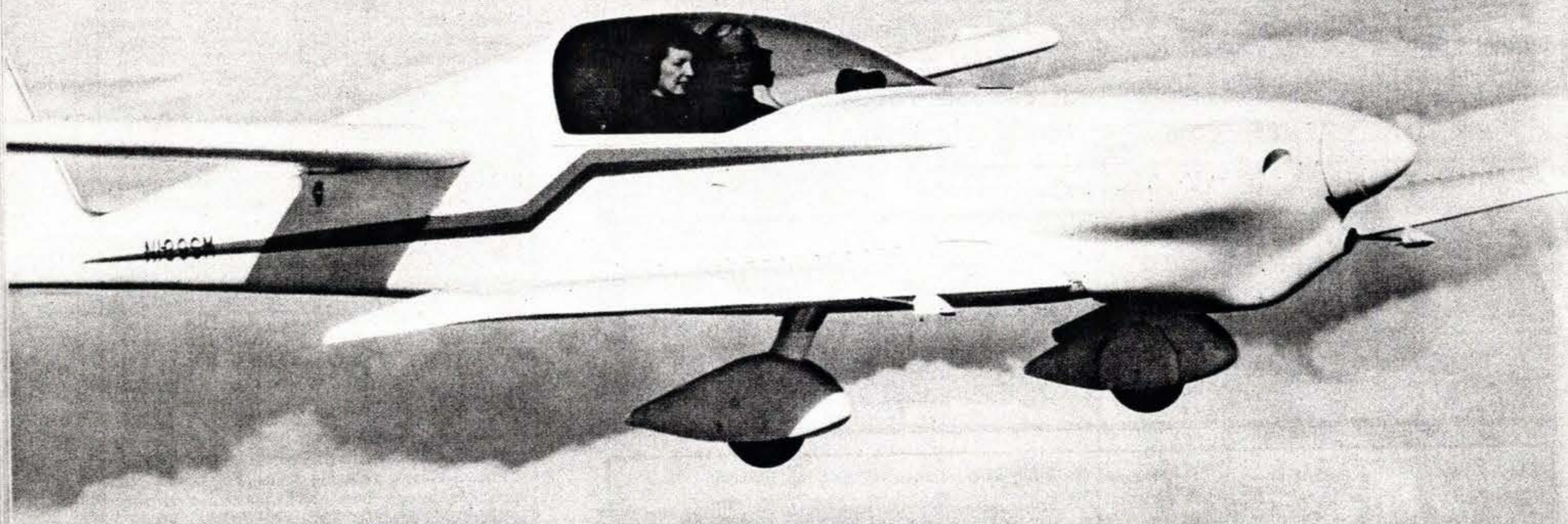
Hot Sparkin'



"What's that?!" Terrence and Cynthia O'Neill enjoy flying their new Dragonfly until engine misfiring spoils the fun.

A Light Speed Engineering Capacitor Discharge Ignition (CDI) system uses solid-state circuitry to reliably replace the standard magneto ignition.

a Cool Bird

The author throws out the mags and installs an electronic ignition system.

By Terrence O'Neill

"What was that?" she said casually on intercom, as she piloted our Dragonfly through a blue sky with a few puffy clouds. Our smooth-running Continental had missed a couple of beats.

"Might be carb ice," I said, pulling out the carb heat. The sky was clear but humidity felt like 99%. Fifteen minutes earlier we'd loaded up our tandem-winger—one small bag into the boot—and taken off for the 1999 Oshkosh bash.

Now at 2500 feet and just passing Vandalia, Illinois, the engine missed a few more times. I pulled the manifold pressure back to 22 inches. With an "I'll take it, C," into my lip mic, I started a gradual turn to the left. We were right over Vandalia's 4000x100-foot paved strip.

"I'll circle the airport and we'll see if it clears up," I said.

I varied the throttle, mixture, carb heat, checked the mags—nothing eliminated the misfires.

