into play. To date then we have no experience upon which to evaluate how effective the cables are, or what flying characteristics will result with the engine hanging down.

I should point out that we have had three fatalities in Formula I (or similar) aircraft due to prop failures. In all three cases the engine penetrated the cowl and separated completely. In eleven other cases, the engine did not penetrate the cowl and none were fatal.

I believe that there is good evidence to substantiate that, when the engine does separate, the aircraft ends up in a stable 'deep stall' condition where it is in a relatively stable level attitude but descending at a very high rate. I believe that a pilot might be deceived by the level attitude and think that he had things under control, until he got close enough to the ground to visually determine that he had a high sink rate and then it's too late to get out! One fatality occurred where the pilot rode the aircraft down from high altitude and apparently made no attempt to unlatch the canopy or use the chute he was wearing. You could not depend on any instruments functioning after a blade failure — the **vibration is too severe** (until the rotation is stopped) and usually damages the instruments.

Additional information on propeller vibration and fatigue failures is contained in the following references:

FAA Advisory Circular, Vibration Evaluation of Aircraft Propellers. AC No. 20-66 dated 1/29/70. U.S. Gov't. Printing Office.

Airplane Propeller Principles, Wilbur C. Nelson, John Wiley and Sons, Inc.

Mechanical Vibrations, Den Hartog, McGraw-Hill Book Co.

SPORT AVIATION, Nov. 1972 Propeller Fatigue, by Luther D. Sunderland.

I hope that the above will help you in your evaluation."

George also forwarded several pages from the Official Specifications, Formula One Class Racing Airplanes, Professional Race Pilots Association.

ENGINE RETENTION CABLES

Annex 3a thru 3e are offered as suggested ways to install the "safety cable" which becomes mandatory 1 January, 1972.

Annex 3a and 3b provide a method suitable for detachable engine mounts and is similar to the one currently installed on "Stinger" #21. Annex 3c, 3d and 3e are intended for integral (welded on) engine mounts, but could be used on either type. If the strength of the attachment of the mount to the upper longerons is suspect, then the type shown in Annex 3d and 3e should be used if possible. You are cautioned that Annex 3c, 3d and 3e have not been tried out yet and therefore are subject to the usual unforseen prototype manufacturing problems. If you have problems, or come up with better solutions, please pass them on to Ray Cote.

The intent of these drawings is to assist rather than restrict you. Alternate methods of installation will be approved if, in the judgment of the technical committee, they are suitable.

The following assumptions provided a basis for the designs enclosed and should be considered in any alternate designs:

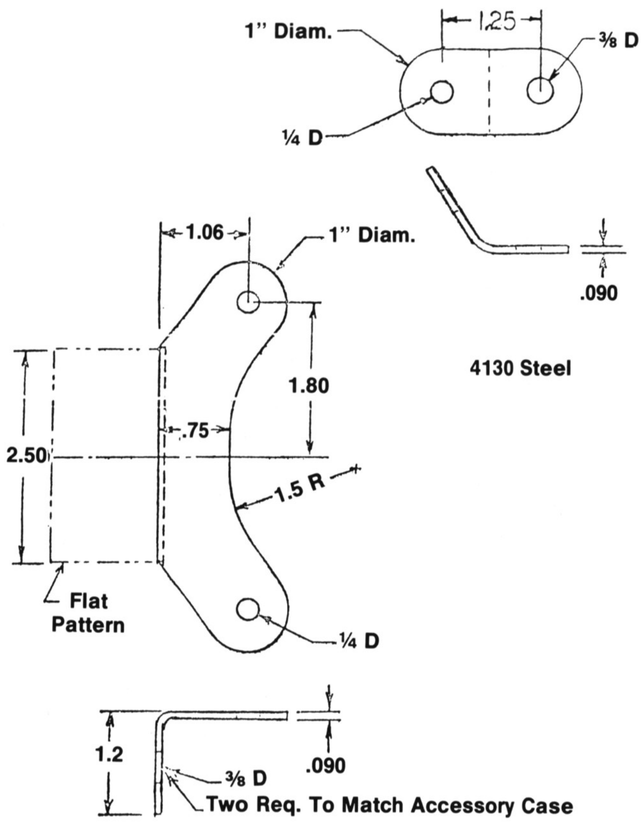
1. Loss of a significant section of blade will probably result in failure of at least 3 of the 4 primary load paths, permitting the engine to flail and act as a counterbalance to the remaining blade.
2. Tight restraint of the flailing engine would result in high loads in the restraining system — and probable failure of same. Consequently, the safety cable must be loose enough to permit the flailing, but still prevent complete separation from the airplane and, if possible, retention on what is left of the mount. Just how loose is loose enough is probably impossible to analyze. The specified 1 to 1.5 inches of slack is only a designer's judgment — so keep your fingers crossed and don't get careless about operating at resonant frequencies. Let's hope we never get a true test of the cables.

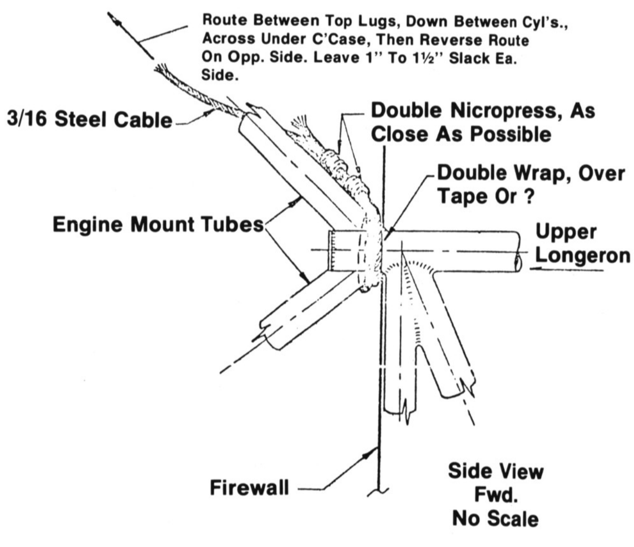
As noted earlier, the above information and comments are several years old and in one respect may be dated — however, from a safety standpoint, this info may be as current and meaningful as ever.

Although IAC contest rules do not require the use of engine safety/retention cables, several IAC members have installed them on their aircraft. In the IAC Technical Safety article on propeller service life, IAC members were asked to complete and submit a questionnaire on propeller service experience in the hope the IAC may be able to compile enough information to establish propeller service life guidelines.

We would also like IAC members to comment on the use of engine retention cables: (a) any direct experience with the use of retention cables; (b) any cable in-service difficulties, such as cables chaffing on mounts, etc.; (c) opinions regarding the possibility of retention cables as a contest entrance requirement; (d) etc.

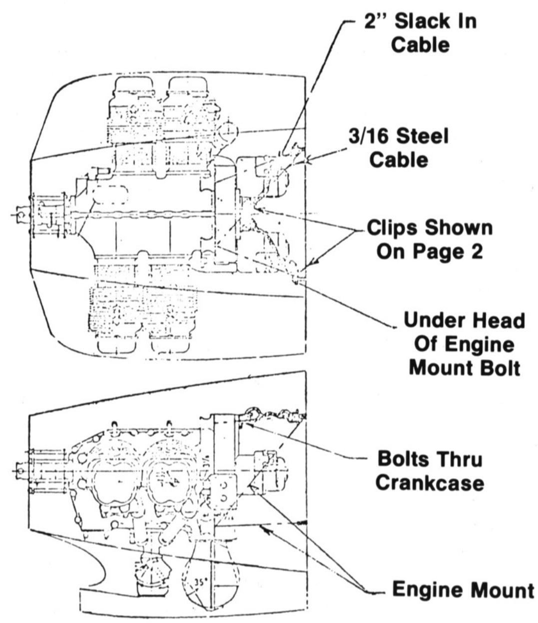
Input on these two subjects, propeller service life, and engine retention cables, may help give IAC rational direction on two related and highly critical technical/safety aspects of our sport.



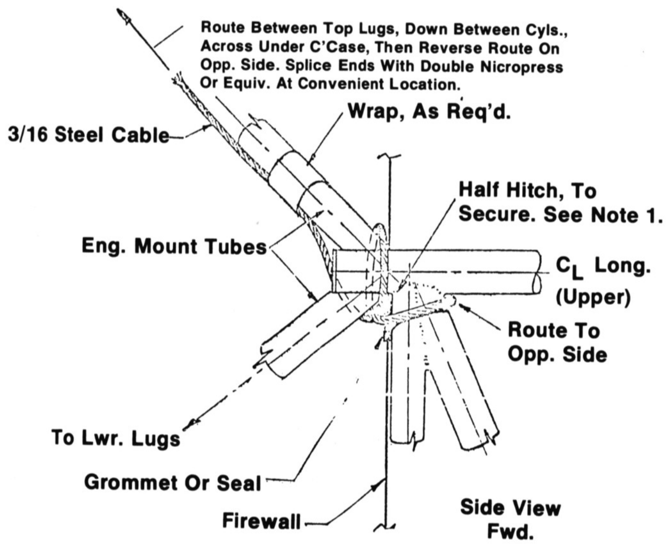


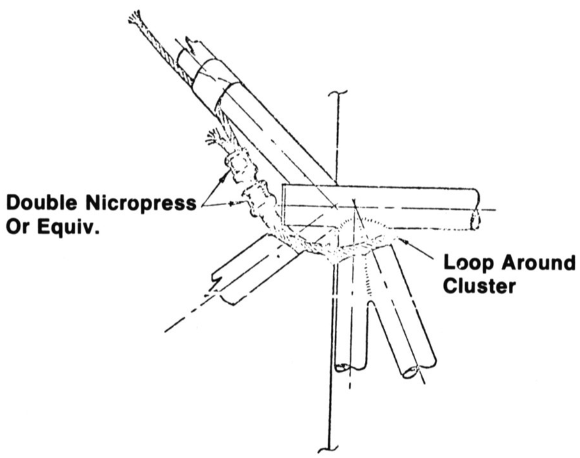
Suggested Safety Cable Instal., Welded Mount

NOTE:
1. Nicropress Orientation May Be Arranged To Facilitate Application Of Squeezer.
2. This Type Attachment Can Be Used With Any Type Mount, Provided Attachment To Longeron Will Withstand 3900 Lb. Tension.
3. Alternate Attach Schemes, Of Equiv. Strength, Are Permissable.



Typical Safety Cable Instal.

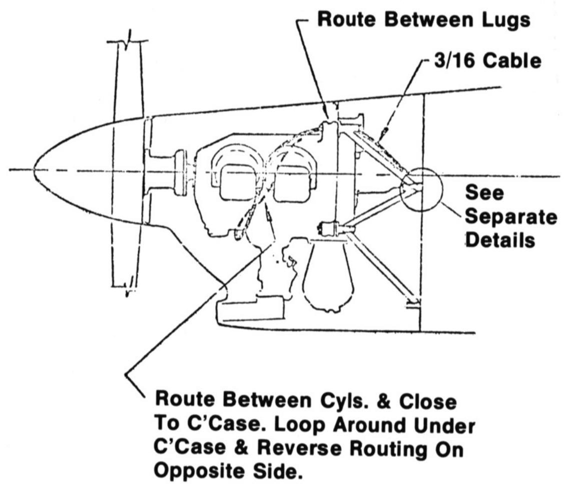




Suggested Safety Cable Instal.

NOTE:
1. Secure To Cluster As Shown, Or Equiv., To Prevent Cable From Slicing Down Thru F'Wall If Engine Separates From Aircraft. Cross-Ship Section Of Cable Behind F'Wall Would Then Slide Down Tubes And Pin Or Sever Pilot Legs, If Not Secured. It Can Be Assumed That The Top Mount Will Not Fail At The Firewall Cluster.
2. Leave 1" To 1½" Slack Each Side To Assure That Mount Takes Initial Shock.

Suggested Safety Cable Routing



NOTE
Added Cable Length For Loop Under Case Is Beneficial In Providing More Cable Stretch To Reduce Shock Loads.

"TWOFOLD"

A Malfunction & Defect Report recently received by the IAC T.S. Committee is as follows:

"Your article on tail wheels was most interesting :— but a little late. Mine broke about a month before your article in **exactly** the same place. Rather than rip off fabric to weld and repair, I welded that bracket to a smaller size tube and put it up inside the tail post tube and bolted it. Makes an excellent repair and easy to fix again should it break — also strengthens the tail post." (REFER TO FIGURE #1.)

Another tailwheel problem was encountered by an IAC Board of Directors member on his homebuilt Pitts. His problem was that the steering arms on the rudder were much shorter than the steering arms on the tail wheel and this meant a lack of directional control on landing. He advised once he welded extensions onto the rudder steering arms so the rudder arm compared to the tail wheel arm was approximately a 1 to 1 ratio, his landing control improved greatly.

Also, a 1978 Bellanca 7ECA owner advised that the tail wheel spring U-bolt on his aircraft broke at the base of the threaded portion of the U-bolt. He further advised that he hit a pretty good ice ridge while taxiing and believes this may have caused the breakage.

The purpose of this article, as stated in the title, is "twofold". First, it is to relay technical/safety information to IAC members — in these cases relating to tail wheel problems. Secondly, it is to point out a problem or condition over which we may not have complete control, but one on which we can take positive and direct action. Please re-read the first two sentences in the first tail wheel problem report. Note the "but a little late" phrase. It should be pointed out that the first report was received by the IAC T.S. Committee kind of secondhand and whether or not the "your article" line had reference to the August 1978 *Sport Aerobatics* Technical Safety Report on tail wheels is not certain, but that is really immaterial. It is very disheartening and discouraging, to say the very, very least, to have a part break on your aircraft and **then** find out that the same part on another IAC member's aircraft also failed six months prior to yours — and realizing that if you had been aware of this potential problem, perhaps in your

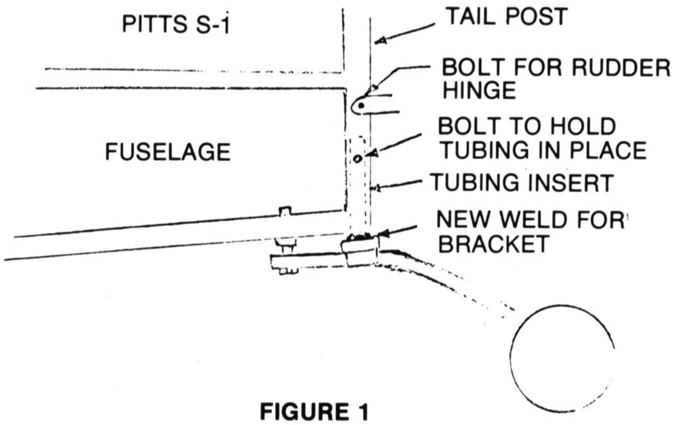


FIGURE 1

case an accident could have been avoided. One of the basic purposes of IAC is to pool information and ideas for the mutual benefit of all. This premise is probably best reflected in the IAC Technical Safety Program. The gathering and disseminating of technical and/or safety-related information has to be one of the keystones of IAC's overall goal of promoting sport aerobatics.

What we should realize is that all of us, every IAC member, is a member of the IAC Technical Safety Committee. The Committee Chairman's function is merely to try to organize information, but the key to the Program, i.e., **THE INFORMATION**, has to come from IAC members — like yourself. We may like to think of the T.S. Program as sort of a self-help tool that we can use, but possibly in a larger sense, we should consider the T.S. Program as a way in which we can fulfill our responsibility to other IAC members by reporting on technical and safety aspects of our sport. If a part malfunctions or fails on your aircraft, there is most probably no reason to think it will not also fail on some other member's aircraft. Remember, we are all on the T.S. Committee and as such and as IAC members have obligations to our fellow members. Please submit IAC M&D Reports on any difficulties you encounter and let's try to keep our fellow members from having the same problems.

IAC thanks to those members who submitted the reports noted in the first portion of this article.

Decathlon Aileron Inspection

In the early part of September a Decathlon pilot encountered a serious control jamming problem. He initiated a full aileron deflection roll at 1500' and at the 270° position of rotation when he attempted to apply opposite aileron to stop the roll he found the ailerons jammed. The small inspection covers (there are four of them) on the underside of the "up" aileron, caught on the trailing edge of the lower gap fairing. By using both hands and a knee on the control stick, the pilot deformed the inspection covers and the gap fairing and recovered the aircraft — at 400 feet. The plane was safely landed.

The IAC T.S. Committee contacted Bellanca Aircraft for their comments and suggestions on this incident. The recommendations of Bellanca Engineering are as follows:

"BELLANCA DECATHLON 8KCAB AILERON INSPECTION PROCEDURE"

A. Check aileron travel each Annual/100 Hour Inspection per Service Manual instructions.

B. Perform the following inspection during each Preflight.

1. Check aileron inspection covers for condtion: all edges must lie flat against the aileron.
2. Check aileron inspection covers for position:
   - 2.1 The inspection covers must be centered on the inspection hole
   - 2.2 The aileron inspection cover bend-line must be aligned to the aileron bend-line.
   - 2.3 The inspection cover spring clip must retain the inspection cover securely to the aileron and not allow free movement.
   - 2.4 The aileron gap fairing must overlap[1] the inspection covers by at least ⅛ inch.
3. Check aileron gap fairing to insure that it and its trailing edge are straight and provide a uniform aileron/aileron gap fairing clearance which may contact but which does not apply pressure to the aileron; aileron in all positions.

C. Replace inspection covers if any of the conditions noted in the above paragraph B1 and B2 are noted. Replace the aileron gap fairing if it is not straight as required in the above Paragraph 3.

[1]Aileron in full up position.

Please note that Bellanca is planning to further investigate this incident and requests any information regarding incidents similar to the above.

* * * * *

IAC has benefitted greatly from the assistance on technical/safety matters we have received from Bellanca Aircraft Corp. engineers. The above aileron inspection procedure checklist is just one example. Bellanca engineers have not only shown technical expertise but have shown a spirit that hopefully will someday encompass the entire aviation/aerobatic community. This "spirit" has been demonstrated by Bellanca's Dick Johnson when he worked on the IAC Tech Inspection team at Fond du Lac and by Bellanca's Chief Engineer Andy Vano in a couple of statements in his last letter — to quote Andy, "In the meantime, we will appreciate your (the IAC T.S. Committee) efforts to disseminate this (aileron inspection) information; safe flight operations and flying habits can do nothing but benefit us all," and "I think it is important that we (IAC and Bellanca) work closely together to promote our mutual interest — safe sport and acrobatic flying." Once again, IAC thanks to Bellanca engineers.

