



RVator's Log

Newsletter of the Twin Cities RV Builder's Group

December 2007

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Upcoming Events

December 8: December Minnesota Wing meeting featuring airshow pilot John Mohr. Lake Elmo, MN. Details on page 8.

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**Minnesota Wing
Van's Air Force**

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Shop Notes

-Doug

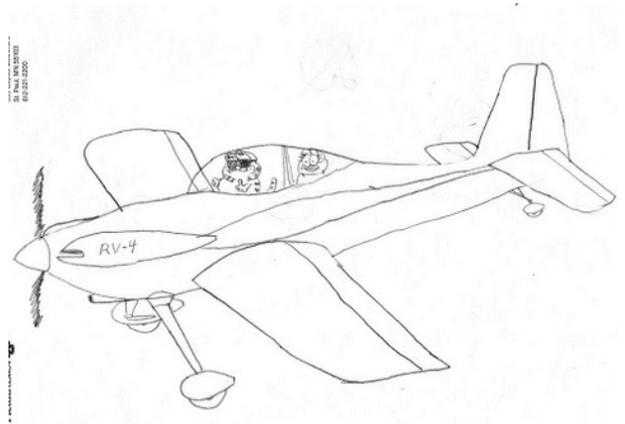
I'll fess up right now. My basement is a disaster. In all likelihood I'm not alone. Basements often end up as some type of surrogate landfill. I'm not sure if mine would qualify for any Superfund program or not. I really don't think there is anything toxic down there, but you never know.



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We have just a half basement and it served as RV central for the first part of my -4 project. Frankly, not a lot has changed since the day I shimmed the wings up the stairs, around the corner into the extra bedroom and then out through the family room doors. There is still an old box of aluminum shrapnel that lays in testimony to my early lack of any sheetmetal skills. Two wing jigs are still in place. The rest of the basement has slowly been taken over by the cast-offs of suburban life: a couple bikes with flat tires, several old computers, a low mileage Nordic Track machine that once held such hopes of restoring my aging body to its previous glory.

I have really intended someday to clean this mess up and throw most of this junk away. But every time I go down there to check for the occasional leaks after a storm, I realize all the memories down here amid the clutter. The basement walls are still adorned with old and faded drawings of RVs that my kids drew when they were somewhere around 7 or 8 years old. Old catalogs from long defunct supply houses sit curling on the shelves. Even an old photo of the initial dozen or so Minnesota Wing members circa 1988. This dusty and debris-strewn workshop of old spoke of hours and hours of aligning wayward pieces of aluminum, laying out thousands of rivet holes, drilling, de-burring, riveting, messing up and doing it again.



Yes, it's an RV-4. Garfield is PIC, unknown feline co-pilot. Artist: Craig Weiler, circa 1991

If you had asked me 3 months ago whether I would ever build another RV, the answer would have been a definitive "Are you out of your mind?" I was firmly rooted in the "only once in a lifetime" camp.

But in August, Jean and I made an aborted trip to Oklahoma. Long story short, we got stuck in Beatrice, Nebraska trying to get through a small area of IFR weather. After waiting all day (and with no hotel rooms to be had... don't ever land anywhere near Lincoln when the Huskers are playing), we bagged the entire idea and flew back home. We got to seriously thinking that an IFR airplane would have made this a simple trip. And, my long suffering co-pilot, for the first time ever, was just beginning to question the line I had given her about the spacious accommodations in the back pit of the RV-4.

With retirement now just 11 months away, I had spent a lot of time considering how I was to re-invent my life. Long suffering co-pilot suggested maybe a side-by-side RV might be more to her liking. I began to consider whether I really could build another one.

Hmm... pre-punched holes, precision cut parts, instructions written in modern English, maybe even a quick-build kit. Gosh, I even hear that the fuel tanks are pre-built (my cat Vern still has Pro-seal stuck in his fur from the first time around). Maybe I could do it again.

