Servicing Thermic Sniffers

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The Thermic Sniffler was a cutting edge product brought out by Dr. Walt Good and Don Clark. It operated in the two meter amateur (Ham) radio band at about 144.00 MHz and had a companion receiver.

The Sniffler was installed in a sailplane and sensed the change in altitude. It didn't give absolute altitude, just the change, up or down, by varying an audio tone. A higher pitch tone indicated lift while a lower tone showed sink.

The RF circuit was tunable over several kilohertz so that nearby interference could be avoided. The Sniffler was sensitive to height changes as small as several inches, so a pilot with sharp ears could fine tune the sailplane's path in the smallest puff of good air.

Since the Sniffler operated in the Ham radio band, non-Hams were not supposed to use it. However, many sailplane pilots bought them and used them to learn how to thermal.

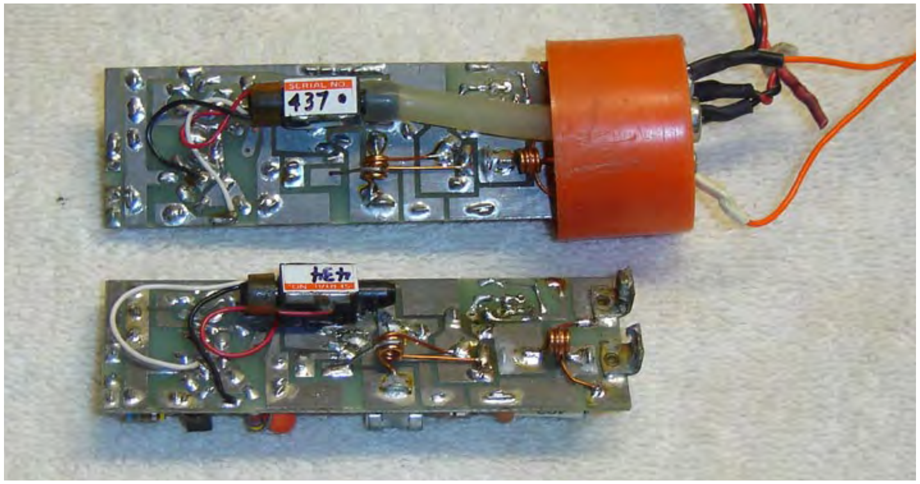
It was such an effective tool that some contests in the '60s and '70s actually outlawed their use as unfair technology. Those pilots without a Ham license could fly the Sniffler at their home field but couldn't compete with them because they were not licensed.

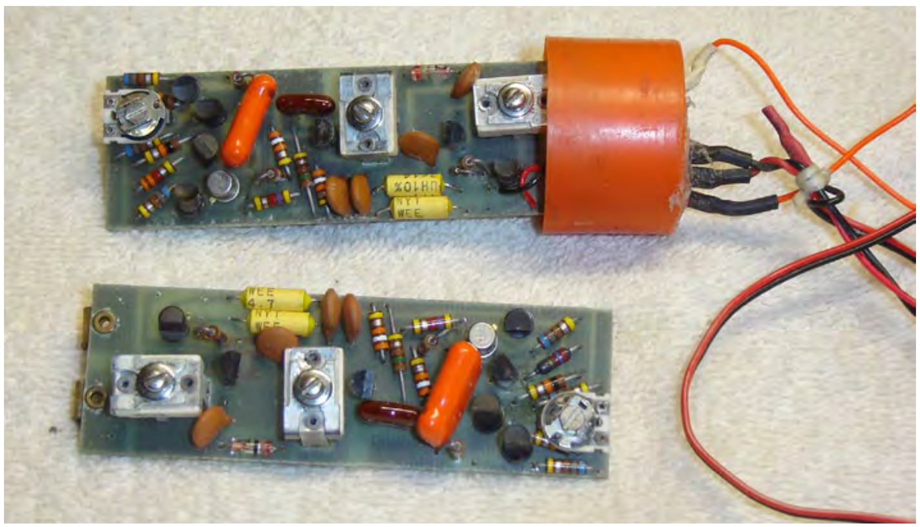
Later, Don and Walt sold their design to Ace RC Incorporated of Higginsville, Missouri.

Ace decided to rework the RF section and move the operating frequency to the 49 MHz band which didn't require a Ham license. They also did away with the fragile "pill bottle" housing and installed the electronics in a square white plastic shell.

A companion receiver was used to pick up the fixed RF frequency signal from the airborne unit. Normally an earphone was used with the receiver so the pilot wouldn't share the Snifflers' data with other competitors.

The Sniffler was comprised of an audio oscillator with a temperature/pressure sensor module that varied the tone frequency. This circuit modulated an RF oscillator on about 144.00 MHz which was the carrier. A variable capacitor matched the RF oscillator output to the two antenna wires that extended out from the pill bottle housing. These were about 3.5 feet in total length or a half wavelength (468/frequency = 1/2 wave) at two meters. The two antenna wires were usually taped to the bottom side of the wing in a swept "V"pattern. Some sailplanes had pieces of inner Nyrod





Upper: These are two Sniffler circuit boards, one with the pill bottle cap in place. This is the bottom side of the board with the black sensor module in the middle. You can see the rubber tubing that brings air to the sensor. The bare board has the two elbow-bent screw terminals for the antenna wires shown.

