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Fly safer with these handy tips

by Tedd McHenry

This article was inspired by a talk given by John Laing, an ATP– and CFII–rated pilot and fire–bomber from Delta, BC. John spoke at a meeting of the Langley Aviation Council. He gave a fascinating presentation on the job of aerial bombing of forest fires, which I couldn't possibly do justice to by reviewing. However, at the end there was a discussion in which John passed on quite a few tips and rules of thumb that I thought readers of WCR would find interesting and useful. Some of them are reproduced here, with John's permission. For a much more complete explanation of these and other flying tips, read John's book, "IFR Hints and Pilot Principles."

There's an old saying: a little knowledge is a dangerous thing. I suppose that's true, if the "little knowledge" tempts you to mess with something you don't understand. But, in flying, a little knowledge can sometimes save the day. Here are some handy rules of thumb and simple calculations that can make flying easier, and safer.

Take–off performance: altitude, winds, and slope

We all know that density altitude affects take–off performance. So do winds and runway slope. But by how much, and how do we allow for it? Certified aircraft come with extensive charts from which you can calculate precise take–off distances. If you're really keen, you may have developed such charts for your RV. But you can make reasonable allowances for density altitude, winds, and slope without the charts.

Let's look at a real–world example. You've flown from Langley up to Prince George with a friend to visit relatives. On the way home, you decide to stop in at Barkerville (AS3) because you've been told that nearby Wendle Provincial Park is really beautiful. With your fuel load, passenger, and baggage, you're tipping the scales pretty close to gross in your RV–6, and it's a warm summer day—24°C. Are you safe to take off?

The table below summarizes the calculations we'll use to answer

more on page 2...

Performance Rules of Thumb

For density altitude, add 1,000 feet to the field elevation for each 8°C above standard temperature.

Increase sea–level take–off distance by 10% for each 1,000 feet of density altitude.

Decrease take–off distance by 1% per knot of headwind; increase take–off distance by 10% for each 2 knots of tailwind.

Triple the runway gradient (in percent) and treat that like knots of wind (headwind if downslope and tailwind if upslope).

Conditions

Field Elevation		4060	ASL
OAT		24	˚C
Headwind Component		10	kt
Runway Slope		2.15	%

Performance

Estimated Density Altitude		5950	ASL
Take-off Roll:	Sea Level	550	ft
	at density altitude	880	ft
	with headwind	790	ft
	with headwind & slope	1040	ft

...from page 1

that question. Let’s say that, in this configuration and weight, your 150 HP RV–6 would have a take–off roll of 550 feet at sea level. Using the density altitude rule, Barkerville’s elevation of 4,060 ASL is equivalent to 5,950 ASL. (Remember to reduce sea–level standard temperature—15˚C—by 1.5˚C per 1,000 feet. So Barkerville’s standard temperature is 9˚C.) That alone will add 60 percent to your take–off roll, bringing it up to 880 feet.

Now you have to consider winds and runway slope. Let’s say the winds are from the east, so that runway 11 gives you a 10–knot headwind component. That would reduce your take–off roll by 10 percent, to about 790 feet. Unfortunately, runway 11 at Barkerville slopes up with a gradient of 2.15%. Should you use runway 29 instead, and take off downhill?

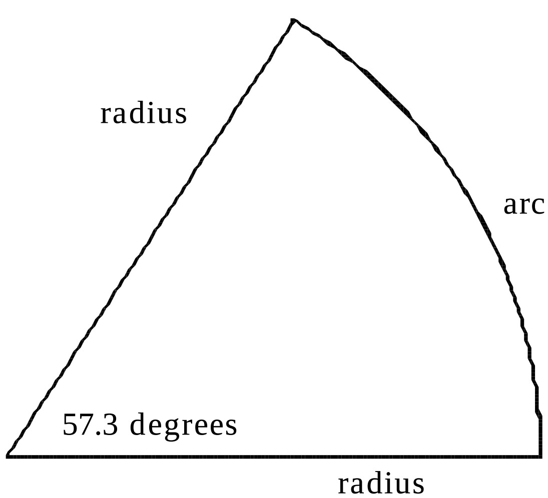
“Unfortunately, runway 11 at Barkerville slopes up with a gradient of 2.15%. Should you use runway 29 instead, and take off downhill?”

