ACRO SPORT NEWS # 8

& Project Schoolflight July 1984

P.O. Box 462 Hales Corners, Wisconsin 53130

AEROBAT BOB DAVIS FLIES THE ACRO SPORT II

AS TOLD TO BEN OWEN - PHOTOGRAPHY BY JEAN SORG

Bob Davis is the first alternate for the U.S. Aerobatic team for 1984 and was a member of the 1976 aerobatic team that competed in Russia. He has been competing in aerobatics since 1971 and owned the first symmetrical winged Pitts that Curtis Pitts ever built. He owned that aircraft for some thirteen years. He has also built a Lazair 200 in which he competes actively in unlimited aerobatics and is currently building a Christen Eagle. Bob is familiar to many of you from having flown the single-seat Super Acro Sport at Oshkosh on quite a few occasions. PHOTO - right: Paul & Bob Davis.

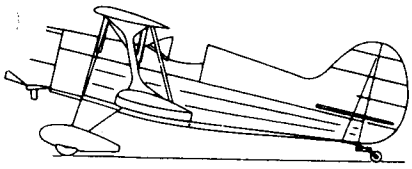
Hi, I'm Bob Davis and I'm always delighted to have an opportunity to fly aerobatic aircraft. Today, it's a nice clear day, but the wind is really blowing, it's out of the West switching to the Southwest occasionally. At the time I took off on the Acro Sport II, they were giving 20 knots gusting to 30. Of course, that's one of the real strong points of the Acro Sport II, it's got the nice wide gear and excellent Cleveland brakes. Taxiing is just absolutely no trouble at all, or landing either for that matter.

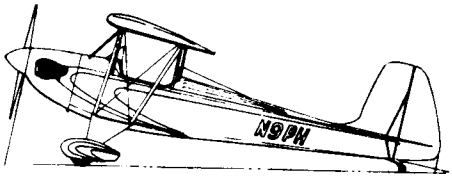
You have large ailerons - four of them - and it's quite easy to keep the wing down in the wind. The rudder and vertical fin are both large enough that directional control on roll out is no problem at all and the airplane handles a lot of crosswind.

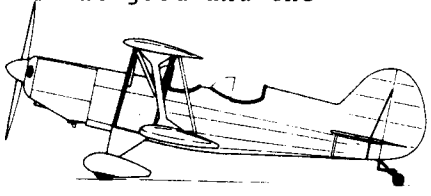
One of the things that I like about the two-place is that you've got that long nose and the relatively large wingspan that makes it very easy to pick up apparent drift, either on take off or landing. I think it's one of the strong points of the airplane as far as ground handling is concerned, particularly on touchdown.

On take off, we lifted off at about 62 MPH. We were starting to accelerate, of course, but that was very close to it. The technique I use and I think is a good one for somebody that's maybe been away from traildraggers a little bit or brand new in this airplane, I would suggest that as soon as the elevator becomes effective, which is within a second or two of full power application, I would bring it up on the main gear just about level. This gives you excellent visibility over the ground and it also pins the main gear on the ground. Your rudder control is very effective and directional control then is quite good.

On take off we had full gas, about 26 gallons, and my personal weight is about 180 lbs, not including the parachute. Longitudinal stability on take off was good and the



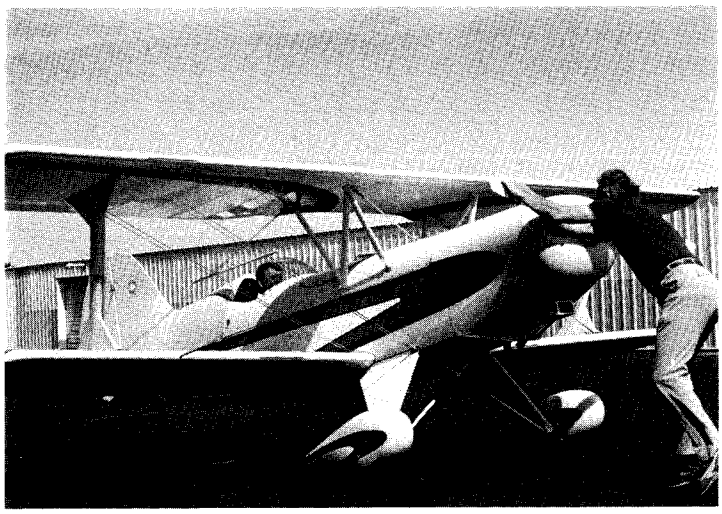




airplane is very, very nicely balanced under these conditions. The climb out speed I used was 80 - 85 MPH. I didn't experiment with that at all, but this appears to give good visibility over the nose for other traffic and a nice, comfortable climb.

When I leveled off in cruise, I was indicating about 119 MPH at 2500 ft MSL at 2600 RPM with this 180 HP engine. At that speed, for those of you who are new to flying the Acro II, the cowling is about two inches below the horizon (relatively speaking).

Once I was clear of the airport traffic area, I did a number of spins, loops and rolls. In the stalls I did with it, I found that this particular aircraft is rigged very well. I did several stalls with just back stick pressure and made sure I had no rudder on input. There was no tendency to drop a wing in stalls and the stall broke at 59 MPH. The airplane is very stable in the spin, it has a gentle stall - not an abrupt stall break at all. When you initiate autorotation with the rudder, it's a fairly slow entry compared to other small biplanes. It's fully into the spin after about a half turn. I let one go three turns and when I initiated a recovery at about a quarter of a turn prior, it came right out.