Lower: This is the top side of the circuit board with the three tunable capacitors. The capacitor furthest from the end cap sets the resting tone frequency. The middle capacitor determines the RF frequency and the one closest to the end cap peaks the RF output.

installed inside the wings for the antenna wires to slide into as the ship was assembled at the field. Since a straight dipole like the one on the Sniffler has a signal null off the ends, the “V” pattern would lessen the null and make the tone readable all the way around the thermal circle.

There are several thermal sensing telemetry devices on the market today. They make use of microprocessors, improved sensors and multi-channel data formats, but mainly they give the same information as the Sniffler. They do seem to have better range and also are not prone to the signal fades of the antenna system used on the Sniffler. The downside is that they use the R/C airborne pack for power instead of the separate 9-volt battery in the Sniffler. For power hungry aircraft with a lot of servos this is a serious consideration.

A typical flight would begin by switching on the aircraft and also the Sniffler, then the ground receiver. A tone of about 400 Hz would be heard in the receiver earphone when the sailplane was resting on the ground. When the ship was raised to launch position a small tone increase could be heard telling the pilot that the Sniffler was operating. At launch, as the ship rotated and went up the line the Sniffler tone would go to maximum pitch and remain there until the ship came level and released the tow line. The tone would then settle back to around 400 Hz and go up or down as the ship went in search of lift.

The Sniffler would basically sense two types of rising air. First, it would sense the warm rising air of a thermal. This would make the tone rise at a fairly rapid rate and stay high until the ship came out the lift. Second, it would sense gusty turbulence. There would be a sudden rise in tone pitch followed by a rapid decrease as the wind gust blew through. This second type would fool many a pilot into starting a thermal turn where there was no lift. In both situations the ship would move its wings and tail indicating that dynamic air was in the area.

I found the Sniffler particularly useful for coming down out of big lift. I originally used mine in a Sailaire 12-foot span sailplane that loved to get high. When diving the flying stab has been known to come off, especially with the spoilers up and adding rough air over the tail. If I couldn't fly out of the lift then I'd pop spoilers and begin a shallow dive while in a wide circle. The dive was just steep enough to shut off the Sniffler tone and I used that low growl or hiss of the blank RF carrier in the earphone to monitor the descent. If an flutter developed in the airframe the resulting vibration could be "heard" by the Sniffler and the tone would "warble". That was very effective at giving alarm before things came apart.

Those pilots who are involved with the League of Silent Flight LSF tasks know what a challenge they can be. In my view the two toughest tasks are the 10000 meter cross country and the two hour thermal. The cross country or goal and return task requires that the sailplane be flown to a goal over 6.2 miles distant and then return to the launch point. The pilot chases along behind the sailplane in a vehicle and tries to keep the ship in view and in rising air at the same time.

A Sniffler will tell the pilot if lift is there while warning him if it starts a dive or steep turn for some reason. Of all the tasks, this one needs the ship to fly high and the pilot to maintain visual contact. When bouncing down a road at 30- 40 miles per hour with the wind making your eyes water, it's a comfort to hear that the ship is doing fine.

The LSF two-hour thermal is best flown with several people at the same time. That way each sailplane can show conditions in a separate part of the sky. If sink happens in one spot then maybe another ship is finding lift so everyone can fly toward it. The Sniffler used by an experienced pilot can maximize the good air while helping him avoid the bad stuff.

You will notice in the pictures that the top of the circuit board has three variable capacitors on it. The one nearest the edge is the tone-set cap. This allows the pilot to choose the "resting" tone of the unit as the ship sits on the ground. The middle capacitor sets the RF frequency of the unit. I set that to the middle of the tuning range of the ground receiver.

The capacitor partly hidden by the pill bottle cap is the matching capacitor. That is adjusted for strongest signal from the Sniffler to the receiver. I like to use an AC millivolt meter plugged into the receiver earphone jack and tune for maximum on the meter.