"Let's land," I said.

Cynthia nodded agreement, looking cute in her "Governors Run" golfing capless-eyeshade-thingey. She did most of our flying, unfazed by things like the huge thermal bumps over eastern Colorado in July or a weeping header-tank gas leak near her right armrest...or misfires. Way cool, C.

Well, we weren't going cross-country like this, I thought with a sigh of disappointment. We spiraled down, landed, and left our pretty homebuilt crammed into a T-hangar alongside a Cessna. We drove to Oshkosh.

Mystery in the Air

When I returned to Vandalia, after a circling 45-minute test with misfires that didn't get any worse, I made the 15-minute hop back to home base, and called our antique-engine guru, Skeezix Adkisson. He decided it was probably the mags. "Scatter-firing," he said. "The only way to check is to pull the mags off, inspect and test them." He suggested a university with an aero maintenance shop.

An instructor at the terrific aero shop at Southern Illinois University at Carbondale told us to bring the mags down. "We'll check 'em out," he said. When I handed him the mags, he began turning them around and wiggling them and saying things like "Oh, that's bad" and "It shouldn't do that." He had me wiggle the shaft, and I could feel the slop. The bearings were worn. We put them on a tester, and we could see the sparks miss.

"These are old Slick Model 4030 throw-away mags...designed to be used about 400 hours and then thrown away," he said. "Can't repair 'em. Awhile ago Slick had a promotion accepting these as cores if you bought their new mags, which are better, but they don't accept 4030s as cores anymore."

"Bummer!" Both my mags were worthless, even as cores.

In 20 telephone calls to mechanics and folks selling both the new and used sparkers, I heard many prices and even more opinions: "Eisemanns are good, but parts are getting hard to find." Or "Slicks are OK, but Bendix last longer...and they cost more." Or even "You'll have to buy junk cores to trade in."

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Mags—Used, New or ?

As my cutie co-owner and I discussed magnetos over breakfast one morning, it became clear to us that what we really, really wanted was *reliability* even more than we wanted a low price and more than ease of installation...meaning I might have to do some more modifying work on the plane. We didn't want any more problems with engines running rough. We would pay extra to avoid that.

So it was settled:

1. No used mags because there was no way to tell how long they would last.

2. If new mags (we'd also have to buy two cores first), they might last 'til overhaul, with some maintenance.

3. Possibly no mags at all. I had heard many times in the last few years that electronic ignition was much more reliable. After all, mags are obsolete. How many of our hundred million automobiles and trucks use magnetos for ignition? Right.

Pacemaker for an Old Dude

OK, so who had an up-and-running EI system? I looked through recent years' magazine articles on rally and speed dash winners. I didn't want to help develop somebody's new idea. I wanted a proven, reliable system that would work on our antique Continental A-80. Kind of like a pacemaker for

PHOTOS: TERRENCE O'NEILL

an old dude. The name that kept coming up was Light Speed Engineering, a system sold by Klaus Savier, whose little VariEze has for years won speed dashes clocking 239 mph propelled by his tweaked, EI-sparked Continental O-200.

I was soon looking over Savier's web page and a thick file of printouts on his LSE Plasma CDI system. CDI costs more than new Bendix mags and cores, but for a few hundred dollars more, reliability was promised, and the system requires virtually no maintenance.

After studying the stuff, I telephoned the man himself. Savier has a slightly detectable German accent, which of course bespoke uncompromising efficiency...if you did it his way.

That first call verified the web site information, and I asked about installation on our semi-centennial engine. Yes, probably. The LSE system's spark trigger comes from a pair of small trigger coils on a plate bolted to the front of the engine crankcase, sensing when a trigger bolt attached to the prop flange passed. But on our A-80 there was no room for plate-mount coils because we had a belt-driven alternator and a starter in that area. Savier suggested his cylinder-shaped Hall Effect module that plugs right into the hole left by the dead mag and has its own timing light. He would check with his engineer, but he believed the LSE Plasma CDI Ignition would work on the 50-year-old engine, even though our mag drive turns to the right, not to the left as the later C-85s do.