"REVISED BELLANCA SERVICE LETTERS"

Bellanca has recently released two revised Service Letters. They are 119A and C-129B and are as follows:

BELLANCA AIRCRAFT CORPORATION
Municipal Airport
Alexandria, Minnesota 56308

Date: April 8, 1975
Revised Date: July 5, 1978
FAA APPROVED

SERVICE LETTER NO. 119A

SUBJECT: Aileron Clearance
AFFECTED AIRCRAFT: Model 8KCAB S/N 4-71 thru S/N 416-78.
COMPLIANCE: Within next 10 hours flight or 30 days.
INSTRUCTIONS:

Bellanca has received a few reports of interference between the aileron leading edge and the wing rib trailing edge. Conduct the following inspection/modifications to insure proper clearance.

1. Check aileron control for proper travel. Center stick with ailerons in neutral position. Cable tension shall be 30 ±5 lbs. (Check cable tension thru zipper in headliner.) Aileron travel 19 ±1° up and 19 ±1° down.
2. Inspect the aileron bay area for proper aileron clearance between nose of aileron and wing in full up and full down aileron positions. It is recommended that the large upper and lower aileron gap covers be removed to facilitate this inspection. Proper aileron/wing clearance is 0.060 inch minimum.
3. Install aileron hinge fitting/spar spacer per Service Kit No. 246A if the aileron/wing clearance is less than 0.060 inches.

The service letter describes inspection procedures which apply to a standard production aircraft. It may not apply directly to aircraft which have been field modified or a few production aircraft which may incorporate alternate designs. Contact the Bellanca Service Department if you have any questions concerning this Service Letter.

January 30, 1978
REVISED: September 6, 1978
FAA APPROVED

SERVICE LETTER NO. C-129B

SUBJECT: Engine Oil Pressure Gauge Line and Fitting
AFFECTED AIRCRAFT:

7ECA — S/N 813-72 thru 1248-78
7GCAA — S/N 231-72 thru 359-78
7GCBC — S/N 317-71 thru 1021-78
7KCAB — S/N 291-72 thru 617-77
8KCAB — S/N 5-72 thru 433-78
8GCBC — S/N 1-74 thru 270-78

INSTRUCTIONS:

The engine oil pressure gauge line is connected to the engine on the right side directly under the upper right engine mount bushing. It is possible for this line to interfere with the engine mount under negative load conditions when the engine is deflected towards the engine mount. This interference becomes more critical when the rubber engine mount bushings are soft as a result of age and/or usage.

Aeroquip has notified Bellanca of a possible oil pressure gauge line nipple defect and has recommended that certain Aeroquip lines be replaced.

Bellanca therefore recommends that the following engine oil pressure gauge line inspection and engine fitting replacement be accomplished within the next 30 days or 10 hours of flight.

1. **Inspect Oil Pressure Gauge Line**
   Remove the upper cowl and disconnect the oil pressure gauge line P/N 624000-3-0104. Inspect the line end fittings with a magnifying glass to insure that they do not have visible cracks or deformations. Check the Aeroquip manufacture date on the line to insure that it is not dated A2Q77, A3Q77 or A4Q77. Replace the line with a new line dated A1Q78 or later if there are visible cracks or deformations and/or the above Aeroquip manufacturing dates apply.
2. **Replace Oil Pressure Gauge Line Engine Fitting**

2.1 **7ECA, 7GCAA, 7GCBC, 7KCAB, 8GCBC, 8KCAB & With P/N 4-1033-10 Non-Ring Support Engine Mount**
Examine the fitting which connects the oil pressure gauge line to the engine. Install a 45° fitting P/N 1-10595 if the engine is not so equipped. The 45° fitting P/N 1-10595 provides greater oil pressure gauge line/engine mount clearance than the straight fitting P/N 1-9644. Note that the 45° fitting P/N 1-10595 is not a standard 45° fitting in that it has an orifice restriction built into it. The new 45° fitting should be aligned to the engine pointing down to allow maximum oil pressure gauge line/engine mount clearance.

Connect the oil pressure gauge line to the engine fitting and install the top cowl.

The engine fitting required by this Service Letter is included in Service Kit No. 265: Installation Engine Oil Pressure Line Fitting.

2.2 **8KCAB Aircraft with P/N 7-1522-1 Ring Support Engine Mount**
Examine the fitting which connects the oil pressure gauge line to the engine. Install a 90° fitting P/N AN914-1D on the engine if not already so equipped and position it pointing aft. Install the P/N 1-9644 fitting in the AN914-1D fitting. The 90° fitting P/N AN914-1D provides greater oil pressure gauge line/engine mount clearance than the straight fitting P/N 1-9644 or 45° fitting P/N 1-10595. Note that the 1-9644 fitting has an orifice restriction built into it.

Connect the oil pressure gauge line to the engine fitting and install the top cowl.

The engine fitting required by this Service Letter is included in Service Kit No. 269: Replacement Engine Oil Pressure Line Fitting.

Service Kits No. 265 & 269 and Line P/N 624000-3-0104 are available at Bellanca Dealers and Service Centers.

The Service Letter describes inspection procedures which apply to a standard production aircraft. It may not apply to aircraft which have been field modified or a few production aircraft which incorporated alternate designs. It may also apply to aircraft outside the serial numbers designated if they have been field modified. Contact the Bellanca Service Department if you have any questions concerning this Service Letter.

"DECATHLON AILERON INSPECTION-COVERS"

Below is Bellanca Service Letter C-134 regarding the inspection and replacement of Decathlon aileron inspection-covers and also the Bellanca Service Policy Notice relating to this service letter.

BELLANCA SERVICE LETTER
SERVICE LETTER NO. C-134

FAA APPROVED
Date: October 27, 1978

SUBJECT: 8KCAB Aileron Inspection-Covers Inspection and Replacement
AIRCRAFT AFFECTED: 8KCAB S/N 4-71 thru 432-78
COMPLIANCE: Bellanca recommends that the inspection presented herein be performed by the pilot prior to each flight until the factory installed aileron inspection-covers are replaced with those supplied in Service Kit No. 268.

INTRODUCTION

Bellanca has received a few reports of interference between the aileron inspection-covers and the lower aileron gap cover. This interference is caused by loose and/or improperly installed inspection-covers or improperly rigged ailerons. Bellanca recommends that the following inspection and aileron inspection-cover replacement be accomplished to insure that interference and possible control difficulty does not occur.

This Service Letter describes procedures which apply to standard production aircraft. It may not apply directly to aircraft which have been field modified or a few production aircraft which incorporated alternate designs. Contact the Bellanca Service Department if you have any questions concerning this Service Letter.

INSPECTION

The aileron inspection-covers are located on the lower surfaces of the ailerons, four on each side. Perform the following inspection during each preflight until the aileron factory installed (round) inspection-covers are replaced with those supplied in Service Kit No. 268 (teardrop shaped).

1. Check aileron inspection-covers for condition: All edges must lie flat against the aileron.
2. Check aileron inspection-covers for position:
   - 2.1 The inspection-covers must be centered on the inspection hole.
   - 2.2 The aileron inspection-cover bend-line must be aligned to the aileron bend-line.
   - 2.3 The inspection-cover spring clip must retain the inspection-cover securely to the aileron and not allow free movement.
   - 2.4 The aileron gap fairing must **overlap** the inspection covers by at least ⅛ inch with the aileron in the full up position.
3. Check aileron gap fairing to insure that it and its trailing edge are straight and provide a uniform aileron/aileron gap fairing clearance which may contact but which does not apply pressure to the aileron; aileron in all positions.

If the above inspection finds any discrepancies, have an authorized airframe inspector (1) examine the aircraft, (2) determine if the ailerons are correctly rigged per the procedures set forth in the Decathlon Service Manual and (3) correct any discrepancies.

AILERON INSPECTION-COVER REPLACEMENT

Teardrop shaped aileron inspection-covers are available which fasten to the ailerons with a rivet well forward of the gap cover trailing edge (aileron in any position). These covers are available as Service Kit No. 268: Replacement Aileron Inspection Cover. Replace the existing (round) aileron inspection-covers with those supplied in the kit per the kit instructions.

Date: November 28, 1978
Subject: 8KCAB Aileron Inspection-Covers Inspection and Replacement
Reference: Service Letter #C-134

The following aircraft are affected by the referenced Service Letter.

Model 8KCAB S/N 4-71 thru 432-78

Bellanca Service Kit #268 for complying with this Service Letter is available from our Part Sales Department, Osceola, Wisconsin.

Bellanca will assist with the compliance of this Service Letter as follows.

1. Provide Service Kit #268 at no charge for all aircraft affected.
2. Pay a labor allowance not to exceed 1½ man hours for the installation of Service Kit #268 on all Dealer inventory aircraft and all aircraft placed in service after February 29, 1978.

Service Kit #268 will be supplied at normal dealer price and credit will be issued upon receipt of the following:

1. Compliance Card
2. Warranty Application Claim

IAC members should be aware that the first reports of infield Decathlon aileron problems that were received by Bellanca Aircraft Corp. came from the IAC Technical Safety Program and the first approved aileron inspection procedures were forwarded to the IAC Technical Safety Committee by Bellanca and subsequently published in the January **1978** issue of *Sport Aerobatics*. Note, therefore, that IAC members, through the concern and interest of Bellanca Aircraft, had privy to safety-related information ten (10) months before the release of the FAA approved service letter regarding the same problem.

Giles Henderson and his clipped-wing Piper "Cub" N-6620H.

A COMPARISON OF A STOCK J3 WITH A CLIPPED-WING "CUB"

By Giles Henderson (EAA 53234/IAC 159)
and
Amos Townley (EAA 53090)

ED. NOTE: The following article was unearthed from the December, 1970 issue of SPORT AVIATION Magazine. Considering that date, some of the names and/or owners of aircraft etc. may be presently incorrect. The technical information, however, should still be relevant.

The J3 "CUB" has been a long-time sentimental favorite of the aviation buff. Many articles, books, and even poems have been written about this aircraft. In its stock configuration it has gained an almost legendary reputation in the roles of a trainer, bush plane, ranch hand, float plane, duster, and all-around sport plane. It has probably won more spot-landing and flour-bombing contests than any other type of aircraft. To top it off, it has frequently been the star of the air show. The "Stolen 'Cub'," "Drunk Pilot," and other comedy acts flown by the late Dick Schram, Marion Cole, Bill Lumley, Dale Cites, and many others have always been real air show crowd pleasers. The stock "Cub" has been used by National Air Shows, Henry Mallet, Cole Brothers, Bill Adams, and many other professional performers for car to plane transfers, car-top landings, etc.

The "clipped-wing" "Cub" has also been a long-time air show performer. Many of the best-known aerobatic pilots in the country including Duane Cole, Harold Krier, Bevo Howard, Pappy Spinks, Charlie Hillard, Bill and John Lumley, Pete Myers, and Mary Gaffaney started their aerobatic careers in "clipped-wing" "Cubs".

A few ultra-high-performance "clipped-wings" have been built up for exhibition and unlimited competition. Probably the best known are N-42963 owned, built, and flown to an EAA international unlimited championship in 1966, by Pete Myers of Oak Lawn, Illinois; and N-10135, built by Howard Dutton of Haverill, Massachusetts and presently owned by Bill Lacy of Chandler, Arizona. Both of these all-out machines have had their fuselages shortened, vertical fins modified, been converted to single place, and had 150-hp or better engines installed. The wings on N-42963 have undergone an evolution of changes. At this time they are Taylorcraft wings shortened to a 24-ft. span. This nearly symmetrical airfoil improves the outside capabilities of the aircraft tremendously. However, the Taylorcraft wing does not produce as fast a roll rate as the "Cub" wing of equivalent span. Also well known in both competition and air show exhibition is N-38333 built by the Piper factory for Bevo Howard, later owned by Charlie Hillard, and presently owned by Bob Copeland, also of Chandler, Arizona, Bob has converted to Taylorcraft wings also.

In the last couple of years, both experimental "Cubs" and standard category Reed "clipped-wing" "Cubs" have been active in primary competition. Table 1 lists some of the more-active competition pilots and their "Cubs".

Because of the popularity and interest in the "Cub" as both a sport plane and as a competition/air show plane, we felt it would be of interest to compare the character-

TABLE 1
COMPETITION "CUBS" AND PILOTS

Registration	Name	Base	Engine
N-151A	Harold Tapley	Shaw, MS	0-200
N-188F	Dot Etheridge	Greenville, MS	0-200*
N-4413	Gary Wilson	Kaneoke, HI	C-85
N-23317	Joe Molinary	New Orleans, LA	A-75
N-30551	Jim Guzman	Dallas, TX	C-85
N-35258	Gene Olson	Crystal Lake, IL	C-75
N-3655K	Dan McGarry	Riverdale, IL	C-90*
N-41116	Jerry Spear	St. Louis, MO	C-85
N-6620H	Giles Henderson	Charleston, IL	A-65*
N-70628	Don DeWitt	Worth, IL	C-85*
N-77531	Jay Harowitz	Shreveport, LA	C-90

*Air show smoke system

TABLE 2
PERFORMANCE DATA

Aircraft	**Stock J3**	**Clipped-Wing**
Engine	A-65	A-65
Propeller	Metal	Metal
Empty Weight	728 lbs.	696 lbs.
Useful load	501 lbs.	404 lbs.
Wing span	35 ft.	28 ft.
Wing area	178.5 sq. ft.	143.0 sq. ft.
Aileron area:		
Wing area	.107	.134
Power loading	15.2 lbs./hp	14.7 lbs./hp
Wing loading	5.53 lbs./sq. ft.	6.69 lbs./sq. ft.
Stall speed		
(Power off)	38 mph	46 mph
Cruise speed		
(75 percent power)	70 mph	75 mph
Maximum speed	82 mph	86 mph
Take-off ground run	230 ft.	344 ft.
Normal rate of climb	560 fpm	473 fpm
Maximum glide ratio	10:1	6.8:1
Roll rate	33 deg./sec.	86 deg./sec.
Snap-roll rate		150 deg./sec.

NOTE: Above data measured with one pilot (160 lbs.), 12 gals. of fuel, and air temperature 94-100 degrees F.

istics and performance of a stock "Cub" and "clipped-wing" with equivalent power. Amos Townley, owner of N-2041M, is a newspaper writer and photographer for the "Coles County Times" of Charleston, Illinois. N-2041M has been used by Bill Lumley for air show comedy acts. Giles Henderson is a chemist and member of the faculty at Eastern Illinois University at Charleston. He is a co-owner with Dan Foote, also a chemistry professor at EIU, of the "clipped-wing", N-6620H. Henderson and Foote modified the aircraft in 1968 and it has been active in both competition and air shows since.

In order to obtain a meaningful comparison of performance, the test flights were made with identical loads in both "Cubs" and were flown on the same day under identical weather conditions. The data used in this report represents an average of at least three trials. The airspeed indicators were calibrated relative to each other using a pressure manometer. All altitude measurements were made with the same calibrated sensitive altimeter in both aircraft. Rates of climb and descent were measured with a sensitive altimeter and stopwatch beginning each test 300 ft. above or below the starting altitude and timing point to take up the lag in the altimeter. In a climb test, for example, full power was applied and the attitude of the aircraft adjusted for the desired air speed at 1700 ft. At 2000 ft. the stopwatch was initiated. The rate of climb for that particular trial could be obtained by dividing the change in altitude by the corresponding elapsed time. Table 2 compares the characteristics of the "Cubs".

Note that the take-off ground-roll requirements for the "clipped-wing" is approximately 50 percent higher than for the stock "Cub". The shorter wing raises the stall speed by 21 percent and only increases the cruise speed by seven percent. A very significant point is the tremendous loss in useful load. In fact, with a full load of fuel, the "clipped-wing" can only carry a 120 lb. passenger (with parachutes and a 150 lb. pilot).

Fig. 1 compares the rate of climb as a function of indicated air speed. At normal climb configuration (full power and 56 mph IAS) the stock "Cub" has a substantially better climb rate. The difference is much more dramatic when both aircraft are at gross weight. It is interesting to note that at extreme pitch attitudes, right on the verge of stall, the "clipped-wing's" performance is better. Naturally climbs in this range are normally considered abusive to the engine and potentially unsafe.

FULL POWER RATE OF CLIMB

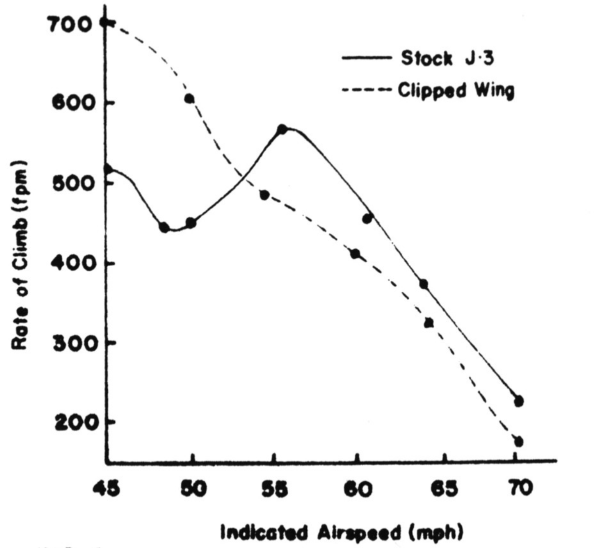


FIG. 1

POWER OFF DESCENT

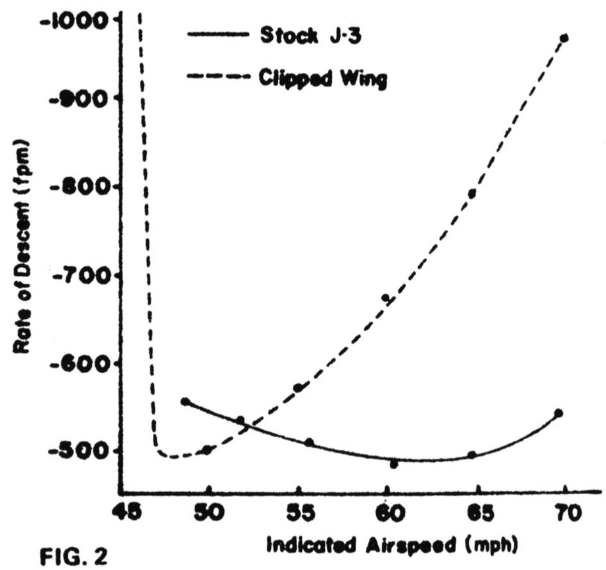


FIG. 2

MAXIMUM GLIDE
zero wind, power off

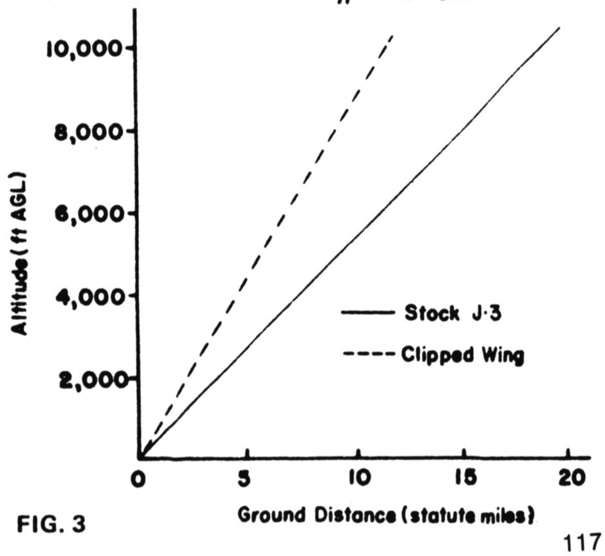


FIG. 3

AIRSPEED & POWER AT CONSTANT ALTITUDE

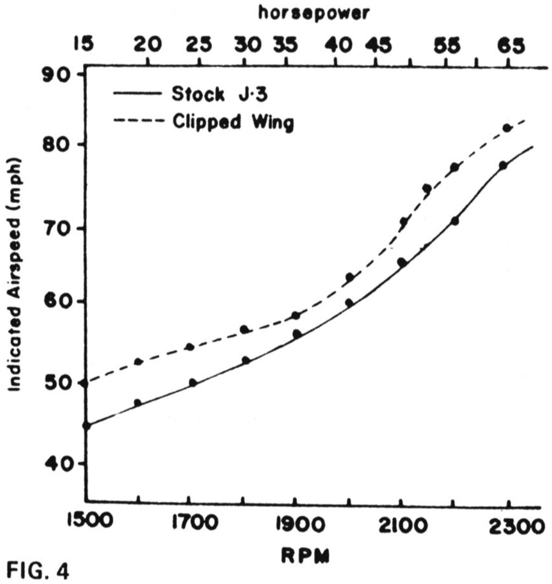


FIG. 4

Fig. 2 and 3 clearly reveal that without power the "clipped-wing" "falls out of the sky" in contrast to the stock "Cub". Shortening the wings does not improve the air speed very much. Fig. 4 plots air speed as a function of horsepower and engine rpm.