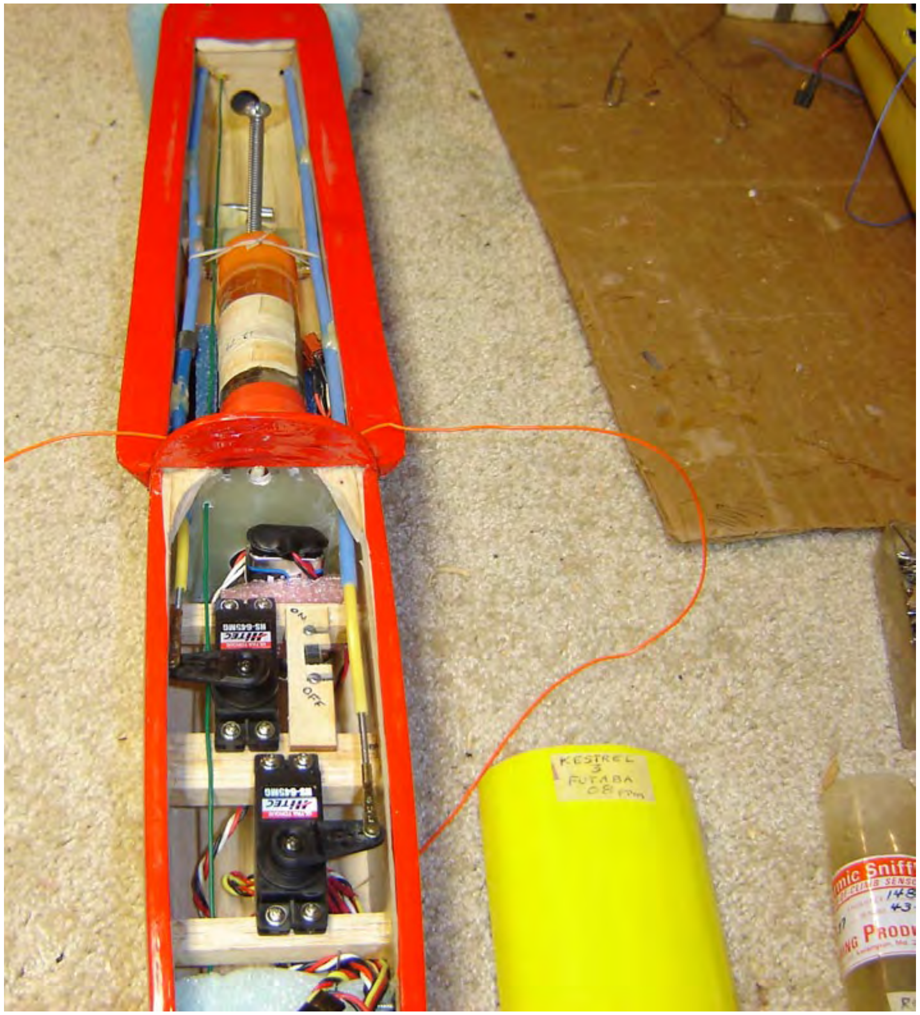
The 9-volt battery in the Sniffler will last for several days making it a useful airplane tracker if you happen to land in a corn field or the woods. The rod type antenna of the receiver will null or loose signal when pointed at the plane so is easy to use for searches.

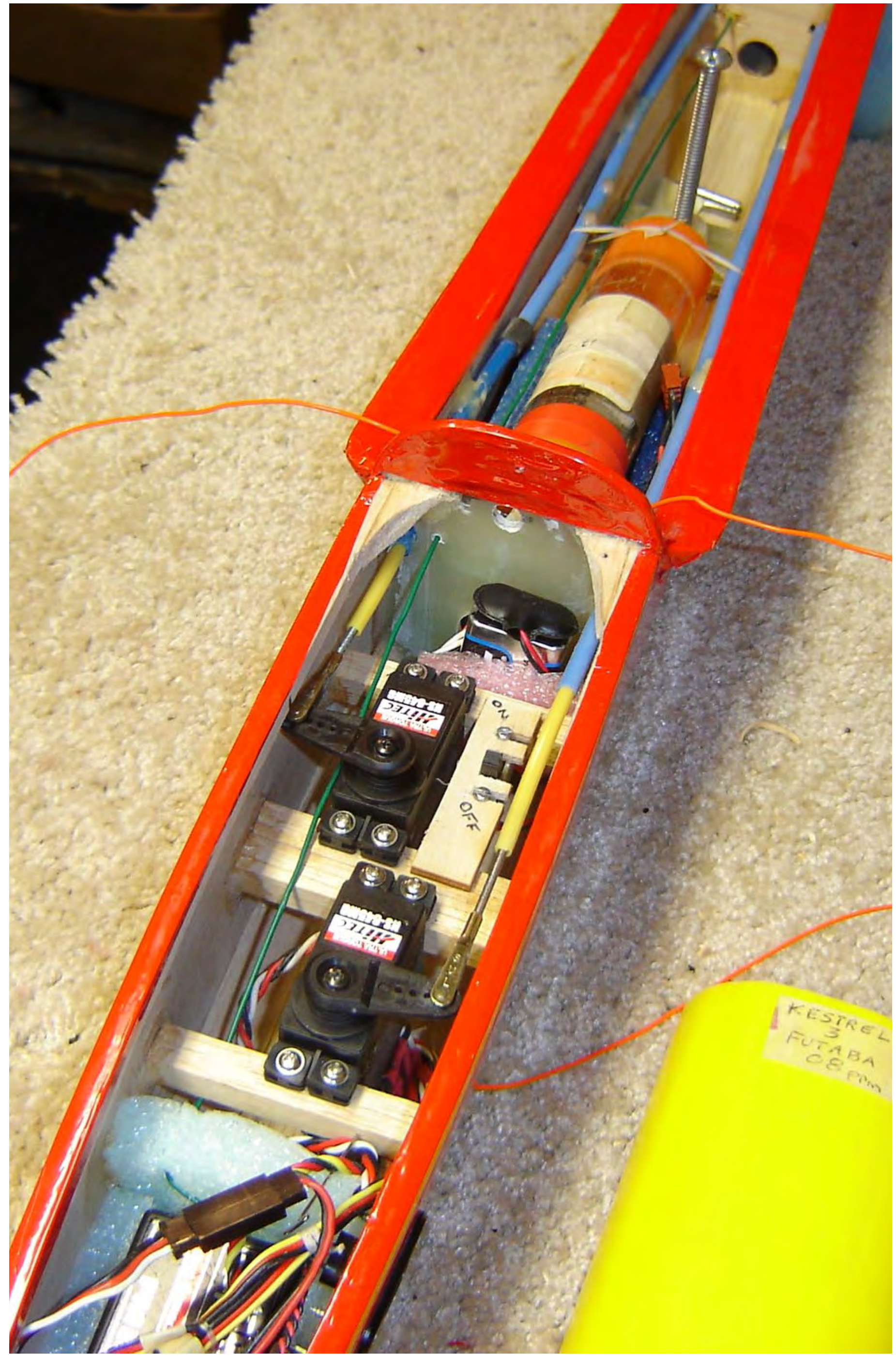
When you change the battery be extra careful not to reverse the polarity. The battery snaps should only go onto the battery one way, but if you aren't using an on-off switch and touch the battery to the snaps the wrong way it will take out a diode on the circuit board. (Ask me how I know!)