"They work either way," he said on call two, "but for right-hand drive, the timing light needs to come on at 48° BTDC (below top dead center) instead of TDC itself.

"For it to be reliable," he emphasized, "you must install it exactly according to the instructions." I could tell from his concerned tone of voice that the workmanship on the electrical wiring and layout had to be serious first class. "I solder all my own connections," he added. However, he allowed that good-quality squeeze connectors would work.

On a dual system, Savier insisted on a second, separate electrical source—a small auxiliary battery of 4.5 ampere hours. A battery selector switch directs the electrons to only one of the CDI systems should the plane's electrical system fail.

"Klaus," I said in my third call, "if the CDI boxes draw 1.2 amps each, why do you call for a battery with only 3 hours capacity for just one of the CDIs?"

"That is to save weight," he explained, "and to encourage the pilot not to try to fly too far after one CDI fails."

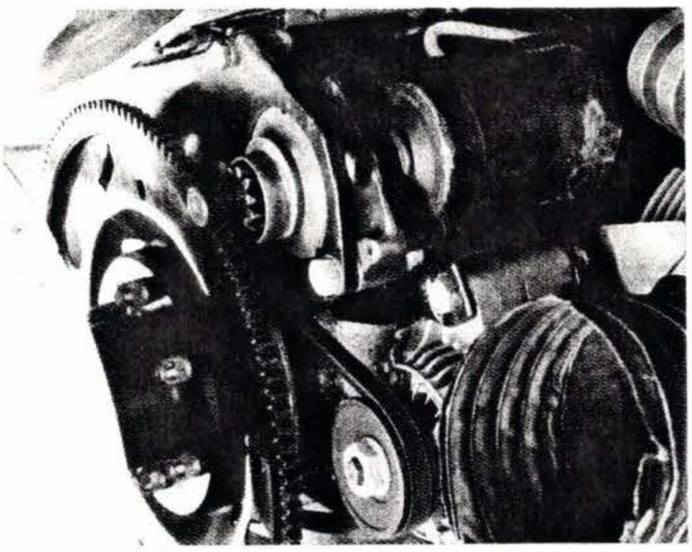
After finding a 9 amp-hour battery that weighed only a pound more than a 4.5, I overruled Herr Savier,

Savier suggested his cylinder-shaped Hall Effect module that plugs right into the hole left by the dead mag and has its own timing light.

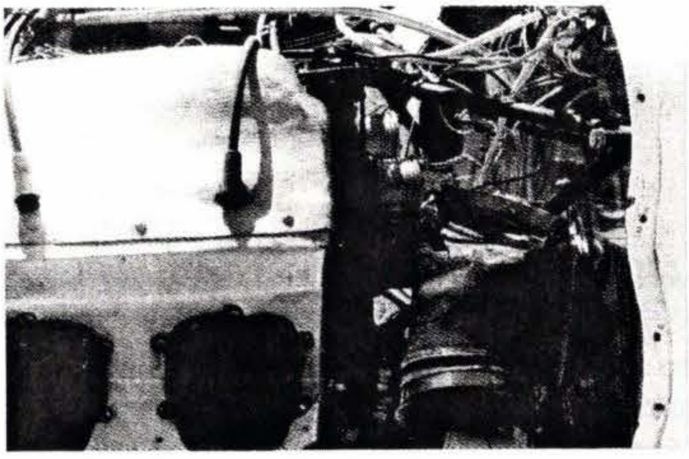
and I also changed the wiring so that the auxiliary battery would serve both CDIs instead of just one. After all, if I wanted to increase endurance I could just switch off one CDI myself. And if for some unimaginable reason one CDI—or more likely my less-than-perfect wiring—should fail, I would still have access to the alternate CDI.