By conventional standards, the stock "Cub" clearly has higher all-around performance and is a far safer airplane than the "clipped-wing" with an equivalent engine. However, this very significant sacrifice in performance (particularly useful load) is compensated by a large increase in structural integrity due to the larger struts, fittings, and shorter coupling. From an aerobatic standpoint, the "clipped-wing" has far better aileron and rudder response resulting in a high increase in roll rate (See Table 2). Practically the entire trailing edge of the "clipped-wing" is aileron. Barrel rolls and slow rolls can be completed with only a fraction of available aileron travel. In experienced hands, the "Cub" can hold its own in Primary competition, even with the little 65-hp engine. There is no question that it is handicapped with the small powerplant, but contest records speak for themselves.

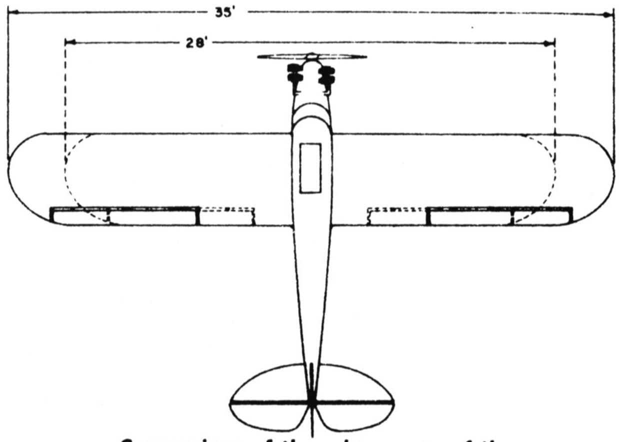
Many of the performance deficiencies can be greatly improved with larger engines. However, this invariably raises the modification costs substantially. In fact it is not at all uncommon that the powerplant, inverted system, propeller, cowl, and engine mount will cost considerably more than the rest of the entire airplane.

The "clipped-wing" "Cub" offers a compromise between aerobatic capability and a more general sport aircraft. Certainly the "clipped-wing" Taylorcraft is a far more efficient aircraft with considerably more aerobatic potential. However, the "Cub" offers a two-place configuration.

In conclusion, we hope we have pointed out the rather severe sacrifices in clipping the wings of the "Cub". The consistent appearance of "clipped-wing" "Cubs" in "Trade-A-Plane" vouches for the dissatisfaction of many owners. Typically the air show buff goes home from the fly-in with a great deal of enthusiasm and determination to saw the wings off his "Cub". After the modification, he discovers that he doesn't really enjoy aerobatics and that the loss in performance was far greater than expected. He can either go to a larger engine or sell. If he has lost his enthusiasm for aerobatics he probably elects the latter.

Our advice is either to buy an already modified "Cub" (which is almost always far cheaper than modifying one yourself) or, if you insist on cutting up your own stock "Cub", at least be certain that you know what you will wind up with. As scarce as good "Cubs" are becoming, it seems a shame to cut the wings off and then decide that's not what you want after all.

The authors would like to express their gratitude to Co-Air, Inc. of Coles County Airport at Mattoon, Illinois for the use of a calibrated sensitive altimeter and, in particular to Earl Adkisson, EAA 1476, owner and operator of Tuscola Flying Service at Tuscola, Illinois for his interest, encouragement, and technical advice. Earl, well known in the Midwest for his 1908 French "Demoiselle" replica and an original gull-wing design, supervised and assisted in the modification of N-6620H.



Comparison of the wing spans of the stock J3 and the CLIPPED-WING.

(Photo by Dave Gustafson)

The most recent photograph in *Sport Aerobatics* 'files of Giles' Clipped-wing Cub, N6620H, was taken at Fond du Lac '78.

AVCO LYCOMING AIRWORTHINESS DIRECTIVE Volume I

79-04-05 **AVCO LYCOMING:** Amendment 39-3418. Applies to all fuel injected Lycoming series engines equipped with the following Bendix Injector Models and Parts List Numbers and to all Lycoming fuel injected engines irrespective of parts list number or serial number, whose Bendix Models RSA-5AB1, RSA-5AD1, and RSA-10AD1 fuel injectors have been overhauled after March 31, 1977, in which the fuel diaphragm has been replaced with a new P/N 2529471 diaphragm assembly.

Model Number and Serial Number		Parts List Number
RSA-5AB1 Serial No. 63503 thru 66027		2524254-4
		2524712-1
RSA-5AD1 Serial No. 61032 thru 66920		
2524054-4	2524297-3	2524469(B)
2524147-6	2524307-3	2524550-1
2524171-4	2524335-3	2524673-1
2524213-4	2524359-3	2524682-1
2524291-4	2524450-2	2524723-1
RSA-10AD1 Serial No. 63399 thru 66941		2524163-7
		2524175-3

Compliance required within the next 10 hours in service after the effective date of this AD, unless previously accomplished.

To prevent an in-flight power loss due to the separation of the P/N 2529192 regulator diaphragm stem assebly, the P/N 2529471 regulator diaphragm assembly must be removed, inspected, and replaced if necessary, in accordance with the Accomplishment Instructions listed in Bendix Energy Controls Division Service Bulletin No. RS-57 Rev. 1 or FAA approved equivalent.

Equivalent methods of compliance must be approved by the Chief, Engineering and Manufacturing Branch, Federal Aviation Administration, Eastern Region. Upon submission of substantiating data by an owner or operator through an FAA Maintenance Inspector, the Chief, Engineering and Manufacturing Branch, FAA Eastern Region may adjust the compliance time specified in this AD.

NOTE: AVCO Lycoming Service Bulletin No. 433A also pertains to this subject.

This amendment is effective February 26, 1979.

BELLANCA SEATS

Over the years Citabrias and Decathlons have come equipped with several different style seats. Certainly all Citabria and Decathlon owners are aware of the United States Federal Aviation Administration's Airworthiness Directive A.D. 76-22-01 and the corresponding Bellanca Service Letter #C-125 which deals with the installation of a reinforcing kit (Bellanca #252) on certain 1976 7ECA, 7KCAB, and 8KCAB models with adjustable front seats.

Several *Sport Aerobatics* Technical Safety articles have carried reports of Bellanca seat problems. For reference these articles are:

January 1977, "Inspection Aids"
February 1977, "The One You Save May Be Your Own"
May 1977, "Technical Safety 3, More Etcetera"
October 1977, "Bellanca Service Letters"
March 1978, "Inspection Aids"

These articles made note of failures concerning the seat models covered by A.D. 76-22-01 and also noted problems with seat models **not** included under this A.D.

Recently the IAC T.S. Committee has received some more input concerning Bellanca seats. One IAC member wrote the following:

"I noted in the March, 1978, edition of *Sport Aerobatics* a report of a Citabria having had structural failure of a seat frame. This is to report a similar structural failure on my 1975 7KCAB. The metal fatigue occurred on both sides of the tubular structure at the point of attachment to the rest of the seat by bolts. The right side fractured first and the left side was badly weakened with the usual appearance of metal fatigue.

"Luckily I was not flying at the time, but had gone to the airport to run my engine during the continued bad weather of this winter. In sitting in the front seat and pushing my brake pedals to set my brakes before starting the engine, the seat back broke off. Lucky I was not in the air doing a 4G maneuver."

The March 1978 T.S. report referred to by the above gentleman concerned an 8KCAB and it stated, "The front seat frame broke during aerobatic maneuvers. The break occurred in the lower portion of the frame just forward of the bend at the aft attachment to the floor."

Although it is "second guessing" on our part, from the member's description of his seat breakage point, we believe the break was "more similar" to the 1976 8KCAB problem reported in the May 1977 issue of *Sport Aerobatics* where ". . . The seat back failed — on the right side. The hinge bolt tore through the mounting fork." Obviously, the most important point of this discourse is to make IAC members aware of the potential of seat breakage and to encourage, as part of pre-flight inspections, a close examination of the aircraft seat.

Another IAC member who owns an early 7ECA with the standard, non-folding back, non-adjustable seat, advised that although he has encountered no seat breakage problems he has made the following seat modifications as precautionary measures. (SEE SKETCH #1)

IAC thanks goes to the above-mentioned two IAC members for their contribution to the IAC Technical Safety Program and to the safety of sport aerobatics.

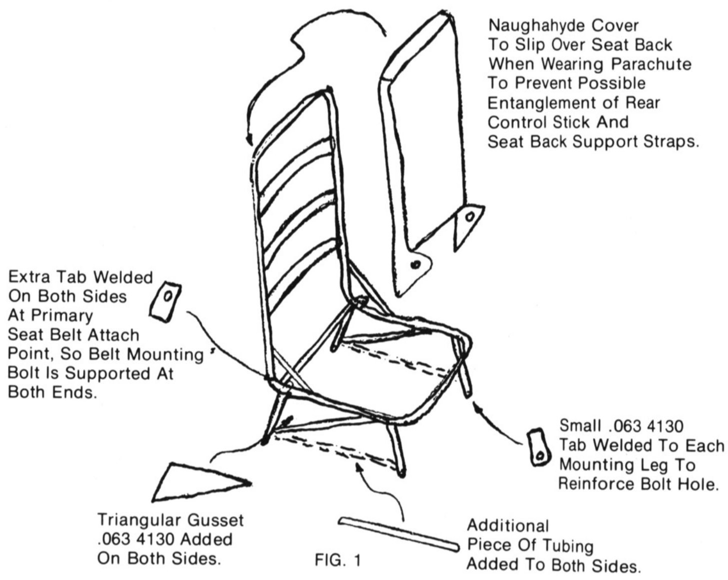


FIG. 1

BELLANCA PARTS KITS

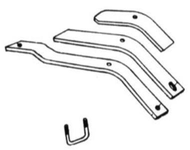
Bellanca Aircraft Corporation now has available several kits which will permit owners of early model Citabrias and Decathlons to update their aircraft to the latest factory configurations. (Kits and specifications listed below.) IAC members will recognize that several of the new parts kits cover areas that in the past have had records of service difficulties. Therefore, the new Bellanca kits will not only let Citabria and Decathlon owners update to the latest model configuration but also update from a safety aspect. We feel the Bellanca kits are a step in the right direction in helping to keep the sport of aerobatics safe and fun.

BELLANCA

Factory-Approved Parts

FOR YOUR CITABRIA, DECATHLON OR SCOUT

Update or modify your airplane using only factory-approved parts.



HEAVY DUTY SPRING SET

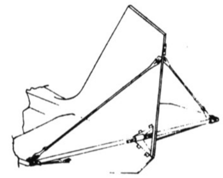
Replace your older tail wheel springs with this Heavy Duty 1¾"-wide Spring Set. Provides better ground ride - longer life. Set includes three springs and U-bolt and all hardware.

Heavy Duty Spring Set **$40.00**

STAINLESS STEEL TAILBRACE WIRES

Replace existing tailbrace wires with this longer life Stainless Steel set.

S.S. Tailbrace Wires (Set of 4) **$40.00**



U-BOLT SET

Bellanca recommends that you change your landing gear hardware every 500 hours. Use only these factory-approved U-Bolts. Complete set includes two (2) U-bolts and necessary nuts and washers.

U-Bolt Set **$66.00**

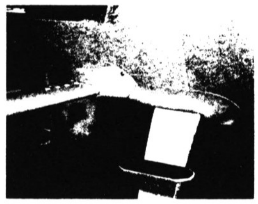
CONTACT YOUR NEAREST BELLANCA AUTHORIZED DEALER OR SERVICE CENTER FOR FACTORY-APPROVED PARTS:

Bellanca Aircraft Corporation, Alexandria, Minnesota 56308 / 612-762-1501

BELLANCA

SPEED KIT

FOR ALL CITABRIA AND DECATHLON AIRCRAFT



Kit Contains:

- ★ UPPER AND LOWER MAIN WING STRUT FAIRINGS
- ★ LANDING GEAR STRUT FAIRINGS
- ★ STREAMLINED TAIL WIRES
- ★ INSTALLATION HARDWARE

Easy to install, the Bellanca Speed Kit not only improves cruise performance* but also your aircraft's appearance.

Available for either factory installation, or field installation by a customer. Can be installed on all model Citabria airplanes from 1966 and all Decathlons from 1967.

(Suitable only for aircraft with the flat spring steel main gear.)

Available in white only.

Complete Kit: **$325.00** Factory Installed

(SPECIFY MODEL AND YEAR WHEN ORDERING) **$395.50** Retrofit Kit

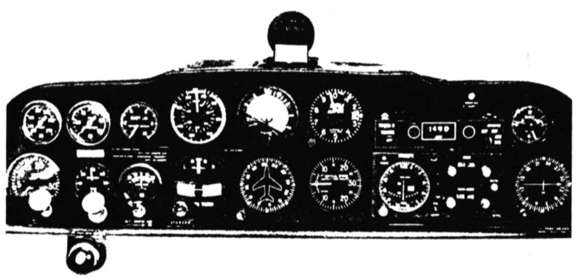
*Improvement in aircraft performance will vary with different models.

Bellanca Aircraft Corporation, Alexandria, Minnesota 56308 / 612-762-1501

BELLANCA

Low Profile Instrument Panel

FOR ALL CITABRIA, DECATHLON AND SCOUT AIRCRAFT



You can now update your Citabria, Decathlon or Scout airplane to 1979 configuration with this special "Low Profile" instrument panel.

Designed to accommodate a complete set of gyros, flight instruments and radio/transponder combination, the new panel provides improved visibility over the nose, both on the ground and in the air. Of all metal construction, the panel face is covered in a fine grain quality black vinyl.

Kit includes front sub-panel/tray, panel cover and all necessary hardware for installation.

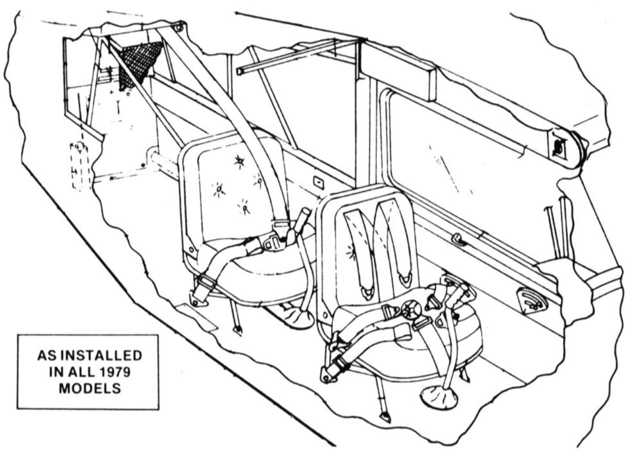
Complete Kit: **$165.00**

Bellanca Aircraft Corporation, Alexandria, Minnesota 56308 / 612-762-1501

BELLANCA

Adjustable Front Seat

FOR ALL CITABRIA, DECATHLON AND SCOUT AIRCRAFT



Update your Citabria, Decathlon or Scout model to present-day configuration. Allows fore-and-aft adjustment of front seat to accommodate all pilot heights.

Complete kit includes front seat frame and base, with adjusting mechanism, a pair of longer (and specially formed) replacement control sticks, stick boots, and all necessary installation hardware and instructions.

Complete Kit: **$285.00**

Bellanca Aircraft Corporation, Alexandria, Minnesota 56308 / 612-762-1501

By Giles Henderson
(EAA 53234/IAC 159)

The Clipped-Wing "Cub" and Competition Aerobatics

(This continuing series of articles was taken from SPORT AVIATION, March 1972.)

Giles Henderson of Charleston, Illinois spends most of his spare time strapped in his highly modified Clipped Wing Cub. Over his 20 year flying career he has established a national reputation in precision aerobatics. He is a two-time national champion in the Sportsman Category of the International Aerobatic Club (1971 & 1975) and has also won the Canadian Championship in 1974 and the L. Paul Soucy Award in 1975. In the past few years he has won over 20 aerobatic competition meets. After watching Giles snap and tumble over and over through his famous "wifferdill" maneuver, it's hard to visualize him as a Chemistry Professor. He has been employed by Eastern Illinois University for the past 12 years and has published over two dozen papers on molecular physics and related topics. Giles is also a spelunker, amateur radio operator and a certified scuba diver.

Since the article "A Comparison of a Stock J3 With a Clipped-Wing 'Cub' " appeared in the December, 1970 *SPORT AVIATION*, I have received numerous requests for specific information on modifications of the "Cub". This article has been prepared in an attempt to answer the most frequently asked questions. Please keep in mind that the following comments reflect the opinions of a professional chemist that engages in competition aerobatics as a hobby and not those of an engineer or aircraft mechanic. Also, in view of the gross sacrifice in performance (take-off, ground roll, increased stall speed, rate of climb, glide ratio and, in particular, the tremendous loss in useful load) discussed in the previous article, shortening the wings of a stock "Cub" deserves considerable consideration. In all fairness to the ever-decreasing quantity of good "Cubs", the would-be akro pilot should be absolutely certain that he knows what he wants and what he will get from a clipped-wing "Cub" before he starts sawing.