I whipped out my trusty Mac and started punching in numbers to add up what my dream RV would cost. WOW, sticker shock! Might have to do a considerable amount of creative accounting to make this work. But if I peddled the fancy car, maybe it could work. Several weeks later, Alex Peterson set the hook when he told me Bill Swanson had an unstarted RV-7 tail kit he would like to sell. That did it. In short order I was the owner of RV-7 kit 71727 and I was out in #2 garage planning how to convert it back to an airplane shop (think I'll just leave the basement alone to remind me of my roots).

So unless I get cold feet, I plan to get the tail finished in the next couple months, and order an RV-7 quickbuild kit (we are all hairy-chested taildragger pilots where I come from so there is no "-A" in my vocabulary). This winter I'll get the tail done and plan that when I retire, jump on this project 100% full-time. And this will not be a 12-year project like before. You can hold me to this that I want to be flying by fall of 2009. Yep, the RV-4 will be up for sale at some point in time. Stay tuned.... The saga begins... again....

* * * * *

So how are we doing?

-Doug

Over the years the Twin Cities RV Builder's Group, aka Minnesota Wing of Van's Air Force, has held its own as one of the largest and most active RV clubs. Our membership hovers right around 250 folks give or take a dozen or so each year.



About half of that number is actively building RVs and about half of that number (around 60-70) have completed their airplanes and are happily enjoying the flying phase of RV ownership.

Our publication costs have gone down thanks to the fact that most people receive their copy of the newsletter via our website (www.mnwing.org). We have kept our dues at \$20 per year primarily to sustain our quarterly meetings and our September picnic. This year the club funded the picnic entirely without soliciting donations and we should be able to continue that policy based on our current rather rosy financial health. For 2008 we will be again sending out a separate dues requests via snail mail so you can expect that sometime after the holidays. For newcomers, welcome again to our ranks and we hope you will partake of the collective knowledge, camaraderie, and fun that we enjoy as members of the Minnesota Wing.

A Picture Perfect Picnic

-Doug

Yes, I will admit I did conduct some meaningful talks with the Man in control to order up such a perfect day for our September picnic. Frankly I couldn't recall being blessed with such perfect weather. Light winds, comfortable temps... yes we really do have a couple nice days in Minnesota each year!!

Believe it or not, this was our 18th gathering! RV picnic #1 was held on June 16, 1990 at Jerry VanGrunsven home at the southeast corner of Sky Harbor Airpark. Judy VanGrunsven was diligent in having everyone sign into a ledger book (which we still have safely tucked away in the MN Wing history vault). There were 53 folks in attendance and there are several familiar names on the roster, which are still members today. It must have had a great time; they had another picnic the same year in September. The following year they also had two picnics, one in spring and one in the fall. Finally it looks like the club went to an annual September gathering in 1992 and the rest is history.



RVs at the Sky Harbor picnic

Noah's RV-4 Takes to the Air

- Doug

For you RV newbies, there actually was a time in history when RV construction required actually laying out, drilling, and riveting thousands of rivets. Pre-punched skins, precision cut parts, and the term "quick-build" were years down the

road. Hey, the RV builders of the 80's and 90's actually kept in touch by mail (remember that?) and telephone (the kind that hung on the wall). No cells, no forums, no web pages... just brutal hours in the shop.

New Ulm, Minnesota builder Noah Rosenbloom started his RV-4 in 1994 when kits were cheap, but so was one's own labor. Noah's 13-year project has been a patient labor of love. Most of the work was completed at his home in New Ulm while the final assembly was wrapped up at Paul Irlbeck's shop in Wabasha. Paul made the first flight on August 13, 2007 out of his 1500' strip near his home.



Noah started flying during WWII (1943 to be exact) while serving in the Navy. Most of his early flying was in Dubuque at a local flight school (Cubs and T-Crafts). Later after the war, he owned a Fairchild PT-26 and then rented various Cessna and Piper aircraft. An attorney by training, Noah completed a distinguished career in the legal field and retired as a judge. Now, at 83 years old, Noah has been flying the RV-4 with instructor Joe Dooley and finally enjoying the end result of all of those years of construction.