Call number four: "Klaus, if we decide to order two systems, do you have them in inventory now, and when could you ship them?" He checked and said they would be shipped Friday—in three days. I wanted to make the Dragonfly fly-in at Ottawa, Kansas, in a couple of weeks.

"OK," I said. "Do you take Visa?"



There is no room up front for the CDI's trigger coil. The starter and alternator are in the way.



Two compact Hall Effect trigger modules (center) plug into the holes left by the old mags.

Hot Sparkin'

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Installing EI on a 'Fly

The LSE package arrived but was three ignition coils short. Call number five: "They were due in from Germany," Klaus explained, "but when they arrived they were the wrong ones. Sorry. The right ones are en route now."

When the missing coils came in, I began the firewall mods. The CDI boxes fit on the cool side of the firewall. Their white sensor leads from the Hall Effect modules came to the CDIs through the center of the firewall. The black coax ignition leads going from the CDI to the coils went back out at the sides to keep the white and black leads 5 inches apart. The harness came completely wired to connectors and needed only trimming to length.

I mounted coils on the cooling-air-boxes' outside with a ⅜-inch hole underneath each one for cool air (from higher pressure in the boxes). Each coil fires two cylinders' plugs: 1 and 2 top, and 3 and 4 top. It was the same for the bottom plugs. The instructions said these coils were temperature limited to 180°F, but Savier (call number six) says the coils now are OK to 220°F. I later checked the temps in flight with a cheap water temp gauge, and the ambient air around the coils is only 120°F, peaking at 150°F after shutdown. No problem.

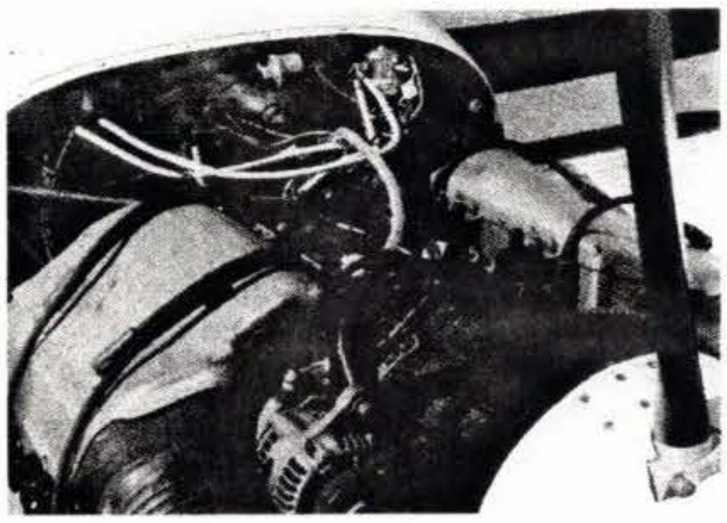
All my orange high-tension sparkplug leads stay neatly outside the boxes. They're supposed to be replaced every 500 hours or three years, whichever comes first. No radio-noise shielding is needed thanks to the latest spiral-wound plug leads.

Though we had just bought our second $130-plus set of aircraft-type spark plugs, I opted for Savier's automotive-type plug bushings and automotive N-D plugs, so the three-times-hotter spark could have its 0.032-inch spark gap. Big spark, easy start. It's difficult to regap the massive electrodes of aircraft plugs.

I made a crank angle indicator for the back of the prop flange to time the engine and epoxied it on. In the cockpit I took out the mag switch wiring and used the mag toggle switches (key switch not recommended) as CDI switches to power each CDI box. A three-position (on-off-on) single-pole switch was put on the panel for routing the main or auxiliary battery juice to the CDI switches. Likewise, a panel-mounted circuit breaker with a Schottky diode was used for charging the aux battery.