There is a piece of rubber fuel tubing that connects the sensor to the drilled bolt in the plastic cap. This routes outside air to the sensor. The case or pill bottle must be air tight so that the pressure inside is a steady reference for the sensor. Similarly, the rubber tubing can't have any holes and the fit around the bolt end must be tight. Also check that the hole in the bolt is clear.

Right: The R/C system antenna blue wire goes toward the tail and crosses directly over the right side Sniffler antenna wire. They cross at 90 degrees so coupling is minimal and no interference has been noted.

Below: This is a view looking aft from the nose. The rudder and elevator servos are mounted with enough room for the Sniffler power switch to sit beside the rear one. The 9-volt battery sits between the rear servo rail, and the bulkhead and is secured with a bit of foam.





The following is a brief sequence for repairs of the Sniffler.

First, Do a complete visual inspection of the outside including the battery wires and switch if used.

Second, if the Sniffler is dead, start by replacing the battery. Hook the negative lead of a multimeter to the battery minus terminal, then use the positive lead to follow the voltage across the circuit board. You should see a voltage drop across the diode. From there check voltage to the sensor, and the various transistors. Snifflers are not hard to work on. I have not been able to locate a schematic for them, but use standard troubleshooting procedures to find problems.

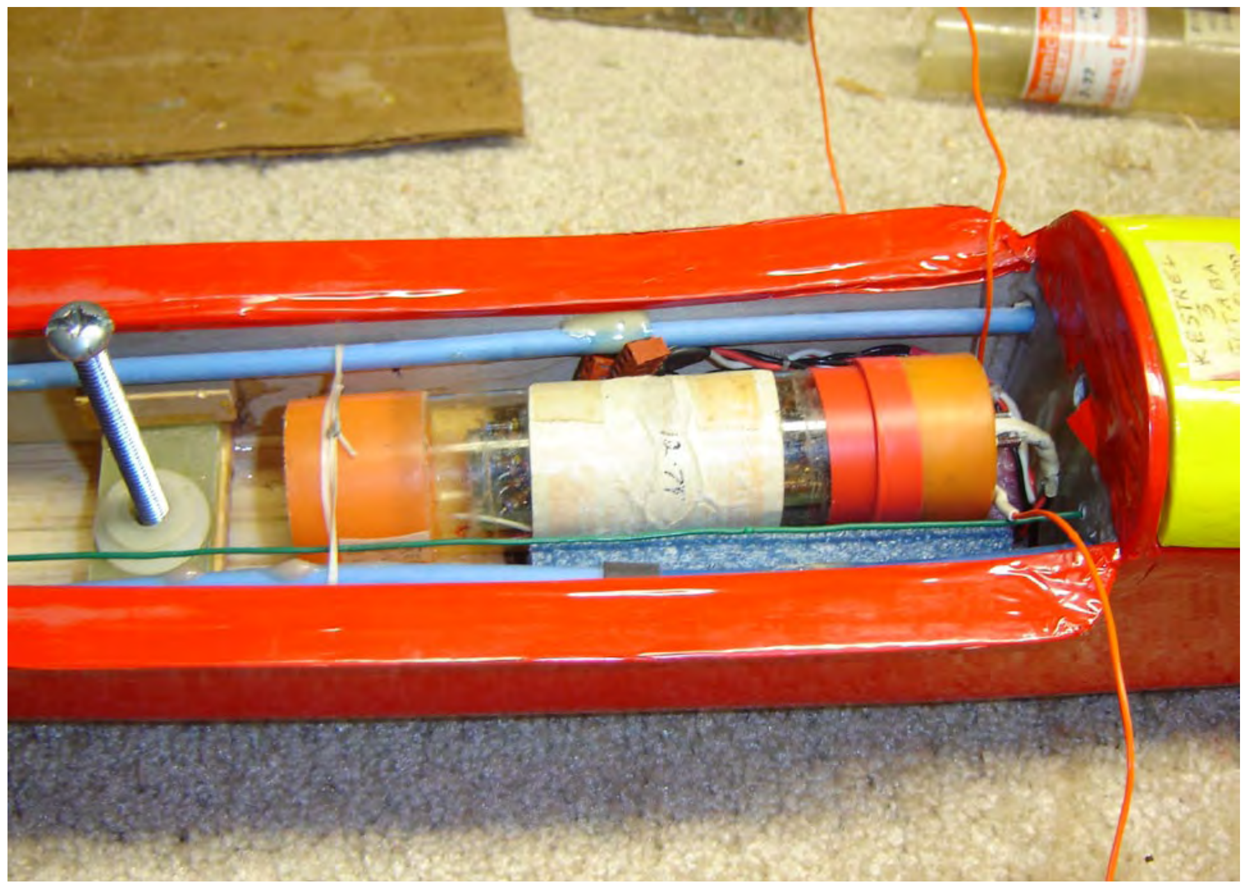
Third, if range is the problem, hook up the AC millivolt meter to the receiver and tune the capacitors for max output. I've had "firm" landings detune one or more of the capacitors. Sometimes a readjustment is all it takes.

