We don't know whether this is due to the larger diameter, fewer blades, different airfoils, or whatever.

Our conclusions from our comparative evaluation of the Sensenich 2-blade vs the Performance 3-blade are:

1) The Sensenich is, is slightly more efficient, can be "clocked" in 3 different positions to optimize missing the exhaust gases, and because it is much less expensive, provides good value for the money.
2) The Performance runs smoother, has more ground clearance, but is more expensive and can't be "clocked" to miss the exhaust.

When we discussed these results with Steve Boser, at Sensenich, he asked if we would be willing to evaluate the same prop, but with 2 inches less diameter, and a new prop 70 x 85. We agreed and will report the results when available.

Steve told me that they make propellers for experimental airplanes the same way that they make their certified props for certified airplanes. I told Steve that the FAA requires us to fly off 40 hours with an uncertified prop, but only 25 hours with a certified prop, and asked him to check out the possibility of certifying props for the Cozy Mark IV.

Incidently, some propeller manufacturers measure pitch using the bottom surface as a reference, especially if the bottom surface is flat. Other manufacturers (like Sensenich), who use airfoils that are not flat on the bottom, use the chord line as a reference. This could account for a wide divergence of pitch specs between propellers of different manufacture, i.e. 76 vs 87.

## PROP FLANGE SIZE VS HORSEPOWER

(By Steve Boser, Sensenich, with some paraphrasing.)

It is important to ensure that the drive-torque capacity of a crankshaft flange/propeller hub is adequate. Since only one of the four strokes of a four stroke engine makes a positive contribution to rated engine torque, the contribution of the other three strokes is negative. Therefore, the instantaneous peak torque is greater than the rated engine torque. The ratio of instantaneous peak torque to rated torque depends upon the number of engine cylinders, the type of prop extension, and other factors.

Most flanges designed to drive wood propellers have two distinct torque-transmission systems. The flat surface of the flange transmitts torque to the propeller hub by static friction. The propeller could also be considered driven by the drive-bushings in the flange. But the two systems are not additive, so the system which transmits the greatest torque will govern. If the propeller is driven by static friction, the drive bushings will not feel any load, but if the drive bushings experience a fluctuating torque load, some movement of the hub against the flange must occur, and scorching of the hub boss will result.

The friction force between the face of the flange and the propeller hub is determined by the compression force perpendicular to these surfaces multiplied by a coefficient of friction between the two materials in contact. If the compression force and coefficient of friction are known, then the maximum allowable peak torque can be calculated as a function of flange diameter.

The maximum allowable peak torque which could be transmitted by the drive bushings can also be calculated. It is the product of the allowable bearing stress for the drive bushings against the side of the holes in the prop hub, the total drive bushing bearing area, and the drive bushing radius from the flange center.

Calculations for both torque transmission systems reveal that the drive bushings at best can transmit only one quarter as much torque as static friction. This is why maintaining proper bolt torque compression on the wooden propeller hub is critical, since the drive bushings would only be short-term backup.

The peak torque to be transmitted depends upon whether a prop hub extension is used. Any extension which moves the propeller farther away from the crankshaft flange will reduce the torsional rigidity of the system and lower the resonance frequency. Spool extensions are "softer", which can cause the propeller to lag behind and then race ahead of nominal engine RPM. This lag/lead may appear as increased peak torque at the propeller / engine interface. Thus, a propeller mounted on a spool extension requires a larger drive torque capacity (greater diameter flange) than a direct installation on the same engine.

Installations of wood propellers with satisfactory service histories are as follows:

1) For the 0-320 160 hp Lycoming engine, the 6" dia. engine flange is satisfactory, and spool extensions with 6" dia. flanges are satisfactory up to 4" in length. At 6" in length, the 6"dia. flange is marginal. A 6-1/2" dia. flange is better.
2) For the 0-360 200 hp Lycoming, the 6" dia. engine flange is unsatisfactory for a wood propeller and a 6" dia. extension flange is also unsatisfactory. A 7" dia. flange is satisfactory for a spool extension up to 6" long.

## VOICE ANNUNCIATED WARNING SYSTEM

Dear Nat, 5/19/99

Enclosed please find a write-up of the voice annunciated warning system I demonstrated to you and other builders at Sun-n-Fun and talked about at the Cozy banquet.

You asked whether it was necessary to run all new wiring from the engine compartment if you already had existing wiring. I have just installed my system in an aircraft with existing wiring. I had to modify my modules so they would not interfere with the existing engine instruments, but it was a big plus because I did not have to install new sending units. All I needed was voltage levels at high and low readings. It was easy to adjust my system.

## MY COZY TALKS TO ME

Have you ever had these things happen to you or heard of such things happening? 1) I was flying along when suddenly my radio and all navigation went out. It turned out my alternator had quit working and the battery went down. 2) My engine suddenly seized up from lack of oil pressure. If I had only known this sooner, I could have made a safe landing and saved my engine. 3) My engine started running really rough. I tried everything I could think of to clear the problem when I noticed the CHTs or oil temperature was

way too high. I found later a bird's nest in the cowling that I failed to find on my preflight. 4) Bang??? Oh, #*#*#*, I forgot to put down the landing gear. I thought this would never happen to me, but here I sit. 5) or the engine quits for e of the most stupid reasons on earth, out of fuel.