It has been my observation that it is almost always cheaper to buy an already modified "Cub" than it is to modify one yourself. Rebuilding a clipped-wing "Cub" would involve considerably less work than starting from scratch, and at the same time preserve the relatively scarce "antique" classic stock J3. Furthermore, in rebuilding, and possibly more extensively modifying, a clipped-wing (or any other aerobatic aircraft) you will have the opportunity to become thoroughly acquainted with the mechanical condition of the machine. The peace of mind that this knowledge provides is indeed a valuable security. Needless to say, exposing an aircraft of unknown structural integrity to the stresses of aerobatics has frequently proved fatal. Not only is the quality of the aircraft's structure a cardinal safety factor but also an important element in the quality of the pilot's airmanship. It is essential to have complete confidence in the aircraft's structural integrity before the pilot can concentrate completely on the precision of his maneuvers. Somehow you just can't execute a quality nine descending snap roll if you are haunted by the thought of a wing coming off.

Any modification or alteration that results in a departure from the original Piper Type Certificate will revoke the Standard Airworthiness Certificate unless it conforms to an approved Supplemental Type Certificate (STC). There are indeed, several STC's available for major alterations of the J3. Probably the best known is the Reed-Lippert conversion, which allows shortening the wings seven feet. This STC is applicable only to wood-spar wings. Other STC's are available for similar metal spar modifications. Information concerning STC's and the name and address of the holder is available from the FAA. It is necessary to comply with and obtain the FAA approved data for a particular modification from the STC holder. Usually the holder will fix a user's price for the privilege of using his engineering data, drawings, etc. Of course, the actual alteration must be conducted by an A and P mechanic, and an AI or FAA approved repair station must complete the paper work, including the 337 forms, to return the aircraft to service. In some instances, it is possible to incorporate modifications without STC's by placing the aircraft in the Restricted Classification and operating with a Special Airworthiness Certificate and Restricted Operating Limitations. This approach requires the production of complete engineering data describing the modification. A third alternative, is to license the aircraft in the Experimental Exhibition Classification in accordance with FAR 21.191. This type of certification offers the highest flexibility in the nature of the alteration, but is usually the most restrictive in operating privileges. The specific limitations are made at the discretion of your local FAA GADO. It should be noted that a modified production aircraft is ineligible for certification under Experimental Amateur Built Classification.

In some cases it is possible to obtain certification in multiple categories in accordance with FAR 21.187. For example, this alternative might allow a Standard Category, Reed clipped-wing "Cub" to utilize a portable smoke system or inverted system under Restricted classification during air show performances and be returned to Standard Category after removal of the equipment, provided sufficient design and engineering data is available for the modification.

To the best of my knowledge, it is not possible to build up a fully aerobatic clipped-wing "Cub" with available STC's under Standard Airworthiness.

The extent of specific modifications is naturally contingent on the competition category the "Cub" will be used in. Hence, the modifications are discussed approximately as they apply to current competition levels.

Sportsman Category

The obligatory routine of the Sportsman Category is composed of basic positive G maneuvers. Furthermore, the competition rules provide 2000 ft. of altitude to complete a typical sequence of ten maneuvers (3500 ft. max. — 1500 ft. min.). These two important factors make it possible to be competitive with low horsepower and no inverted power. Of course, a maneuver such as a 45 degree ascending half roll (Aresti 9.2.1.2.1; 18-K) is much easier with a big engine that runs inverted. However, by trading altitude for air speed and using proper timing, it is possible to fly such a maneuver with a quality 8 score using an A-65 running on three cylinders. Furthermore, the typical Sportsman Sequence can be completed within +4.2 and −1.5 G's and 120 mph. Hence, a clipped-wing "Cub", modified per Reed-Lippert type conversion, is well suited for this type of performance envelope. A typical Sportsman Category competition "Cub" might include the following modifications:

1. Balanced 65-90 hp engine, equipped with a balanced metal prop and standard float carburetor.
2. Fuel tank equipped with either an inverted check valve in the cap, or a pressure cap with a vent line running from the filler neck to the bottom of the engine cowl, with proper clearance from the exhaust system.
3. The crankcase breather line is rerouted and possibly a "separator-slop can" installed to minimize oil losses while inverted.*
4. Wings shortened seven feet from the root bay.
5. Wing strut fittings modified and reinforced since they are no longer collinear with the new strut angle.
6. Aileron cables shortened.
7. The struts are replaced with custom-build struts, manufactured from streamlined tubing equivalent to (or preferably stronger) than the original front strusts and equipped with 7/16-in. (Piper 13710) or larger forks.
8. Fuselage strut fittings modified.
9. Lower door modified to clear struts.
10. Install G-meter.
11. Since the weight of the pilot and parachute may frequently exceed 1000 lbs. during aerobatic routines, the original canvas-sling, rear seat is usually unsatisfactory I have personally had the misfortune of discovering this, halfway through a competition flight. It should be emphasized, that this can potentially lead to very grave consequences since tearing the canvas seat could cause a seatpack to jam the elevator bellcrank located directly behind the seat. Hence, I would recommend that the canvas seat be replaced by a suitable metal seat, constructed to provide the proper elevation with a seat pack or security parachute. It is probably impractical to utilize a back pack in the rear cockpit of a "Cub" without major alterations.
12. Install shoulder harness and additional military type seat belt in the rear cockpit in accordance with IAC regulations (Sec. 2.1).

* If a return line is used between the can and the oil sump, provisions should be made to drain condensed water from the lowest point. The smallest drop of water in contact with a hot bearing can total the engine.

In addition to these alterations, there are certain critical points that deserve close attention. The tail-wire fittings (Piper part nos. 40521-08, fin; 40521-07, top stabilator; 40521-09, bottom stabilator; and 40531-00, fuselage) may crack after prolonged use under high stress. They should be checked routinely in every pre-flight. I personally keep a spare set of the fittings on hand and exchange them every hundred hours and Magnaflux the set removed. Likewise, the strut forks and bolts should be periodically Magnafluxed. All of the engine mount bolts can be replaced for less than $2.00 and a couple of hours' work. This is another high stress area in which failures have occurred. I'm sure most experienced aerobatic pilots are personally acquainted with fatal mishaps involving engine-mount structural problems.

One final point. The fuel system should be inspected very carefully. Aerobatics will cause the fuel to slop around with a lot of momentum. This will put a great deal of stress on the seams of the tank. Furthermore, the support straps are subjected to frequent, high G loads. If the tank moves or shifts slightly during aerobatics, the fuel line connecting the tank to the gascolator will eventually become brittle and crack if it is made from copper tubing. A serious in-flight fuel problem can be avoided with proper maintenance.

Intermediate Category

Although the intermediate category has no outside maneuvers in the obligatory routine, it does require prolonged inverted flight, vertical roll maneuvers and higher G positive maneuvers. Hence, a good inverted system becomes essential as well as higher overall performance capabilities. Fuel can be obtained while inverted by using a standpipe or flop-tube in the main fuel tank or by installing a small ½ gal., auxiliary "header tank", usually located on the floor of the front cockpit between the rudders and just behind the firewall. Each of these methods have certain advantages and disadvantages. In terms of overall mechanical safety and simplicity, the stand-pipe arrangement is undoubtedly the best, although aerobatics must be done with a full tank of fuel. The best inverted systems utilize either a fuel injection or a pressure carburetor. The fuel-injector systems are becoming increasingly more difficult to locate.

A pressure carburetor such as a PS-5 will require a custom-built adapter for the intake manifold spider and probably require modification of the engine cowling to accommodate the larger carburetor and adapter. Sufficient fuel pressure can be obtained from some diaphragm pumps driven by the cam shaft from the front auxiliary pad of the Continental "C" series engines. Probably the most difficult problem is getting proper metering and mixture control. This is a job for the professional carburetor specialist (if you can find one).

Inverted oil pressure is a controversial point. Many pilots feel that as long as the aircraft is only flown a few moments inverted (such as in a square loop) oil pressure is not important. In fact, you can find many engines that have flown several hundred hours of aerobatics where prolonged inverted flight was avoided, with no apparent damage upon tear-down. On the other hand, factory representatives, and in many instances engine mechanics, shudder and have fits at the mention of such abuse. I suppose the old premise "better safe than sorry" is in order.

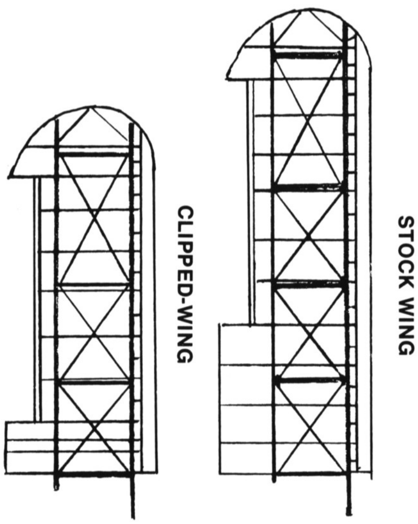
In my opinion, it is not possible to be competitive with a clipped "Cub" in the Intermediate category without at least 85 hp and a good inverted system. I would highly discourage the use of the float-carburetor modifications that are frequently suggested. These methods have proven totally unsatisfactory for competition aerobatics.

Many of the maneuvers in the Intermediate sequence will require substantially higher entry speeds than the Sportsman sequence. Experimental category "Cubs" are often operated 10-15 mph above the original Piper redline air speed. Hence, not only will the ship need higher performance and inverted capabilities, but it will also need to be stronger. The following modifications will improve performance and strength of the "Cub":

1. Replace the normal ⅛-in. (0.125) windshield with $^{3}/_{16}$-in. (0.187) Plexiglass, if available. Also, brace the windshield near the top center from the cabane structure.
2. Use heavy gauge leading-edge material in the wings, such as that manufactured for the "Tri-Pacer".
3. Replace all of the false ribs with full ribs. Note that although this will greatly strengthen the wings, some pilots claim that the inverted flight characteristics are poorer than with the standard rib spacing.
4. Use closer rib stitching.
5. Modify the compression members (such as using double tubes, one above the other) to prevent torsion of the spars. Abrupt, high-G maneuvers such as multiple snaps or square loops can cause torsional stresses in the wing which may result in multiple rib failures.
6. Rig the wings with no dihedral. This will lessen the stability but improve inverted-flight characteristics.
7. Install full-length tubes in the center of the struts to increase the compressional strength.
8. Modify the wheel rims by removing a center section to take 5.00 x 4 tires and wheel pants.
9. Remove the bungee shocks and weld the gear solid.
10. Some pilots prefer to add stall strips to the leading edge of the wing (typically 7 in. long, installed directly in front of the strut fittings). This will change the flight characteristics considerably. In particular, snap rolls may be executed at substantially lower wing loadings. The abrupt, high-speed stall characteristics may or may not be desirable.

(Photo by Amos Townley)

Presentation and the precision of a hammerhead stall are frequently the decisive factors in Sportsman competition. Although smoke is popular for airshow appeal, it is not used in competition flying.



Advanced Category

A few years ago it was indeed possible to be competitive in Unlimited competition with high performance clipped "Cubs". Today, however, it seems extremely unrealistic that a super-modified "Cub" is going to be competitive with a Pitts, Stephens, "Chipmunk" or "Akromaster" in a sequence that is 50 percent outside and 25 percent vertical. In my opinion, ultra-modified "Cubs" could be a top contestant in the Advanced Category. You can probably count all of the F.B.U.H.P. (fire-breathing ultra-high-performance) "Cubs" in the country on one hand. These machines typically incorporate chopped T-Craft wings, beefed-up shortened fuselage with extra brace wires, tubing and gusseted clusters, dorsal fin, balanced elevator, single-place cockpit, and 150-200 hp fully inverted engines with "Super Cub" pressure cowling. Modifications this extensive are clearly complex and require a master craftsman.

The clipped "Cub" has a very respectable competition record. The following table summarizes the "Cub's" Primary/Sportsman competition standing over the last few years at the major aerobatic meets.

Anyone that has ever attended a Sportsman Contest can testify that there is some real close competition. Typically, at a major meet, virtually all of the well known and exotic akro mounts, including Pitts, Bueckers and Zlins are competing. To get in there and have a go at it with any kind of machine is a challenge to say the least.

Finally, let me say a word about cost. Question: "Could I buy a stock 'Cub', strip it down and build up a good little competition machine for, say $3,000.00?" My answer: No, if you start from scratch with a stock J3, in all probability, it would cost twice that. It would be well worth your effort to look around a bit before you start butchering the beautiful little "yellow bird".

PRIMARY/SPORTSMAN CONTEST RESULTS

Year	Contest	Place	No. Of Contestants
1968	Rockford, Ill.	3	15
1968	Oak Grove, Tex.	3	16
1969	Monroe, La.	3	17
1969	Ottumwa, Iowa	4	18
1969	Oak Grove, Tex.	2	31
1970	Hammond, Ind.	1	6
1970	Monroe, La.	3	11
1970	Aurora, Ill.	1	14
1970	Fond du Lac, Wis.	2	23
1970	Centralia, Ont.	1,2,3	17
1970	Newnan, Ga.	2,3	11
1971	Vivian, La.	1	23
1971	Morris, Ill.	2	10
1971	Centralia, Ont.	3	10
1971	Fond du Lac, Wis.	1	31

BELLANCA SERVICE LETTERS

Recently Bellanca Aircraft Corp. released two new Service Letters — C-135, "Landing Gear Thru-Bolt and U-Bolt Inspection and Maintenance; Parts and Service Manual Part Number Corrections," and C-136, "Over-Rich Operation of Model 8KCAB Fuel Injector."

IAC members may note that Citabria and Decathlon MLG thru-bolt and U-bolt problems have been mentioned in several *Sport Aerobatics* Technical Safety articles, namely, February 1977 "Walk Around", September 1977 "U-Bolts and Thru-Bolts", November 1977 "1977 Fond du Lac Tech Inspection", and March 1978 "Inspection Aids". The most comprehensive of these articles was the September 1977 *Sport Aerobatics* T.S. article "U-Bolts and Thru-Bolts" — and it should possibly be reviewed by all Citabria and Decathlon owners and pilots.

Members may also note that an earlier Bellanca service letter, C-124, addressed itself to "Engine Over-Rich Operations" on 7KCAB Citabrias.

Below are Service Letters C-135 and C-136 in their entirety.

SUBJECT: Landing Gear Thru-Bolt and U-Bolt Inspection and Maintenance; Parts and Service Manual Part Number Corrections

AIRCRAFT AFFECTED: 7ECA, 7GCAA, 7KCAB, 7GCBC, 8KCAB, 8GCBC

COMPLIANCE: Bellanca recommends that the inspections presented herein be performed on or before the 100 hour inspection and at 100 hour intervals thereafter, and at more frequent intervals if aircraft is used in soft or rough runway operations.

INTRODUCTION

There have been reports of cracked and failed thru-bolts and U-bolts used to attach the landing gear to the fuselage frame. These problems are due to one or more of the following: (1) Excessive loads during soft or rough runway operation; (2) improper torque; (3) corrosion.

In order to prevent cracking and to detect cracks before failure occurs, the following inspections and replacements are recommended.

Certain hardware callouts as shown in the Citabria, Decathlon and Scout Service and Parts Manuals are incorrect; correct the manual as indicated below.

INSTRUCTIONS

1. **Inspections and Torque Checks**

   Conduct the following inspections at intervals consistent with the compliance paragraph above.

   1.1 Lift aircraft using jacks at fuselage strut-attach fitting until weight of aircraft is supported by jacks and wheels are just touching floor.

   1.2 Check torque of thru-bolts. If torque value is **below minimum value** specified in Table 1, remove and inspect bolts, nuts and washers. Inspect bolts for straightness, excessive wear, cracks and corrosion. Verify that proper parts are installed per Table 1. Standard AN parts are **not** acceptable. Install thru-bolts, washers and nuts. Torque to values shown in Table 1.

   1.3 Check torque of U-bolts. If torque value is **below minimum value** specified in Table 1, remove and inspect U-bolts, nuts and washers. Inspect U-bolts with particular attention to the inside radii at front and rear. Inspect for straightness of legs, excessive wear, cracks, corrosion and thread condition. If cracks are suspected, accomplish dy-penetrant or magnetic particle inspection. Verify that proper parts are used per Table 1. Install U-bolts, washers and nuts. Torque bolts to values shown in Table 1.

2. **Replacement**

   At intervals not to exceed 500 hours of operating time and at more frequent intervals if aircraft is used in soft or rough runway operations, remove and replace thru-bolts and U-bolts or inspect each part using magnetic particle inspection.

3. **Service and Parts Manuals**

   The Citabria, Decathlon and Scout Service and Parts Manuals should be corrected per Tables 1 and 2.

TABLE 1

LANDING GEAR ATTACHMENT PARTS

	Thru-Bolt					U-Bolt			
Models	Bolt	Head Washer	Nut Washer	Nut	Torque	U-Bolt	Washers	Nut	Torque
7ECA, 7GCAA, 7GCBC, 7KCAB 8KCAB	MS20007-32 (1 Req'd)	MS20002C7 (1 Req'd)	MS20002-7	ZEB1845-070 (1 Req'd)	650-700 in-lbs	1-9805 (1 Req'd)	MS20002-7	ZEB1845-070 (1 Req'd)	450-500 in-lbs
8GCBC	MS20007-28 (1 Req'd)	MS20002C7 (1 Req'd)	MS20002-7	ZEB1845-070 (1 Req'd)	650-700 in-lbs	1-10376 (1 Req'd)	MS20002-7	ZEB1845-070 (1 Req'd)	450-500 in-lbs

NOTES: 1. Number required is per one landing gear assembly.

2. Thru-bolts and U-bolts to be replaced or inspected using magnetic particle inspection every 500 hours, or at more frequent intervals if aircraft used in frequent soft or rough runway conditions.