Well, the gradient rule–of–thumb says to treat 3 times the gradient like wind. So a 2.15–percent upslope is like a 6.45–knot tailwind, which is less than the 10 knots of actual headwind. In this case, it’s better to take off uphill. If the runway gradient was more than 3.33 percent, it would more than offset the 10 knots of wind and you should take off downhill and downwind.

But don’t make the mistake I once did! You can’t just take the 10 knots of headwind, subtract the 6.45 knots of “equivalent” tailwind, and assume you’ve got a 3.55–knot headwind. Remember, tailwinds have about five times the effect of headwinds. So calculate the wind effect first, then the slope effect.

Your take–off roll on runway 11 will be 1040 feet.

But we still haven’t answered the question: are you safe to take off? Another good rule of thumb is that the airplane should take off in the first half of the runway. If you’re half–way down and not yet flying, you should abort the take off. Runway 11 at Barkerville is 2,700 feet long. That’s comfortably more than twice your calculated take–off roll. So, at least so far as runway length is concerned, it looks like you’re safe. But don’t waste any of that 2,700 feet, start right at the button. And pick a “go/no–go” point halfway down the runway.



Climb Rate and Climb Gradient

One of the easiest in–your–head calculations that can really help you out is the conversion between climb rate and climb gradient.

To get feet per mile from feet per minute, divide by your true airspeed in miles per minute.

The RV–6 plans have climb rate plots for N66RV. They show a Vy (best rate of climb speed) of 120 mph, giving a climb rate of 1,500 fpm. They also show a Vx (best angle of climb speed) of 82 mph, giving a climb rate of 1,200 fpm. What’s the difference in climb gradient?

1,500 fpm @ 2 miles/minute
= 750 feet per mile
1,200 fpm @ 82/60 miles/minute
~ 900 feet per mile

Actually, either way you’re getting a pretty good climb gradient. At higher altitudes (such as on climb–out from Barkerville in the example above), you’d find a much greater difference in climb gradient between Vy and Vx.

The 1:60 Rule

One of the reasons I like using nautical miles, rather than statute miles (or kilometres), is the 1:60 rule. The 1:60 rule is based on the mathematical ratio of the length of an arc to its radius. The length of an arc is equal to its radius when the angle of the arc is about 60 degrees. (It’s actually equal at about 57.3 degrees, but 60 is close enough for rule–of–thumb purposes).

This might sound like an abstract idea, but it gives us a very simple tool for estimating small angles. For example, because a nautical mile is close to 6,000 feet (6,080), we can easily compute that the normal slope of an ILS final approach—3 degrees—is equal to 300 feet per nautical mile. Ten miles back on final the glideslope will be about 3,000 feet above aerodrome elevation. If you’ve ever been caught unaware by intercepting the localizer when you’re already above the glidepath, you’ll know how handy that calculation can be.

“I’m not an IFR pilot,” you might say. “Is the 1:60 rule any use

more on page 3...

You can overhaul your engine

by Ken Beene
Burnsville, MN

I recently completed my engine overhaul. I did all of the wrench work myself—my first overhaul of an airplane engine, although I have rebuilt a few Porsche engines. The only special tools required were the cylinder flange wrenches (two at $15 each). Anyone who can build an airplane should be able to overhaul the engine if they follow the overhaul and parts manual with applicable ADs and SBs.

> "Anyone who can build an airplane should be able to overhaul the engine"

I wanted an engine to put in the RV-6A and fly, then overhaul later. I found this O-320-E3D engine through our Van's Minnesota Wing. The engine had 2,244 hours, and had never been opened (except the accessory cover for the oil pump AD). Both mags had been replaced at 2,000 hrs. It was running good, but metal was found in the filter during annual. The owner replaced it with a salvaged engine, and I bought the core from the owner.

Upon teardown, the cam and lifters were found to be the problem, as is common for these engines. It would have been possible to replaced the cam and lifters and fly it, as the plain steel cylinders were within service limits. I decided to do a complete major, with an increase to 160 HP. I followed the Lycoming recommendations for replacement and inspection of items for a major overhaul.