Hernando, Florida via RV-6

- Larry Dodge

The weather in WI was great on Wed. of this week. The direct flight from RNH to MO6, Washington, MO (near St. Louis) was a little bumpy at 5500 feet, but it was nice to have a little quartering x-wind from the NW. Total time 2 hr 39 min. Ground speed for N16LD was 160 to 165 kt. Gas \$4.25/g.



Larry Dodge's RV-6 spent Wed. night through Thursday night with friends. The next morning, the big low-pressure area finally moved east enough to allow proceeding on to FL. Thunder storms were predicted in mid-FL. The first leg to AUO, Auburn, AL was smooth at 9500 feet. Ground speed was 160-170 kt. It was bumpy on approach to Auburn, but winds at the airport were 9 kt without the advertised gusts. Big runways for corp. jets, but still a small field atmosphere. Total time 2.9 h. Gas \$4.28/g.

The last leg to 12 Oaks Airpark, Hernando FL was flown at 9500 feet. N16LD got up to 10,000 feet at one point to clear a developing cumulus. At that altitude she still climbed at over 1000 ft/min. with less than full power. Ground speed was 150 to 165 kt. Total time was just shy of 2 hr. A thunderstorm was doing its thing about 10 miles West of 12 Oaks moving pretty fast. On final, the rain hit, but not enough to restrict visibility. I could have easily escaped to the North, East or South if needed.

My landings were all very good which is a pleasant surprise for me. I hadn't flown the plane since early July, so I was a little rusty. The compliments at each stop were very nice to receive. Just about all pilots seem to admire the RV's. Good testimony to Van's aircraft.

The plane performed perfectly. It would be nice to have an autopilot for these long trips. I had repositioned the Garmin 296 GPS and the visibility for the screen was much better. The canopy sun shield cut down on the glare. These days, my eyes need all the help they can get.

Fuel consumption was typically under 8 gph at 2500 rpm and leaned to peak EGT as per Lycoming's recommendations. All in all, a lovely way to travel!!!!

Mixture Management and Cylinder Head Temperatures

-Alex Peterson



When most of us were taught to fly, our instructor told us to use “full rich mixture on takeoff, level in cruise, lean until it gets a little rough, then turn it half a turn in. This seems simple enough, especially when one is renting the plane wet. However,

with the RV's, there are reasons other than economy alone to look a little closer at the mixture. Specifically, cylinder head temperature is dramatically affected by mixture. This article will hopefully help us to understand a bit more about mixture and its effect on our engines.

Let's look first at the basic chemistry involved, namely combining fuel with oxygen. If we have just the right mixture of gasoline and oxygen (which is 21% of our air) and we burn them, there will be no fuel left over and no oxygen left over. This mixture is called stoichiometric. With any mixture richer than this, there will be extra fuel left over, while leaner will mean extra oxygen left after combustion. In piston engines, at the stoichiometric ratio, exhaust gas temperature will be near a maximum (peak egt).

So, where do we want the mixture to be? Rich of peak (ROP)? Lean of peak (LOP)? It depends on a number of variables, including manifold pressure, fuel octane, RPM, compression ratio, ignition timing and intensity, and other variables. For full rated power, we need to run our engines well rich of peak, indeed, a lot rich of peak. This excess fuel does a couple things: first, it modifies the combustion process to reduce or eliminate detonation. Additionally, it reduces the amount of heat transferred to the cylinders, keeping the cylinders cooler. Running too lean at full or high powers can damage our engines, typically through detonation and overheating. A 180hp Lycoming type engine will burn about 15 to 17 gph at sea level, full throttle and mixture full rich. Anything less than that can be problematic. Lycoming recommends no leaning until at or below 75% power.

Before we continue on with less than full rich operations, we should have a look at how the fuel gets to the cylinders. The throttle's job is simple – to control the amount of air entering the engine. The carburetor or FI servo's job is to add fuel in some ratio to the amount of air. The mixture control simply tells the carb or FI how to ratio the fuel/air.