At this point I deviated from Savier's wiring scheme. He says the voltmeter needs to be installed between the batteries and the CDI

and over to Greenville to an open house. There were instant start-ups every time. A week later, again to Greenville for some auto gas. On takeoff, just as I lifted off, the plane transformed into a glider. Absolute silence. There was runway ahead, so my thought was: "Interesting." I



Two black ignition coils hang on each of the cylinder cooling boxes. They convert the LSE CDIs 300 VDC to 40,000 for a nice, hot spark. Mags make about 17,000 volts.

landed gently, continuing the roll-out through the turnoff to clear the runway.

I flipped the battery switch to aux, cranked, and the engine started right up. I switched back to the main battery, and checked the CDI switches. The engine quit on the left CDI. I switched again to the auxiliary battery and started the engine again. Both CDIs worked.

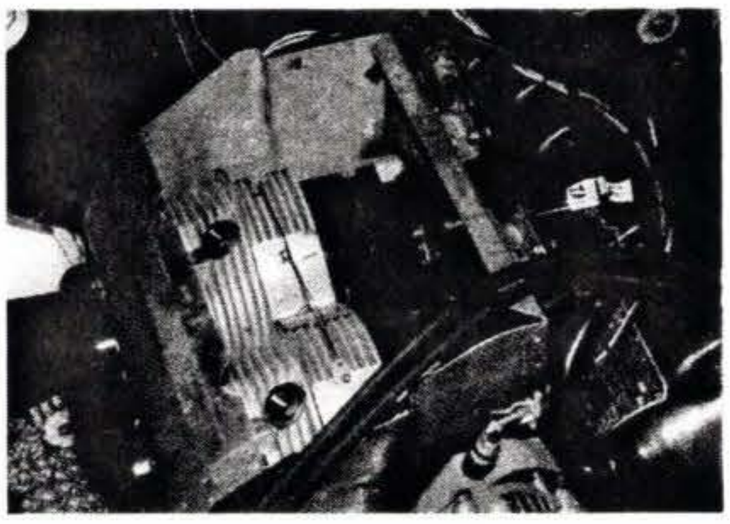
Strange. The starter was cranking on the main battery, but the CDI quit when on the main battery. Was the main battery run down or not? If the left CDI was faulty, why would it work on aux battery? I spent about 15-minutes checking various combinations, and then gave up, put the plane in the big hangar and got a ride home from the kind gentleman who sold powered parachutes at the airport.

It was about 6 p.m. in Illinois, but it was only 4 p.m. for Savier in California.

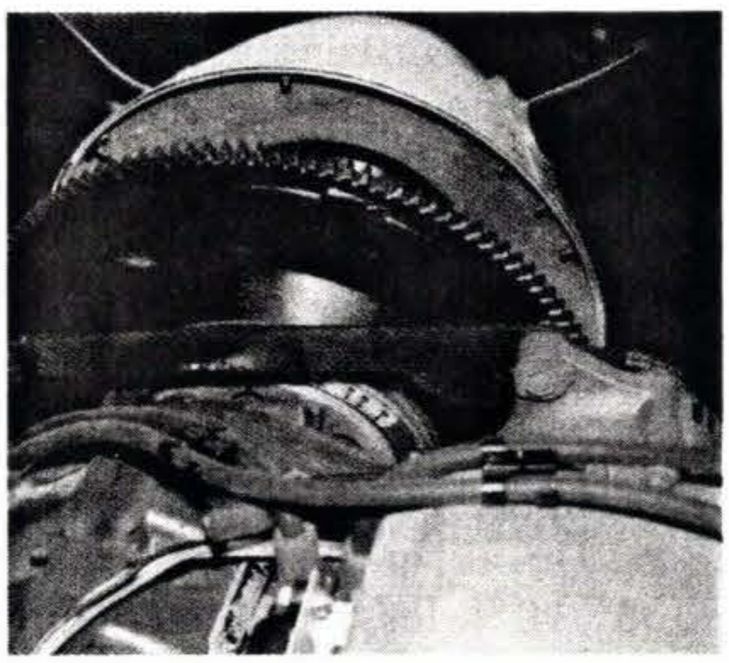
Call Number Seven

After I described the symptoms, Savier's first question was, "Where do you have the voltmeter hooked up?" This was the single instruction I had neglected to follow. I confessed non-compliance.