I would like to make a reference here to Gene Biggs and his excellent articles he's been writing on spins for SPORT AEROBATICS. I really recommend people read those articles because it'll save lives. Those articles are outstandi

Back to the Acro II and the entry to the snap rolls at about 100 MPH both left and right. It seems to snap a little better to the left. It has a better autorotation to the left and that gave us about a 3.8 G positive on the G Meter. It's such a stable airplane that you actually have to hold the controls into the snap until you're ready to recover. If you back off the pressure, it'll stop snapping right at that point.

Regarding the relationship of the three controls, the controls are very nicely harmonized. The stick forces both pulling and pushing are nice and light. Certainly on inside maneuvers rudder and aileron forces are very nice and nicely harmonized. No single control has an undue force to it.

On loops, I used 150 MPH as the entry speed because the cruise speed was about 120 MPH. I just add 20% to cruise speed and I have found that works well with almost any of the sport biplanes. I think it's a reasonable speed because at about a 3 G loop (which is a normal competition loop) I had about 65-67 MPH at the top of it. I tried to float it across and make it round. So 150 is a good speed. I also used 150 for the hammerhead.

In inverted flight I rolled it inverted and flew for probably, oh I don't know, probably 1-2 minutes and stabilized it at cruise airspeed of 120 and about 2600 RPM. The cowlin - at about three inches above the horizon - will give you level inverted flight. All the pressures can easily be trimmed off, in fact, I let go of the stick and it just continued flying stably.

On landing, I entered the pattern at about 110-115 and then slowed it down to about 100 on base and then bled that off to 80 and 75 on final. There was quite a bit wind today, so the power setting I used wouldn't be very representative of an average day. I had about 800 RPM on a normal glide slope and holding 75-80. At about 50 feet up, I cut the power. One thing we might mention is, there is a point on final where, because of the long nose and the reduced airspeed, it does start to hide the runway a little. But if you just look around the side of the windscreen, one side or the other, you know you can easily see where you're going. Then once you're into the flare and the nose comes up and you get into the ground effect environment, why there's just all kinds of references - - the nose, the wings, you know? Regarding the balance of the airplane, I don't see any problem there. I rarely touched the trim any time in flight.

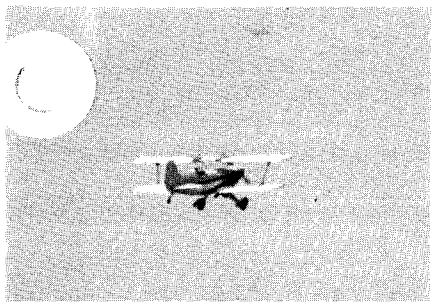
I did put in a little forward trim inverted, but here's the trim I had for the final (here Bob put a straight edge on the horizontal stabilizer, the elevator and the trim). Yes, it's almost dead straight. It's a little bit up elevator, it looks like. And at my weight and with the parachute, it was balanced very nicely.

As to comparing this with other two-place biplanes, it's got 180 HP in it, so it's not going to have the performance of a two-place Pitts with 200 HP. That extra 20 HP you can really see. It does compare very favorably with it, though. And I think what you can compare with it price-wise - well I think you've got a winner! And as to comparing it with two-place airplanes that have the same power, it's at least equally as good as any other airplane. You have to be fair in that comparison, too.

One thing, I just think so many of the two-place aerobatic airplanes are so expensive. Some of them new or even in kit form will run $70,000 - $80,000. And the average man - the average EAAer - just isn't going to be able to afford that. I had a partner on some of my airplanes and that really does take the sting out of it. The Acro II can probably be built considerably cheaper than most other two-place biplanes.

This is such an attractive airplane to fly with the excellent paint job and I'd almost forgotten how much fun it was to fly. I had a Pitts for 13 years, and you know I loved it and still do, but you know it would be a handful on a day like this in this kind of wind. And it's kind of fun to be able to get in an airplane that's very straightforward, very forgiving and easy to fly/easy to taxi, especially in conditions like this.

After the flight I had an opportunity to go over to Paul Poberezny's home to look over the Acro Sport II that he's personally building. Looking at the fuselage, we were commenting on the seating for the airplane. You can look at the fuselage and see why a person is so comfortable in the machine. There are some two-place biplanes in which you're particularly cramped, greatly so in the front cockpit in one or two. The Acro Sport II does have large roomy cockpits in both the front and the rear. I was talking to Paul on this and these are his thoughts on the subject.



PAUL: While this is a problem where a fellow will get everything welded into the prototype and not give much thought about seating, I've found that on my airplanes, it's nice to sit in the airplanes in the shop for at least 15 minutes. The

designer should actually sit in his own creation for about 2 1/2 hours on a wooden seat. You'll find out then that you'd better make some changes before you weld everything in! And you can always add a pillow to the seat to make it easier for the shorter pilots to fly, but it's tough to increase the leg room in our small airplanes. You know an inch more of leg room - that's a big difference on a leg angle and one of the things that probably makes the Acro Sport cockpit more comfortable than most.

I'd like to close at this point by saying that's it's always a pleasure for me to be able to fly the other man's airplane. The Acro Sport II has a lot of good things going for it and I hope I've gotten that across in the article. For further information on the Acro Sport plans, you might like to write to Acro Sport Inc., P.O. Box 462, Hales Corners, WI 53130.