Pilot error? You bet. All of these problems could have been prevented by being more observant and monitoring instruments more closely. But if you stare at the instrument panel too much and don't pay attention to what's going on outside, you're probably equally doomed. Even though there is no substitute for good engine instruments, you just can't stare at them all the time. Scanning quickly is best, but when we are just having fun, we might ignore the instruments all together. Wouldn't it be nice to have someone, or something watching over our engine and aircraft every second? Well here it is.

I have designed a voice annunciated alarm system and I am offering it in kit form or assembled and tested. Only basic soldering skills are needed to assemble. You will find the unit very simple to build and you can have it working in just a couple of hours.

The system is based around a popular voice chip, which has superb voice reproduction. It's all electronic, no tapes, and can store up to eight messages at a maximum of 10 seconds each. Most typical messages will only be from 3 to 5 seconds duration. As an example: Warning! Low oil pressure! Warning! Low battery voltage. Warning! High cylinder temperature. Landing gear down and locked. Warning! Landing gear up. Warning! Low fuel pressure. Etc. These messages are easily recorded by the user and can e re-recorded if a mistake is made. Messages can be recorded over 100,000 times.

The unit comes in a die cast metal box measuring 4.7 x 3.7 x 1.3" and weighs 9.6 oz. All wiring to the unit is made through a 15 pin "D" connector and can operate from 10.5 to 30 volts. Idle current is only about 80 ma.

The system's audio output can drive an 8 ohm speaker, headsets, or audio panel. I use mine to drive my audio panel using the dme input, since I didn't need it for dme. Any other unused input can also be used. There is a volume adjustment on the circuit board to adjust for the proper audio level. The unit comes with a built in microphone to record the messages.

The unit's power should be wired through the nav switch, to avoid voltage spikes when cranking your engine. Once energized, the unit starts sensing each of the input lines for a ground. If it finds a ground on any line, the corresponding message will be broadcast. If more than one, it will say each message. The messages will repeat until the problem is solved or the 5 min. mute button is pushed. You can arrange the grounding circuit, or I can provide sensor modules and/or sending units.

In a kit form, my unit sells for $280; assembled and tested, $340, shipping included. Senders & modules range from $5 to $20. Voltage levels of existing instrumentation may operate the modules without interference, to avoid additional wiring, but I will need information from you.

I will offer a 2 year guarantee. I will accept checks or money orders. If you have questions, call me at (423) 376-1450 after 7PM EST. Richard Lewis, 367 Pleasant Hill Rd., Philadelphia, TN 37846.

*Editor: Rick demonstrated this unit to us at Sun 'n Fun, and it was really neat. If you want to make sure to heed the warning, have your wife record the warning messages. That sure will get your attention !*

## FUEL MANAGEMENT

The original Varieze relied on the transparency of fiberglass (when it has mirror-smooth surfaces) to see right into the fuel tank and observe the level of fuel. Then Vance came along with the clear plastic sight gages, which was a big improvement and which we recommend. Then there are builders who prefer to also have remote fuel guages on the instrument panel, and there are those who also would like to have low level alarms.

We just have Vance's sight gauges. We carry quite a bit of luggage, but pack it so we can see the sight gauges. We have learned that we usually burn about 8 gal/hr leaned out in cruise, and when we are going on a long trip, we anticipate we will have to switch tanks after 2.5 hours, try to always do it over an airport, and we plan our fuel stops at 5 hours or less. We mark our route in 10 minute intervals, so we are always aware of elapsed time. We never run a tank dry on purpose, although it has happened twice in the last 7 years. The prop windmills, and the engine starts again as soon as we switch tanks. When we are stretching out a fuel stop as far as we can, we have run until the level disappeared in the guage before switching, but the engine has never stopped. On local flights, we usually know how long we will be flying, and as long as we have enough fuel for that plus reserve, do not fill up. We have never felt the need for either a remote gauge, or an alarm, or a fuel flow meter. We are not keen on gadgetry and maintenance, and like to keep our systems as simple as possible. In other words, KISS! Quoting David Domeier (retired TWA captain), "If there's anything primal in aviation, it's seeing your fuel!".

Rego Burger writes: "My instructor always taught me to taxi on one tank and run-up on the other. This exercise sounds silly but has two valuable features. 1) Checking for blockage in each tank prior to take off and 2) Checking that the fuel selector valve is working properly, i.e. not sticking. I feel this check is vital and if John Denver had been used to this technique he may have picked up the difficulty in switching tanks (with a torque tube) and done something about it. My instructor fails us on flight tests if we don't do this, grounds us for a day, and once the sulking is over, we tend to get it right on the re-test. If this isn't standard practice in the US, please suggest it to our fellow Cozy pilots."

Rego Burger,
RSA

## NEW COMPACT ELECTRIC NOSELIFT

Cozy builder/pilot/inventor Jack Wilhelmson didn't have room to install one of Steve Wright's nose lifts because his radio stack was in the center of his instrument panel, so he decided to design a more compact unit that would fit entirely forward of F-22, would be lighter, and just a "drop in"