# SONERAI NEWSLETTER

**APRIL-MAY-JUNE 2007**

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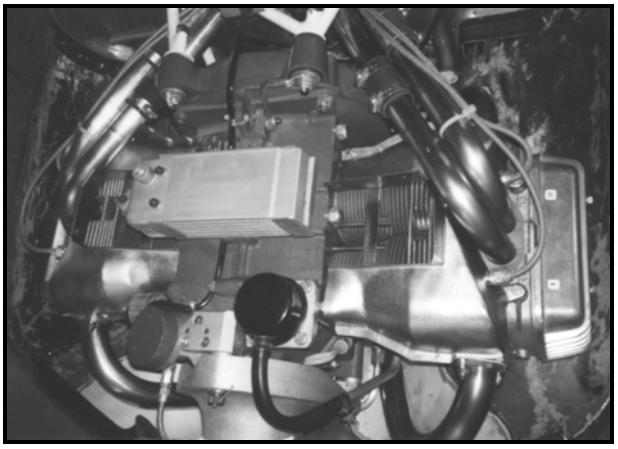
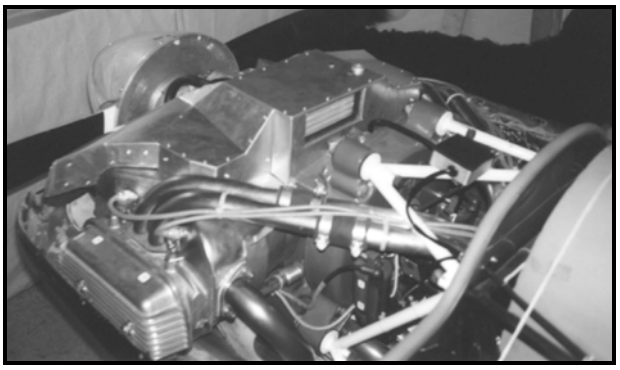
## *BAUMGARTNER HUGUE'S SONERAI I*

*A few years ago, Baumgartner, who lives in Savigny, Switzerland, supplied me with photos of his airplane, and attached the following note:*
*"In 1994, I bought a Sonerai I airframe without an engine that was not in good health and was sleeping in a farm. Its last owner, Ulrich Nater, was the builder, and he had flown it between 1979 and 1983, and stopped when the crankshaft failed. Between 1994 and 1997, I rebuilt it (new engine, new fabric, new paint, and … and…). It really took a lot of time to do this job. I spent 1500 hours on it. In the photos (on the next page), you can see how I made the intake and exhaust tubes and the baffling. The engine was tested for 10 hours on a stand before mounting in the airframe. It is a HAPI 1835 cc, with one magneto and one electronic ignition, a HAPI/Mosler UltraCarb, oil cooler, and complete exhaust system. The prop is wood with a 50" diameter and 34" pitch. The empty weight is 550 lbs and the cruise is 120 mph. The prop pitch is that low due to my airfield being 2100 ft long grass at 2400 ft msl. I enjoy flying this little airplane, as it is very responsive and fun, but it takes a lot of time to learn to fly safely."*

Buamgartner's classic VFR Sonerai I panel.
You just can't put much more there.



A top view of the engine showing the unique use of modified automotive shrouding in the baffling design. It makes for a very tight-fitting set of baffles.



Another top view showing the installation of the baffling ducts that connect the cowling inlets to the shrouds and the oil cooler.

Here's a pretty good view of the "complete" (meaning extended 4-into-1, matched-length) exhaust system. I suspect that it was designed to increase the horsepower output, and to help deal with the strict European noise regulations.
You can also see the Monnett SuperVee prop hub/extension.

Having fun over the Swiss countryside.
Note the change to a composite landing gear.