If that's not it, then check for broken antenna wire connections under the white shrink tubing. If they are okay there may be corrosion on the two screws that terminate the antenna wires to the pill bottle cap.

I also had trouble with the receiver. The swivel at the base of the telescoping whip has gone open on occasion and dirt has made it noisy at other times. I use a product called Deoxit <http://www.deoxit.com> that removes oxidation from electronic connections and is great stuff. As with the Sniffler, it's always best to change the 9-volt receiver battery first.

It is a challenge to keep this old gear working, but well worth it. When doing maintenance or moving the Sniffler to another ship I can appreciate the skill and devotion that Don and Walt put into it.

It's fun but also a privilege to work on the stuff they built.



005: The complete Sniffler is installed in a 12-foot span Kestrel sailplane. It is well padded. The wires to the switch and battery are passed forward into the radio room. Space was provided for the two flap/aileron wing wiring connectors so that they don't press on the Sniffler when the wing is bolted down.

A TOTAL ENERGY PROBE

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Joe Wurts' reputation in cross-country soaring is legendary and justified.

Ben Trapnell is a frequent contributor to RCSD (Big Wing review, August 1988) and a friend of Joe Wurts. Ben is also an accomplished soaring pilot and enjoys testing new ides and equipment.

In this article, Ben describes a new (to R/C soaring) device adapted by Joe Wurts from full scale soaring. It has already proved to-be an effective and outstanding addition to the R/C soaring pilot's "kit." Using Ben's instructions you can build one yourself. This is believed to be an RCSD "first" scoop.

Earthbound soaring pilots have long been at a distinct disadvantage to their airborne counterparts when It comes to recognizing lift. While the full-scale pilot can feel the lift, the model pilot must react to the visual actions of his aircraft.

When the plane's reasonably close, this may or may not be too difficult. On the other hand, an aircraft at high altitudes (during a crosscountry contest for example) is relatively difficult to see. Whether it's "cored" is often very difficult to determine. Visible or not, there still remains the problem of "thumb thermals."

These pilot inputs may serve to mask or give false indications of lift. The dilemma, then, is how to tell when the sailplane encounters true lift (or is just reacting to pilot inputs) and how to keep the plane in that lift.

Devices, new and old, have attempted to "tell" the model pilot when his aircraft encounters lift. Two of the most popular are the Thermic Sniffler produced by Ace R/C, and the Thermal Navigator.

Both are electronic devices which are placed in the model, but operate quite differently. The first sends a signal to a ground receiver which translates it into an audible indication of climb and