In carbureted engines, things are a little complicated downstream of the carb. As the air travels through the carb, fuel is metered into the air stream. Some of this fuel evaporates, but not all. So, downstream of the carb there is a mixture of air, vaporized fuel and liquid fuel droplets. As this mixture travels through the induction system, it has to make turns on the way to the cylinders. Unfortunately, due to the geometry of the induction system, the droplet portion of the fuel/air mixture does not remain evenly distributed on the way to the cylinders. The end result of this is that the fuel/air ratio is not the same cylinder to cylinder. So, what does this mean? What it pri-

marily means is that power and waste heat will not be equal between cylinders. This can cause roughness, since cylinder 1 might be putting out 15% more power than the other cylinders, for example. Additionally, and very importantly for RV's, it can cause large ranges in cylinder head temperatures from cylinder to cylinder. Hottest to coolest cylinders in RV's can commonly range from 400F to the low 300'sF, in the same engine! For engines with FI, the distribution of mixtures between cylinders can be almost equal, since fuel is sprayed directly upstream of the intake valve, and does not have to travel the same path as the induction air.

When we burn fuel in our engines, almost all of the energy created goes to one of three places. One of these is creating work at the propeller, which is of course the point of the whole thing. Secondly, heat energy is transferred to the cylinders, and thirdly, heat energy is discharged out of the tail pipes. Unfortunately, the waste heat of #'s 2 and 3 comprises the majority of the energy expended. Only about 20% of the combustion energy actually gets to the propeller! To get a sense for the amount of heat that must be removed, think about pouring a pint of gasoline per minute on a bon fire and you get an idea of just how much burning is going on up front!

So, how does mixture affect cht's? Here is Lycoming's chart showing, in a general sense, how mixture, egt, cht and power are related:

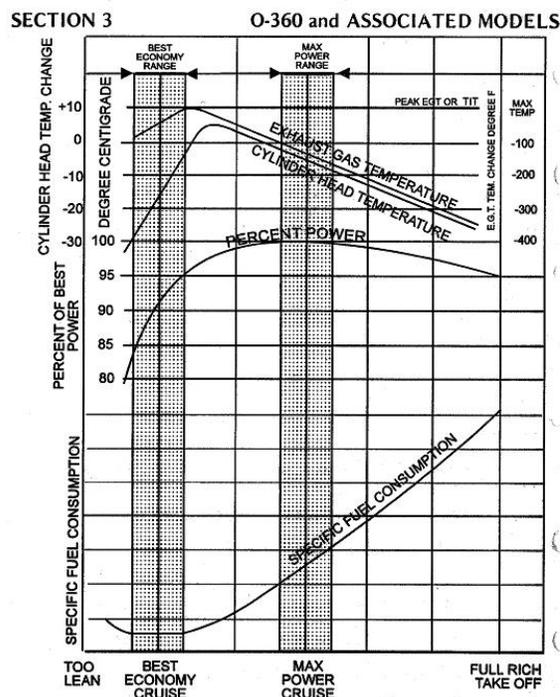


Figure 1

Referring to Figure 1, if we look at the curve labeled “cylinder head temperature,” we can see that it peaks around the same point that exhaust temperature peaks. Notable is how rapidly the cht curve drops off to the left (lean) of peak, compared to it dropping relatively slowly on the right (rich) side of

peak. It indicates that the cht can be lowered by about 35 Celsius degrees, or about 63 Fahrenheit degrees, just by going to about 80 degrees F lean of peak with the egt! However, there are several classic problems with running lean of peak (LOP). Recalling what we discussed earlier about uneven mixture distribution, if we have cylinder #1 running nicely at this 80F LOP point, cylinder #3, for example, might be right at its peak egt, and hence, close to peak cht temperature. So, cylinder #1 might be at 320F, while #3 is at 380F. *With a carbureted engine, it is not uncommon for one cylinder to be running at peak power while another is in the best economy region!* Think of your four or six cylinder engine as actually four or six separate engines, each running with the mixture knob at a different setting. Another article is planned in the near future on the art of persuading a carbureted engine to run smoothly LOP, so stay tuned...