(Continued on Page 28)

SUBJECT: Over-Rich Operation of Model 8KCAB Fuel Injector

AIRCRAFT AFFECTED: Model 8KCAB S/N's 313-77, 315-77, 317-77, 318-77, 321-77, 324-77, 326-77, 328-77, 329-77, 330-77, 331-77, 333-77, 334-77, 335-77, 339-77, 341-77, 343-77, 345-77, 347-77, 348-77, 350-77, 351-77, 356-77, 359-78, 360-78, 365-78, 368-78, 369-78, 370-78, 372-78, 373-78, 374-78, 377-78, 383-78, 398-78, 419-78 with Bendix Injectors P/N 2524742-2, 2524752-1 Modified per Bendix Service Bulletin RS-52

COMPLIANCE: At Owner's Discretion

INTRODUCTION

Fuel injectors, which have been modified per Bendix Service Bulletin No. RS-52, may exhibit over-rich operating characteristics due to an incorrect fuel flow setting. This over-rich condition may exist if the following symptoms occur at low altitude operations: (1) Loss of power and roughness at full throttle; (2) exhaust smoke; (3) excessive magneto drop. These characteristics are most apparent during hot weather operation. If these symptoms can be eliminated using the mixture control, the fuel injector fuel flow setting is too rich.

INSTRUCTIONS

Determine if your aircraft has over-rich operation symptoms per the above paragraph.

Only fuel injectors which have been modified per Bendix Service Bulletin No. RS-52 (identified by a blue dot or stripe on the brass body plug) are subject to this problem; the Bendix part numbers for these injectors are as follows: P/N 2524742-2, P/N 2524752-1. New manufacture injectors which are **not** subject to Bendix Service Bulletin No. RS-52 and are **not** subject to this Service Letter are identified by Bendix part numbers as follows: P/N 2524742-4, P/N 2524752-3.

The pilot should use the mixture control as required to obtain smooth engine operations to eliminate an over-rich operating condition. The injector fuel flow may be adjusted by a Bendix Service Station to the correct setting at the owner's discretion.

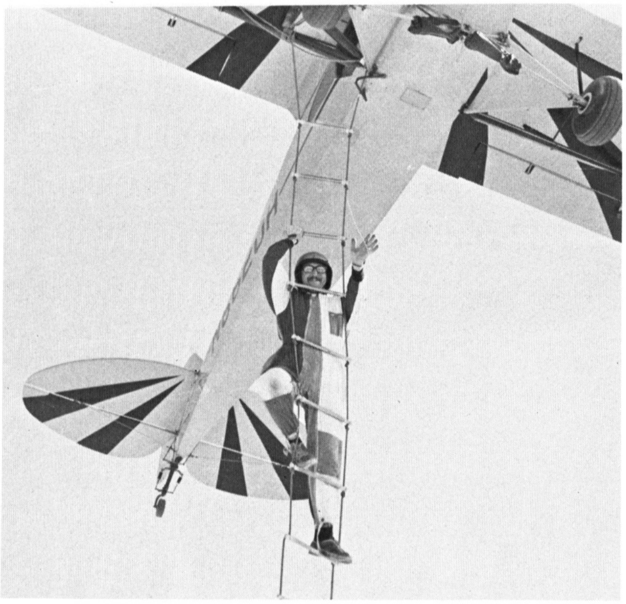
If you have questions concerning the applicability of your aircraft, contact the Bellanca Service Department.

THE CLIPPED WING CUB
an update

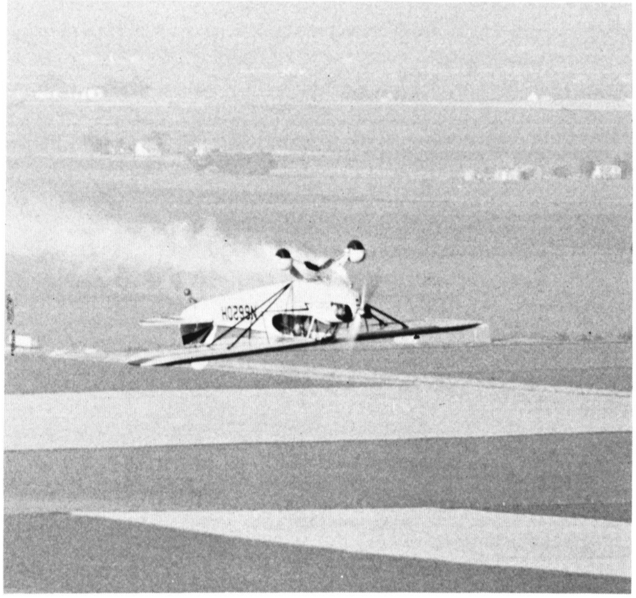
by
Giles Henderson

The previous articles in this series originally appeared in *SPORT AVIATION* several years ago. It should be obvious to the reader that the sport of competition aerobatics has advanced considerably in recent years. In today's world it is quite unrealistic to contemplate picking up the marbles in Intermediate category with an 85 hp Cub. (Indeed, it takes an exceptional pilot to earn an Intermediate smooth patch with this kind of equipment). However, the Sportsman category has continued to maintain a grass roots philosophy compatible with the low horsepower aircraft. Although the Cub is clearly handicapped in terms of performance, it has a unique nostalgic appeal along with some distinct advantages. A typical Sportsman sequence can be executed with relatively low entry speeds (around 120 mph for a Cub). Therefore a Cub pilot has the advantage of composing a presentation with time to think between maneuvers and to position maneuvers almost at will in the box. How many times have you seen a Cub penalized for violating the boundries (I didn't mean the bottom of the box). The Cub driver can afford to practice 3 hours for every one hour of a Decathlon or Pitts pilot. He also enjoys the two place configuration which enables his wife or girl friend to fly with him. If past years are any indication, his capital investment is better than any stocks or bonds I know of (make a graph of the value of a Cub vs. time and you will be envious). So much for Cub propaganda.

In this article I would like to add more recent information concerning useful modifications and performance. As indicated in the previous articles, the Standard Category clipped wing is rather severely restricted. The adaptation of larger engines, inverted fuel and oil systems, structural or control modifications invariably be-



Giles Henderson uses his Clipped Cub to pick up stuntman Wally Parks on a rope ladder. Parks and Henderson have been doing the car-to-plane transfer act at airshows for the past six years.



Henderson's Cub in its favorite attitude cruising over midwestern farm country on a summer afternoon.

come extremely difficult to implement with STC's. To obtain a competitive level of performance it becomes increasingly attractive to sacrifice the Standard Airworthiness for an Experimental-Exhibition, Special Airworthiness. However, the intent of this category is clearly intended to accommodate an aircraft used exclusively for competition/airshow aerobatics or air racing and typically places rather severe operating limitations on the aircraft (see FAR 21.101).

An aircraft licensed in this way would typically be subject to the following operating limitations:

1. The aircraft may not be operated for any other purpose than that stated on the special purpose airworthiness certificate.
2. No take offs, landings or flight may be conducted over cities or congested airways without prior authorization.
3. FAA controllers must be notified in advance of the experimental nature of the aircraft when operating in airport traffic areas.
4. Persons or cargo cannot be carried for compensation or hire.
5. No person may be carried in the aircraft unless that person is essential to the purpose of that flight.
6. The airworthiness certificate is valid for only one year and must be renewed by the FAA.

Thus a Cub licensed "Experimental" immediately loses much of the flexibility and privileges of its STC'd cousin. Many owners are indeed reluctant to make such a sacrifice for the sake of more extensive modifications. Moreover, the nature of the modifications frequently implemented on an Experimental aircraft are frequently just that, **experimental.** In my own limited experience, for example, I have found that the development of inverted systems are often an evolution of empirically optimized parameters and are at best "trial and error" experiments. With this in mind, the above limitations are certainly reasonable in so much that they are intended to "protect the innocent".

The smaller Continental engines are not natural candidates to bolt on a Bendix pressure carburetor (although it has been done). In the past few years there has been a reasonable success with slide injector carburetors such as a Lakes or Posa injectors. These little units are unbelievably simple, light weight and relatively inexpensive. However, they are usually temperamental and virtually every installation has its own unique problems to work out. One persons experience does not seem to be applicable in different installations, even with the same type aircraft and configuration. There are some general features which are probably worth discussing. These units seem to work best with a very low positive inlet fuel pressure (between 0.0 and 0.5 psi). However, they will operate over a range of several psi negative or positive inlet pressure with corresponding changes in engines performance. Since they have no float bowl and work mechanically equally well in up, down or side draft attitudes, they are a natural choice for aerobatics. They work best with provisions to maintain a positive inverted fuel supply (standpipe, flop tube, header tank, etc). Unregulated fuel pumps should be avoided. Since the effective inlet fuel pressure of a gravity system changes appreciably with G loads, the pilot will often notice a definite change in engine performance due to corresponding mixture changes during high negative or positive G loads. Again this characteristic seems quite variable from one case to another. My own Cub seems to like to quit about 2/3 of the way around an outside loop (the kind you start from the top, naturally). In my case the combination of negative G load and this particular inverted climbing attitude results in the extreme negative fuel pressure and lean mixture condition since I use only a simple standpipe in the fuel tank with no header tank.

Another feature that seems to be a common trait of all the slide injector carburetors is an approximate 15 to 25% increase in fuel consumption. This is probably due to lower efficiency in atomization and vaporization of the fuel compared to conventional carburetors.

The Lakes injector is more expensive than the Posa but has some advantages including machined vs. cast components, an external or remote mixture control and roller bearings on the slide which prevents excessive throttle slide friction at idle due to the low intake manifold pressure.

Everything considered, these units are cleary a compromise but probably everything we do to fly better upside down results in some sacrifice in rightside up performance. I have used a 32 mm Lakes injector on a Continental C-90 for approximately 700 hours and have had no difficulties with icing or other problems beyond those discussed above. I do find it necessary to replace the metering rod and nozzle after about 250 hours due to normal wear in these components.

A variety of inverted oil systems have been used on continental engines. Perhaps the best system has been the adaptation of the two-ball valve system so popular on Lycoming engines. This requires modifications of the rear crankcase cover assembly in order to incorporate the selector valve in series with the oil pump. The original oil pump suction tube port is plugged and a fitting is installed in the oil sump to accommodate the supply line running to the valve. There is room on the firewall above the magnetos to accommodate a four quart slobber pot for the crankcase breather line.

A pilot accustomed to flying a Citabria is overwhelmed with the control response of the Clipped Cub. On the other hand, some of my Pitts driving friends have unbuckled my Cub muttering things like "I don't see how in the H--- you do snap rolls in that thing with one hand". Although the Cub has a very respectable roll rate and light aileron pressures, I will be the first to admit the elevators are heavy, particularly at higher airspeeds. In its original 74 mph configuration, elevator pressures were well balanced with the other controls. In an aerobatic sequence the modified Cub is routinely operated at or near the original red-line airspeed resulting in a substantial increase in elevator control pressure. In some respects this is a desirable feature since it prevents a pilot from inadvertantly overstressing the plane. I have incorporated a servo boost tab on one elevator along with a conventional trim tab on the other. The servo makes a dramatic improvement in this department. However with this kind of a control boost, a pilot could overstress the airframe with "three fingers on the stick". The airplane has a very different feel about it and it takes some time to acclimate to the feedback characteristic of servo systems.

The J-3 has a notorius amount of parasitic drag, so much in fact that it's hard to even know where to start if you take a notion to do something about it. The obvious things might be a pressure cowl, removal of the bungee shock system and a new gear cabane constructed from streamlined tubing, smaller wheels and tires, wheel pants, fearings and cuffs around the strut attach points, gap covers around the gear legs and the root of the horizontal stabilizer (providing of course the aircraft now has rigid gear and a different trim system). These kind of modifications can easily increase the speed from 10 to 20 mph or more.

At this point it becomes critically important to say a word about the windshield. I have experienced a total failure of the original stock windshield support. Higher operating speeds undoubtedly contributed greatly to this problem. Two other Cub drivers I know have had identical experiences. One of these occurred within days after converting to streamlined stiff gear. The consensus was to install a suplimentary brace anchored from the wing spar cabane structure with a rubber cushioned support centered about 3/4 the height of the windshield. This brace prevents deformation of the windshield at high airspeeds and after two years of use appears to solve the problem.

It seems that the typical American solution to higher performance is to bolt on more horsepower. This brute force approach does indeed increase performance but with a substantial increase in capital investment and operating cost. Cubs have been powered with everything from 40 to 200 hp. After sitting a few minutes behind a big Lycoming, I'll admit that I'm envious of the thrust vector, of being able to just point the nose where you want to go and hang on. On the other hand spectacular performance is not the key to success in Sportsman competition and the smaller Continental powered Cubs have clearly established a respectable track record in this category. A comparison of the Cubs performance with these economy engines is given in Table I.

Aerobatic Champ, Giles Henderson and his Clipped Wing Cub.

MEASURED PERFORMANCE DATA

Aircraft	Stock J3	Lippert-Reed Clipped Wing		
Engine	A-65	A-65	C-85	C-90
Rate of Climb	560 (fpm)	470	610	685
Cruise Speed (75% power)	70 (mph)	75	85	89
Max. Speed	82 (mph)	86	98	104

Note: Above data measured with one pilot and 12 gals. of fuel.

The Clipped Cub is an economical aircraft to own and operate. It is a delightful all around sports aircraft with excellent shortfield and off airport TO&L capability. It has been a consistent winner in Sportsman level aerobatic competition and is well suited for airshow performance (comedy act, car-to-plane transfer, car top landing and an acro act that provides a nice contrast to the many high performance Pitts acts). With its low speed and short range (about 130 miles) it leaves something to be desired as a cross country aircraft. Believe me, you will be physically handicapped at a contest if you don't leave home at least a day in advance of your buddies. However, if I find myself over the Appalachians in marginal weather (that never happens, right) I would much rather be buckled up in my Cub than any other kind of airplane.

Clipped Cubs seem to be in reasonable supply. You can almost always find one in Trade-a-plane. The Lippert-Reed STC can now be obtained from Dick Wagner of Wag-Aero Inc. of Lyons, Wisconsin as well as materials and plans to build one from scratch. In my opinion, it makes more sense to look at these alternatives as opposed to cutting up an airworthy, stock J-3 (they are an endangered species). In conclusion, if you are considering a Clipped Cub it would probably be worth your while to go fly one first as anything I might tell you is bound to be somewhat distorted. They tell me that anyone who drives a Cub for 20 years is probably a little bit narrow minded, prejudiced even.

PITTS SERVICE DIFFICULTIES

The EAA Headquarters, the IAC Technical Safety Committee has received the FAA Service Difficulty computer printout of 2/15/79 on Pitts aircraft covering the last five years. A breakdown of this printout is as follows:

Model	Problem
S1	Crack at outside circumference of weld of hinge boss to left of control stick flange (201 hrs. T.T.).
S1	Engine quite on takeoff when fuel pump drive pin disintegrated. Fuel pump (TRW) on this installation is driven from vacuum pump drive pad. (138 hrs.)
——	After first landing shock cords (1280 HD) stretched beyond limits. Six other known failures.
S1A	Shock strut slotted internal section of telescoping strut cracked and finally separated allowing left main gear leg to collapse. (102 hrs.)
S1C	Brakes failed after landing and aircraft veered off runway and overturned. Master cylinders found devoid of fluid.
S1C	No left brake action due to being out of fluid.
S2S	During landing tailwheel started to lose chunks of rubber causing bracket holding tailwheel spring to break and aircraft ground looped. (20 hrs.)
S1C	Inspection found baggage compartment rear bulkhead had three 4" lightening holes which would possibly allow articles to get into flight controls.
S1C	Torque rolls and tailslide maneuvers apparently caused excessive loads to trailing edge of wing and trailing edge of four ribs on right wing and two ribs on left wing broken. (109 hrs.)
——	Rib stitching cord missing from top rib to bottom rib.
S1	Main spars of both lower wings cracked at fuselage attach fittings. Aircraft used in airshows. (1650 hrs.)
S1C	Piece of rubber found over the engine driven fuel pump inlet valve with a corner stuck between poppet and seat. (806 hrs.)
——	Throttle cable separated approximately two feet from handle during air show. Hard landing and minor damage resulted. (90 hrs.)

PITTS MLG

Several IAC M & D reports submitted by IAC concern Pitts main landing gear problems. A compilation of these reports follows:

1. "The hard rubber bumper located at the top of the Pitts landing gear separating the frame where the bungee cords wrap around has severed in one instance causing the elevators to jam.

   "This bumper is usually attached in the well by safety wire through the holes. With the constant sawing action from the gear this wire tends to cut through the rubber at the holes. When it separates it becomes a dangerous foreign object inside the fuselage.

   "The above incident occurred during aerobatic flight when the aircraft was inverted on a 45 degree descending line. Release of pressure caused the bumper to dislodge and it was discovered upon inspection after landing. Recommended solution: Drill the holes to a larger diameter to allow the use of welding rod. This will not cause the same sawing action as with safety wire and prolong the life of the bumper. Also, a good rubber cement is helpful in keeping the bumper in place. Time-scheduled changes of the shock cords will help to inspect these bumpers which are not visible with the cords in place. (See Figure #1)
2. "I lost the 30-9 brake on this 78B wheel you see here. The forward sleeve on the hanger separated throwing the brake up into the fairing where I found it minus its two pins and hanger lugs. Exactly why this happened I'm still not sure. This separation was not the result of hitting something."
3. "The aircraft is a homebuilt and is the 2nd S-1 which I have purchased from the builder. When the aircraft was first completed, the gear was found to sag and the 1380 shock cords were replaced with 1374's (13/16" x 7.5") made on special order. These shorter cords held the gear securely in place.

   "The builder reported the handling on the last half of the landing run, to be much trickier than on the previous aircraft, and it continued to be very tricky to handle on landing. On 3 occasions it ground looped to the left without serious damage. After approximately 75 hours, on landing the aircraft turned violently to the left at about 50 mph, and ran into a ditch, damaging the MLG, right lower wing tip, and breaking the Hoffman wooden prop. The cause was suspected to be brake failure in a strong crosswind, as the brakes had just been serviced (poorly). The gear was replaced with factory gear and the other damage was repaired. The right master cylinder top link was found to have broken in the desperate attempt to stop the veering action. On the next flight the aircraft again turned violently to the left on landing, struck a ditch, and flipped over. A crack was found in the gear weld and it was erroneously assumed that this had permitted one wheel to toe out. The damage was repaired and after some further checking with no certain cause determined, the aircraft was flown again. The aircraft repeated its tendency to ground loop to the left, with damage resulting to the gear, wing tip, and prop.