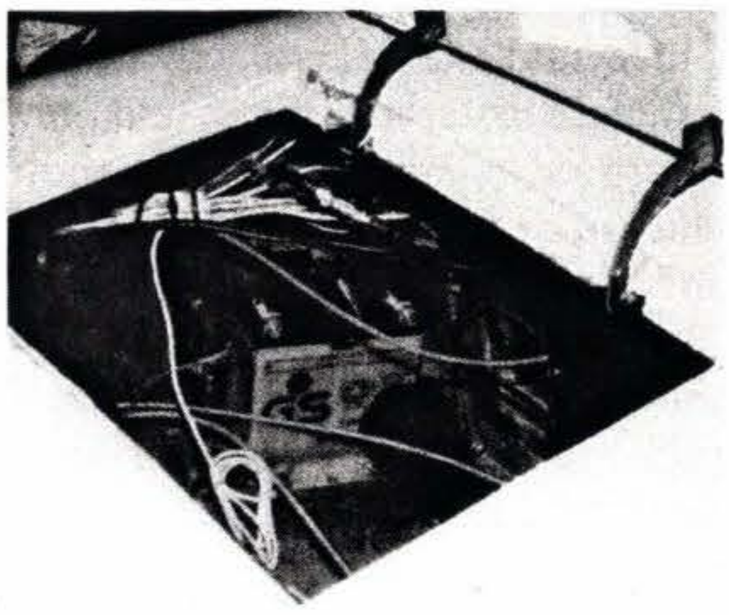
He thought that I must have put the battery selector switch in backward, and he also thought I had the Schottky diode in backward. He chewed me out for not following voltmeter orders. I pleaded that I had carefully checked each circuit before



Automotive spark plugs in LSE adapters permit a 0.032 plug gap for a fatter spark.



A hand-made crank timing scale was epoxied to the crankshaft flange, and a pointer was bolted to the alternator bracket on the case centerline.



The auxiliary battery is shoehorned into the left corner at the firewall and is fixed in place with epoxied brackets.

wiring it, and I had checked the diode for flow direction.

The next day I rechecked the circuits. Yes, indeed, somehow I had managed to put the battery selector switch in upside down, and also put the Schottky diode in backward. Incredible. So when I thought I was running ignition on the main battery it was actually on the aux battery. And that's why the main battery ignition (really the aux ignition was dead) couldn't power the CDI, but the plane's main electrical system could crank the engine and power the CDIs.

With the diode in backward, the main system couldn't recharge the aux battery. In 3 hours I had run the aux battery so low that the CDIs couldn't make spark...under 4 volts! The LSE Plasma CDI system uses discrete logic in place of programmable memory or microprocessors, to avoid any potential problems from static discharges, minor lightning strikes or other single-event upsets. The CDI can operate on voltage from 4 to 35 VDC.

If I had placed the voltmeter as instructed, I would have seen the low aux battery voltage and found my errors. The fix: I moved the voltmeter lead per Savier's directions, reversed the diode, and turned the battery selector switch over. Now all works perfectly. Pull the circuit breaker and read either battery's voltage. Call number eight was to thank him.

I just checked the Dragonfly's VN (maximum speed, level flight). Instant start-up. Climb to 2000 feet, and full throttle. The airspeed settled at 139 knots at 27.5 inches manifold pressure and 2800 rpm...a little faster than before. Not bad for 80 hp. Now for some cross-country flying with EI. **KP**

FOR MORE INFORMATION about the Light Speed Engineering electronic ignitions systems, contact the company at P.O. Box 549, Santa Paula, CA 93061; call 805/933-3299; fax 805/525-0199; e-mail lse@west.net.