The total cost was $7,957.

I still need to replace the 3/8 inch prop flange bushing with the 7/16 inch ones required with Van's new prop adapter. Any assistance in finding a low cost source would be appreciated.

See page 8 for a complete breakdown of the cost of Ken's engine...

...from page 2

to me?" You bet. It's a really handy way to estimate wind drift when you're using dead-reckoning navigation. Let's say you've been following your planned heading of 090. Ten minutes into the leg (30 miles in your RV) you see, by reference to a ground feature, that you're about a mile south of track. That's 1 mile in 30, which is 2 miles in 60, or about 2 degrees off of track. Head 086 for the next ten minutes and you should be back on track. After that, 088 will hold the track, at least until the winds change. (This technique isn't much use in the mountains, but it works great on the prairies.)

Another 1:60 ratio that's really handy comes from the fact that there are 60 nautical miles in one degree of arc at the Earth's surface. This means that you can convert the latitude markings on VNCs and WACs directly into miles. Each degree (of latitude) is 60 miles. (Note: this doesn't apply to degrees of longitude, unless you're at the equator.) Because latitude is shown in degrees and minutes, it's easy to measure a distance on the chart with a pair of dividers (or your fingers!), compare it to the latitude markings, and get a distance measurement that's accurate to within a mile!

Thunderstorms

There are few things that worry pilots more than thunderstorms. We all want to know how to avoid them.

If the lapse rate is more than 2°C per thousand feet, be extra–alert for signs of thunderstorms developing.

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Lapse rate is the change in temperature with altitude. The faster the temperature drops with altitude, the less stable the air. Be particularly alert for lapse rates greater than what was forecast. That means that the air is less stable than the forecaster thought; the risk of thunderstorms is greater than forecast. Whenever the lapse rate is more than 2°C per thousand feet, you're in relatively unstable air.

Thunderstorms are meanest on the side toward which they are moving, and the side from which they are fed.

In the northern hemisphere, thunderstorms are usually fed by southerly winds and travel eastward. So you can generally expect the worst conditions to be on the south and east sides of thunderstorms.

Thunderstorms are not all bad news, though. CB clouds create strong, low pressures. Like all lows, air flows into them following a counter–clockwise path. So, as with all lows, if you pass a thunderstorm on the right you'll get tailwinds. This effect is strongest at altitudes below the base of the CB. Remember to remain well clear of the thunderstorm area though—as in tens of miles clear.

Torque those bolts properly!

by Bob Steward, A&P IA
From the RV List, in response to a question about measuring bolt torque when friction is present.

I was in a class some years ago that was totally devoted to proper torque in fastening systems. The instructor went to great pains all morning to show us how every day we were violating some basic ground rules of proper use of threaded fasteners. By the end of the morning, at the lunch break, I think we'd all about decided that it was hopeless, and that we'd never be able to successfully torque a bolt.

"Did you know that your torque wrench—freshly calibrated by someone traceable to the National Bureau of Standards—is not accurate in the first 1/6th and last 1/6th of its range?"

The afternoon was spent teaching us the correct methods to avoid the common failures we had discussed all morning.

In the exact situation you described, where a friction component was causing inaccurate torque readings, he suggested that we use a very accurate measurement of the existing drag on the fastener, and add that amount to the torque spec for that particular system. Since nut plates have a higher friction when new than when re-used, I might suggest running the bolt into the nutplate once, and then removing and measuring the torque the second time, and then adding that amount to the value originally intended. (For example, 6 in.lb drag + 35 in lb torque = 41 in lb corrected installation torque.) Measuring the torque on a new nutplate would give a higher reading which would then be incorrect for the reinstalling of the bolt. Each time in the future you remove and replace the bolt(s), you will want to use the corrected torque rather than the standard torque, so make a note of the corrected torque.

Of course, we all know that you only turn the nut and hold the bolt, right? In a perfect world, maybe. Anytime the bolt is turned and the nut held, the torque applied will be incorrect. The drag of the bolt in the hole will contaminate your reading, making it read okay when the actual torque is too low. What about tightening bolts onto soft materials (like Aluminum)? Did you use washers to spread the load and prevent galling? Did you use the correct thread lube? In some cases it's none, with the plain, cad–plated surfaces bearing on each other. In other cases it can be some pretty bizarre (and not commonly available Sunday morning at the airport) lubricants. (We already have "Mouse Milk;" can "Yak Butter" be far behind?) Any substitution will give bad readings.