ACRO SPORT GALLERY

Georges Coussement and Fred Haeck from Belgium are pleased to report the completion of their Super Acro Sport which is flying since August '83. We have built the aircraft from plans over a six-year period (September '77 - August '83) during our limited spare time. Georges made the metalwork and I did the woodwork, both at our homeplaces, almost 50 miles from each other. In fact, we had a mini-group building project and we divided materials, plans and "how to build" manual in two parts and each of us started construction. At the time of completion of the structures we brought our parts together and everything was fitting nicely without any adjustments! Covering and finishing was done together as much as possible and I can state that it was a nice time to work together in good "co-operationship". The most difficult things were getting all the materials, purchased in the U.S.A., in Belgium which was not always without problems. Very few items are available in Belgium and at very expensive prices. The total operation was spread over years and fortunately at a dollar rate which was reasonable. Time is now changed and actual rate is double of that of mid 1980! Almost 28% of costs are spent on taxes and transport.

OUR AIRCRAFT HAS THE FOLLOWING SPECIFICATIONS:

*Empty weight: 886 lbs with 10 lbs ballast in tail
*Empty weight on tail without ballast was 33 lbs
*Lycoming O-320 E2D, 160 HP - *Prop.: wood, 74"/53"
*Inverted fuel and oil system (Christen)
*Starter and alternator - *Battery located behind seat
*Smoke-oil system - *Radio equipped
*Paint finish: Randolph dope for Dacron and DuPont enamel for metal parts
*Date of first flight: August 11, 1983

SOME FLIGHT PERFORMANCES:

*Rate of climb: 1200 ft/min at 100 MPH
*Cruise speed: 140 MPH at 2350 RPM
*Approach speed: 90-95 MPH

EDITOR'S NOTE: The Acro I or Super Acro weren't designed to use starter, alternator . . . to improve power/weight.

Empty weight center of gravity is 57.6" behind datum which is front face of propeller.

The aircraft has flown 22 hours and we can already give some first considerations:

ıe CG should be further back and the installation of 10 lbs ballast in the tail after ;irst flights has slightly changed the noseheavy behavior of the aircraft. Trim tab is just not adequate enough to level the aircraft during approach with the throttle closed. We think a design review, as suggested by builder R. A. White in Newsletter #4, whereby the nose length should be shorter could be considered and especially for aircraft with starter and alternator. So far, we have not performed aerobatics as this is not yet allowed by the aviation authorities (our aircraft is the first homebuilt aerobatic aircraft ever made in Belgium!).

During the first flights in August with outside temperature around 77°F we encountered heating problems, so an oil cooler will be installed before next summer. (Oil temperature was 240°F; 5° below limit.)

During final assembly and rigging we could not reach the 25° up and 25° down travel of the ailerons. It could be understood as total up and down travel is 25° but we learned from our friend, John Kimber, that it should be 25 up and 25 down. To reach this angle with full side stick, we had to relocate the hole in the U-shaped fitting of the aileron where the aileron is attached to the control. Compared with John's Acro Sport and to some pictures in the newsletter, our "bellcrank" is protruding more the wing surface. Something must be wrong. Yet fittings are made to conform to the drawings.

Off-set of fin should be increased and is not enough for a 150 HP engine. There is a big torque which needs full rudder travel during take-off and a rather big trim tab is necessary for straight flying.

e have also increased the heater capacity which was insufficient by using a muffler around each stack. We brought warm air from one muffler into the muffler of the other stack.

We are very pleased with the Acro Sport and we held a nice presentation and demonstration of our aircraft for family and lots of friends on Sept. 17th. We were assisted by John Kimber with his Acro and Richard Teverson with his Skybolt, both from England. So it was a nice experience and we were together with two Acro Sports, one Skybolt and the Pober Pixie of Georges Hageman who has the same home airfield. He also has a very nice aircraft and I will ask him to send some photographs and information.

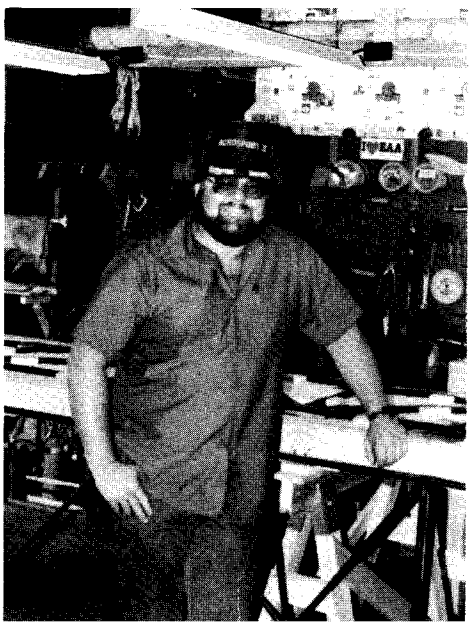
TONY HOHENWALDE

TWO ACRO SPORT II's - UNDER CONSTRUCTION

Acro Sport II, Builder Tony Hohenwalde of Thornton, CO, began life on November 12, 1980, with the construction of wing ribs. As a first time builder, I felt that this approach would provide a good test of skills and patience with a minimum investment in materials and tools.