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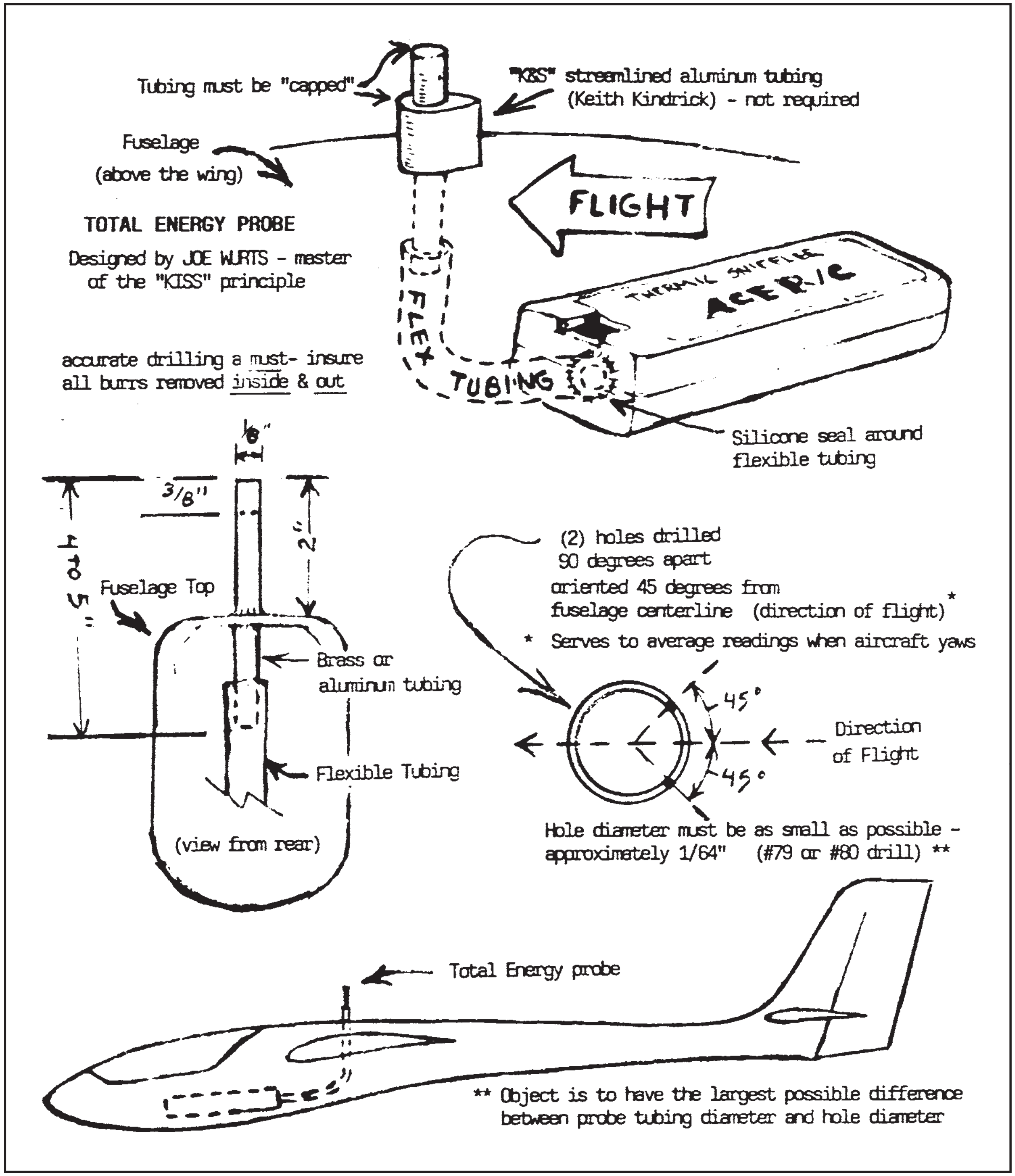
descent. The Thermal Navigator, on the other hand, sends an input to the aircraft's radio which causes the aircraft to turn, thus, "showing" the pilot that he's in lift.

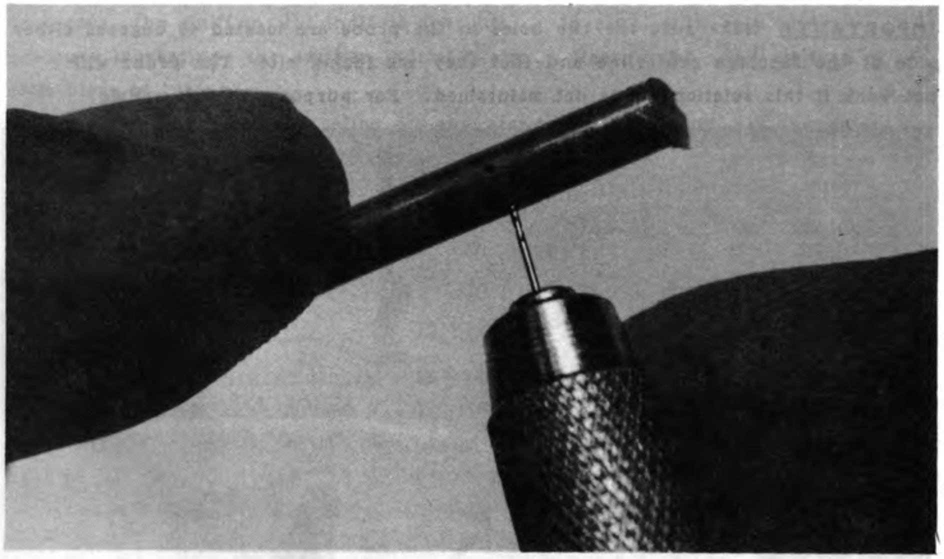
Both work relatively well but suffer from the fact that each will falsely interpret spurious pilot inputs as lift or sink. If the pilot pulls back on the stick, both devices will indicate lift, while doing the opposite indicates sink. These "thumb thermals" have fooled even the best and, up to now, were considered something to live with.

Enter "The Boss."