What we are attempting to do is not measure torque, but rather to approximate the amount of preload, or stretch, we apply to the bolt. Torque is only a secondary means of reaching our goal. Any of the factors (like incorrect thread lube for the torque spec given, incorrect technique on the part of the torque wrench operator, mis–calibrated tools, etc.) will give bad readings, which means improperly loaded fasteners.

For instance, did you know that your torque wrench—freshly calibrated by someone traceable to the National Bureau of Standards—is not accurate in the first 1/6th and last 1/6th of its range? That's right: a 100 ft.lb torque wrench is accurate only over the middle 2/3 of its range. So it should not be used for anything outside of 16–84 ft–lbs! Size the wrench to the job, and don't fool yourself into thinking that you can just figure the conversion from in lb to ft–lb, set that 100 ft–lb torque wrench to 3 foot pounds, and have 36 inch–pounds. No telling what you'll have, that far away from the calibrated zone.

Having said all that, many joints in aircraft are designed so that the primary load is shear and not tension. In these applications it is only necessary to see to it that the bolt is still in place (nut has not come off) and the exact torque is of no other concern. It is difficult and awkward to measure small torques accurately. Most people over torque the airframe bolts on their planes. I used to employ a car "mechanic" (who learned his trade in the Navy) who used the "uniform torque standard" (he wrung the little ones off and left the big ones loose) and was relieved of his bolt tightening responsibilities. I never let him near my airplane.

(Editor's Note: Bob has made a good summary of bolt torquing practices, and raised some very important points. However, I believe he is mistaken about bolts mounted in double shear. A shear–mounted bolt is essentially a clamp running through the joint, whose purpose is to prevent relative motion of the various parts of the joint. Relative motion in a joint will lead to fretting and eventual fatigue failure of the joint. For this reason, proper preload is as important in shear as in any other application. For excellent discussions of bolts and threaded fasteners in general, read Carroll Smith's "Nuts, Bolts, Fasteners, and Plumbing Handbook," and John Schwaner's "Sky Ranch Engineering Manual.")

Austin Tinckler flies new RV–6

by Tedd McHenry

Austin Tinckler is one of a growing group of RV builders in the Langley, BC, area. I first met Austin at the coffee shop at Langley airport. Like many RV builders, he's modest about his building accomplishments. But the RV-6 he is about to finish comes at the end of many years of building, and several airplanes.

Austin has been a private pilot for about 45 years. Like so many pilots who've been flying that long, he learned to fly on Cessna 140s, and really enjoys flying tail draggers.

He became a builder after joining the EAA, and his first project was a plans–built Zenair. The Zenair took nearly ten years to complete, and Austin is quick to point out that the quality of today's kit RV plans is better than the Zenair plans of those days—and the Zenair had very few prefab parts! It may be difficult for a contemporary builder like me to appreciate the dedication and ingenuity it took to complete a project like that.

After the Zenair, Austin discovered RVs, and began building an RV–4 from plans. By the time he got the wings and tail done, the RV–6 was on the scene, and Austin's wife commented, "I'd rather sit beside you than look at the back of your head." Austin sold the RV–4 bits, and used the money to buy the airframe kit for his current project, an RV–6.

Austin has enjoyed building his RV–6. The kit, he says, is far superior to what homebuilders used to work with. "Today's builders have a great option in that whole kits are available, which allows faster building and more completions. The RV is the best of the bunch. It is the most affordable and has the quality as well.

"Building the RV is as straightforward as Leggo, in a way. `A' fits into `B', and a jig is built to hold it all and keep it straight. The plans are first–rate and, if you care about your work, it will come out looking pretty nice.

"The spar seems to scare some people, but it's not hard to do at all. You don't even need any help on this part. If anything holds a person back in the building process, it would be weather for priming, or nobody around to buck rivets, or money needed for parts not in the kit. You will learn a lot of new things, like how to work with fibreglass. I had never even seen any of this done before. If I can do it, I think anyone can."

