

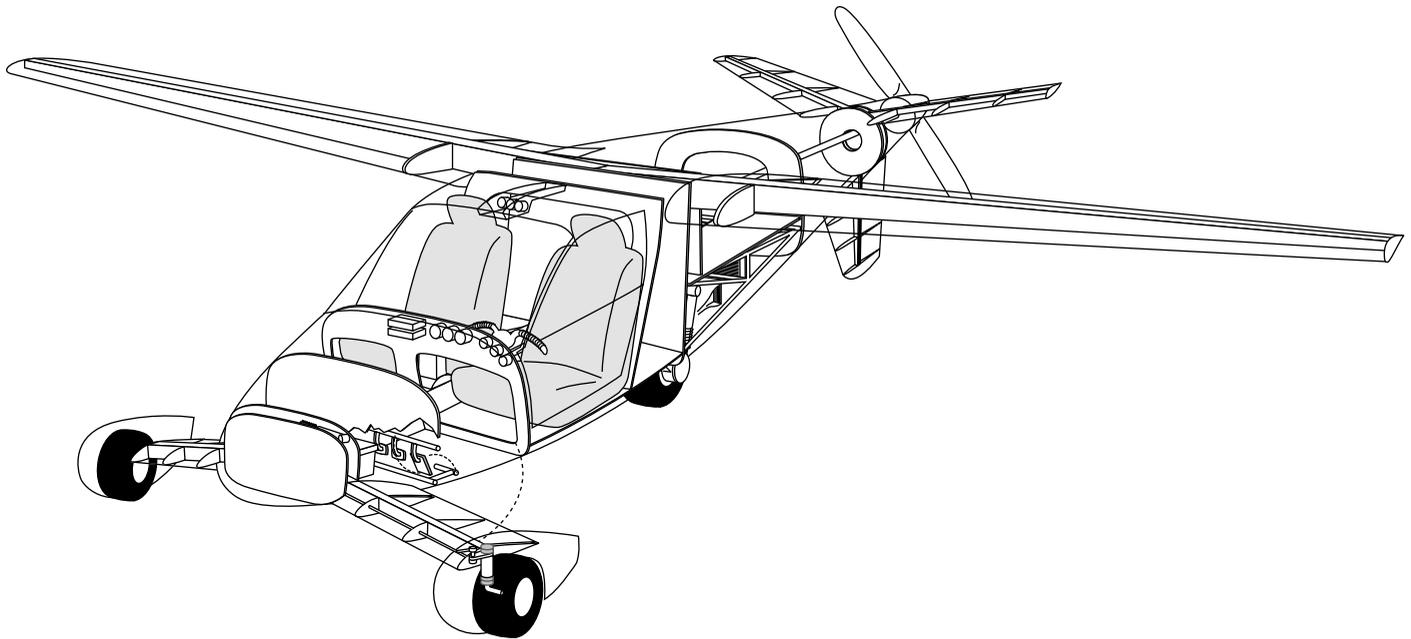
# Turn Bank



OFFICIAL NEWSLETTER OF RAAC CHAPTER 85

October 2002

## **Roadable Aircraft Design Considerations Technical Stuff Medical Stuff**





*On The Cover:  
The latest version of George's obsession. Artwork by George.  
Above: A Thruxton Jackaroo, unless I miss my guess;  
Kiwi registered, at Delta (!?)*

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*The TURN AND BANK is the monthly publication of RAAC Chapter 85 and is intended to keep members informed as to the club's activities, and to promote safety and technical excellence in the field of sport aviation. No responsibility or liability is assumed, expressed or implied as to the content of articles contained in the Turn and Bank: the intention is to provide a forum for discussion and exchange of ideas.*

*Newsletter contributions should be mailed to George Gregory, 19470-88th Avenue, Surrey, B.C. V4N 3G5 no later than the 12th of each month. Business Fax is (604)-469-3495. Please remember to indicate "attention George Gregory" on your fax. Contributions can be e-mailed to George at:*

[gregdesign@telus.net](mailto:gregdesign@telus.net)

*Enquiries to the Membership Chairman should be mailed to Rob Prior, 3032 Carina Place, Burnaby, BC, V3J 1B5*

For inspections of Amateur Built Aircraft Projects contact the MDRA Inspection Services , ph. 1-877-419-2111 fax 1-519-457-0980 email: [mdrainsp@on.aibn.com](mailto:mdrainsp@on.aibn.com)

Regular Meetings are held on the first Tues. of each month at 20:00 in the clubhouse:

Delta Airpark, 4103-104th Street Delta, B.C. Clubhouse  
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Executive meetings are on the third Tues. of each month at 19:30 in the clubhouse.