Many of us chase this elusive cylinder head temperature problem by mucking around with baffling and other hardware. An additional problem with this situation is the uneven power output cylinder to cylinder mentioned earlier, which we will now discuss.

Referring again to Figure 1, look at the curve labeled **percent power**. Just to the left of those words are numbers, starting at 100 and counting down the left side to 80. Let's not think of this as the classic percent power (100% = 180hp, for example). Rather, think of that as percent of maximum power available at a particular manifold pressure (MAP) and rpm. Say that we are running full throttle at about 8500'. This roughly corresponds to about 75% power (in the classic sense). In our 180 hp engine example, this is 135 hp. Looking at that curve, and assuming that one cylinder is in the peak power portion while another is in the best economy area, we can see that the lean cylinder might be only putting out 80% as much power as the one operating in the peak power range. This uneven power distribution cylinder to cylinder will cause roughness. For sure, this drop in power as we go LOP will show up in reduced indicated airspeed, which we may choose to do, provided the engine is running smoothly, for economy purposes.

The final curve we will discuss on Figure 1 is the one at the bottom, labeled "**specific fuel consumption**". This curve tells us that when we operate in the shaded area labeled "**best economy range**", we get the most power *per gallon of gasoline* consumed. It says that if we operate in that range, the engine is burning the gas in the most efficient way possible with respect to power output. Do not confuse this with the most efficient airspeed to fly, as that is a different topic.

Additionally, engine roughness can result when one cylinder is so lean of peak that it simply misfires occasionally. Many of us will attempt to run LOP only to find that misfire occurs in one cylinder while another of the cylinders is running too hot (sitting right at peak). Indeed, the very description "running my engine LOP" is misleading if the mixtures aren't balanced. We should say "running engine #1 LOP," when one thinks of each cylinder as a separate engine as described above.

Another challenge with running LOP is to get the fire started. At low MAP's and lean mixtures, a hotter spark is needed. It is also helpful to advance the spark more than the typical fixed 25 degrees (that mags provide) in this situation. Both of these problems are solved with most of the electronic ignitions available for use on experimental aircraft.

So, how well does the ancient Lycoming chart in Figure 1 hold up in the real world? Amazingly well, it turns out. This data is from an RV6A, taken about a year ago. Note that in the following charts, the engine is fuel injected, and reasonably well balanced with respect to mixture distribution among cylinders (i.e., running "one" engine instead of four separate engines).

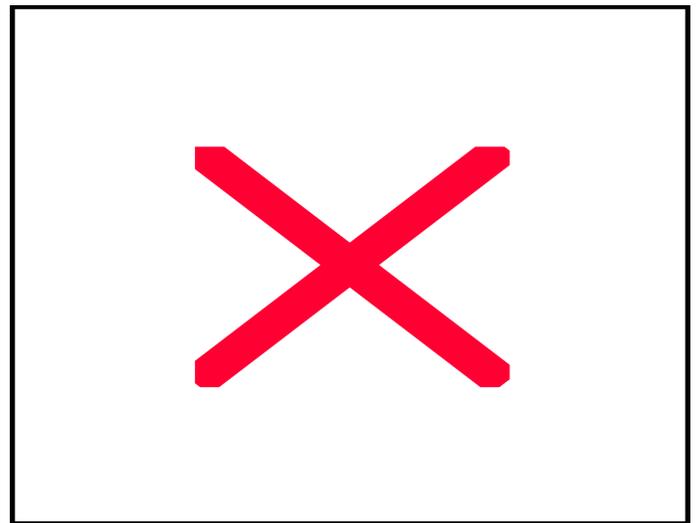


Figure 2



Figure 2a

Figure 2 shows the relationship of mixture (fuel flow) to cylinder head temperature. Note that the cylinder-to-cylinder variation in temperature is fairly constant over the entire mixture range. This probably means that the differences are indeed due, in this case, to baffling inconsistencies or cowl air-

flow differences. *Note also that by going from peak egt to about 60 to 80 LOP, the cht's dropped about 60 to 70 F degrees! This is the main point of this entire article!*

It is an interesting side note, that cylinder #3's temperature was brought into line with the others (after this data was taken), by putting a spacer behind #3. The range of hottest to coolest cylinders on this engine is now typically about 25 F degrees. It should also be again recalled that this engine is fuel injected, so egt's tend to peak at about the same total fuel flow, as can be seen in Figures 2a and 3.

