Issue 95.2 February 1995

The Newsletter of the Portland RVators; Builders and Fliers of Van's RV Series Aircraft

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January Meeting

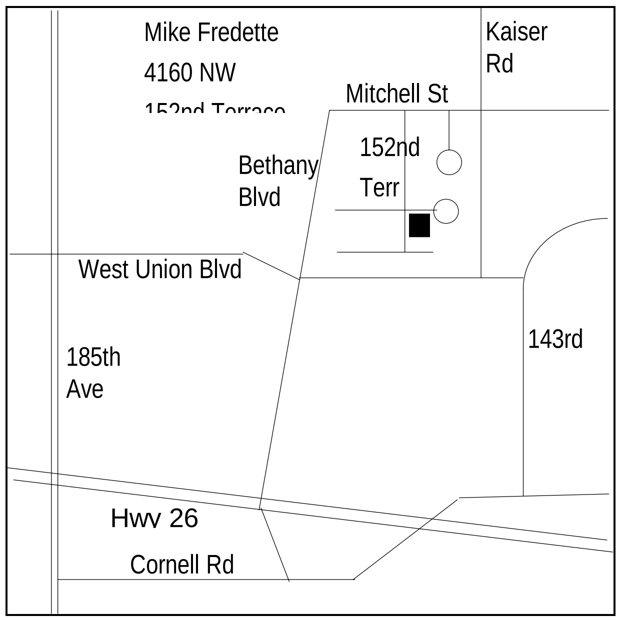
The January meeting was held in Frank Justice's nice roomy 3 car garage. As usual for winter meetings, the turnout was good, with around 40 people in attendance. Frank's fuselage is in the jig and he has drilled about half of the bottom skins. Due to the fact that the previous meeting was also held at the site of an RV-6 fuselage, and that Frank had led a discussion about it at that time, there was no real "program" about this phase of the project. We did, however, discuss plenty of other topics, including the latest on Don Wentz's "working rivets" at the bottom of his fuselage. Bob Neuner's wing skin back rivet contraption was there, (being passed on to Dick Zander), and Bob described how he made it and how it works. New member Tim Steele introduced himself and offered his services as an independent, reasonably priced helper for avionics installation.

The food and drink was what we've come to expect from Frank and Peggy -- a cut above the "chips and lite beer" (which is fine too!) that is the usual fare. *-rh*

Meeting Notice

Place: Mike Fredette's
4160 NW 152nd Terrace, Beaverton
Date: February 9 (Thursday)
Time: 7:00 pm

The next Builder's Group meeting will be at Mike Fredette's place at 4160 NW 152nd Terrace where he is just starting on the empenage for his RV-4. The development is called Parc Bethany; the phone number is 645-4034. Hopefully this will give a jump start (or hand prop depending on your main interests) to all of the new builders who have appeared on the scene in the last few months. Mike will have the free-standing empenage jig that I have been describing for those of you who want to avoid installing a semi-permanent jig. Bring all your questions about what tools to get, how much space you need, how to set up shop, and anything else you need to know about the first or any other stages of your RV. The old-timers like nothing better than to give advice to the newcomers. *- Frank Justice, Meeting Coordinator*



General Business

Randall Henderson, Editor

Calendars

I sold the last of the calendars at the last meeting. Of course Van's still has them, so that's the place to go if you still don't have yours.

T-Shirts, Patches, Decals

I still have a few "Portland RVators" T-Shirts left, mostly XXL. OK so that's not your size, but hey, you could always use one for a night shirt....?

I got a quote on 12" x 7" all-weather "Portland RVators" decals -- they'll cost $15 a piece for 50 of them. It's kind of steep due to the small quantity. Anyway, I'll have to get close to that many people signed up before

I order. I'll be sending around a sign-up sheet at the next couple of meetings. If you don't attend but want one, give me a call and I'll sign you up. Don't send money though, I won't order unless there are enough takers. *-rh*

Top Ten List

Well I guess turnabout is fair play -- after reading last month's "Top Ten Questions I'm Tired of Being Asked...." list, my wife Jeanne promptly came out with her own....

Top Ten Things I'm Tired of Hearing From my Husband the RV Builder

10. Sure I'll clean the gutters dear, just as soon as I finish the airplane.

9. Hey honey, where do we keep the Band-Aids?

8. Man, if I *ever* get this thing done I'm going to....

7. Honeeey, I just got back from an EAA meeting and I have an RV meeting coming up and I have to finish the newsletter before I go to the pancake breakfast! How do you expect me to finish my plane if you keep bugging me to take out the garbage?