Austin's RV–6 has come together beautifully. It's finished in attractive, plum– and burgundy–on–white polyurethane paint, which he applied himself. "I wanted to paint it myself, because I had done everything else on the aircraft, and I could not see why I couldn't do this, too. The worst that could happen was that I'd have to sand it down again and treat it as an undercoat.

"Well, it got done, and now we have pink shrubs and a pink carport, and the doorway and my shoes are a nice, plum colour. That's not as bad as the Pro–seal spots on the washer and dryer, from where the fuel tanks sat!"

Every builder I've ever met has stories about using parts of the house in strange and unexpected ways. From engines in the kitchen to airframes in the living room, the stories get wilder and wilder. Austin seems to have kept things pretty well under control on the home front—other than building all his planes on top of the freezer.

Austin's RV–6 is powered by a O–320, 150 HP, with a High Country exhaust, spinning an Ed Sterba 70x69 prop. The engine is low–time, originally from another homebuilt project—a BD–4, he thinks—that had an accident, but no prop strike. Everything about the plane is per the plans, and it sports a sliding canopy. "The canopy can be a challenge," he says, "and can easily take two months or more to complete." At 977 lbs it's nice and light, with a panel that's more than adequate for VFR flying. He used few, if any, prefab parts, other than what comes with the basic kit. The upholstery was done by a custom car shop in Langley, to the dimensions developed by Tony Bingelis.

"If I were to start over," Austin says, "I believe my first concern would be how I would find an engine that was good and also affordable. I made the huge mistake once of buying an engine from a salvage operator. He had this engine from a wreck, sitting in boxes, all for $3,000. The crank was good, but that was all that was good. Parts were missing and others smashed, and it was frightful. Lucky for me, the man was gracious enough to take it back. Engines are in such demand that the only solution to their acquisition is money."

The RV–6 was moved to Langley airport around Christmas, and Austin has been busy with the final preparations for his first flight. "Two things have slowed me down. One was fitting the alternator, finding the right belt, and getting the alignment correct. The other was trying to fabricate the heat muff for the cabin and carb. My exhaust is a four–pipe system, and it gets busy under the cowl for clearance. Things finally came together, and I'm now awaiting the paperwork."

[On March 15, Austin made his first flight. He reports slightly high oil temperature, a slightly heavy left wing, and sore face muscles—fromsmiling, not G—Ed.]

Can Chevys last?

by Tedd McHenry

Judging by the RV List, one of the most consistently hot topics among RV builders is alternative engines—especially auto engines. I'm in the strange position of being more comfortable with auto engines than aircraft piston engines. I only have about 30 hours in the air with pistons, and I've scarcely even *seen* the insides of a Lycoming. But I've rebuilt quite a few auto engines, for both road–going cars and racing cars. And I've watched with interest as the durability of auto engines has shot up over the years. I can remember—and I'm a youngster compared to many RV builders—when it was a real milestone to get 100,000 miles out of your car, especially if it was a four–cylinder. Now, the manufacturers are talking quite seriously about having the first scheduled service at 100,000 miles! So I'm inclined to be skeptical when people confidently claim—without any analysis—that an auto engine couldn't have reasonable durability in an RV.

But it's quite correct to claim that the duty cycle of an aircraft engine is very different from the duty cycle of an auto engine. While it's true that auto engines typically last a lot longer, in hours, than aircraft engines, they also operate well below their peak power output for most of that time. So it's quite appropriate to ask, "How long will that auto engine last if it's putting out 120 horsepower in sustained cruise, and 160 horsepower in TO and climb?"

On the other hand, one very inappropriate discussion that often takes place is about the percentage of rated power that the auto engine runs at. Auto engines aren't rated the way airplane engines are. An aircraft engine's rating is, by definition, a measure of how much power it can put out for some defined period of time. So, naturally, it can be expected to last that long. An auto engine's rated power is simply the peak power that it can produce—far more than an aircraft engine of the same size would be expected to produce. For example, the Chevy 4.3 V6, with a displacement about the same as an O-235, is rated at 200 HP. If the auto engine was rated the way airplane engines are, it's rated power would be much less, and you would find that it's cruising at a much higher "percent of rated power" than the 20 or 30 percent that's often quoted.