## SONERAI NEWS

- Great Plains News: If you are going to Sun-N-Fun, be sure to stop by and see Steve and Linda in their booth. It'll be in the same place that it's been almost forever in Building A. Steve is running a VW engine building seminar in the Engines Workshop from 11AM to 1 PM Tuesday thru Saturday, and has a "VW Engine Conversion for Light Sport Aircraft" forum on Friday at 9 PM. Be sure to take advantage of these opportunities. Also, they have upgraded their prewelded axle kits. The mounting plates now come laser-drilled to the Sonerai plans dimensions.
- First Flights: I've gotten no new reports. Be sure to let me know, and send a couple of photos.
- 2007 Fly-In Schedule:
  Here's a list of the big ones this year. Make plans now to go to the one nearest you, and show off your Sonerai:
  - Sun-N-Fun, Lakeland, FL 4/17-23
  - SWERFI, Hondo, TX 6/1-2
  - Rocky Mountain, Watkins, CO 6/22-24
  - Golden West, Marysville, CA 6/29-7/1
  - Northwest, Arlington, WA 7/11-15
  - AirVenture OSH, Oshkosh, WI 7/23-29
  - MERFI, Mansfield, OH 8/25-26
  - Virginia, Petersburg, VA 10/6-7
  - SERFI, Evergreen, AL 10/12-14
  - Copperstate, Casa Grande, AZ 10/25-28
- Midwest Sonerai Gathering?
  A couple of years ago, we had a "Sonerai Gathering" at the North Central Old-Fashioned EAA Fly-In at Rock Falls, IL in September. I would like to try it again, if there is interest. Last time, mine was the only Sonerai there, but everyone who came had a good time, so this time I'd like to see more Sonerai's, more people, and more fun. Let me know if you'd be interested in joining me.
- VW Air Racing Update
  Jeff Lange continues to work toward the establishment of a cross-country racing class. (He now owns Sportsman Air Racing, LLC) It appears that the Sportsman Class for the AirVenture Cup racing is moving forward. If you are interested in more information, go to *http://vwairracers.proboards98.com/index.cgi?board=raceinfo&action=display&thread=1173536825*, and/or contact Jeff at *jeff@sonic-art.net.*
- Sonerai Wing Construction Manual: There are 18 pages of text, 85 photographs, and 12 drawings, as well as a complete materials and a tools list. If you have an older set of plans (The manual is now included with the plans, so you new plans holders already have it.) and would like your own personal copy, sent me cash, check, money order, or PayPal (at the email address on the front page) for $25.00. Postage is included.
- Back Issues: **Sonerai Newsletter** back issues are now available in three forms. The first is a CD which contains all of the complete newsletters published by Ed Sterba from 1987 through 1995 in ".pdf" format. It costs $40.00. The second is a CD which contains complete copies of all of the newsletters published from 1996 through 2006, also in ".pdf" format. The cost is $50.00. If you buy both CD's, the package price is $75.00. And finally, there are also hardcopy back issues for $3.50 each. I have the last two issues from 1994, and all of the issues from 1995 thru 2006 (That's 50 issues!). If you want any of the above, send me a note requesting the ones you want and cash, check, money order, or PayPal for the correct amount. Postage is included.

## 2180 TRANSPLANT, PART 1

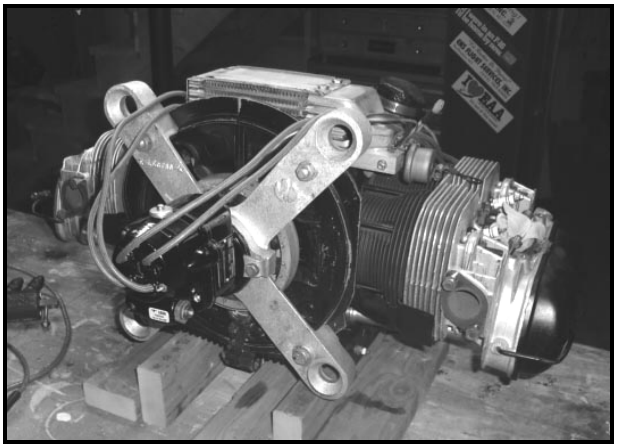
This story begins at last year's EAA convention at Oshkosh. I had stopped off at the Great Plains Aircraft Supply booth to chat with Steve and Linda, which is something I do several times during the week. Steve asked if I had seen Jim Phillips, a mutual friend and Sonerai builder/owner. I hadn't, so Steve told me that Jim was retiring his Sonerai II. You see, Jim had finished, and was now flying, a brand new Van's RV-8, and decided that he really didn't need to support two airplanes, and he wasn't comfortable with the potential liability risks of selling the Sonerai. So, the Sonerai was going to get parked.