5. Tell me again how high the limit is on our Visa account?

6. Hey come in here and help me write a top ten list!

4. Uhhh... is it OK if I build another extension onto the garage today?

3. Pleeease come to the pancake breakfast with me? I promise I won't make you eat any of Rion's grits!

2. Tell me again how high the limit is on our home equity line of credit?

1. Are you *sure* you don't want to get the Portland RVators Logo tattooed on your....?

Subscriptions Due:

Look at the date under your address on the cover. **THAT IS THE DATE YOUR $8 IS DUE**. Mail to me (***Randall***) or give it to me at the next meeting (my address is the return address on the cover). If you are paid up but the date doesn't reflect this, please give me a call so I can correct it.

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EVENTS CALENDAR

12th Annual Northwest Aviation Conference and Trade Show - Tacoma Dome, February 11 & 12

EAA Chapter 105 Meeting - Thursday February 16, (third Thursday of every month), 7pm at Twin Oaks Airpark. Good programs, don't miss em.

EAA Chapter 105 Breakfast - Saturday March 4th, (first Saturday of every month) at Twin Oaks Airpark, 8am. Pancakes, eggs, and grits!

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Cowl Pin Eats Prop

Steve Harris

A couple of Sundays ago I had an experience with a cowl pin eating into a prop, that other folks may be interested in.

I left Hillsboro, and flew to Scappoose for gas. I ran into Don Wentz there and chatted for a while. We even talked about the prop design (Aymar Demuth) and how straight the trailing edge was. (Happy Birthday Don!)

From there, I flew to Vernonia OR, picked up a passenger and joined up with Andy Hanna in Van's RV-6A for some air-air video. I flew directly to Tillamook, about 50 miles away and parked right next to Carl Hay's RV-6 and Dan Delano's RV-6. We toured the air museum there, talked with Carl & Dan for a few minutes, then went out to the plane to fly home.

Have you ever just hopped in a plane and flew it without a preflight because you just landed a few minutes ago and knew it was fine? Here is a good reason not to! Fortunately, I DID do a preflight and found that the right cowl pin had broken and worked forward. It had eaten about 0.5" into the prop and chunked out some even larger pieces!

If you aren't familiar with the Oregon coast range between Tillamook and the Willamette valley, there are damn few places in there that I would want to put a plane down. I shudder to think what could have happened if either the cowl had come off or the prop had failed! Remember the damage had to have all occurred in a flight of less than 70 miles. There definitely was no damage at Scappoose, Don & I were looking at and talking about the prop. I could easily have missed it at Vernonia, I did not do a thorough preflight there, only shut down long enough to unload my boy, help push a TriPacer into the hangar then load up and go.

The cowl hinge pin was secured by a loop bent in the end and secured by a bolt into a nutplate in the cowl. The pin had broken right at the bend, the bolt was still securely holding the broken off loop to the cowl. Obviously, inspection and care in handling of these pins is the first step - don't yank on them with nice serrated pliers! The plane had just been annualled and the pins had been removed and reinstalled then. Another idea may be to heat the pin before bending.

Fortunately for us, Dan and Carl were at Tillamook. I jumped in with Carl and got a ride back to Hillsboro. My partner got a ride to Vernonia with Dan. Del (my partner) hopped in our trusty TriPacer, flew to Hillsboro where I had gathered a spare prop (can't have too many props!), all the tools I thought we might need and then some, extra spacer plates, two cheeseburgers

and a couple of large cokes. Armed with food, tools, and prop, we headed back to Tillamook. Meanwhile, Dan Delano had flown to Dietz airpark where he had a spare spinner backplate and we both landed at Tillamook within a few minutes of each other. Dan, Del, and I got the new prop on and torqued. We carefully re-bent the hinge pin and re-secured (checked the other one too!!!) and flew home. I logged my first night landing in a RV-6.

Given the fact that the cowl pin broke, everything worked out absolutely as best as it possibly could have:

- Nobody was hurt, neither the prop or cowling came off.
- The problem was caught on the preflight.
- Generous help and rides were available (Thanks to Dan & Carl)
- A spare prop, spacers, and backplate was readily available.
- We had another airplane available to us to shuttle props/people.
- Very little damage was done, other than to the prop which may even be rebuildable.

Ken and I fit a new spinner and backplate to the prop a few nights ago. The old spinner/backplate is fine, it just doesn't fit the new prop... If we get the Aymar prop rebuilt, there will be two complete prop/spinner/backplate sets for the plane.