> "If the auto engine was rated the way airplane engines are, it's rated power would be much less, and you would find that it's cruising at a much higher `percent of rated power' than the 20 or 30 percent that's often quoted."

Given all this, is there some way that we can fairly compare an auto engine to a Lycoming when used in an airplane? Here's my suggestion: compare the two on the basis of mean piston pressure (MPP), mean piston speed (MPS), and peak piston acceleration (PPA). These factors are used by engine designers to provide a feel for the amount of stress the engine is experiencing. You can find the equations to calculate them in most mechanical engineering handbooks. I used the Bosch Automotive Handbook, 2nd Edition, to compare the Lycoming O–360 and O–320, and the Chevy 4.3 V6. I have assumed that the Chevy would use a reduction drive, allowing it to rev to 3,600 RPM.

I was quite surprised to find that the MPP for the Chevy was actually less than for the Lycomings, despite producing the same power as the O–320 with only 80% of the displacement. The penalty of the 900 extra RPM, of course, is piston speed. Nevertheless, because of having more cylinders (allowing a shorter stroke), the Chevy's piston speed is only slightly higher than the Lycoming's.

Piston acceleration is another story, though. The Lycoming's is quite a bit less than the Chevy's, again due mostly to lower RPM. How significant is this difference? It's important to bear in mind that piston acceleration is a function of RPM only, not power output. In

Engine	**O–360**	**O–320**	**4.3 V6**
Displacement	**361**	**320**	**262**
Peak Horsepower	**180**	**160**	**160**
Cruise Horsepower	**135**	**120**	**120**
RPM	**2,700**	**2,700**	**3,600**
MPP peak (psi)	**146**	**147**	**134**
MPP cruise (psi)	**110**	**110**	**101**
MPS (ft/s)	**33**	**29**	**35**
PPA (G)	**600**	**521**	**836**

more on page 7...

Installing a platenut for a #8 screw

by Marco DeGirolamo

All airplanes have such things as inspection covers, panels, and fairings that use screws as holding devices. The screws go into platenuts—nutplates, anchornuts, whatever term you wish to use. The RV, being a metal airplane, has *lots* of these in the airframe. There are any number of ways to install these critters. Using a jig and doing them one at a time is one way, but if you have to put a lot in can be rather slow. Here is how I have done them....

1. Put the part to be attached with nutplates on the plane, and clamp it to hold it in its final position.

2. Mark out where you want the platenuts (make sure you have sufficient edge clearance).

3. Drill all holes #40 and put in clecos.

4. Enlarge these holes to #30.

5. Mark and take off the part and set aside. Put a platenut in every hole. Use a # 30 cleco in the center of the platenut and through the # 30 hole you just drilled.

6. Put the # 40 bit back in the drill. Use the holes in the platenuts as a jig for drilling the rivet holes. Drill one hole, and put something into it to keep the alignment (a rivet , cleco, awl whatever—you don't want the platenut to move when you drill the second hole) and drill the second hole.

7. Take all the platenuts off. Deburr and dimple or countersink the rivet holes.

8. Enlarge the center hole so the screw will go through, and you can dimple it at this time if platenuts are the countersunk ones—make sure you dimple the right way!

9. Put the platenuts back on with clecos and put rivets in them. Rivet the platenuts on. A Rivet Squeezer works best but they can be pounded too.

10. Enlarge or dimple the holes in the part (the # 30 holes you drilled in step 4 —do you remember where you put it?) for the # 8 screws.

Voila ! All done—perfectly.

Alligators to watch out for:

• edge clearances on all layers being drilled

• if a symmetrical cover or piece, make an indexing marks, so the holes will all line up later.

• don't drill your finger!

News from Saskatchewan

by Marc DeGirolamo

Just a little information on what is happening here in Saskatoon.

Tom Makinson flew his RV–6A last year. Doug Tomlinson and three partners should be flying their RV–4 later this summer. I have heard rumours that an RV–8 is going to be built, but have not met the guy yet.

One of our high schools (Aviation Studies) is starting to build an RV–3 (Jim Veikle's) as part of their curriculum.