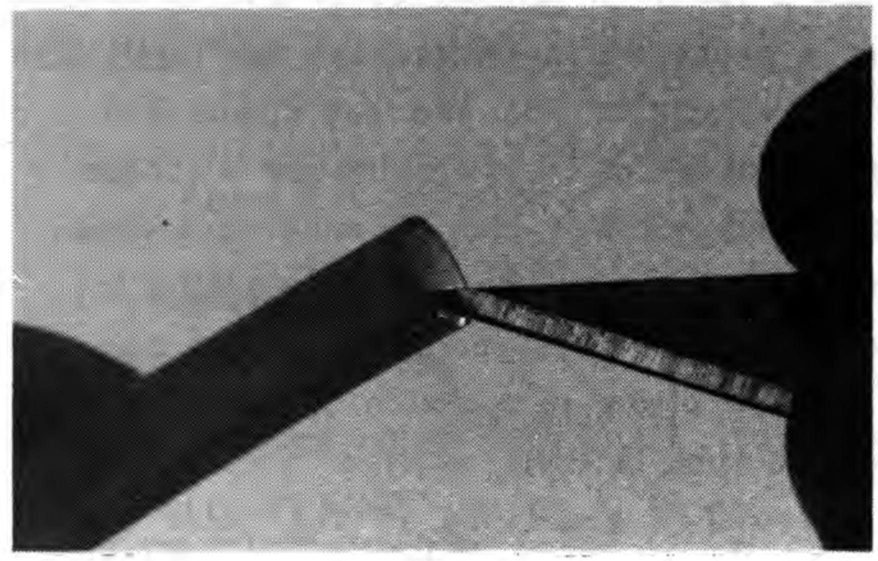
Famous for his cross-country exploits and fiberglass construction techniques, Joe Wurts has been winning nearly everything in sight with his transmitter in one hand and Thermal Sniffler in the other. Realizing the limitation of his Sniffler, he knew there had to be a "better mouse trap." Borrowing from full-scale soaring's total energy probes and using his own aeronautical engineering talents, Joe proceeded to modify the Thermic Sniffler allowing it to, in effect, disregard any of the pilot inputs, thereby transmitting only indications of true lift or sink!

The device is extremely simple yet functions surprisingly well. Though not enough of an expert to explain all the aerodynamics involved, I will show you how I made my probe and, basically, how It functions.





A #80 drill bit in pin-vise used to drill 1/8th inch K&S aluminum tubing. Holes are 90° apart, 3/8th inch from top end. Note tubing is “capped” with hot-melt glue.



Close-up of chamfered end cutting process.

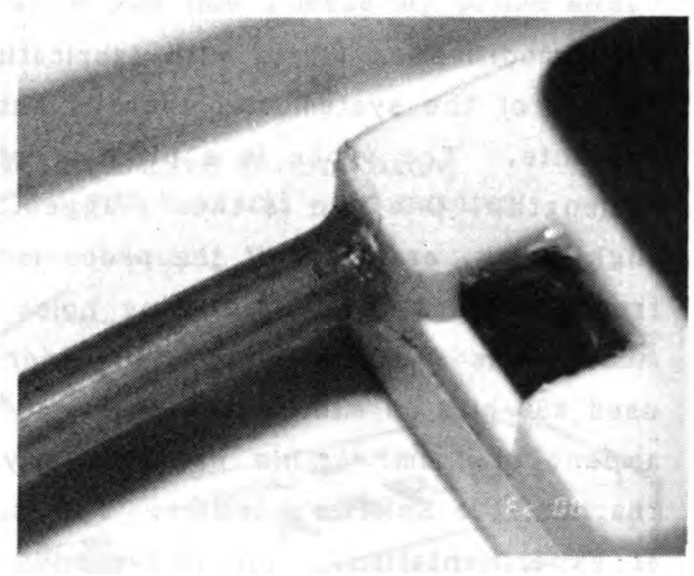
The heart of the system is the standard Thermal Sniffler. If you’re not familiar with it, the device is a transmitter with a small orifice at one end which allows air to enter or exit a plenum chamber with changes in atmospheric pressure (translate: climbs or descents). The rate at which the air enters or exits is “measured” and transmitted back to the pilot as an audible signal. The higher the pitch of this signal, the faster the air is leaving the cavity, hence, the faster the aircraft is rising. Just the opposite occurs when the aircraft is descending.

Joe’s modification starts with fabricating a probe which “measures” the total energy of the system and cancels out the effects of pilot-induced climbs and descents.