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"Outlaw" Props

Bob Seibert

The cut down metal propeller controversy flared anew last fall when the RV newsletter published an article condemning them for failures. That same issue contained an article listing 2 WOODEN prop failures also. Since I already had a metal prop and can't afford to feed a surplus B-52 engine, I investigated the problem.

All of the metal propellers I have information on are Sensenich 76EM and 74DM. (Although the numbers look similar, the 2 props are totally different designs.) These 2 types of metal prop are very popular on RV's, T-18's, Mustangs, etc. This discussion deals only with those 2 types.

I am personally aware of 3 metal prop failures on RV's here in Texas. All 3 failures were on cut down 74DM's. 2 of the 3 failed props had known histories of damage and restraightening. The 3rd prop had an unknown history. All 3 were between 68 and 70" dia, narrowed chord and repitched. None of them gave any warning. Luckily, nobody was hurt in any of the incidents.

In an effort to determine just how scared we should be about these props, we sent 3 of them out to Specialized Testing Service in Arleta California. The data follows: 76EM cut to 70" and chord narrowed to 2.375 at the tip has critical RPM's at 2608 and 2646 for no continuous operation from 2560 to 2695 RPM. A 74DM cut to 69" and chord narrowed to 2.375 at the tip has critical RPM's at 2645 and 2633 for no continuous operation from 2580 to 2695 RPM. And finally a 76EM cut to 70" and full width blades (paddle blades) has critical RPM's at 2630 and 2732. No continuous operation between 2580 and 2780 RPM.

There are several other critical RPM's for these props but they are well above any sane RPM to turn a Lycoming.

It is important to understand that ALL metal propellers have a spectrum of critical RPM's. The stock 76EM, for instance, has 3 points within the RPM range of Lycoming engines. They are at approx. 2150, 2180 and a minor one at 2550 RPM.

Cutting the diameter of a 76EM (or 74DM) shifts the critical frequencies upward and you can see that the 2 bad ones land in the 2600 RPM range.

What to do? If you are going to run a cut down metal prop, get it tested or try to match it to the data we have so far. Stay out of the critical frequencies for continuous operation. Get an accurate tachometer. John found out his was 125 RPM off. Mine was 200 RPM off! (Hopefully Diane will appreciate a new Tach. for Christmas.) I plan on tweaking the pitch on my prop to cruise below 2550 RPM and run wide open above 2700 RPM. An interesting result of having narrow blade tips on my prop is that I can turn lots of RPM's even above 10,000 feet.

If you want to test a metal prop, the recognized authority on it is Sandy Friezner who owns Specialized Testing Service. He tested our props for $50 each (the shipping costs about $50 also) which is a real bargain. He can be reached at (818) 899-9201. If you do get some tests run, please copy me as I am trying to build a base of data on these props.

This investigation wasn't a one man effort though. I want to thank John Glader and Evan Roberts for their help in the vibration analysis. I would also like to thank Herman Dierks, Jim Stugart and Kent Williams for the information they shared. We spent about $300 on vibration studies and I feel it was an excellent investment.

Note: In order to keep this in the right perspective, please remember two things: 1) My RV6 says EXPERIMENTAL on it. 2.) Advice is like mushrooms. The wrong kind can kill you. B.S.

[Bob is the president of EAA chapter 187, in Georgetown, Texas. His article was originally printed in their chapter newsletter, and has been reprinted here by permission. - Ed.]

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Everything You Ever Wanted to Know about Aluminum (but were afraid to ask)

Brian Monetenich

Aluminum Designation System

A standard four digit numbering system is used for designating Aluminum and Aluminum alloys. The first digit in the designation identifies the principal alloying element. The following table lists all of the available types of Aluminum:

Series	Principal Alloying Element
1000	None (99% or higher pure aluminum)
2000	Copper
3000	Manganese
4000	Silicon
5000	Magnesium
6000	Equal amounts of Silicon & Magnesium
7000	Zinc

The second digit in the designation (except 1000 series) indicate minor modifications in the alloy or impurity limits. The third and fourth digits (for all but 1000 series) are used to distinguish specific alloys and have no numerical significance. In the 1000 series, the third & fourth numbers are the same as the two numbers to the right of the decimal place in the purity of the aluminum. For example, a 1050 aluminum is 99.50% pure. The second digit for 1000 series is used only to designate impurity limits.