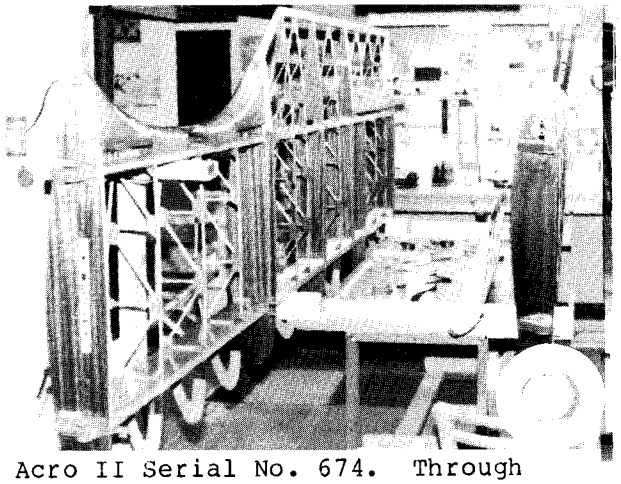
Following completion of the ribs, wing construction was begun, and as the pictures show, the wing framing is now complete except for drag/anti-drag wires, leading edge skins and a few miscellaneous fittings, which are made but not yet installed.

RAY LENTZ



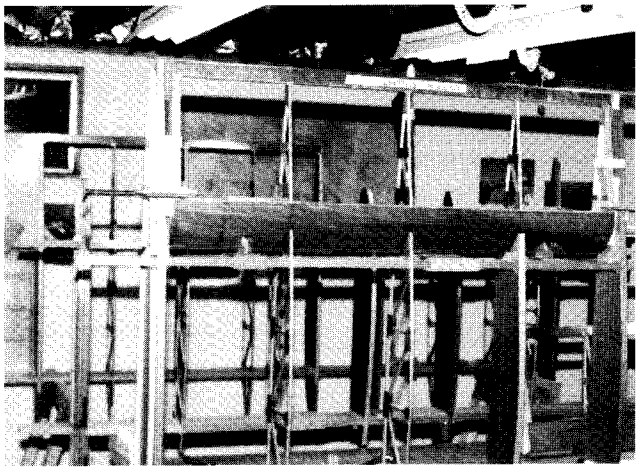
The center section lower surface will be sheeted following installation of the drag wires. The ailerons are also completed; hinge fittings are made, but they have not been jigged into position yet for drilling and attachment.

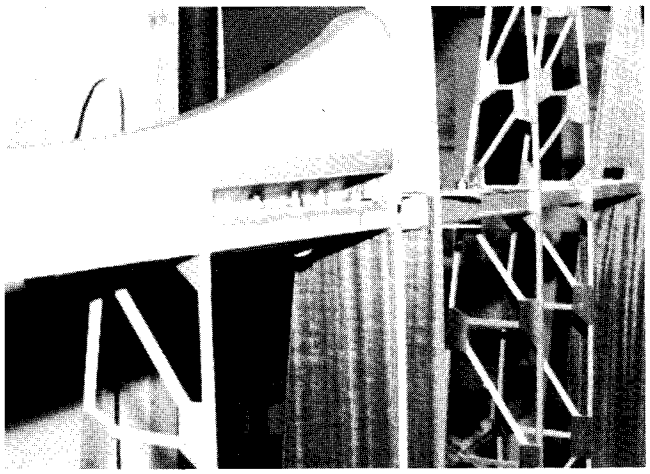
A special note concerning the ailerons: the leading edge plywood skin is put on in two pieces. The plans were not too clear on this (and neither was my understanding), therefore, my first aileron was sheeted with one piece of birch ply. It took the bend over the leading edge OK but tended to bulge between ribs. A phone call to Bill Chomo got this problem resolved, and I began unskinning the aileron. (Bill Chomo said building an airplane was an educational and recreational experience - I was in the educational phase now; the recreation comes later)! Anyway, all worked well; the aileron ply skins are straight and smooth and the leading edge gap between the upper and lower ply skins was filled with Stits Micro-Putty and sanded down for a smooth contour over the D-section.



At this point, one may ask "Is there anything you would do differently if you were starting over?" My answer thus far would be "no". The plans are exemplary in their clarity and attention to detail. My only two deviations from the drawings were to build a shallow reverse curve into the continuation of the center section bow where it merges into the trailing edge of the upper wing and in the design and installation of the access plate in the bottom of the lower wing (see photo).

At this time, July 1983, enter Acro 455's sister craft, Acro II Serial No. 674. Through our local chapter, Chapter 43, Denver, CO, I met fellow builder Ray Lentz, of Arvada,