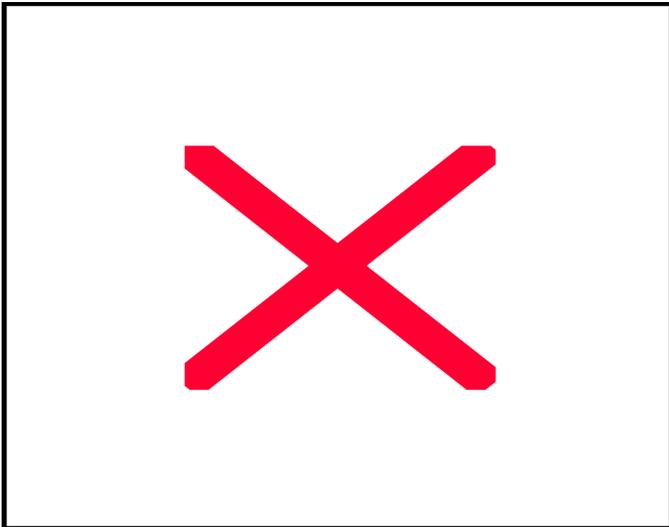
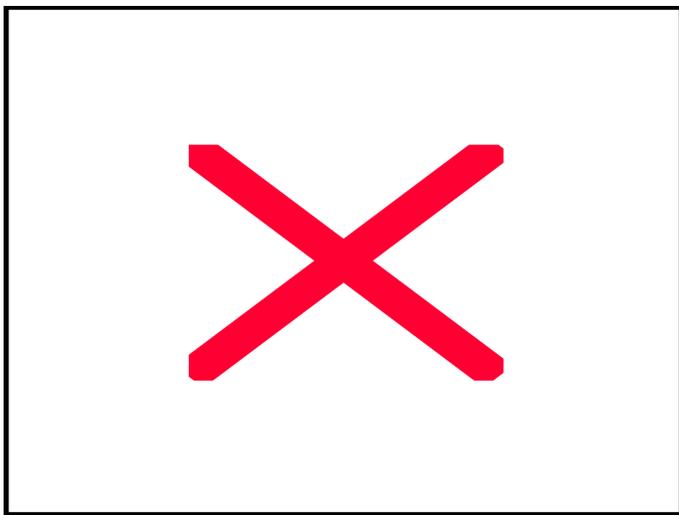


Figure 3

Figure 3 shows how power drops as mixture goes LOP. This graph shows the power drop as mixture goes leaner by graphing IAS (power) vs mixture (fuel flow).

Figure 4 shows how the maximum fuel economy, shown here as indicated n.m. per gallon, is at a maximum when running LOP, for a given MAP and rpm. While we know that we can increase fuel economy by pulling the throttle and flying much slower, in this case we are attempting to keep as much speed and power as possible by getting the engine to convert avgas to mechanical energy in the most efficient manner. As a bonus, the engine will also run cooler! In other words, the miles per gallon could be much higher just by flying slower, but that is not what is being illustrated here. This correlates very nicely with the Lycoming chart in Figure 1, specifically the specific



ic fuel consumption curve.

The RV6A from which the above data was collected regularly flies along side other RV's that are burning 1 to 1.5 gallons

per hour more fuel! This is \$4 to \$6 per hour at today's fuel costs. The total savings over a couple thousand hours can pay for an engine overhaul.