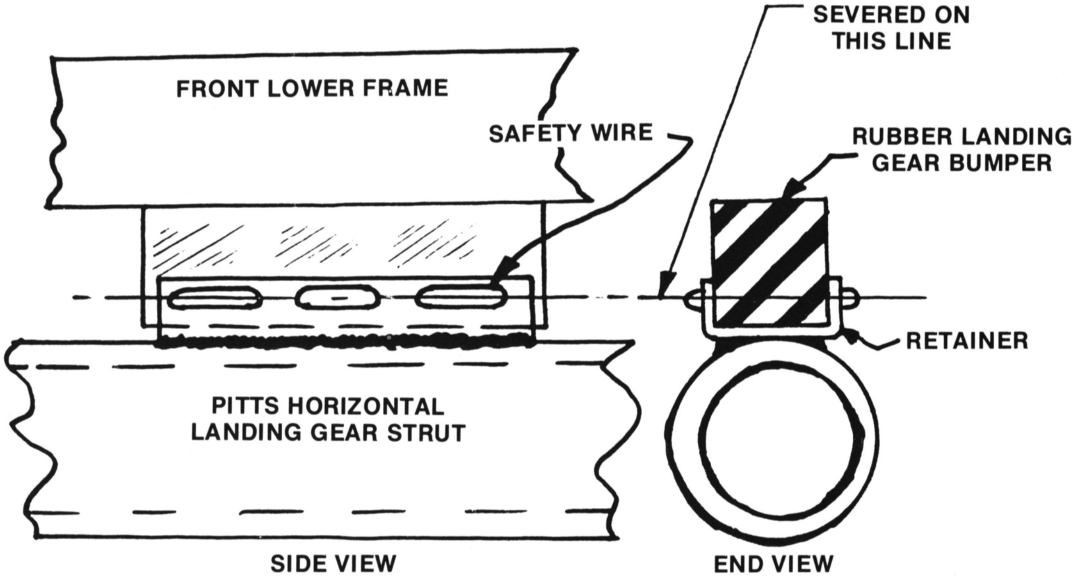
   "The article on tailwheels then appeared in *Sport Aerobatics* and the tailwheel was examined and found to be free-swiveling. It was sent to Maule for repairs where it was reported to be O.K. except for a 'little slack in the steering arm.' After the first two serious accidents the shock cords were replaced with 1380's which appeared to be a good snug fit. After the third accident it was noted that the gear was sagging and the wheels were toed out considerably. This was noticed after the aircraft had been pushed for approximately 1000 feet. Also, the rubber bumper blocks had a space approximately 3/4" between them and the fuselage cross member. The tires were actually 1" further apart at the front than at the rear! When the aircraft was lifted by the engine lift point this toe out diminished to 5/8" and the bumper blocks seated.

   "It was concluded that the gear attach points were improperly aligned although the builder stated this would be impossible due to the method of construction. It was decided to change to spring-type gear. Herb Anderson suggested this would not be necessary and suggested that the axles be aligned by heating the cluster at the bottom of the gear and straightening the axles by inserting a rod in them for correcting the misalignment. The 1374 shock cords were installed after the gear was straightened. There have been three successful landings, since, with no tendency to ground loop.

"My conclusion is that the accidents were caused by the excessive toe-out (hidden by the fairings) with the defective tailwheel being a contributing factor."

A very large IAC "thank you" to the members who contributed the above information. We will mention again that anonymity is the policy of the IAC T.S. Program and thus the names of individual IAC members do not appear in IAC T.S. articles. However, we should all appreciate that these contributing members are the essence of the technical safety aspect of our sport and that they are the ones helping keep sport flying safe and enjoyable. Thanks again.

FIGURE 1



PITTS HORIZONTAL STABILIZER SUPPORT TUBE

On the weekend of June 9-10 two experimental Pitts S-1 a/c suffered in-flight stabilizer failures. Both failures occurred just outboard of the horizontal stabilizer support tube (carry-thru tube) bushing. This tube is a 3/4" x .049" member approximately 16" long located horizontally across the two upper longerons. The support tube has two 3/8" x .058" bushings through which it is attached to the fuselage and the outer ends of the tube form the attachment point for the horizontal stabilizer leading edge. (See Figure 1)

The two above-noted incidents constitute the fourth and fifth known failures of Pitts S-1's at this location. It is recommended that all S-1 a/c be inspected in this area by removing the horizontal stabilizer and checking the stabilizer support tube with dye penetrant. In view of the good service record of Pitts a/c and the amount of flight time accrued by these planes, it is thought that if **no** cracks are found, the planes should be considered airworthy for at least some yet-to-be-determined number of hours. Naturally any a/c found to have cracks in the stabilizer support tube should be considered unairworthy and a report made to the IAC Technical Safety Committee and to Herb Andersen of Pitts Aerobatics. Pitts Aerobatics has notified the FAA of this problem and is presently writing a service letter regarding the stabilizer support tube. A copy of this service letter will be published in *Sport Aerobatics* as soon as it is available.

Once again, IAC members owe Herb Andersen of Pitts Aerobatics a very large thank you for the above information . . . and for his concern for sport aerobatics.

Fred L. Cailey
Technical Safety Comm.

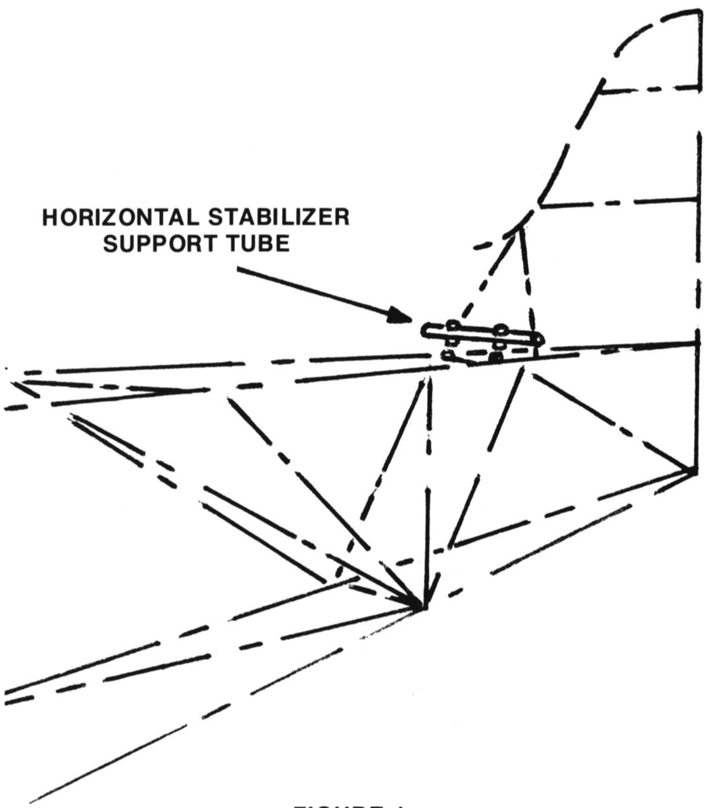


FIGURE 1

PITTS PARADE

Recent Technical Safety input has concerned itself with several problems occurring on Pitts S-1 aircraft and its outlined in this article. However, when reviewing the following information, IAC members should obviously relate these problems and recommended fixes not only to Pitts S-1's, but to **all** aerobatic aircraft of similar construction and/or using similar components.

One of the IAC Technical Safety Program's most ardent supporters has once again come through with some pertinent aerobatic safety information and he states the following:

"Subject: Expander type gas tank caps on aerobatic aircraft.

"If you have to abort your flight during a contest because gas is leaking from your gas cap you will not be allowed to refly the sequence as this is considered poor preflighting.

"This can be eliminated by following a few simple rules when installing the expander cap after refueling. The mechanism inside the rubber seal tends to wear along with the resiliency of the rubber deteriorating, therefore, one must periodically reset the tension by turning the locking lever whilst holding the cap.

"There is a drilled hole on the flange, presumably for safetying, however, this hole can be used to set the alignment by noting the o'clock position of the hole in relation to the centerline of the aircraft. This hole will gradually move around anticlockwise as the cap "seats" and still provide an adequate seal. If you leave the hole in the same o'clock position eventually it will surprise you and leak on a push out. It is just a matter of becoming more familiar with your equipment.

"In addition to 'blowing it' at a contest leaking gas is always a fire hazard under any condition especially when inverted and pushing out."

Another IAC Technical Safety Program "committee-person" (remember, **ALL** IAC members are members of the IAC T.S. Committee) submitted the following Pitts tips.

"Tailwheel steering spring clips: Pitts Aerotek has recently been furnishing a heavier wire diameter clip. I personally change the clips every 100 hrs. and the steering springs at 200 hrs. The forward tailspring attach bolt and the tailwheel assembly to tailspring bolt require frequent retorqueing on my airplane (50 hrs.?). The tailwheel (Maule) on my airplane started unlocking with just a slight side load. I replaced the lock pin #13 on the Maule diagram and the spring #14. The original lock pin was only slightly worn and appears to have been improperly made. On all current production Maule tailwheels I have seen, the #12 locking pin retaining plate is held on with three 4-40 machine screws with elastic nuts. (These used to be PK screws). August 1978 *Sport Aerobatics* mentions broken aft tailspring attach fittings on the S2A and the gusset plate fix. The S1S factory fuselage which is in my shop also has the gusset plate. (See Figure #1.)

"S1S lower fuselage diagonal: On my airplane I can reach back in flight and grasp the diagonal with my right hand. I was shocked at the vibration in this tube. I have a balanced engine which runs very smooth. The vibration in this tube is worse in the 2500 rpm range and starts to decrease at about 2650. I have always flown my x-country above 2650 and I think this has prevented the tube from breaking. As a fix I installed a rubber block between the tube and the plywood stringer bulkhead and tie-wrapped the tube and spacer block to the bulkhead.

"At about 270 hours total time my gas tank cracked. The tank was made by Acraline and is similar to the factory Pitts tank. The crack was in the right upper portion of the front bulkhead, and about 1" long. The aluminum was slightly creased indicating considerable flexing. One fix for this is a foam spacer block between the tank and firewall.

"Aileron bellcrank main bearing bolts — loose on first 100 hour inspection.

"Aileron pushrod bearing lock nuts — loose on 100 hr.

"Engine mount to fuselage bolts — **one** bolt loose on 100 hr.

"Fuel tank flop tube wears bottom of fuel tank. Fix: install 0 ring on flop tube weight.

"I have found small nicks in my lower tailwires on several occasions. I have dressed these out each time and plan to replace the lower wires for next season. I am installing two brace struts on the airplane I am currently building.

"P.S. I'm sure you know about the high failure rate on S-1 prop spinners. I polish out all tool marks in the blade cutout. I have never had a cracked spinner even though time does not track straight."

An IAC "super thanks" is due the two members who contributed the above info. It is only through the concern and dedication of individual IAC members, like the above two noted persons, that the IAC T.S. Program functions — and provides the safety-related information that benefits all IAC members. AGAIN, THANKS.

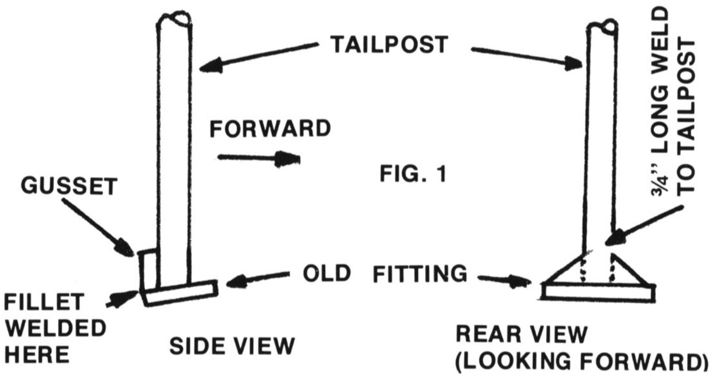
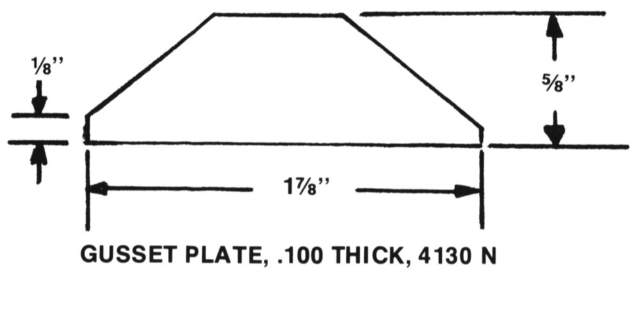


FIG. 1



GUSSET PLATE, .100 THICK, 4130 N

PITTS SMOKE OIL SYSTEM

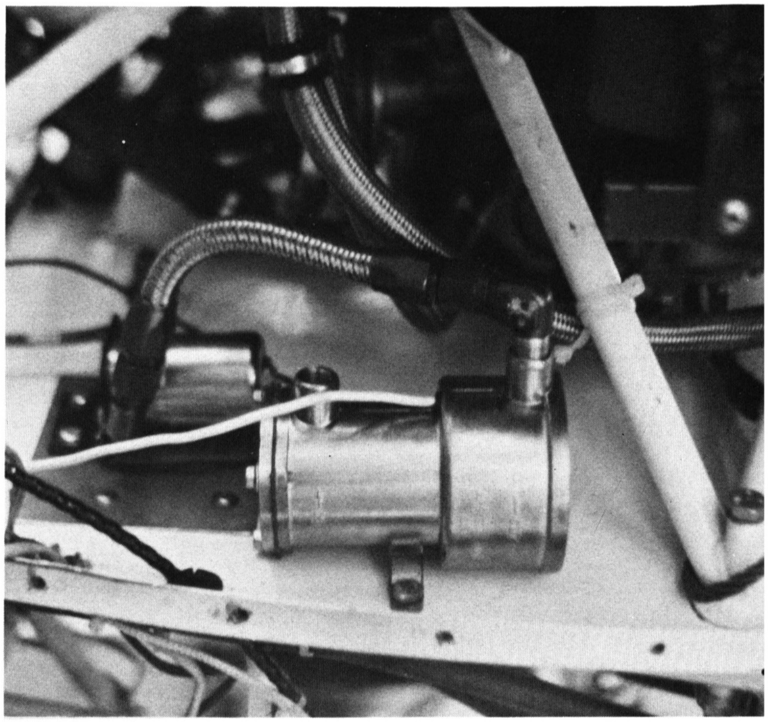
Courtesy of
Ben Owen

The basic system uses the Pitts smoke oil tank with the internal flop tube on the Pitts plans.

There is an electric pump and electrically actuated solenoid valve mounted on the front of the firewall. The solenoid valve is needed as the tank is higher than the pump off. These are hooked up in parallel to a switch mounted at the pilot's throttle quadrant position, both are 12 volt actuated. The pump and solenoid operated valve are connected with aircraft braided hose using aircraft fittings with ¼" pipe thread. The solenoid is mounted downstream of the pump or between the pump and the exhaust nipple.

At the exhaust stack an AN flared tube fitting is screwed into a nut which is welded to the stack. This nut is a cut off AN 817 or similar. The flared tube fitting has to be removable from the stack. It is necessary to adjust the size of the opening in the end of the flared tube fitting by brazing it over and drilling it out in progressive stages until the proper smoke output is reached. This should be at about ⅛" but depends upon the engine, the location of the output fitting in the exhaust stack, etc. The output nut in the exhaust stack is about half way from the engine to the end of the tube.

The pump, solenoid valve and electric switch are available through auto supply houses. The tubing, flared ends and braided hose are aircraft quality items.



PUMP USED:	SOLENOID VALVE USED:	SWITCH USED:
Stewart Warner Cass City, Mich.	Skinner Electric Valve Co.	Any of Suitable 12 Volt type
12 Volt-8205C (D.C.) 7 psi (low pressure) Has a built in filter on the bottom.	12 Volt D.C., 10 Watts V52DA2008	

NOTE: Prior to developing the above system, a Thompson TF-1900 pump was used, mounted on the engine. Due to lack of adequate lubrication this pump frequently failed. Also the high pressure lines ran into the cockpit where the switch was. On one occasion failure of the line caused the pump to fill the cockpit with oil spray, making it hard for the pilot to see. The electric system above avoids these problems.

SEAT BELT ADDENDUM

While on the subject of seat belts, IAC members may want to review the following seat belt tune-up tips that have been mentioned in previous IAC Technical Safety articles.

1. The use of dual seat belts (with separate attach points) does not only make good sense but is an entrance requirement for IAC-sanctioned contests. (See pages 13 and 46 of current rule book.)
2. When installing belts that have a buckle end and lock end arrangement, consideration should be given as to which side of the aircraft to mount the buckle/release end of the belt. For example, if one is flying an a/c with a control stick (as opposed to a wheel) and using your right hand on the stick, you would want to mount the buckle/release end of the seat belt on the left side to reduce the possibility of inadvertently opening the belt locking mechanism in flight by bumping it with your forearm or elbow or catching it on a shirt or jacket sleeve.
3. Color coding your seat belts, i.e., using belts of differnt colors, may help to eliminate confusion in an emergency situation. The same thinking might also be applied to the color of your parachute harness. Perhaps it would be good thinking to have each of your seat belts and your parachute harness all different colors. If a person is really scramblin', you need all the help you can get.
4. Secure the loose ends of the seat belts (and parachute harness) with rubberbands, elastic bands, or tape. Again, this relates to a possible emergency situation — and at that time you don't want to have to dig under loose belt ends to find the belt release mechanism.
5. Most acro pilots probably believe the old axiom that "practice makes perfect". Now when your flight is over and you are going to "unbuckle" and get out of your plane, how do you unfasten your belts and parachute harness? If you start at the top and work toward the bottom indiscriminately releasing buckles, you may be practicing the wrong sequence for leaving the plane in an emergency, e.g., unbuckling part of the parachute harness before releasing the seat belts. Think about it — how would you get out of your plane if an in-flight problem occurred that required immediate departure? Once you have your emergency departure plan thought out, each time you climb out of your plane after a flight, you can go through your emergency drill — which includes unbuckling your seat belts in a proper/logical sequence. In a high stress situation, a well-thought out and well-practiced procedure could pay very large dividends.

Product: Christen 820 Seat Belt/Harness System
Effectivity: All systems delivered prior to May 10, 1979.
Subject: Inspection and possible modification of main seat belt buckle. CRITICAL TO FLIGHT SAFETY: THE INSTRUCTIONS IN THIS SERVICE BULLETIN MUST BE ACCOMPLISHED PRIOR TO NEXT FLIGHT.

1. EXPLANATION:

A report was received recently which explained that a pilot had experienced difficulty in unlatching the main seat belt buckle of his Christen 820 Seat Belt/Harness System when attempting to bail out of an aircraft which had entered a flat inverted spin from which he was not able to recover. The pilot was finally able to release the buckle, but considerable effort and force were required.

Examination of the buckle assembly revealed that the inboard edge of the latch lever portion of the buckle had been formed incompletely in manufacture. This condition caused the inboard edge of the latch lever to contact the edge of the nearest shoulder harness connector whenever there was a substantial load on the shoulder harness as would be encountered in inverted flight or during sever negative-g conditions.

This possible adverse condition of the buckle assembly is illustrated in Sketch 90101. If the buckle latch lever is shaped so that its curved inboard edge extends beyond the edges of the buckle base, it is possible for the shoulder harness connector adjacent to the buckle to move under the inboard edge of the latch lever.