This, of course, saddened me some, as I hate to see a good airplane retired, but it also intrigued me. Jim's Sonerai had an almost new 2180 that had been built up from the original 1835 that was installed when the airplane was first built. I have always thought that it would be fun to put a 2180 in my airplane, but I had a really hard time justifying the $6000 cost of a brand new engine. And besides, my 1807 had always run pretty well. Another fact about this 2180 was that it was configured almost identically to my engine. It had the same Monnett EV prop hub and Electro-X rear mount. It could be drop-in exchange.

After the convention was over, I gave Jim a call to talk Sonerai's (it's something we do a couple times a year), and I asked him if he'd consider selling me the 2180. I was willing to pay a fair price for it. He

told me he'd think about it and let me know. That was fine with me, as I was in no hurry. Sure enough, a week or so later, I got a call from Jim, and he decided to let me have the engine for a very good price. I could HAVE the engine and prop if I helped him remove it from the airplane. I agreed so fast , it almost hurt.

So, a couple weeks later, we met at his hangar, and with the help of one of his neighbors, pulled the complete engine, prop, and spinner, and loaded them all in the back of my truck. It was like Santa came early.



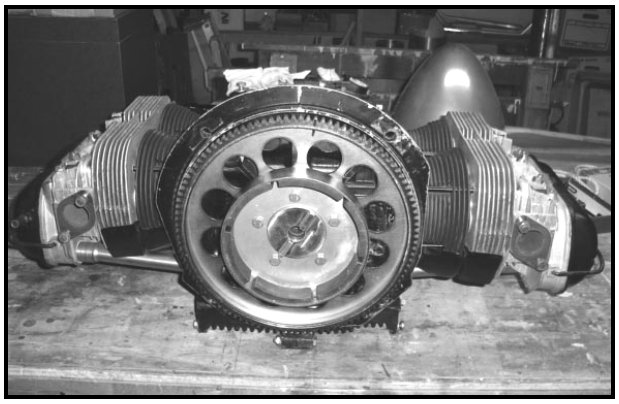
The "new" 2180 as received
with it's Electro-X mount.

Once I got all of the stuff home, I commenced disassembly and inspection. One stipulation that Jim made was that I perform a visual inspection on all of the components of the engine before putting it on my airplane, and I agreed. So, I stripped the engine down to the long block with the prop hub and Electro-X attached. My plan was to use the box baffles, exhaust pipes, and oil cooler from my 1807, so I needed to do that anyway. At this point, I decided to remove the stock rocker arm shafts and valve adjusters, and install heavy-duty bolt-on rocker shafts, and swivel-foot adjusters. This required longer push rods, so I made them from a kit that Jim gave me with the engine (actually, he gave me a whole bunch of VW engine stuff that he had accumulated in his shop, and didn't need anymore). I also pulled the heads, and slid the cylinders our far enough to look at the crankshaft, rods, and the camshaft. Everything looked like new. Heck, there was no more than 100 hours on it. It was good to go. I'd swap engines during the winter months. It should be easy.

So goes the best plans… As you know from last month's "Dumb Ass" article, I hurt myself trying to prop start the 1807 with the secondary ignition ON. My first reaction the following day was to call Steve and order his X-Diehl starter kit. At that point, I didn't care what it cost, I just wanted to put a starter on the darned thing. It bothered me that the weigh of the airplane would increase by 25 to 30 lbs, but I figured that the extra horsepower of the 2180 would more than offset that. (After I got the kit, I waffled back and forth a lot about installing it. Being something of a purist, I wanted to keep the airplane as light as possible to take advantage of the extra HP. But the lazy, old guy in me thought that having an electric starter would be really NICE. The lazy, old guy won.)

With the decision to install a starter made, and the parts on hand, it was time to remove the Electro-X and the mag drive from the back of the engine. The Electro-X was easy. Remove four bolts and it was off. The mag drive was a challenge. The gland nut (I'm not sure why it's called a "nut" when it is actually a bolt) that secures it to the crankshaft is torqued to 217 ft-lbs. First I had to buy a 36mm, ½" drive socket. Then I had to secure the engine to my work bench, and bolt a 3 foot long piece of square tubing to the prop hub to keep the crank from turning. Using the new socket and breaker bar with a 5 foot long piece of pipe on it, the gland nut came loose. The mag drive, the rear seal, and the end play shims were removed.