Chapter aircraft pilots, mail cheques (Payable to RAAC Chapter 85) to: Tedd McHenry  
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## TECHNICAL GUY

### Checking the Fuel Pump

*Melvin Shaffere as taken from the Coupe Capers and printed in the EAA Technical Counsellor News*

On my way to the airport, I had the thought that a good way to check the fuel pump would be to turn on the electric boost pump (which pressurizes the system) and check for leaks around the mechanical pump and plumbing. I will never fly a Coupe again without doing this.

After turning on the pump, I immediately smelled gasoline. A quick look at the pump showed it dripping fuel. The culprit turned out to be that little screw which is used as a capture point for the safety wire to the cap bolt. For reasons unknown, it was loose.

I did not check to see if this screw is on the suction or pressure side of the pump, but neither would be good.

Morover, in a Coupe with only the mechanical pump, there is no way that this device can be checked under pressure in a preflight. Prop wash would blow the fuel away before it would become visible, even if you were foolish enough to stand in front of the whirling prop to take a look. Chalk up another advantage for getting rid of that fuselage fuel tank and installing the electric backup pump.

### Elevator Rigging

*EAA Technical Counsellor/Coot Builder's Newsletter*

It's a good idea not to have too much play in your elevator system. One way to test for this is to tie the control stick in the full forward (nose down) position. Place a straight-edge on top of the stabilizer at the outboard hinge position and let it project out over the elevator. While holding gentle downward pressure on the trailing edge, measure the distance from it up to the straight edge. Repeat this measurement with gentle upward pressure on the trailing edge, keeping the control stick secured full forward. The difference is the approximate free play in the elevator system. My old Coot had 1" of play from this measurement. Even with only 50 percent static balance weights on the elevators, I never had any flutter in the system flying at 100 mph. Carl Anderson brought this to my attention, and he wonders how much play other builders are finding with their Coots. My new one has only half as much play, and I think that would be a much better criterion to shoot for, especially if you expect to exceed 100 mph.

### BENDING SMALL TUBES

*By Gary Wolf RAA#7379, VP Programs*

A chapter member recently asked how to bend small diameter steel tubing to a very tight radius for fuel cap vents for his wing tanks. He was using thin-wall material and the usual brake line bender. Each time, the inside of the bend would kink and immediately afterwards, the outside of the tube would pull flat over this kink. There was not enough diameter left for airflow, and the appearance was amateurish.

The solution to bending tubing is either to increase the radius of the die over which it is bent, or to support the material so that

it cannot distort. For small tubes the easiest way to provide this support is to fill them with ordinary solder. I use the rosin-cored variety to avoid corrosion problems with the tubing.

Pinch one end of the tube in a vise with the open end upwards, and insert a length of solder. Heat the tubing with a propane torch and the solder will wiggle its way in like a worm going into its hole. Add more solder to nearly top off the tubing and pinch this end off as well. When it all cools down, this tube may now be bent in the normal manner and the solder will support the wall to prevent wrinkling and flattening. Cut off the pinched ends and melt the solder out with the torch. Voila!

If it is necessary to make a bend of a tighter radius than the die on the usual tube bender, take a piece of small-diameter aluminum rod and lathe-cut a groove to fit the tube to be bent. In this case I used a 7/8 diameter rod and cut a half-round groove to fit the 1/2" tubing we were using. The tubing was laid on top of a block of rubber and the die was placed on the tubing. The hydraulic press was used to force the die and tubing out of sight into this 6" cube of rubber and the pressure exerted by the rubber forced the tubing tightly into the groove.

My block of rubber was cut off from an old loading dock bumper and has been working in the press for twenty years now. It is sometimes used for forming sheet metal as well, and can act as the female die with a piece of angle as the upper male die. If a lot of pressure is required, weld up a tightly-fitted nest for the block from angle iron. Do not underestimate the force that the rubber can transmit. I have seen the weld crack from the pressure exerted by the rubber. 

**The Chapter's second aircraft carrier trailer is for sale. It's a gem! \$480 or best reasonable offer. It's at John Keon's place 16301 - 20 Ave., Surrey ph. 536-8589 or call Jim Hunter at 576-2678.**

# AIRFrame



Aircraft Portraits

**Rob Prior**  
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rv7@b4.ca

3032 Carina Place, Burnaby, BC, V3J 1B5

604422.8448

# Bulletin Board

Last I heard, Norm Helmer is looking for someone to help with his Paradyne project. The Paradyne is a cutting edge new concept in STOL aircraft that shows promise. He's now residing at the George Kerby Centre in Burnaby.

Dan Lawler would like you to send your email addresses to him at:

dan.lawler@kvaerner.com

He will create a database so he can send announcements about meeting programs, etc. Currently he has a list of about 20 e-mail addresses, and would like to expand it and keep it up to date.

Want to learn more about aircraft construction? Want to contribute to the community good? Get involved in the J-5 project! Also, we are looking for help from someone knowledgeable in fabric work. Talk to a member of the executive and they'll put you in contact with the right people.