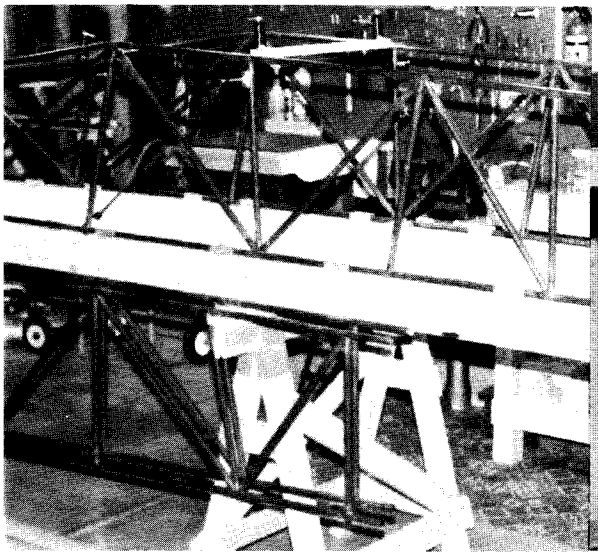


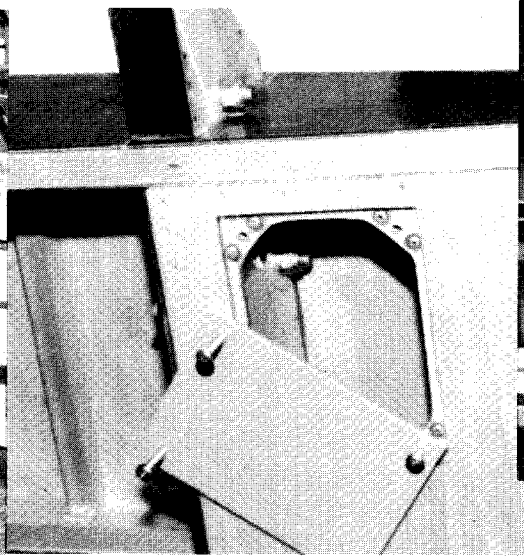


CO. Ray had his plans for only a few weeks and wanted to begin with the fuselage. I was ready to start my fuselage. Ray is an A&P and experienced welder. I was buying my welding equipment but as yet didn't know which end of the torch to hold. I had shop space and a fuselage jig table. Ray was looking for a place to work. What more needs to be said? We decided to build two fuselages together.

We are working together laying up the tubing and so far (November 1983) have one weldment tacked and are working on the second. We are fish-mouthing the tubing with Dremel type rotary tools, using tungsten-carbide bits - works great and provides a good contoured fit virtually eliminating the need for large gap-filling during welding.

have an engineering and drafting background, and consequently ve a good eye for visualizing how the tubing fits together and for marking the cuts, which I have been teaching Ray. He has been teaching me to weld (Lesson No. 1 was which end of the torch to hold!). Together we are learning, working and progressing. Isn't that what EAA is all about?





ACRO SPORT II BUILDER
DAVID BLANTON JR. OF VALLEY CENTER, KS

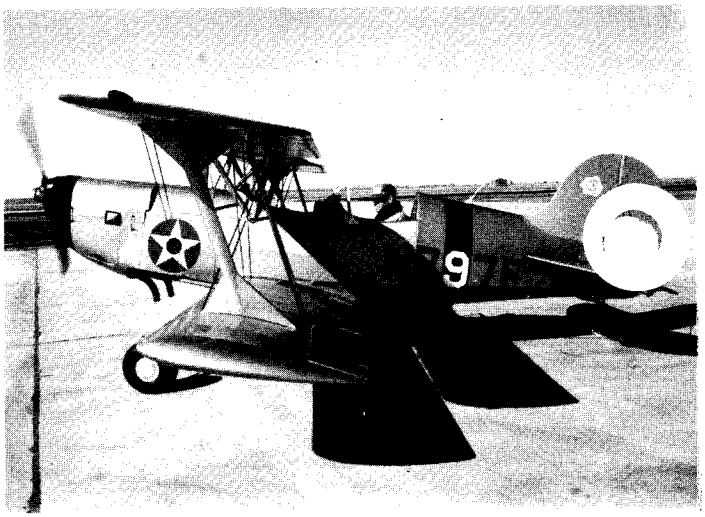
It's a cold, winter day here in Wichita. I imagine when people see me getting out of the Acro Sport with my insulated overalls, boots, gloves, ski mask, motorcycle helmet, and sun glasses they must think I have arrived from another world. But that's the only way to stay warm when flying open cockpit during the winter. I've flown the Acro Sport five times and have become very comfortable in the airplane. I just finished talking to the FAA and let them know that the first flight went well. I only have to fly 10 hours before carrying passengers.

Enclosed please find the picture I promised and a copy of my weight and balance data. The datum line is still located in the same place ahead of the main gear, but is not at the face of the prop. My engine mount is 20-1/2" which gave me a tail weight of 38 pounds. I plan to send more pictures later to the Acro Sport people. Thanks for the support you gave me during the Acro project over the last four years. I hope someday you can fly the airplane. I'm sure I will have it to Oshkosh '85!

AMARILLO ACRO SPORT II FLIES

AMARILLO--"I've been building airplanes, at least repairing and rebuilding commercial aircraft for 30-35 years," said Glade Hoyle, Aircraft Mechanics instructor at TSTI-Amarillo, "I've been in the industry since 1942."

Glade began his lifelong interest in building and rebuilding aircraft when he joined the U.S. Navy in 1942 and was stationed on an aircraft carrier during World War II. "In



1942 they (the U.S. Navy) were just taking out of service the only biplanes," he said. "I guess you could say I cut my teeth on biplanes and I've always been interested in them."

It was this interest that lead Glade to choose the Acro Sport II design for his first completed, "homebuilt" aircraft. The Acro Sport II is a biplane as were the 1938 U.S. Navy planes Glade first worked on. The aircraft is 18 feet long, has a 24-foot wing span, and weighs 1200 pounds. It will fly 120 MPH and has a range of three hours flying time. The Acro Sport II is designed for sport flying; it is a pleasure craft and the design has been used in aerobatic flying.