Figure 4

Thoughts from the Right Seat

– Doug

This summer I have had the pleasure of giving quite a bit of transition training to a variety of RV pilots. I can look back at almost 40 years of flight instructing and truly say that teaching in RVs rates high on the fun meter. Granted, I always got a big kick out of starting a primary student from scratch and helping them to gain the skill and judgment required to fly an airplane. But the RV "student" is unique. In most cases he built the airplane he is learning in. For years he has dreamed of the day when he graduated to being a flying RV pilot. This brings a special set of expectations to the left (or front) seat.

The term "transition training" might be a new one to you. In other circumstances one might use the word "checkout". We've all been "checked-out" in a new aircraft model. We show up at Joe's Aircraft Rental Emporium and a bored CFI gives us a brief intro to that shiny new Belchfire 500. We do some steep turns and stalls, then back to the pattern for a couple bounces. If things work out, the instructor bestows his blessing on you and you are "checked-out" to rent that Belchfire 500 and amaze your family and friends with your aeronautical acumen.

I look at RV transition training somewhat different. "Transition" is the key word. It is defined as "the process or a period of changing from one state or condition to another". For the average RV student this may be a two-fold process. First is the transition from a builder to a current pilot. Many builders spend the vast majority of their efforts during the building process, doing just that: building. The focus is on everything BUT flying. The time, the money, and the opportunity to maintain one's flying skills may be few and far between. So when the project is finally completed, a transition has to be made from aircraft builder who scoffs at the sight of a toppled rivet to safe, competent and current pilot.

Dusting off the cobwebs does not necessarily have to be done in an RV. And frankly, if you are truly rusty and have not flown for several years, I highly suggest that you regain your currency in an airplane you were previously familiar with. Is that a waste of time and money? Not necessarily. You will regain your flying skills quicker in something a little more familiar and maybe a little slower. Something with a constant

speed prop might be good if you are not familiar with its operation.

If you have built a tail dragger RV and are not tailwheel current, more of a challenge lies ahead. Finding a qualified tail dragger CFI and an appropriate airplane is increasingly difficult. If you can find one, a Citabria is a perfect tailwheel trainer. I spent over 3000 hours in the back seat of Citabrias and in my opinion if you are comfortable in this aircraft, the transition to a tail wheel RV will be relatively smooth.

Once you have sanded off most of the rust, part two of the transition process is to move from current pilot to current RV pilot. So what is different about RVs? Well they are kind of the Porsche of the light aircraft world. They are quick, responsive, and handle wonderfully. Here are some traits that I consider a little "different" than the typical Wichita spam can:

1. Landing gear - The tri-gear RVs have a non-steerable nosegear. You need to use the brakes to assist maneuvering. Not a big deal, but different at first. The nosewheel looks a little spindly doesn't it?. It is. RVs are not designed to compete with Beavers on tundra tires. Those little tires require caution on unimproved surfaces. Baby that nosegear!! For tailwheel RVs, their taildragger handling is considered exemplary. But they are short-coupled and quick. Directional steering is positive and truly depends on the tailspring arrangement. Each tailwheel RV differs in this regard.
2. Weight and balance – Tandem RVs handle quite differently with an aft CG. The -8s are not too bad, but the -4s certainly are pitch sensitive when aft loaded. Worse case is a 150 hp RV-4 with a wood prop. The side-by-sides are much better but still expect a more sensitive flare when landing a -7(A) with light fuel and a full baggage compliment.
3. And speaking of sensitivity, new RV pilots do a lot of bobbin' and weavin' the first time they take the stick. Just calm down, be SMOOTH and use some finesse.
4. Constant speed prop vs. fixed pitch – the c/s prop RV accelerates like a dragster. Lots of right rudder needed. BIG fun factor but things happen fast. Climb rate is a kick. BUT lots of drag on final approach. A fixed pitch RV is rather sedate on takeoff in comparison. Same for the climb. Big time glider however on approach and much harder to slow down.
5. Fuel management – should be familiar to low wing types coming from Pipers. Ya gotta switch tanks and don't forget. Fuel pressure keeps the fan turning. The FP gauge is an IMPORTANT instrument. And you have a boost pump to manage. It's ON during critical aspects of flight (such as takeoffs and landings).
5. RVs are CLEAN. They can build up speed very quickly going downhill (especially the fixed pitch prop versions.) Plan accordingly. By the same token, at cruise you will fly these aircraft high and fast. Descent planning is required. A 500 fpm rate of descent is comfortable on the ears. Your GPS