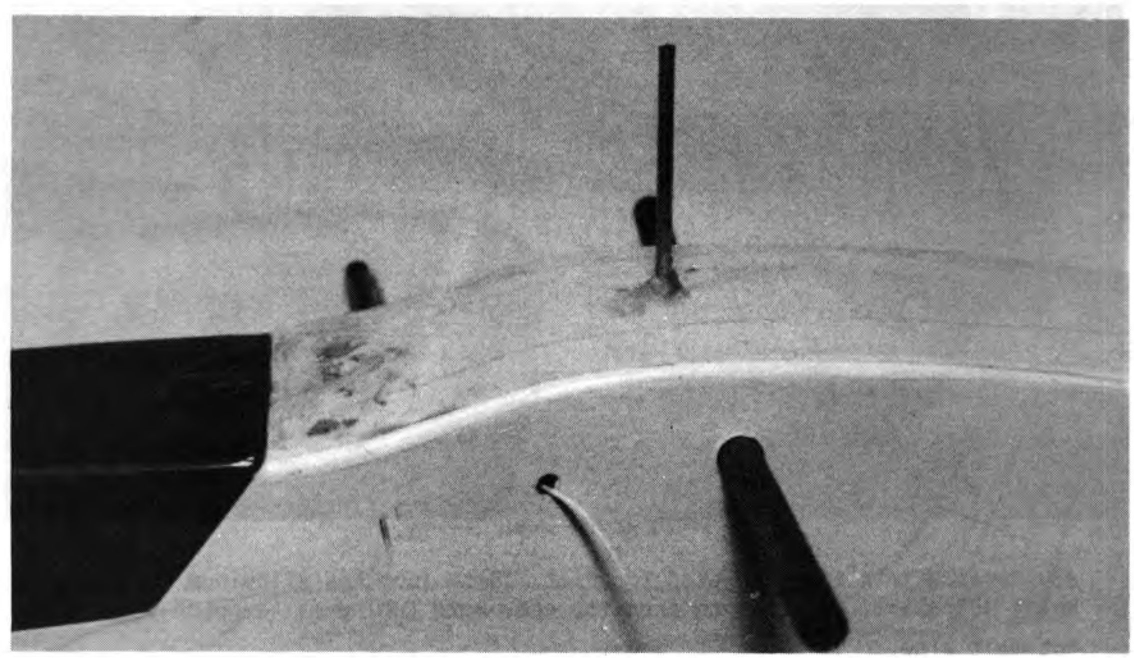
The probe is a piece of 1/8" tubing cut to approximately four inches in length. One end is then plugged. I used hot-melt glue on mine, but epoxy might work, or solder if the probe is made of brass.

Approximately 3/8" from the plugged end, two tiny holes are drilled 90 degrees apart. These holes must be as small as possible in order for the probe to function properly. (I used #80 bits on mine.)

The open end of the tube is then “stuffed” with a small amount of foam. This prevents any turbulence generated in the holes from reaching the Sniffler’s orifice. Just how much foam needed is mostly a product of experimentation. Joe recommends enough to provide a time constant of 1 (meaning: if you were to draw a vacuum, it would take 1 second for the vacuum to decrease by half). A segment of cigarette filter has proven to be very effective.



Left: Tubing tack-glued with gap-filling CyA then caulked with silicone adhesive.



Completed unit installed in aircraft. Drag of 2" probe “negligible.” (<2% max. for planes of approximately 1000 in^2.)

The second part of construction is getting the Thermic Sniffler ready for the probe. A piece of large fuel tubing (What Is that?) is chamfered at one end so it can more easily be fit over the orifice of the Thermic Sniffler. A sharp #11 blade works well. I used a little bit of gap-filling CyA to hold this tubing in place, then applied a bead of silicone adhesive around the tubing. Be very careful in these operations that you don’t plug up the tiny hole in the Sniffler. As the final device may be required for more than one airplane, I use a relatively small length of tubing for this and splice a longer piece in later.

Mount the probe on/in the fuselage with approximately 2" protruding from the top. This is to keep the small holes away from the boundary layer. VERY IMPORTANT: Make sure the two holes in the probe are located 45 degrees either side of the fuselage centerline and that they are facing aft! The probe will not work if this relationship is not maintained.

For purposes of this article, (I was in a hurry) I mounted mine with hot-melt glue, but any adhesive should work.

If you’re wondering about the drag of such an arrangement, don’t! Joe’s calculations indicate that on a ship of approximately 1000 squares,. the drag created is less than 2% of total at high airspeeds. At max L/D, the drag is less than 1%! The potential gain by being able to remain in the lift far outweighs the drag produced. The probe is now spliced to the “modified” sniffler and the unit is mounted as usual in your aircraft. That's all there is to it!

Operation is simple. Turn the system on, launch the plane, then listen for any change in the neutral tone once established in a glide. A change in pitch indicates a change in rate of descent due to the air mass the plane is "floating in."

Theoretically, when moving through the air, the pressure behind a cylindrical body is less than that in front. As the velocity increases, the negative value rises. In our sailplane, one reason for an increase in velocity is due to pushing the stick forward, causing a descent. The normal Sniffler, sensing the increase in static pressure, would Indicate sink. The design of the probe overcomes this because as the static pressure is increasing due to a loss in altitude, the dynamic pressure (negative value) is increasing due to the resultant increase in velocity. Amazingly, this happens simultaneously, cancelling out any change in "total energy." The exact opposite occurs in a climb.

If true lift is encountered, the aircraft's velocity shouldn't change appreciably. Dynamic pressure remains the same while static pressure decreases and the Sniffler will indicate that lift. In sink, with only static pressure increasing, the Sniffler indicates sink. Neat, huh? And all from a little piece of tubing! Well, not an engineering treatise by any standards, it should get the point across.

If you're like me, the advantages of this type of system is Incredibly obvious. If not, check with your competition! Very few things these days are revolutionary. This is certainly one of them.

Thanks again to Joe for "having no secrets."