Glade has test-flown the biplane for two of the 25 hours required by the Federal Aviation Administration (FAA) before the craft can be certified. "First you must prove that the airplane is as safe as human hands can make it," said Glade. Before certification is complete, test flights are restricted to a 50-mile radius of the airport. Once the test period is completed, Glade can fly anywhere he wants. "It's a very gentle, very controllable and very responsive airplane," Glade said, "some planes become violent at stall speed." But at stall speed (55 MPH) on his plane, it nearly becomes like a glider, he said.

The project began three years ago, when Glade received plans for the plane from the Experimental Aviation Association, an international organization devoted to homebuilt aircraft. He completed most of the construction in his own garage. "It took 3000 man-hours to complete, which is about one-half the time it would take the average homebuilder," he said. Why? "Experience," Glade said, "I knew where I was going."

The paint scheme mirrors the 1938 U.S. Navy biplane and is done in fire-proof paint. In many crashes where planes burn, he said, it is because the paint caught fire. "I want to make it as safe as I can."

The fire-proof paint treats the fabric-covered, steel-framed fuselage of the two-seater craft, with the wings constructed of wood. "In order for it to be classified (by the FAA) as homebuilt you have to build 51% (of the craft)," Glade said. The builder can use standard products - engine, propellers, wheels and instruments.

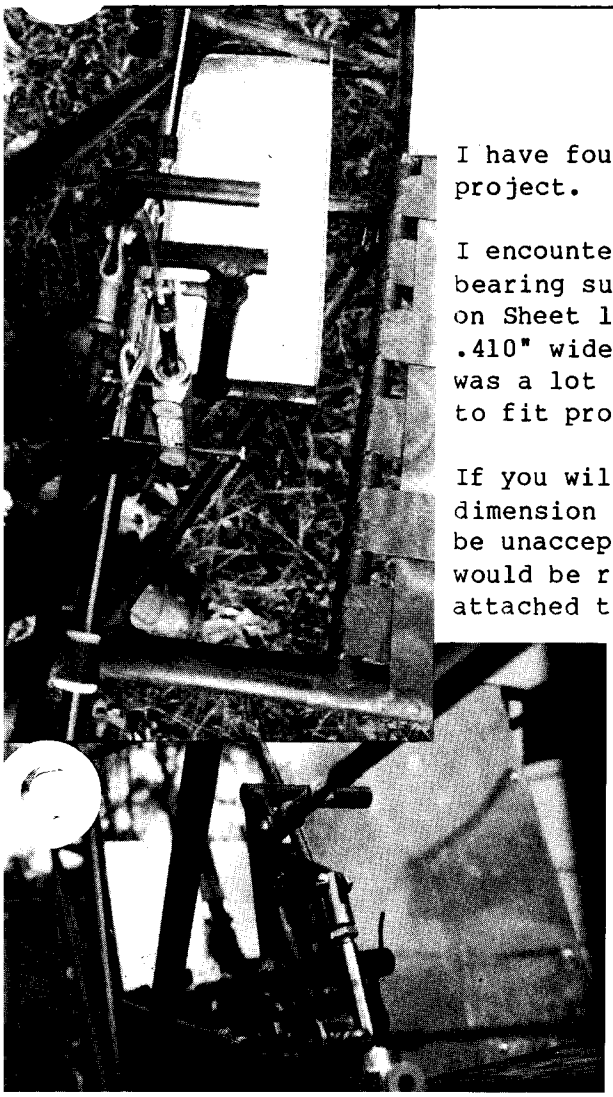
"I'd say I actually built 85% of it," he said, "I even sewed the covering that went on there."

Glade plans to use his plane as a teaching model for his aircraft classes. Biplanes as teaching tools are not readily available, even though the FAA still has questions on them on certifying exams for aircraft mechanics.

He would also "like to use it in a program of advertising for TSTI" and its Aircraft Mechanics program, planning to take it to "fly-ins", or gatherings of sport pilots and others interested in aviation.

The Acro Sport II is actually the second homebuilt project Glade has worked on, but t first he has completed. His first project was a Starduster II craft he worked on 12-1 years ago.

Glade plans to build another plane sometime in the future, but as he said, "there's several ideas I'm toying with, I just haven't made up my mind yet."



ACRO SPORT II BUILDER
WILLIAM HOOD OF MOREHEAD CITY, NC

I have found the Acro Sport Newsletter very valuable in my project. A couple of points:

I encountered difficulty when I tried to install the inner bearing support for the elevator. The 1/4" dimension called for on Sheet 10 area 3C is not enough for the KP-4 bearing which is .410" wide from the inner bore to the opposite bearing shell. It was a lot of trouble to cut the inner spar to allow the bearings to fit properly. A change of dimension seems appropriate.

If you will recall, I wrote previously about the rudder pedal dimension change. I found that moving the pedals inboard would be unacceptable because the width for the front seat passenger would be reduced. I modified mine by using two-.125" gussets attached to the brake pedal. One attaches to the front of the pedal and connects to the brake interconnecting rod, the other actuates the brake cylinder. See photo. This gives adequate clearance for the interconnecting rod and provides a simpler brake cylinder actuator than the tube and U-shaped piece called for in the plans.

Otherwise, I have had no bad problems. I do have a couple of questions.

Was an oil cooler used on the prototype? If so, what kind and where was it mounted? I too am using an O-360A4A with no starter or alternator or any electrical system for weight purposes, as well as I feel that hand propping is as much a part of flying as the landing rollout. I would like to see photos of engine installations in the newsletter.