What I found was that the Monnett mag drive/alternator magnet ring was driven by one dowel pressed into the back of the crank. The new flywheel that came in the kit required four dowels, so a call to Steve had a set of dowels on the way. In the mean time, I went about the process of setting the crankshaft end play with the new flywheel. I had ordered a new set of endplay shims and a new rear main seal, so I had all the parts I needed. Using Steve's Engine Assembly Manual as a guide, I got the shim pack set to provide .004" to .005" of end play. It took 4 or 5 tries to get it right, but I got really good at installing and removing the flywheel.

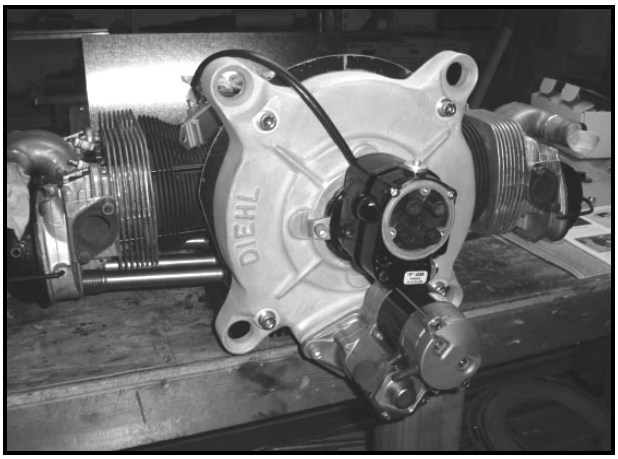


The new flywheel with the alternator magnet ring
and magneto drive.

With the end play shims installed, I then installed the new rear main seal. To make the installation easy, I cut two disks slightly smaller than the OD of the seal from a piece of ¼" birch plywood and put a hole in the center of each large enough to fit the gland nut. Then, I used the gland nut and disks to push the seal into position.

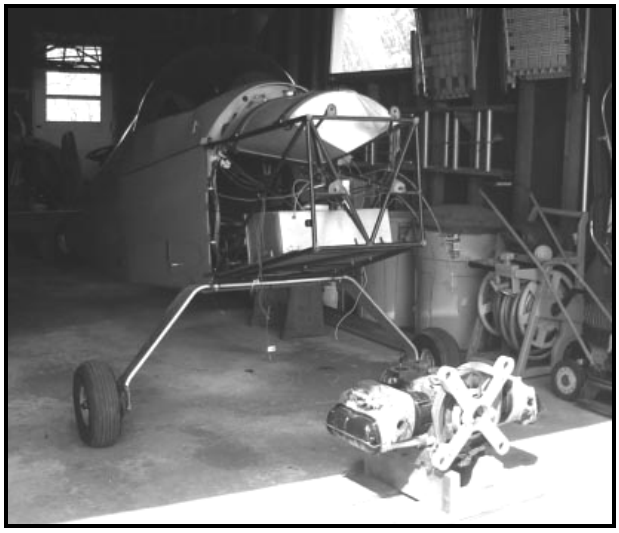
Next, I mounted the flywheel onto the crank with the one existing dowel, and snugged it into place with the gland nut. The gland nut was then removed, and the three missing dowels were driven into the holes already in the crank (it was an 8-dowel crank) using the holes in the flywheel to maintain alignment. A ballpeen hammer and a drift were used to do the driving. The gland nut was then reinstalled and torqued to 217 ft-lbs (give or take), but this time a flywheel locking tool was used to counteract the input torque.

With the nut installed, I bolted the mag drive plate and alternator magnet ring to the flywheel, bolted the alternator stator to the X-Diehl case, and bolted the X-Diehl case to the engine. Finally, I bolted the starter and the magneto to the X-Diehl case. The engine was ready to be mounted.



X-Diehl with the Mag and starter

Since I don't like freezing my buns off when I work on the airplane, I waited until the end of March to bring the airplane (without its wings) home to do the engine swap. I reasoned that if I had it in the garage, I could work on it everyday without having to travel to the airport, and I'd have access to all of my shop tools all the time. So, as of this writing (the first week in April), I removed the old engine, and firewall, and am well into the process of fabricating a new firewall with a new mag and starter enclosure. Once that's done, I'll mount the new engine and firewall. Then, I'll need to design and build a new intake manifold, and rework the electrical and fuel systems. More on that next month.