Rivet Materials

While there are numerous alloys used for aircraft rivets, the most suitable and most common alloy for light aircraft is 2117. It is more corrosion resistant and crack free than any other rivet alloy. Also, the rivets can be used "as received" from the manufacturer without heat treatment. Rivets made from 2117T4 possess excellent swelling characteristics when driven. AN rivets made of 2117T4 material have a material designation of "AD" and have a small dimple on their manufactured heads. The highest strength rivets available (7050T73) are used on the Boeing 767. They are 1 1/2 times as strong as 2117 but expensive.

Basic Temper Designations:

There are five temper designations. They are: "F" (Fabricated), "O" (Annealed), "H" (Strain Hardened), "W" (Solution Heat Treated[i]), and "T" (Heat Treated). The temper of most aluminum alloys used in airframe materials are designated with a "T". The number after the "T" designates the temper of the rivet. A temper designation of "T4" means solution heat treated and age hardened. "T3" means solution heat treated, age hardened, and cold worked. The rivets used on RV aircraft (as well as most other light aircraft) are 2117T4. Once a T4 rivet is driven, It has been cold worked and therefore its temper changes to T3. A temper designation of "T31" means it is an icebox rivet.

[i] An unstable heat treatment applied to naturally aging alloys.

Icebox Rivets

Rivets made of alloy 2024 are called *icebox rivets* because the material is too hard to drive in its original heat treated condition. The rivets must be re-heat treated and kept in a freezer until just prior to use. This keeps them in the annealed ("O") condition. They are relatively soft and easily driven. The driven shear strength of 2024T31 rivets is 41,000 psi. Rivets made of 2024 material have a designation of "DD" and are identified with two raised shoulders on the manufactured head. As RV builders know, the 2024T4 sheet used for ribs are solution re-heat treated and kept in a freezer until being formed.

Strength of 2024 and 6061 Aluminum Alloys

Virtually all of the aluminum used in RV aircraft is 2024T3 sheet or 2024T4 bar. A little bit is extruded 6061T6 (angles). There are two strength designations which are important - Ultimate and Yield strength. There are also two manners in which material can be stressed. It can be subjected to a load along its axis (such as in a bolt when it is stretched) or it can be subjected to a shear such as when you cut a rivet. The Ultimate strength is the breaking strength. Yield strength is the strength where the material begins to plastically deform. That is - where it will not return to its original dimensions when the load is removed. For the purposes of design, yield strength is always used. Strength has units of pounds per square inch (psi). If a 10,000 load is supported by a member with a cross sectional area of 1 square inch, it's stress is 10,000 psi. The data in the table below is taken from Volume 2, Metals Handbook, 9th Edition, American Society for Metals.

Type of Material	Thickness or Dia.	Tensile Strength	Yield Strength
Alclad Sheet 2024T3	0.010"-0.062"	59,000 psi	39,000 psi
Alclad Sheet 2024T3	0.063"-0.128"	61,000 psi	40,000 psi
Rod & Bar 2024T4	0"-0.499"	62,000 psi	45,000 psi
Rod & Bar 2024T4	0.5"-4.5"	62,000 psi	42,000 psi
Extruded 6061T6		45,000 psi	40,000 psi

Strength of 2117T3 rivets

For rivets, driven shear strength is used to determine size and spacing. The driven shear strength of 2117 rivets is 30,000 psi. Multiplying the driven shear

strength by the rivet cross sectional area yields the rivet strength in pounds for *single shear*. Single shear is when a rivet shears at one location (such as when two sheets are riveted). An example of *double shear* would be a bolt in a clevis. Strengths of rivets in double shear are twice those in single shear.

Strengths of Driven 2117 Rivets in Single Shear[ii]				
Rivet Diameter	3/32"	1/8"	5/32"	3/16"
Strength (lbs)	217	389	596	860

Interviews with an RV Builder

Bob Neuner

Name: Brian Moentenich

Occupation: Mechanical Engineer

Pilot Ratings: SEL

Aircraft Building Experience: No Previous Experience

Project: RV-6A

Engine/Prop: "What ever I can find."

Project Status: Tail complete, right wing complete, finishing left wing (80% complete).

Workshop: 1/2 of a two car garage

Special Tools: Hand made scales for weighing Pro Seal. Used an "Optical level" to level the wing spars in the jig.