Don't forget that George is looking for pictures you may have of aircraft for his Stock picture collection. These will be used in future issues of the Turn and Bank as needed as well as use in the Recreational Flyer when a nice picture is needed for articles and fillers.

The October meeting is the chapter's Annual General Meeting. Don't forget to come and vote for your 2003 executive! And if you're nominated, have you given thought to serving the Chapter?

Oct 9-11 is the BC Aviation Council conference at the Grand Okanogan lakeside resort in Kelowna. The Silver Wings Awards Dinner will be held there as well, on the 11th. Tickets are \$60.

November 15 is the Black Tie and Blue Jeans Auction, also (I gather) a BCAC function, at the

Vancouver international Building, Richmond, BC.

If you know of any upcoming events, give George a call! This column is looking a bit thin these days.

**Some of those crazy DHAP guys! A gag pulled on some unsuspecting Cessna driver a long time ago. They dug a hole for his nose wheel and (gently?) lowered it in. Anybody remember this? Before my time...**



## Minutes

Jim Hunter

Minutes of the General Meeting,  
3 September, 2002

Call to order: 8:00 pm by President Tim Nicholas.

Hunter/Banker: that the Minutes of the General Meeting of 6 August, 2002 be adopted as printed in the *Turn and Bank*. Discussion Carried.

Committee Reports:

Membership: Rob Prior: We have 129 members of all categories. This is down 10 from this time last year.

Buildings: David Bell: We may rent a pressure washer to do the hangar roof preparatory to painting (although DHAPCOM owns one and we may be able to scrounge it). We are, after all, also DHAPCOM. Washing this Saturday and painting, hopefully, the next. Dan Weinkam says tie downs OK. Newsletter; George Gregory: he says it is fine, but the usual.

RAAC: Rob Prior: The AGM is in Winnipeg 27 to 29 September. Rob is going. See him if you have any ideas to be taken to Winnipeg.

Aircraft: Tedd McHenry: Turbi was flown 15.2 hours in August. Insurance is due. The rate is up but not all that much. Exec will look into a new radio or some such other arrangement for the Turbi. Gaetan says that the wings [of the J-5] are being Polybrushed

this week. Still time to get in on it and learn a useful trade.

DHAPCOM: Bruce Prior: Breakfast this Sunday. otherwise very quiet (which makes us wonder what our enemies are plotting!)

Old Business:

Nominations/Election Chairman Bruce Prior gave the second notice of the Chapter AGM. He is building a slate. Contact him with any nominations.

Bruce also gave away the last of the awards from the Annual Bash to recipients both deserving or merely unfortunate.

New Business: None.

Weinkam/Prior 2: that we adjourn, and sure enuff, we did.

Jim Hunter, Secretary.

# Design Considerations for Roadable Aircraft

George Gregory

DESIGN OF ANY AIRCRAFT IS A SERIES OF COMPROMISES, the solution being determined by the described mission of the aircraft. What's most important in your design? What things are "must haves", and what trade-offs can you live with?

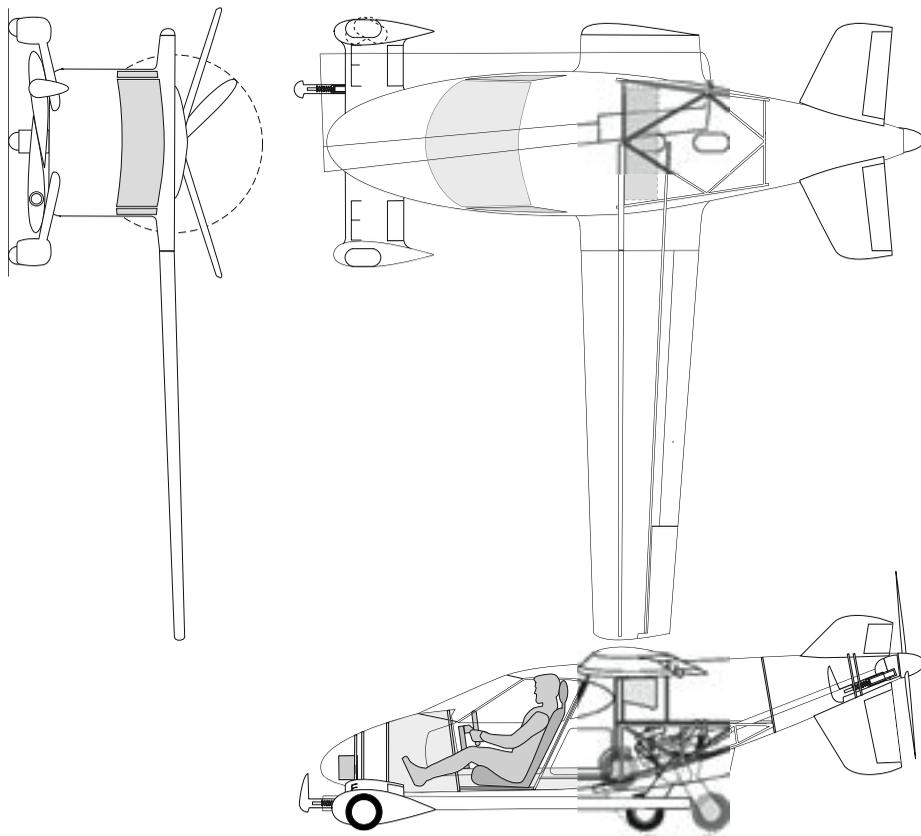
As if the budding designer didn't have enough to worry about, the idea of making a dual-use vehicle such as a roadable aircraft opens up another can of worms. Besides the usual give-and-take, the designer has to allow for the extra weight entailed by easily folded wings which are smaller, more complex, and have to carry more weight. Throw in an automotive transmission of some sort, a sturdier undercarriage, and the like. I'd like to offer some observations on how these things might be resolved.