Oh! And our RV–4 is getting ready to mount engine and instruments. We've had it in my shop all winter setting wings, controls, fairings, etc. (almost ready to pull wings off again).

...from page 6

the days before overdrives became common, a V6-equipped car with 15–inch wheels and a 3.73 rear end would have turned about 3,500 RPM at 120 kph. So, presumably, GM would have anticipated sustained speeds in that neighbourhood. And, because piston acceleration is proportional to the square of engine speed, the piston acceleration that the Chevy experiences at 3,600 RPM is not even half of what it experiences at peak power in an automotive application. So there's every reason to believe that the main bearings, wrist pins, and so on in the Chevy are designed to withstand the 3,600 RPM accelerations with a decent fatigue life.

All things considered, it appears that the Chevy wouldn't be experiencing a lot more distress in an RV than a Lycoming is. You could even make a case that it's operating further below it's operating limit. There are a lot of other considerations to an auto engine conversion, of course: auxiliaries, reduction drives, cooling system, and weight, to name just a few. But durability doesn't look like a problem, to me.

I'd be interested to know what other builders think of this analysis. Are there other factors you think should be analyzed? Other engines? If you have any thoughts about this, please write and I'll include them in a future issue of WCR.

What's Eustace Up To?

Eustace Bowhay reports that the second set of amphibious RV floats, for an RV–4 in the US, are nearly complete. This aircraft will run an angle–valve IO–360, and should perform beautifully. The floats are identical to those installed on Eustace's RV–6, though the installation has been redesigned to match the RV–4 airframe. Look forward to more news on this in future WCRs.

Ken Beene's engine cost breakdown

(see "You can overhaul your engine" on page 3)

Engine (O-320-E3D, 2244 hrs)		exhaust valves	$676	**subtotal**	**3037**
subtotal	3500	valve keepers	$37	**Machine Work**	
Material and Parts		exhaust valve caps	$31	Clean & zyglo cylinders	$156
gasket set	$101	oil return hose	$3	replace & bore exhaust g	$108
silk thread	$5	intake hose	$11	mill exhaust flanges	$108
Hylomar	$4	oil pressure spring	$12	replace studs	$80
engine paint	$15	crank bolt	$15	grind .010 oversize & cr	$276
main bearings	$144	crank dowel	$18	grind seats, valves, lap	$176
rod bearings	$52	crank plug	$2	clean & zyglo case	$92
rod bolts	$139	exhaust studs	$17	bore check & insp. case	$72
rod nuts	$19	exhaust guide	$52	clean, mag.flx. & insp.	$55
cam shaft (new)	$525	rod bushings	$10	polish crank & install p	$37
cam followers (rebuilt)	$152	rocker bushings	$20	repl. crank gear dowel	$68
pistons	$145	exhaust valve guides	$58	rebush & line bore rods	$84
piston pin	$130	spark plugs	$63	rebush-bore-reface rock	$108
comp ring (8) Chrome	$352	ignition harness	$147	**subtotal**	**1420**
oil ring (4)	$71	Oil Filter	$11	**Total**	**7957**

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We can extract MIME email attachments and we can UUDECODE. We do not support HTML encoding, nor do we support any proprietary scheme for encoding non–ASCII information into email, such as used by CC:Mail. Please don't use these forms of communication.

Ken:
So long, and thank you

by Tedd McHenry

Ken Hoshowski wrote a very nice introduction to me in the last issue of Western Canada RVator. I'd like to thank Ken for all his hard work building the newsletter. If you've every tried to do something like start a newsletter, you'll know how much hard work goes into it—work that often isn't even visible. In our parlance, Ken *scratch–built* WCR, and we all owe him thanks for that. The hand–over from Ken was very painless. I walked into a newsletter that was already funded, organized, and had a large and enthusiastic readership. I couldn't have asked for more. Thank you, Ken, for all your hard work, and I hope to honour the tradition you've begun.

I'd also like to thank the many people who wrote or included words of encouragement with their subscriptions. It was obvious from your words that you have enjoyed Ken's efforts, and I hope to give you something you find equally valuable.

The first thing I want to do is start getting to know everyone better, and finding out what sorts of things you want in WCR.