Profile: Brian is a member of the Troutdale chapter of the EAA. He says he decided to build an RV over other designs after hearing Van speak at a chapter meeting. He was concerned with finding a project he could build with little or no help from others. Van assured him that most of the RV can be built by one person. Brian liked the fact that aluminum is a "known" quantity as far as aircraft building is concerned and felt comfortable with it. He chose the RV-6A for it's easy ground handling capabilities and the future marketability of a "Nose Dragger".

He says he spends about 15 to 20 hours a week in the winter working on the project and about half that in the summer. His philosophy is to do a little each day to stay on top of the project. The expected completion date is about two years from now.

Brian chose to use the two piece wing skin which he riveted on in the conventional manner. He also chose to fit the inboard wing skin *under* the outboard skin. He has designed his own landing light placed just outside the fuel tank on the right wing. The wiring will run behind the fuel tank. The lens he made himself and will fit flush to the skin.

[ii]Aircraft Sheet Metal, Nick Bonacci, 1992, IAP Inc.

Brian says his tools are simple, a small drill press, a sander, and an Avery 2X rivet gun. He makes his cuts by hand, and doesn't have a band saw. All "Alclad" parts are cleaned with Acetone or MEK then sprayed with Ditzler Wash Primer. Other parts are cleaned and Alodined before priming. He has tried Zinc Chromate and DP40 but found the fumes hard to take. The "Wash Primer" is easier to use and smells less according to Brian.

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Builder's Tips

Thanks to all who share them with us!

OAT

I had a hard time finding a low cost OAT for my -6. I finally settled-on a nice little unit from "Questair Inc." Cost $65, mounts to the external skin, unit is about 5/8" thick x 2.5" diameter. I mounted it right in the skin of the canopy, below the plexi in my tip-up, just forward of my left shoulder. It has a small little streamlined pickup that is all that shows on the outside, requires no wires, and doesn't take-up panel space. Display is C or F, with on/off switch also.

I like it, a very clean, attractive unit that was quick/easy to install in my RV. This unit is advertised regularly in the back of Sport Aviation. Questar, Inc., (203) 795-0611. - *Don Wentz*

Floor skin repair - Update

I have now completed the 'repair' of my RV-6 floorpan. After drilling-out a bunch of rivets and getting ready to re-rivet the affected areas, I changed my mind slightly. I really didn't like the looks of the NAS1097 rivets, the head is soooooo small.

Another RV-6 builder repaired his by drilling-out the 3/32 rivets, drilling the holes to 1/8, countersinking a little more (but not to the full depth required), then installing std 1/8 flush rivets. Since the countersink is not quite deep enough, he then shaved-off the little bit of head left. This is slightly less than perfect, but WAY better than the NAS1097 (I had never used one before and didn't realize what the head looked like. They are probably fine for replacing an occasional overdrilled rivet, but I didn't want to use them for this application, the heads are just too small). I used the same approach, but with the addition of more 3/32" rivets to insure that I have a 'better than' situation than the 3/32s alone were originally.

The 'failing' rivets are definitely more prevalent in direct relation to the thickness of the material that the skin is riveted to. Keep that in mind as you are working on your project and consider changing to larger rivets where the base material is 1/8" or more. I also found some at the spar carry-thru that I replaced while I was at it.

One more word on machine countersinking. After talking with many local builders, the general feeling is that none of us would ever use machine countersinking

again. We have all had some problems with it, and feel that dimple countersinking is 'much easier for the AVERAGE builder to do consistently'. So, dimple every hole possible.

Again, individual builder's skills & techniques may contribute to this problem, but why take a chance? Do you know what a pain it is to drill-out and replace rivets, then repaint (I SURE DO, NOW)? In the past I always recommended dimpling because we 'heard' that it was stronger and/or easier to do a consistent job with. Well, now we know...

Happy building. *- Don Wentz, N790DW, #20369*

Caution on Duckworks Landing Light Installation

In the last newsletter, Dick Zander mentioned what he thought was a better way to fit the lens in when drilling it. Well, as I found several times during the building of my RV, the 'better way' ain't always better!

By forcing the lens so tightly into the skin, he found it impossible to install the screws in it without being able to push on the lens from behind. So, he had to modify the kit some, and will have to remove his wingtip should he ever need access to the bulb or whatever. I also fear that he will experience lens failure due to the excess pressure on those lenses. I hope not.