I just thought of another problem I had, and feel the plans could be clarified. When installing the tailwheel fork the plans are foggy. First, sheet 4 area 2B is wrong. The fork is more or less shown on the rudder post, not the rudder spar. Second, sheet 11 area 4A and 5A - if you make the tailwheel fork as shown and insert it into the already constructed rudder, it sticks out too far and hits the main tailwheel spring.

In other words, the bottom of the T.E. curved tube should intersect the top of the tailwheel fork crosspiece. To me this was not clear and required some cutting and refitting. Sheet 10 area B4 could show this better too.

Even now my gussets interfere with the spring brace. I put my gussets in the middle of the tubes and if they went on the rear I would have no problem.

EDITOR'S NOTE: We used a "Corvair" type oil cooler on our Acro Sport II. However a Wag-Aero stock #1-820-000 (Harrison) or a 1-938-000 (South Wind) should be satisfactory, mounted on the left front baffle at the nose bowl. Flow through should be vertically down through the front baffle.

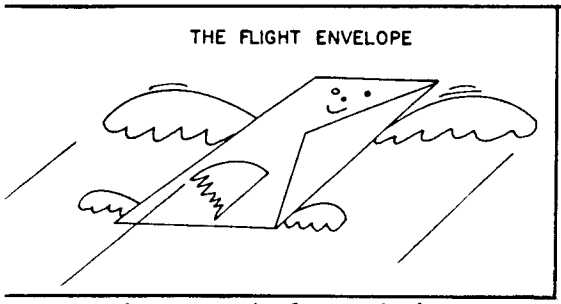
ACRO SPORT II BUILDER MIKE CLARK OF WINCHESTER, ENGLAND

My Acro II (serial number 430) is progressing well with the wings virtually ready for covering and the fuselage structure complete. I am currently just completing the metal fittings and am also negotiating for a Lycoming O-360 engine. My New Year's Resolution is to finish it this year! I have also just got married, so another pair of hands are available!

I flew John Kimber's Acro I the other day and can only describe it as superb. It is the first airplane I have flown with a fully inverted system and this adds a whole new dimension to flying.

I attended Oshkosh '83 and found both the forums very informative, but also the chance to look at completed Acro's and talk to their builders was a great help. I also found the Flymarket and a visit to Wag Aero at Lyons very useful.

So, hopefully, G-BKCV will be flying in '84. Keep up the splendid work.



THE FLIGHT ENVELOPE

By Ben Owen, Editor, Acro Sport Newsletter

Introduction: The flight envelope is known to engineers as the "V-N Diagram". "V" stands for velocity or speed and "N" stands for gravity load or "G". Pilots might better understand the flight envelope as the "V-G Diagram", which, in fact, it is sometimes called. On the left hand side of the attached graph is a vertical line showing G loading. The horizontal line shows speed from 0 to 144 MPH running from left to right. You can find a similar diagram in most aircraft operation manuals. For amateur-built aircraft, it is simple to make up a similar diagram. The area within which the pilot should operate is indicated by the hatched lines. The stall speed is 46 MPH positive and 52 MPH negative, at one G. This is due to the difference in lifting ability of this particular airfoil in positive or negative loading.

ACCELERATED STALLS: The positive accelerated stall line runs from 0 airspeed and G up to 4.6 G at approximately 100 MPH. If you attempt to fly the aircraft in the accelerated stall region, it will stall and it is incapable of being overloaded in that area. Beyond 100 MPH, the aircraft can be overloaded by the pilot in a positive manner. The same is true for the negative accelerated stall area which runs from 0 airspeed and G to a point at 2.4 G and 82 MPH. Beyond 82 MPH, the aircraft can be overloaded by the pilot in negative loading.

GUST LOADS: Gust loads are shown on the diagram as dotted lines. To make a clearer drawing they are not continuous but are a straight line running from 1G at the left to point A for 50 FPS gusts. The 25 FPS gust line proceeds from the same point on the left to points D and E on the right at Vdive. If those 50 FPS straight lines ran all the way to Vdive you can see that aircraft strength requirements would make for a very heavy airplane. The requirements were set up so that aircraft could be slowed down when meeting gusts and still be built lightly. You will note that this particular diagram indicates the current FAR standards of 50 FPS at cruise and 1/2 that or 25 FPS at Vdive. In the old days, aircraft were designed for maximum gust loads of 30 FPS at points A and G and for 1/2 that at points D and E at Vdive. The gust load requirement went up due to experience with various aircraft over the years. Also, wake turbulence from today's wide bodied jets may be quite severe for light aircraft and can hang in the air for as long as 30 minutes.

RSPEEDS: Airspeeds on the chart are true airspeeds. The pilot operating in real orld conditions must correct his indicated airspeed to true airspeed. On this chart, the speeds shown include stall speeds, cruise speed (100 MPH), never exceed speed (130 MPH) and dive or test speed (144 MPH). The never exceed speed was estimated at .9 of the Vdive. Don't confuse the test speed of 144 MPH with the never exceed or "red line" speed of 130 MPH. Age may have an effect on your aircraft and it can grow less strong with age. For this reason, it is best to observe the Vne on all the aircraft you fly. Flutter may occur above Vne and gust loads may also become critical above Vne.