During upright (positive-g) conditions, the shoulder harness is adjusted so that relatively little force is exerted on the harness connector; even if the harness connector is under the inboard edge of the buckle latch lever and the lever is raised, the edge easily pushes the harness connector over, and the buckle will unlatch.

During inverted (negative-g) conditions, relatively high force is applied to the shoulder harness, and the harness and the harness connectors are forced outboard; if the harness connector is under the inboard edge of the buckle latch lever, considerable force may be required to unlatch the buckle because of the possible interference between the harness connector and the inboard edge of the buckle latch lever.

The manufacturer of the buckle hardware has been notified of the existence of incorrectly formed buckle parts, and all Christen inventory of buckles has been reinspected and modified where required. Appropriate action will be taken to prevent recurrence of the problem in the future.

If present, the improper latch lever condition can be corrected on seat belts in the field by bending the inboard edge of the latch lever back enough to eliminate any possibility of interference with the shoulder harness connectors.

2. MATERIALS REQUIRED: None.
3. ACTION REQUIRED:

a. Carefully inspect the main belt buckle. As seen from the side, the inboard edge of the latch lever should be approximately flush with the curved outline of the buckle base, as shown in the enlarged detail in Sketch 90102.
b. If the inboard edge of the latch lever is within the base outline no further action is required.
c. If the inboard edge of the latch lever extends beyond to the base outline, carefully bend the edge back so that it will be within the base outline: Place the buckle assembly between the jaws of a vise with the inboard and outboard edges of the latch lever contacting the vise jaws at points which form a line perpendicular to the faces of the vise jaws. Carefully tighten the vise to form the inboard edge of the latch lever into the proper position as shown in Sketch 90102. Use the vise at several positions along the width of the latch lever to form the inboard edge uniformly over its entire width. The forming operation can also be performed by setting the outboard edge of the latch lever on a firm support and tapping along the in-

board edge with a hammer as shown in Sketch 90103.

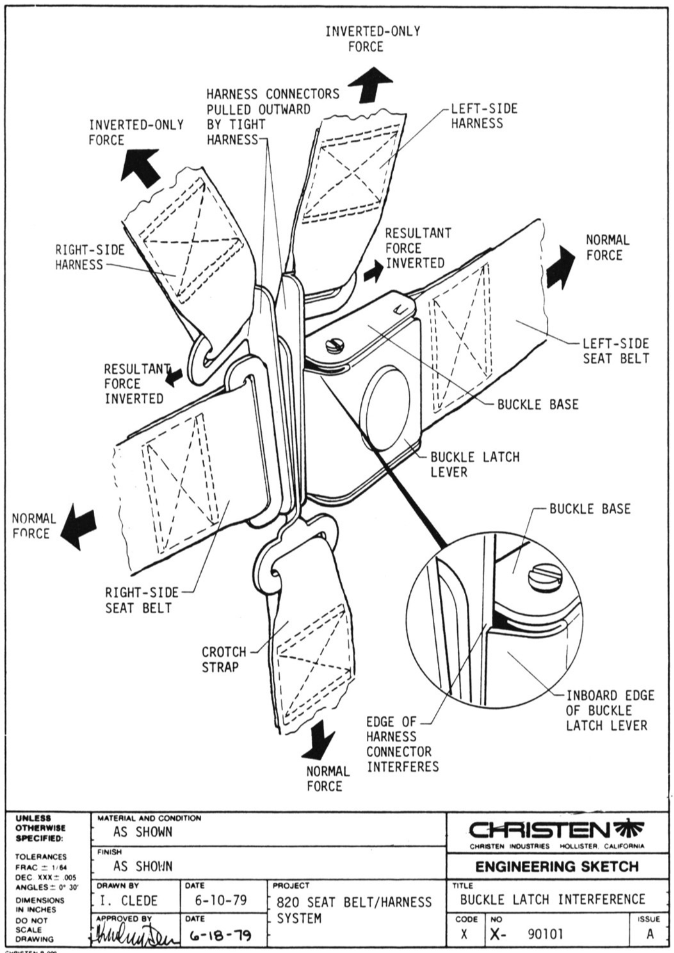
d. After forming, test for ease of unlatching by threading the harness connector onto the main belt connector and latching the buckle. Push the harness connector firmly against the buckle and slowly raise the buckle latch lever. Verify that there is no possibility of interference between the forward edge of the latch lever and the edge of the harness connector.

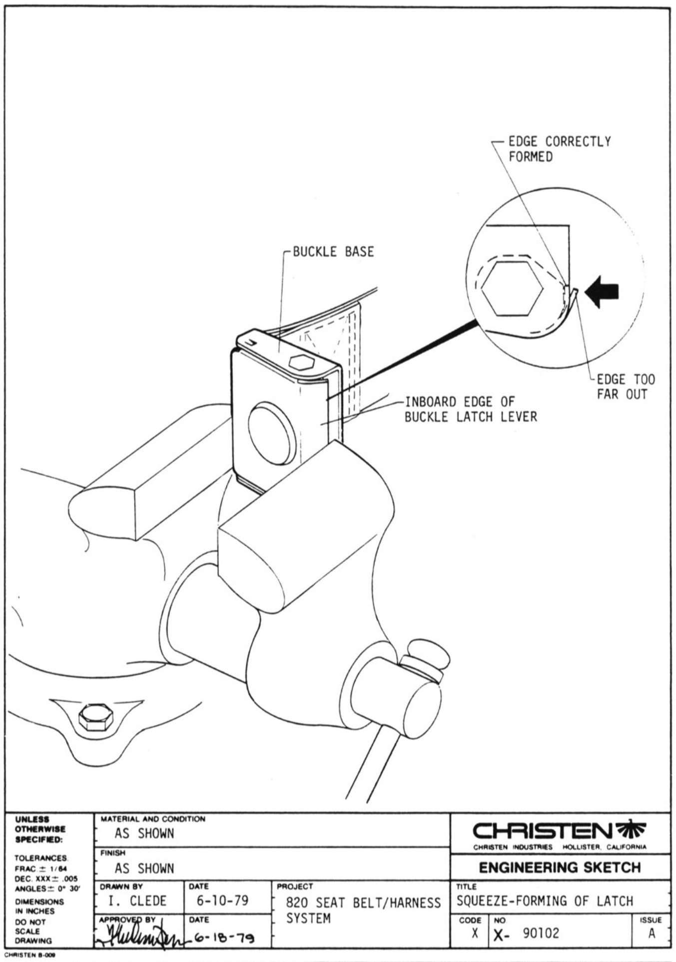
CAUTION

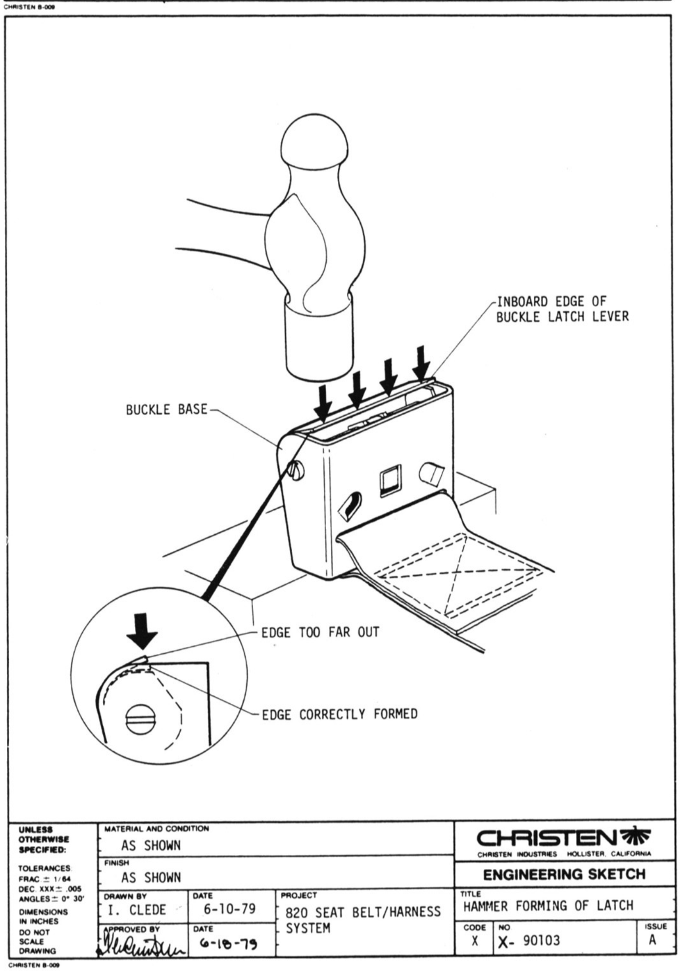
In aircraft equipped with more than one Christen 820 Seat Belt System, be sure to inspect and modify all buckles, as required.

NOTE

Purchasers of the Christen 820 Seat Belt/Harness System who no longer have the System in their possession are requested to forward this Service Bulletin to the new System owner and to notify the Christen factory immediately of the change of ownership.







FORMERS, NAILS & STACKS

Several IAC members have recently made reports to the IAC Technical Safety Committee regarding problems which should be of interest and concern to all Citabria and Decathlon owners and operators.

One IAC member advised that during the preflight inspection of a 1977 180 hp Super Decathlon, total time of 300 hours, a rubbing noise was heard when the elevator moved up and down. Further investigation revealed that one of the two aluminum belly formers had broken loose and worked its way to the tailcone of the aircraft where it was interfering with the elevator control horn. (See Figure 1) This former is held in place by two rivets, one at each end, and both rivets had pulled through the material. A check of the second belly former revealed that one end of that former had also failed. The IAC'er who made the repairs advised that in addition to making suitable repairs to the ends of the formers so they could be reinstalled as originally done by the factory, the formers were also "rib stitched" in place.

***** ***** *****

Two IAC members reported loose and missing Citabria and Decathlon rib to front spar attachment nails. One gentleman advised of three Decathlons in which missing and loose rib to front spar attach nails were discovered. On one of the a/c the fabric was removed from both wing panels, new holes made in the ribs, new rib to spar attach nails installed, and the wings recovered.

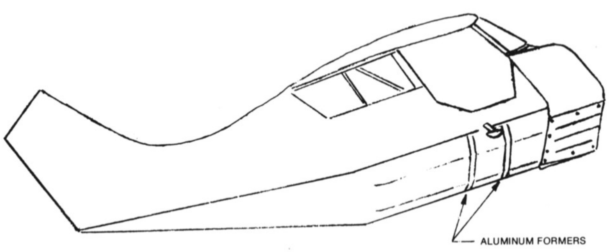


FIGURE 1

On another one of the a/c, additional inspection holes were cut in the bottom wing surface and new nails installed working through the inspection holes. On all three Decathlons epoxy was used to help hold the nails in the holes, with an extra "dab" of epoxy placed over the head of each nail. The IAC'er making this report commented that he preferred the second noted method of repair, i.e., cutting extra inspection holes, for this gave access for future inspections of the front spar/rib attach points. Note that no nails were discovered loose or missing at the rib to **rear** spar attach points.

The second IAC member who reported on the wing rib to front spar nail problem sent in detailed sketches showing exactly which nails were missing and which nails were loose on his 7ECA Citabria (approximately 330 hours total time). (See Figures 2 and 3) This gentleman advised he cut five additional inspection holes in the lower surface of each wing to facilitate repairs. He reinstalled nails in the original holes and used epoxy to help retain the nails the same as described in the preceding paragraph. He advised he used an automatic center punch with the head ground flat to drive the nails into the front spar. He also noted that the nails were **not** aircraft nails but common 16 gauge wire nails, and further stated that approximately 10 hours of flight time have been accrued since the repairs and none of the nails appear to be loosening or backing out. Again, no loose or missing nails were found at the wing rib to rear spar attach points.

The IAC Technical Safety Committee contacted the Bellanca factory concerning the wing nail problem and was advised by Chief Engineer Andy Vano that Bellanca is aware of the problem and they are presently trying to determine the exact cause of the nails backing out of the front spar. Andy said they have a Decathlon wing panel which they are testing by subjecting it to a flexing/twisting cycle at various load limits. For the present time Bellanca is recommending that any missing or loose nails be reinstalled in the original holes using epoxy to secure the nail in the hole and a small amount of epoxy over the head of the nail. Andy further stated that it seems that the nails first start loosening at the ribs adjacent to the front strut to front spar attach point and then proceed to loosen both inboard and outboard of that point. (Note this information correlates with Figures 2 and 3.) It was also mentioned that Bellanca had received no field reports of loose nails at the rear spar to wing ribs attachment points.

We recommend that all IAC Citabria and Decathlon pilots immediately check their a/c for loose and/or missing rib to spar attach nails as detailed above and if any discrepancies are found make a report to the IAC Technical Safety Committee and Bellanca Airport Corporation.

***** ***** *****

Another IAC member reported a broken right rear exhaust riser (pipe) on his 180 hp Super Decathlon (approximately 20 hours TT). He advised that the exhaust pipe in question broke right at the flange and also noted that there was evidence of contact of the exhaust pipe and lower cowling where the exhaust pipe exits the engine compartment. This aircraft is equipped with the late design engine mount and engine mount bushings.

In checking around, the hangar grapevine has it that two or three other Decathlons have also experienced breakage of the right rear exhaust riser (pipe). The "vine" further says the breakage at the rear pipe was caused by the front risers (pipes) being loose allowing the whole exhaust system to twist rearwards.

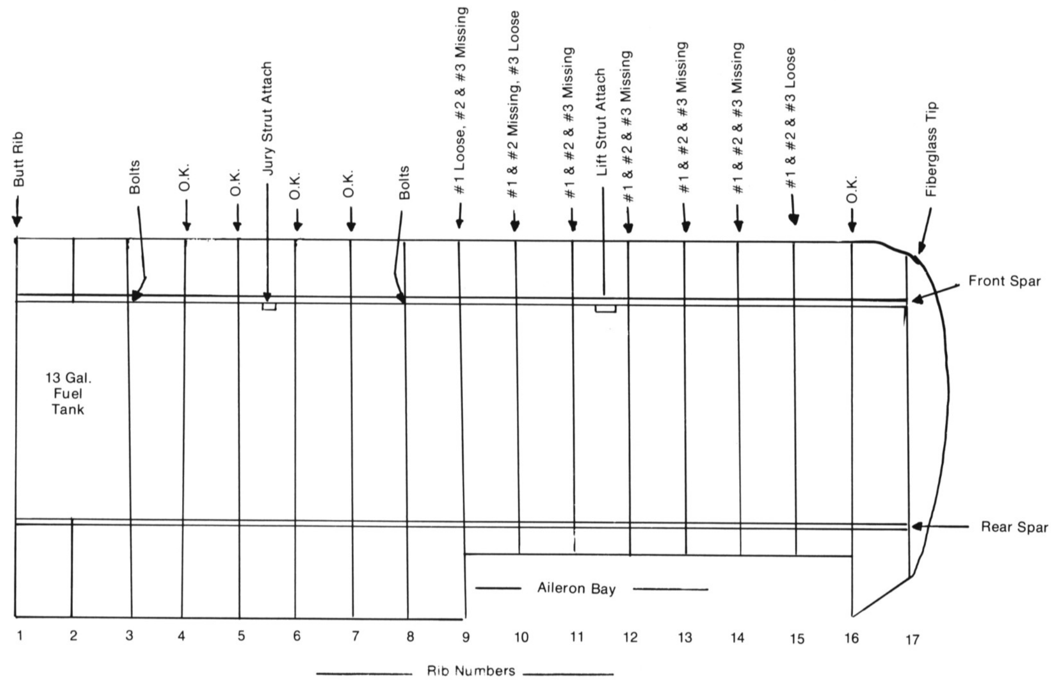
***** ***** *****

The above three noted problem areas should bear close scrutiny by all IAC Citabria and Decathlon pilots. IAC thanks to the IAC'ers who made the above reports and again to Andy Vano of Bellanca Airport. Such information helps keep our sport safe and enjoyable. Thanks.

RIGHT WING
- 16 Nails Missing
- 5 Nails Loose

FIGURE 2

*Rib Spacing Shown Equidistant For Ease Of Drawing



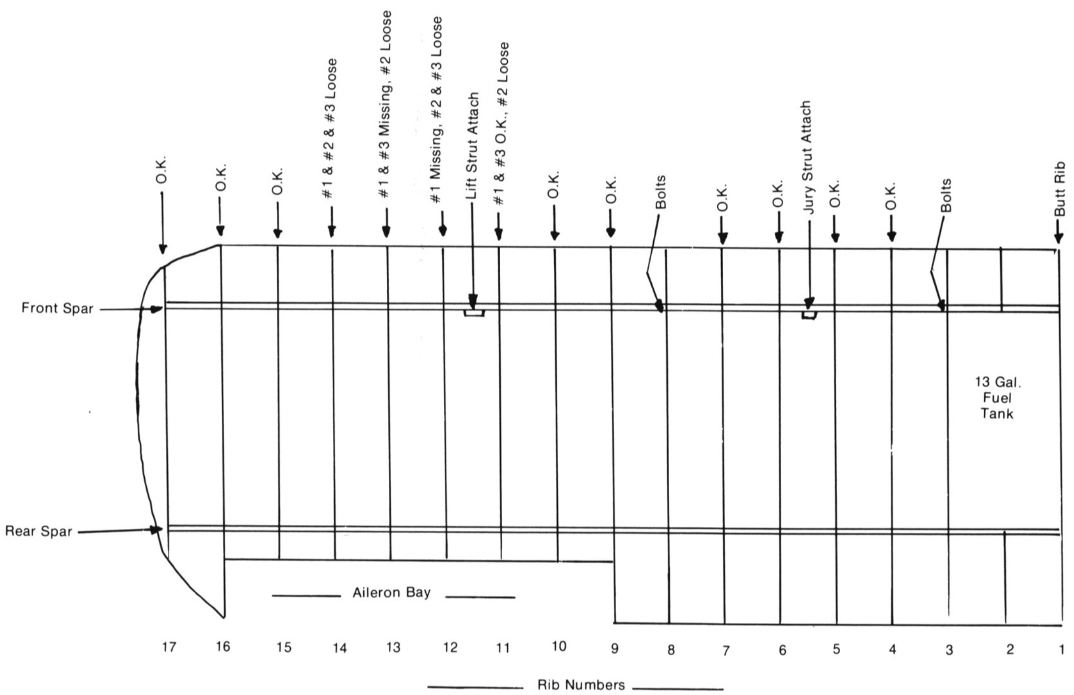
*No Missing Nails Recovered
*All Rib To Rear Spar Attachment Nails O.K.