N99FK waiting for her new engine

## VW ENGINES IN AIRPLANES

A Commentary by Bob Barton

Dear Fred: I just received the latest copy of Sonerai News and was impressed, instructed, and entertained … as usual.

I'd like to share a few observations on the use of VW engines in airplanes. What we often seem to forget is that the VW engine is an automotive engine. Putting it in an airplane will allow it to fly, but it won't make it an aircraft engine.

Now what I mean by that is that the engine was designed as an automotive engine. The geometry of it's combustion chambers was designed for the use of a single spark plug. The small volume above the piston, when it is near top-dead-center, is shaped for the charge to be ignited at a single point and to burn smoothly across the charge. The normal aircraft engine, designed for dual ignition, has a very differently shaped combustion chamber.

But I am putting this thing in an airplane, and airplanes have dual ignition. Have you ever wondered why? The reason is so that the unreliable magneto ignition systems used in airplanes need to be made safer by making the system redundant.

Well, I have a magneto ignition system in my airplane. So I must have redundancy for safety, right? Wrong! What you don't need is a magneto in the first place.

Think about what you have with a magneto. It produces a spark with a voltage of about 16,000 volts. This is very low compared to the automotive system the VW was designed for. To get a consistent spark at the plug, the gap must be about 0.016 inches. Now we are led to use "aircraft" spark plugs. These are expensive compared to the auto-parts plugs, but more importantly, they are prone to fouling ….. right! That's why I have to have a secondary ignition system. Of course the second plug in each cylinder is placed in an area not designed for it.

STOP! Let's think about this. What is the reason for using a magneto to provide spark to the cylinders … that is, beyond the fact that this thing is in an airplane and not a car. The use of a magneto allows my plane to operate without an electrical system. And this is good because we all know how unreliable alternators and batteries are. More unreliable than the magneto and the small gap spark plugs? I don't think so. And if, as we said, there has to be a secondary ignition system, it has to be powered by the feared electrical system doesn't it?

Let me make an off the wall suggestion: Use an electronic ignition module mounted on the base of the automotive distributor. Viola! We have automatic spark retard for starting. We have a 40,000 volt ignition system, firing automotive plugs with 0.040 inch gaps. (Read less fouling.)

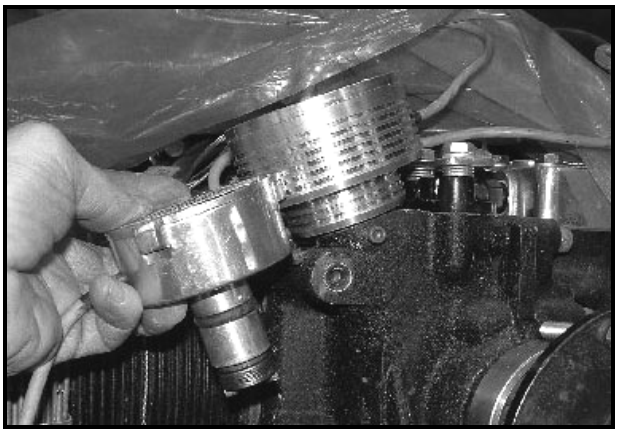
But what about that unreliable electrical system? First: I don't think it is less reliable than the magneto. Second: If it does fail, you have an immediate indication from the voltmeter on the panel. Third: The electronic system will still provide spark from as little as 4-½ volts from the battery. That should last until you divert to a nearby airport.

What do you think?

Bob Barton email:
65xx21@comcast.net
3333 Hidden Acres Dr.
Doraville, GA 30340
(770)938-7271

*Freditorial Comment: In all the years I've been doing the newsletter, I can count on the fingers of one hand the number of letters I've received with comments and opinions on something I've written or published. Bob makes some good points about keeping things simple, and therefore reliable. I've always promoted the KISS principle in building our little airplanes, but over the years have departed from it some to "improve" the machine, and be more comfortable in it. And now I'm adding a starter…*

**CENTRIFUGAL ADVANCE ELECTRONIC IGNITION**
by Bob Quick



This is a Full Time Secondary Ignition System Based on the Dyna "S" dual pick up ignition system, incorporating an early Harley Davison centripetal advance unit.