MANEUVERING AND ROUGH AIR SPEEDS: "A" on this chart is the intersection of the positive limit load factor and cruise speed. In this instance, cruise speed and the positive maneuver speed coincide. Positive maneuver speed (Va) is the speed above which you should not fully deflect the controls without placing an undue load on the airplane. This speed for negative loads is somewhat slower, as you can see, about 82 MPH.

Regarding rough air speeds, the aircraft can take a positive 50 FPS gust at about 100 MPH but this capability decreases with speed. Much above these speeds and the gust load might become excessive in rough air and much below these speeds the aircraft might stall. So for this example, the rough air penetration speed should be 100 MPH max., slightly less would be prudent as the negative load speed is around 82 MPH.

This particular aircraft was not designed to quite take a 50 FPS gust negatively. Maximum speed for rough air penetration and maximum speed for full control deflection should be determined before flight.

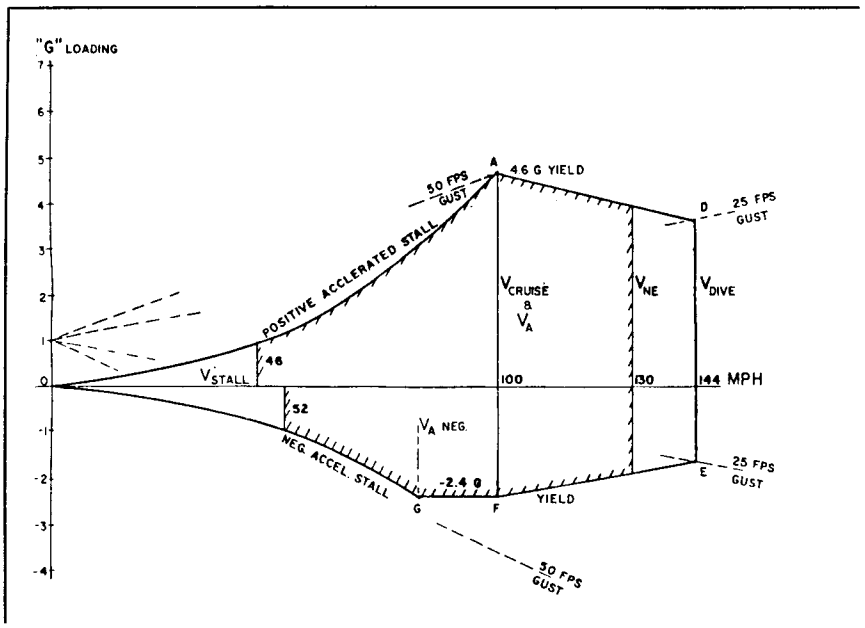
ELD STRENGTHS: Because the yield strengths of aluminum alloys when they bend is arly 2/3 of the ultimate strength of aluminum alloys when the break, most yield strengths are set at 2/3 or ultimate strengths. This applies to aluminum airplanes fairly well, with some exceptions. It applies not at all to fiberglass and wood and must be used with care on steel tube structures.

However, we will assume that our sample airplane has a positive G yield of 4.6, positive G ultimate of 6.9, negative G yield of 2.4 and negative G ultimate of 3.6. It's a case of ground load testing with sandbags being a whole lot safer than flight testing for loads. Also, it is not a good idea to be flying an aircraft at high G loads in gusty air. The combination of the gust load and the aerobatic load may exceed the yield or even the ultimate loading. It is well to apply both yield and ultimate G loads with healthy skepticism as even apparently uniform materials may vary in properties (yes, even steel and aluminum).

GROSS WEIGHTS: Any airplane flight envelope is only good at one gross weight. If your aircraft is built heavier than the designer intended and/or flown over recommended gross weights, you can expect that both the yield and ultimate G loadings the aircraft will tolerate will decrease. The decrease is in the following ratio:

$$\text{" new} = \text{"G" old} \times \frac{\text{design gross weight}}{\text{actual gross weight}}$$

When you pull G's in excess of advertised positive or negative loading,



you overstress the aircraft. When you fly in excess of the red line speed you are overspeeding the aircraft. Both can gradually (or suddenly!) weaken it.

Either can cause airframe failure in a maneuver, such as a fast pass and pull up. When you pull up wings level, you are putting symmetrical loads on the airplane as both wings are lifting equally. If you pull up hard and then roll, the wings are not lifting equally. Your G meter in the cockpit may indicate that you are below the yield limit but the roll places a higher load on one wing. A rolling pullup can reduce the allowable G load to 2/3 of your acclerometer reading. An airplane that can take 6 G (not our example here) should not be flown in a rolling pullup over 4 G. Rolling pullups are best avoided at high airspeeds and high G. And if you plan to engage in high speed and G loads, don't carry excess weight in the form of extra fuel, baggage, passengers, etc. Keep your gross weight down in these situations, because pilots and airplane builders are only human.

AND FINALLY! Structural failures to amateur-built aircraft are quite rare and occur no more frequently than they do to factory-built aircraft. However, the pilot should be familiar with his flight envelope to keep from overstressing or overspeeding the airplane. He should be familiar with maneuvering speeds, rough air penetration speeds, stall speeds and never exceed speeds. Most important of all - fly the airplane within its limitations.

NOTE: This flight envelope approximates the Pober Pixie envelope. However, the Pixie is limited to wingovers, chandelles and an occasional loop. It is not designed for aerobatic flight.