He is not the only one to do this, I got another call from a builder who had his wife help him force the lens in, and he is having a similar problem. Time to add a note to the plans... *- Don Wentz - Duckworks Experimental Aircraft Parts*

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Project Status

Gary Standley reports that he and others are making steady progress on the **prototype RV-3 restoration**:

“The fuselage is progressing well with tailcone fit, aligned, drilled and clecoed to the new forward fuselage construction. Seat bottom skins have been fitted, drilled and clecoed. The "odd" wing skinning has hit a snag. Jim Anglin has seen a phenomenal increase in his business so is not able to spend the time he once thought. He will continue to work on it, as time permits, but has agreed to concede the wing if there is someone out there with more time than he is able to contribute now. I'm glad his business is doing well and he has been a big contributor already to this project. We'll continue to fit skins, drill, then deburr, dimple and get ready for the noisy part. Dan Delano has the tail parts and is removing old paint and generally getting them to look good. He also has the canopy and windshield, drilling out the broken plexi then install new. The work schedule is as from the beginning: 1st and 3rd Wednesday 7pm > 10pm. 2nd and 4th Saturday 10am > 4pm. Maps are posted at the Twin Oaks Airport in the EAA ready room for those who have access. Never hurts to call first (591-9040).” The photo at left is of Gary “match” drilling the mis-matched wing spars. It took a little “reaming” but we got those bolts to fit!.”

I was over at **Dan Benua’s** place the other day (had to borrow some clecoes), and got a look at his RV-6 wings in progress -- he’s getting started fitting up the ribs to the spars. Dan went for the Phlogiston spar and the prepunched wing skins. And those new wing ribs, all nicely notched for the spar strips -- it all looks so nice! Oh well, if they didn’t make these improvements I couldn’t say “you new builders have it soooo easy”. Just like all the builders who came before say to *me*! *-rh*

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New Members

Mo Sabri - Mo is the proud owner of a new set of RV-6 plans. He is another one of these guys I'm jealous of for his tools -- he has quite a few machinists tools including a CNC machine. He plans to build his RV in his 3 car garage, and he told me his wife won't mind if he eventually takes up all 3 spaces. Now I'm even MORE jealous. *-rh*

Steve White has purchased a set of RV-6A plans & manual, and plans on building the plane in his family room. Which he can get away with since he’s a “single kind of guy”. *-rh*

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The Tool Exchange

This section is devoted to listing any tools, jigs, shop space, specialized machines, etc. that are available for loan, or "group property" that is available to pass on to the next builder. Please give me a call (Randall Henderson, 297-5045) to let me know if you have jigs, tools, shop space, etc. to loan, exchange, or provide for free, or if you are looking for something specific to borrow. And whether your item is listed here or not, go ahead and bring it to the meeting. Items for rent (for shame!) or sell should still go in the "Don't Want Ads".

Surveyor's transit level -- makes fast, accurate work of leveling your wing spars in the jigs. Bill Kenny, 590-8011

Back Riveting Contraption -- large, counterweighted bucking bar and suspension system, and offset back rivet sets. (See "Back Riveting Wing Skins, December 1994 issue). Bob Neuner 771-6361

Wing Jigs (2). Bob Neuner 771-6361

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Don't Want Ads

Let us know what you got but don't want, or vice-versa. Ads are FREE.

Avionics Work, $20/hr. Experienced, will work with you. Tim Steele 452-2575

NEW Com 810 720 channel w/tray, $935. Van's Aircraft 647-5117

Heated Pitot-tube (Piper blade style), missing heater element, $35. Brent Anderson 646-6380

Std RV-6 elevator trim control knob/cable. Slightly used, sell for $$ less than new, Evart Eyres, 648-3564.

Standard Gascolator and mount for RV, slightly used. Sell for 60% of new cost. Need, good quality (RC Allen?) Horizontal Gyro, 3000fpm VSI (too much aerobatics). Don Wentz 543-2298

Skip Dennis wants to "buy-in" to an RV project. He has 'some' time to help, but has more $$ that he is willing to pay into a project to help finish it. If you are to the point you may need a partner to help buy that engine and panel, maybe this could work out. Give him a call at 655-7226.

3-month old IImorrow 920, GPS-North American Continent database. Wally Anderson 623-2328 work, 342-5240 home

Duckworks Landing Lights. Retro-fittable, light, easy installation. Kits start at $69 (discount for Ptld RVators). Don Wentz, 503-696-7185 for info.

Wacky Willy's still has lots of those cool sets for rivet guns, for $5 each. Also jewelers file sets (handy for deburring tight corners, etc.) for $5.

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Don Wentz and Jerry VanGrunsven in N790DW (photo R. VanGrunsven)