Just to let everyone know, I had most of these components kicking around the bowels of my garage, from past projects, endeavors, and flights of folly. Why, you might ask, do I make this statement? Simply put, I know someone out there will ask how much it cost to fabricate said unit, the answer being, "damned if I know…" The only thing I HAD to purchase was the 6061 T3 aluminum, for the main housing, and top cover, a walloping $10. (Scrap from a local machine shop) The second point I'd like to make, is the probable need for a bump in the cowl, on a Sonerai.

Having worked with Dyna "S" single fire ignition systems for the past 2 decades, on Harley Davidson's, imagine my surprise, upon opening the box, containing my unit from GPASC, and seeing what it contained. At that point an idea emerged for a better mouse trap, only to be reinforced by Fred's misadventure, hand propping, with the secondary ignition energized.

After taking some measurements, inside the gear case cover, of a Harley Evo, for reference, a basic case was designed, utilizing the drive shaft bushes, from a Bosch 009 distributor. ( I later found out these bushes were NOT available from my local Bosch supplier… Go figure…)

The advance unit was a very high quality after market unit from Rivera Engineering (Rivera Primo to you bikers out there), and had to have it's direction reversed, by fabricating a doppelganger of the base plate, the advance weight's, springs, and pivot pins mount to. I'll say this once, don't buy a cheepo after market unit. The springs, pins, and weights, won't last very long, as they're of inferior metallurgy (Springs too brittle, and weight's/ pivot pins too soft). When all is said and done, these components should have a 100 hr "inspection cycle", replace what ever looks funky, and lube w/ white lithium grease. Rivera has o/h kits for their advance units (Springs, weights, pins). The part # for the Rivera advance unit is #1104-0001. It also comes w/ the special bolt to hold the advance unit to the drive shaft. You can go online to find a Rivera dealer near you, or check w/ your local after market Harley clone shop to see if they can order one for you.

Press out the pivot pins, from the Rivera base plate, after stripping the springs, and weights, and drift out the roll pin, from the bottom drive shaft bore. The small roll pin parallel to the rotor button shaft can be left in, as it won't be needed in the new base plate. After fabricating the basic reverse base plate, turn the bottoms toward each other, and clamp together. Using transfer punches, mark the pivot pin, and travel limit holes, and drill to size. You'll want a .005" interference fit for the pivot pins, and .003"-.005" interference fit for the drive shaft roll pin. Press the travel limit roll pins through the weight's, and flip them over, also reverse the entry/ exit side of the springs, and reassemble the weight's and springs, to the base plate pivot pins. The unit will now advance in the proper direction of rotation.

The rotor button was fabricated from 6061 T-3, as per the drawing, and the magnets I used came from two "give away" (Snap-On, Mac Tool, etc.) promotion screw drivers. You know the kind that has a little clasp/ clip to keep it in your top shirt pocket. I chose these, by using the "little nuts principal", by seeing how many little nuts the magnet from the Dyna S Harley unit could pick up, and finding something real close. Leave drilling, and epoxying in the weights in until you've got the pick up plate, and everything in the housing, and place the magnets at mid height of the pick ups.

The drive shaft was fabbed from a piece of 4130 rod, and the bush area's polished. Having disassembled a Bosch 009 distributor, I used the steel, and fiber thrust washers, at the top and bottom of my shaft, in the same stack up. The drive gear (cog ?) retainer pin hole was drilled w/ a .003" interference fit. Be sure the gear slides freely on the pin, side to side, w/ about .003" end float in the shaft.

The pick up base plate was fabbed from 5250 T-6, .063" thick. Be sure to scribe the 1.875" circle, for the pick up bolt pattern, before you cut out the center. You will note the "short pick up" has a counter sunk Phillips head screw, coming in from the bottom of the plate. This is the first hole to drill, counter sink, and install the screw from underneath. Align the slot for the second mount bolt, on the scribe line, drill, and tap to #4 - 40. The second "long pick up" has a slot to mount the unit, at each end of the pick up. This allows a small amount of timing adjustment for the corresponding coil pack, so don't put the bolts at the inner edge of the mount slots. The second pick up should be mounted close to the first, in a clock wise position, just leave a small amount for adjustment, and drill on the scribed line, tap to #4 - 40… (You do have timing marks for #2 somewhere on your prop flange, don't you?) I used 2 Harley timing plate screws (H-D part# 32606-82) to mount the trigger plate to the main housing. To keep the screws as close to the pick up wiring and side of the housing as possible, I turned the screw end down to about half their stock diameter to ½"" above the threaded end. These "screws" also allow you to mount the top cap to them, as they're tapped to #8 - 32, opposite the threaded end. After the trigger plate has been mounted (be sure to drill all the way through the main case), remove it, place the top cap on the main housing, and flip it over. Use transfer punches to mark the top cap screw mounting holes, and drill. You'll note the top cap hold down screws aren't 180 degrees apart, not to worry, the top cap doesn't care.