Rib To Spar Attachment Nail Position Numbering Code

FIGURE 3

*Rib Spacing Shown Equidistant For Ease Of Drawing

LEFT WING
- 3 Nails Missing
- 7 Nails Loose



Rib To Spar Attachment Nail Position Numbering Code

*No Missing Nails Recovered
*All Rib To Rear Spar Attachment Nails O.K.

HARDWARE

An IAC member recently submitted the following Technical Safety report concerning the engine mount nuts on his Pitts S-1.

"After landing from an Unlimited practice session I noticed a small bump on the nose cowl evidently made from within. This was an unusual condition as the only object near the bump was the corner of the forward baffle plate, but there it was. The only way this could have occurred was for the whole engine to have moved about 1½ inches. This was a worrisome thought. Sure enough, upon inspection of the engine mounts it was discovered that the top right nut had completely backed off — I mean backed off — it wasn't there.

"When this Pitts was purchased the former owner had a mechanic install new engine mount pucks and it was noted at this time that fiber lock nuts were used. I remember the old rule about not using this type of nut near a heated area. As a stopgap measure I painted a slippage line across the nut and bolt to insure there was no movement and checked this lines periodically; however, when the nut decided to slip it must have backed off all the way in a short length of time.

"The engine had accumulated approximately 500 hours of Unlimited aerobatic flying since the fiber lock nuts were installed. These have since been replaced with STEEL lock nuts with no apparent problems. I have noticed some intake and exhaust systems secured with fiber lock nuts which are subject to more heat than the fiber was designed for. It seems that when the fiber is subjected to extreme heat it will deteriorate quickly and back off before even preventative maintenance can catch it."

Just as a note to substantiate the above-noted use of fiber lock nuts on exhaust systems, IAC members should be aware that at Oshkosh last year a Warbird, being flown by an IAC member, had a minor fire on take-off (take-off aborted) with resultant minor damage to the aircraft and, fortunately, no injuries. The bottom line was that fiber lock nuts had been used on the exhaust system, the elastic locking material had melted, and the nuts "backed off" resulting in an exhaust leak and fire.

On the subject of aircraft hardware, two recent articles in the EAA Designee Newsletter bear repeating.

EAA Designee Newsletter, May 1979:

"Defective Bolts Cause A Fatality When Prop Flies Off Aircraft

by Ben Owen, Aviation Safety, EAA Headquarters

"On July 8, 1978 an EAA member pilot was killed when the propeller came off his WAR FW 190 in flight.

"The bolts were six ⅜" AN bolts which parted clean and smooth. A search of the area by Boy Scouts found the prop with the heads intact. The propeller assembly consisted of the front propeller plate, which protects the wood propeller, and the ¾" aluminum prop extension. Bushings had been pressed into the front of the prop extension; these were not recovered. The propeller assembly was not the cause of the accident.

"The six AN ⅜" diameter bolts were taken to Santa Ana for magnafluxing. The test results indicated that the six bolts were defective; the bolts were manufactured by Rockford.

"Some of the homebuilders in the Southern California area discussed bolts with local AN bolt dealers. Some of the comments are recorded here for the guidance of other homebuilders.

"1.) Some manufacturers no longer make their AN bolt products to the strength and quality standards shown on AN charts, although they sell them as AN products and charge accordingly.

"2.) One dealer who supplies AN hardware to the local general airplane manufacturers said he had discontinued the bolts of one manufacturer because of continous defective parts.

"3.) It was reported that another manufacturer had relaxed the inspection and testing of their products to a spot check of about 1 in 600.

"4.) Some dealers had obtained bolts of unknown origin and quality, and are offering them to customers as original stock.

"We conclude that AN bolts do not enjoy the quality or reputation of a few years past, and that if a quality bolt is desired, there is greater assurance that it can be had in the NAS bolt family.

"Each builder should conduct his own tests and be certain that satisfactory parts are installed in critical locations. This means magnafluxing each bolt used in a critical area, at the very least."

EAA Designee Newsletter, August 1979

"Defective AN Bolts

"A reply has been received from the FAA in response to EAA's letter advising of defective AN bolts. As their reply contains an important message for all EAAers, it is reprinted in its entirety below. At present, there is no longer any verification of the manufacturing standard of AN bolts. It is quite likely the FAA will place such bolts used in aircraft construction under FAA Parts Manufacturing Approval (PMA) before long.

"Dear Mr. Strombom:

"Mr. Bond has asked me to reply to your letter dated May 29 in which you expressed a deep concern with defective bolts and a degradation in the quality level of bolts in use by civil aviation.

"Regarding the DC-10 crash and media reports attributing a severed bolt as a possible contributing factor, the National Transportation Safety Board is investigating to discover the probable cause, and no determination has been made at this time.

"Holders of production approvals granted by the Federal Aviation Administration (FAA) must have inspection and/or quality control procedures in operation that will provide for the necessary tests and inspections to be conducted to ensure that all materials and parts to be used in a civil aircraft or related products conform to the specifications in the FAA approved design. The FAA approves/monitors these procedures as part of our normal surveillance activity.

"Replacement or modification nuts and bolts are classified as 'standard parts' and as such are not subject to approval and/or surveillance by the FAA under the provisions of Federal Aviation Regulation (FAR) 21.303(b)(4). As specified by the referenced FAR, 'standard parts' should be produced to established industry or U.S. specifications. In these instances, it is the responsibility of the aircraft owner/operator to ensure that the parts or materials are eligible for installation on FAA certified aircraft.

Advisory Circular 20-62C titled, 'Eligibility, Quality, and Identification of Approved Aeronautical Replacement Parts' (copy enclosed) provides guidance on this subject.

"Most 'standard part' problems originate when materials and parts are purchased on the basis of price alone and not the identity or integrity of the supplier. Presently, there are distributors who buy up over-runs, surplus parts, floor sweeps, or scrap parts and offer these for sale. These distributors have no way for establishing the origin or history of the parts, and unfortunately, the buyer gets what he pays for.

"In the case of the amateur-built aircraft, it is the amateur builder's responsibility to use acceptable workmanship methods, practices and techniques including the utilization of aircraft quality materials and parts when building an amateur-built aircraft. To this end, the Experimental Aircraft Association could be most helpful in emphasizing this point during its many meetings with amateur builders and in its publications. We believe this would be most beneficial for all parties concerned in the interest of safety.

"Our Flight Standards Manufacturing Branch has plans for conducting a study of the problems associated with the manufacturer and distribution of 'standard parts.' However, it is not anticipated that this can be accomplished in the near future due to other higher priority tasks which are also safety related.

"Your interest in aviation safety is appreciated, and we trust the foregoing information is responsive to your query.

Sincerely,
James M. Vines
Acting Director/FSS
DOT/FAA
Washington, DC 20591"

From the foregoing it is evident that we must not only choose the correct hardware for the job at hand but must also give close scrutiny to that hardware. IAC thanks to the member who submitted the above first-mentioned report and brought this subject to the fore.

Fred L. Cailey
Chairman
Technical Safety Committee

GREAT LAKES Airworthiness Directive Volume I

79-20-08 **GREAT LAKES:** Amendment 39-3580. Applies to Models 2T-1A-1 and 2T-1A-2 airplanes having a Lycoming IO-360-B1F6 or AIO-360-B1G6 engine installed.

COMPLIANCE: Required as indicated unless already accomplished.

To preclude engine induction system blockage by pieces of failed alternate air doors and resulting power loss, accomplish the following:

A) Within the next 25 hours time-in-service after the effective date of this AD:

1. Visually inspect the aircraft induction system drain fitting located in the induction elbow below the fuel injector for blockage or restriction. If the hole is restricted in the weld area or not drilled through the elbow, before further flight open up the restricted hole or drill a hole in the elbow at the fitting location using a No. 10 (.193) drill.

B) Within 25 hours time-in-service after the effective date of this AD and each 100 hours time-in-service thereafter:

1. Visually inspect the alternate air door for distortion, heat damage and cracks. If any of these conditions are noted, before further flight repair the existing door or fabricate and install a new door in accordance with Figure I of this AD.

2. Visually inspect the induction system including the filter for cleanliness, security and damage from backfire or induction system fires. Before further flight, repair or replace any damaged components necessary to restore the system to an airworthy condition.

C) Any equivalent method of compliance with this AD must be approved by the Chief, Engineering and Manufacturing Branch, FAA, Central Region.

This amendment becomes effective on October 8, 1979.

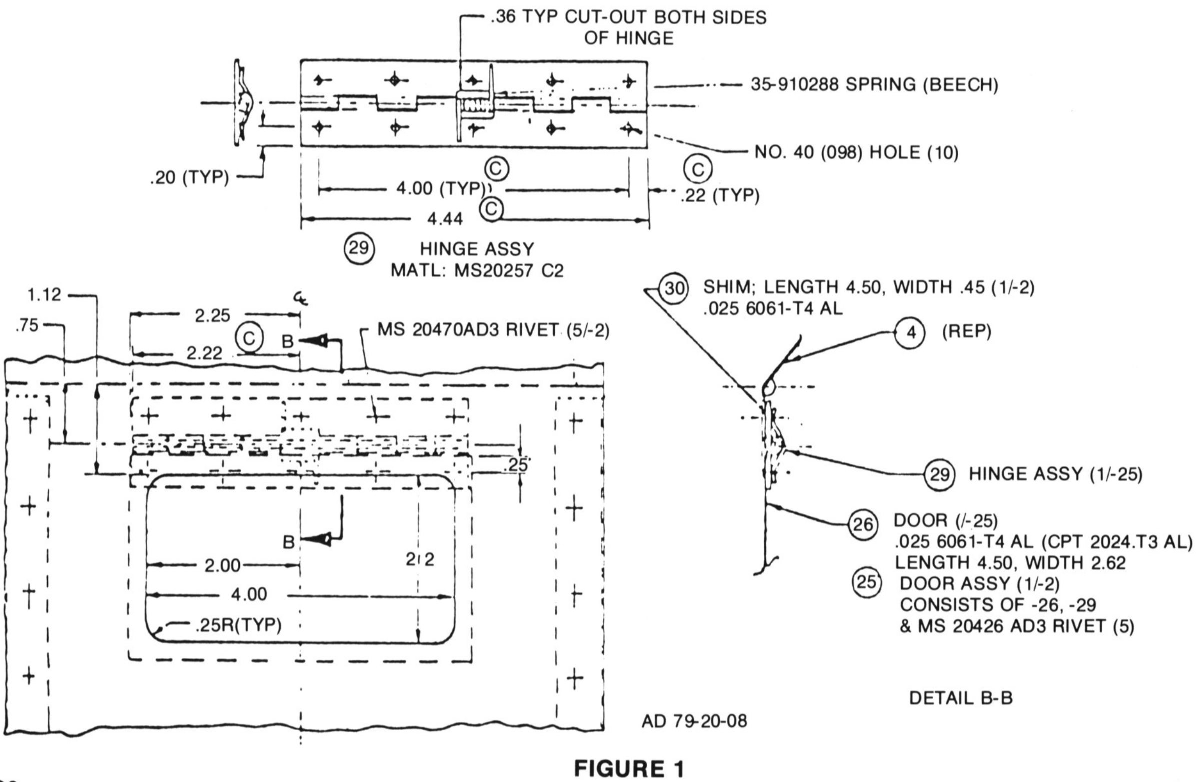


FIGURE 1

BELLANCA SERVICE LETTERS
C-137-A

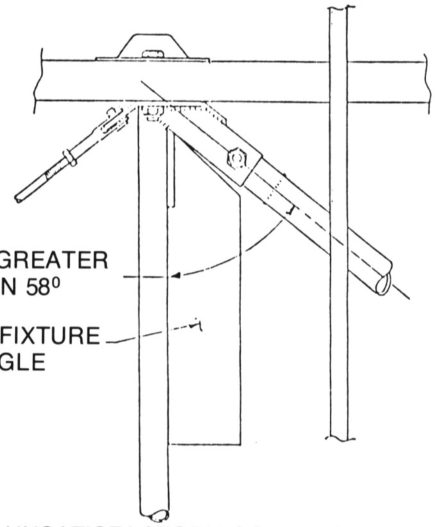
SUBJECT: Exhaust System Inspection
AIRCRAFT AFFECTED/COMPLIANCE:

Model 8KCAB S/N 120-74 thru 550-79 with AEIO-360 Engine
8GCBC S/N 1-74 thru 323-79
7ECA S/N 985-74 thru 1319-79

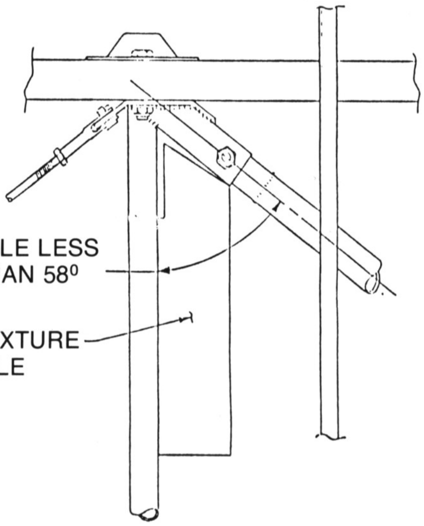
Bellanca Aircraft Corporation recommends that the inspection presented herein be accomplished within the next 30 days or 10 hours of flight, whichever occurs first. If the inspection determines that repair or replacement is required, the repair or replacement must be accomplished before further flight.

Model 8KCAB S/N 120-74 thru 550-79 with AEIO-320 Engine
7GCBC S/N 604-74 thru 1159-79
7KCAB S/N 405-74 thru 617-77
7GCAA S/N 280-74 thru 386-79

Bellanca Aircraft Corporation recommends that the inspection presented herein be accomplished on or before the next 100 hour/annual inspection. If the inspection determines that repair or replacement is required, the repair or replacement must be accomplished before further flight.



UNSATISFACTORY CONDITION



SATISFACTORY CONDITON

FIGURE 1: MEASURING ANGLE BETWEEN COMPRESSION TUBE AND DIAGONAL STRUT SOCKET

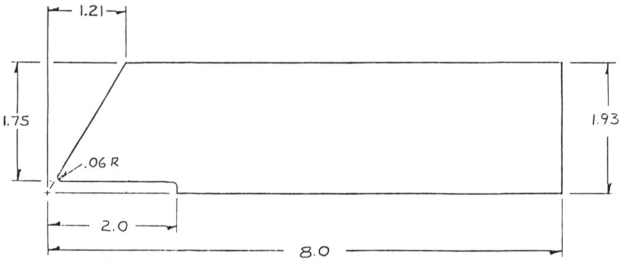


FIGURE 2: CHECKING FIXTURE KIT 270

INTRODUCTION

There have been reports of exhaust riser cracks and failures at the welded joints between the riser tube and exhaust flange, and cracks within the exhaust muffler body. The procedure described in this Service Letter is intended to reduce these failures by (1) inspecting the exhaust system for cracks, (2) correcting misalignment of the various exhaust system components, (3) eliminating interference between the exhaust system and other airplane parts and (4) checking for proper exhaust system installation.

The inspection procedures described herein are not intended to be a substitute for a properly performed 100 hour/annual inspection. Refer to AC 43.13-1: **Acceptable Methods, Techniques, and Practices Aircraft Inspection and Repair,** Paragraph 732, for additional inspection recommendations.

INSPECTION

Remove engine upper and lower cowling. Inspect exhaust system with particular attention to the welded area between the riser tube and the exhaust flange, for cracks, fractures or evidence of exhaust leakage. Remove the heater shroud and inspect the muffler body for cracks, fractures or evidence of exhaust leakage.

If any exhaust system component is cracked or otherwise damaged, remove exhaust system and replace damaged parts or repair per AC 43-13-1: **Acceptable Methods, Techniques, and Practices Aircraft Inspection and Repair.** If there are no cracks or damaged parts have been repaired/replaced, perform the following alignment check before securing exhaust system to engine.

ALIGNMENT CHECK

Loosen exhaust port stud nuts several turns; check bead clamps for tightness such that the clamps cannot rotate on the exhaust system with hand pressure. The riser flanges (1) must have equal spacing to the exhaust port pad at both studs (a small amount of flange bow is acceptable), (2) must be free to move up and down on the exhaust port studs without binding and (3) must all contact the exhaust port pads together.

If any of the above alignment checks are unsatisfactory, determine the cause for the misalignment and repair or replace the parts as required. If the alignment check is satisfactory, install the exhaust as follows.

EXHAUST SYSTEM INSTALLATION PROCEDURE

Assemble exhaust system and install on engine with loose exhaust port stud nuts and bead clamp bolts. Torque exhaust port stud nuts to correct value. Tighten bead clamp bolts until clamps secure risers to exhaust system but allow clamps to rotate with hand pressure; the bead clamps **should not be rigidly clamped to the tubes** but should be able to rotate on the tubes with moderate hand pressure on the clamp assembly.

NOTE: Torque all exhaust port stud nuts evenly and tighten bead clamp bolts evenly to insure uniform loads within the exhaust system parts; torquing bolts individually can cause very large stresses.

Inspect exhaust system for proper clearance between ducts, wiring, controls, etc. before reinstallation of the cowling. Install lower cowling and inspect for proper clearance between exhaust outlet and cowl. Install upper cowl.

Bellanca recommends that the exhaust port and stud nuts be retorqued and the bead clamps bolts be checked to the above criteria after approximately 10 hours time in service.

SUBJECT: Model 8KCAB Wing Compression Tube/ Diagonal Brace Misalignment Inspection

AIRCRAFT AFFECTED: Model 8KCAB S/N 4-71 thru 456-78

COMPLIANCE: Bellanca recommends that the inspection presented herein be accomplished on or before the next annual/100 hour inspection.

INTRODUCTION

The inboard wing compression tube and diagonal brace tube may not be correctly aligned. This possible misalignment may result in an eccentric compression tube and diagonal brace tube. A small amount of misalignment is acceptable. The inspection presented herein will determine if the misalignment requires repair. Service Kit No. 270 describes the repair procedure.

INSTRUCTIONS

1. Remove forward inboard inspection covers just outboard of fuel tanks. If these inspection covers are not installed, cut out fabric inside inspection grommets in this area.
2. Measure the angle between compression tube and diagonal strut socket as shown in Figure 1. This angle may be measured using a prefabricated template supplied by Bellanca (P/N 1A32) or a template as shown in Figure 2.
3. If the angle between the compression tube and the diagonal strut is equal to or less than 58^0, no repair is necessary. If the angle is greater than 58^0, repair per Service Kit No. 270.

IAC Technical Tips Manual
Assembled by Fred L. Cailey
Edited by Michael R. Heuer

INTERNATIONAL AEROBATIC CLUB

EXPERIMENTAL AIRCRAFT ASSOCIATION

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