gives you your time to go to destination. At a 500 fpm rate of descent, multiply the altitude to lose in thousands of feet by 2 and that is how long it takes to go down. If you have 6000 feet to lose, 6×2 equals 12 so start down 12 minutes out. Reducing power by 5 inches of manifold pressure equates easily to a 500 fpm rate of descent (that tidbit courtesy of Tom Berge).

6. Stalls – A rather small wing with no twist results in a "quick" stall. Very little buffet (-8s seem to have more). You might expect an "exhilarating" wing drop if the ball is not centered (or if you built a crooked wing). Reduce the angle of attack with smooth forward elevator and you have a flying airplane.

7. I teach the NWA method of stabilized approaches. In the big iron we have to be on speed, gear and flaps down and on glide path at 1000 feet AGL or we go around. I would say 300 AGL is applicable for an RV. If all your approach ducks are in a row (speed, flaps, glide angle, runway alignment, etc.) the landing is MUCH easier. Remember the old "Hershey Bar" winged Piper Cherokee 140/180. They could get a high sink rate if you got them slow. RVs (especially with the constant speed prop) are very similar. They can drop out from under you. The c/s-prop RVs approach like a heavy single (Bonanzas, C-210s) with power on to maintain a normal glide path.

8. Landing – don't flare high, don't flare high. Tom Berge beat this into my thick skull when he introduced me to his RV-6 almost 20 years ago. You can't dawdle and play with the flare like you can in a Cessna. Not a lot of "residual" lift as I call it. You must flare low, establish the sight picture over the nose, and hold it off, 2 inches above the runway. You CAN-NOT allow the airplane to drop in. Believe me it happened to me once in my RV-4 and I was amazed I didn't bend the gear. Lesson learned. One good thing about touchdowns in an RV: the wing stalls abruptly and you are on the ground. Almost like ground spoilers on the big jets. Nice feature on a windy day.

Most insurance companies now seem to require 5 hours of dual no matter what your previous experience. That might be enough or it could be significantly more. Regardless, as your airplane nears completion, develop a plan for, 1) who will make your first test flight, 2) how do I rejuvenate my rusty flying skills in an airplane I am familiar with, and 3) find a qualified RV transition instructor and discuss your training program. And then... have fun!!!

Minnesota Wing – Van's Air Force
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First Class

Minnesota Wing December Meeting

Saturday, December 8, 2007 – 10 am

**Doug and Paul's Hangar at Lake Elmo Airport (21D)
Hangar 41C - Mooney Lane**



ing up in northern Minnesota and his journey from a young pilot flying the family Cub to a senior captain at NWA. Today, he is ranked as a top air show performer with his amazing routine in a stock Stearman. (See www.mohrbarnstorming.com)

Other topics on the agenda... Pete Howell and Peter Fruehling will debut "Lean of Peak, the Movie" (hmm.. possible Oscar material). Plus your questions!! Coffee and donuts as usual.

We have a great program lined up for the December meeting that you will not want to miss. Our featured speaker will be air show pilot John Mohr who has been recognized as one of the most skillful aerobatic performers in the world. He is the 2000 recipient of the Bill Barber Airmanship award and also the International Council of Airshows' Art Scholl Memorial Showmanship Award. John will talk on his fascinating background in aviation be-

Driving directions: Take I-94 east towards Wisconsin. Go north on Manning Avenue (County road 15). Three miles north to Lake Elmo Airport. Enter at the north entrance (before the RR tracks). Go east past Valter's Aviation to Mooney Lane just past the Civil Air Patrol hangar. Hangar is 41C on the left. (fly-ins are OK as well. Park east of the hangars along taxiway)

Phones: hangar: 651-779-0747, Doug's cell: 651-398-1184