The main difference in the timing of this unit would be the need to set and lock the advance unit to full advance when setting the initial timing to your engine requirements. This is easily done w/ a washer with a larger ID than the rotor button shaft, of the base plate, placed under the advance unit hold down bolt… Just twist the button clockwise, and snug the bolt down enough to hold the rotor button in place at full advance. Then, follow the standard timing instructions, to set @ 23-25 degrees BTDC.

The main housing, and top cap, are fabbed from 6061 T-3, as per plans, be sure to have a .003" interference fit of the bushes, to the snout of the main case, and line ream, or hone the shaft/ bush clearances to .002"-.003". I used an o-ring, on the lower housing from a Harbor Freight assortment. Just make sure it stands proud about .005", to seal the housing in the engine case.. Cooling fins are optional. (A note here: Be sure that the height of

the lower “cup”, where the advance unit sits, is tall enough , so the advance unit doesn’t interfere w/ the trigger mount plate. The dimension I came up with, happened to work, for the stack height, of the upper steel, and fiber thrust washers I took from the Bosch 009 distributor I disassembled to use for basic dimension findings. You could always shim it up, with sheets from an aluminum soda/beer can.)

If you’d like to build one these, contact me at the email address below for the cost of a complete set of drawings. So, let’s get those chips flying, and be sure to use eye protection.

Bob Quick
Quickbobo1@aol.com

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*RACEAIR DESIGNS* IS AVAILABLE FOR YOUR FABRICATION AND RESTORATION NEEDS. Contact Ed Fisher, (863)655-0361, raceairdesigns@hotmail.com. Over 30 years experience in dope, fabric, welding, and sheet metal. Numerous awards including 1991 and 2004 Oshkosh Grand Champion Ultralight. No job is too big or small. Need a fuselage welded? Give Ed a try!!

WANTED: Sonerai I complete airplane or well-along project. Solid workmanship and light weight. Bill, *machouse3462@sbcglobal.net* (2/06)

FOR SALE: Monnett Electro-X engine mount, $150; alternator for Electro-X mount, $25: GPASC Y intake manifold, $25. Jordan Klein Sr., 352-288-6060, *jordan.sr@comcast.net* ….(3/06)

FOR SALE: Sonerai IIL, TT316 hrs, TSTO 145 hrs, 1834 VW 60 hp @ 3400 rpm, A&P owned, always hangared. Must sell, $8500 obo. Lycoming O-235-C1, runout and disassembled, $2000 obo. Ken Christian, 660-263-7937. (4/06)

FOR SALE: Sonerai I project. Approx 80% finished overall, have most parts to finish except cover. For more info write to this address: Dan Maiott, 13152 Washburn Rd., Otterlake, MI 48464 with mailing address and phone. Would consider trade for Mini-Max project. Approx value $3700 - $4000 (4/06)

FOR SALE: Great Plains 1700 VW long block with 3 degree tapered prop hub, purchased new and never installed, $1500.00. Also, 130 HP Subaru EA81 long block disassembled. Dual port heads, forged pistons, stainless steel valves, etc. All machine work performed by Ram Performance, $3300.00. Russ Pratt, 9819 Skycrest Dr., Boise, ID 83704, 208-377-0244, *russ_pratt@fastmail.fm* (1/07)

WANTED: Sonerai II mid-wing or low wing; solid workmanship and lightweight. Ray Hassman 715-386-2089 *rhassman@pressenter.com* (2/07)

WANTED: Sonerai II mid wing with Revmaster 2100, 5/8” landing gear, 12 gal fuel tank, $6000; Also, 1/2” landing gear with mechanical brakes, axles, Azusa wheels, and tires. $150; And Sonerai II fuel tank, $50 Robert Jorgenson, 435-678-3436, *robertjorgenson@yahoo.com* (2/07)

**Ken Christian’s Sonerai IIL**
Ken hails from Moberly , MO and has this airplane for sale. See the ad above.