## Restating the Mission

Above all, real utility is needed in both modes, without safe operation being compromised.

In the air, a cruise of 150 mph minimum in the air, reasonable landing speeds, and room for two and their baggage. Docile handling is important. Easy, car-like access to passenger and baggage areas is also important.

On the ground, the vehicle must fit in a standard parking space. It needs an undercarriage tough enough to handle normal driving conditions, which means it needs to be beefier than your typical aircraft undercarriage. The main mass of the craft needs to be closer to the ground. Ease of conversion is next; the vehicle must convert in under 5 minutes by one person with no tools. Fold up as few things as possible! Obviously the wings will have to go, but stowage of the wings must not affect driving visibility or handling. I'd prefer to leave everything else as they are for both modes. The fewer things you fold, the lighter you will be and the simpler to convert.



## Wings

It seems obvious that if you are going to have stowable wings you want them as small as possible; in cruising flight this is desirable, as the best L/D will be achieved at closer to the design cruise speed (see sidebar). But you are going to have a pretty hot airplane on approach. The solution is a (by homebuilt standards) a relatively complex wing: nearly full span slotted flaps, and full span slots to give a higher lift coefficient when you want to slow things down. The canard will need similar attention. Roll con-

trol can be handled with spoilers.

A three-surface configuration divides the lifting area between the main wing, which must be detachable, and the canard, which is small enough to remain fixed. Besides, you have to hang the front wheels on something. Why not make part of the undercarriage carry its weight (literally)?

One thing that has come to my attention is the potential problem of having a canard with a significantly lower aspect ratio than the main wing. Shorter wings stall at a higher angle of attack than long, slender

**As if the budding designer didn't have enough to worry about, the idea of making a dual-use vehicle such as a roadable aircraft opens up another can of worms.**

ones. Any canard strong enough to hold the front wheels of a light automobile is going to have to be fairly stout; and as the span is limited to 6 feet (the maximum reasonable width for something you drive) this means an aspect ratio of not much more than 4, assuming a 1.5 foot chord. This means that the canard will have to have a significantly higher angle of attack relative to the main wing. This is necessary up to a point (the main wing must reach the zero lift angle before the canard anyways) but the question is, "how much more of an angle?". So much as to create more than optimum (i.e., minimum) drag in cruising flight? Careful choice of airfoils and decalage (angle of attack of different airfoils relative to one another) will be important. Further, the three surface wing limits the lift you can get out of the main wing as the canard must stall first; however, unlike a pure canard, you can flap a three surface aircraft: the elevators in the back are still the primary pitch control. On the plus side, this means the aircraft is virtually stall/spin-proof.

### Wheels

As previously mentioned, the "undercarriage" needs to be a lot tougher and shorter than what you would expect on an airplane. Aircraft generally don't have to contend with potholes and speed bumps; cars do. We need to be closer to the ground, too; a high centre of gravity introduces more of a risk to tipping and vulnerability to wind gusts. The engine needs to sit relatively low. The wings should stow in a low position, both for a low driving centre of gravity, as well as to not obstruct driving visibility. They should stow somewhat forward of their flying position to move weight forward for driving. Remember, we don't want to be light on the front wheels when we are in car mode. Wheels large by aircraft standards, but smallish by auto standards, perhaps the size of those on a Mini-Cooper.

### Weight Transfer

This is an area sometimes overlooked by roadable enthusiasts; but in my opinion is is all important if the vehicle is to be safe to drive. The weight needs to be as evenly distributed between the wheels as possible; in a 3-wheel arrangement, the driving centre of gravity should ideally be low, and about 35% of the distance between the front and back wheels. In air mode it is not far from the back wheel. What devices can we use to improve this ratio?

### Propeller

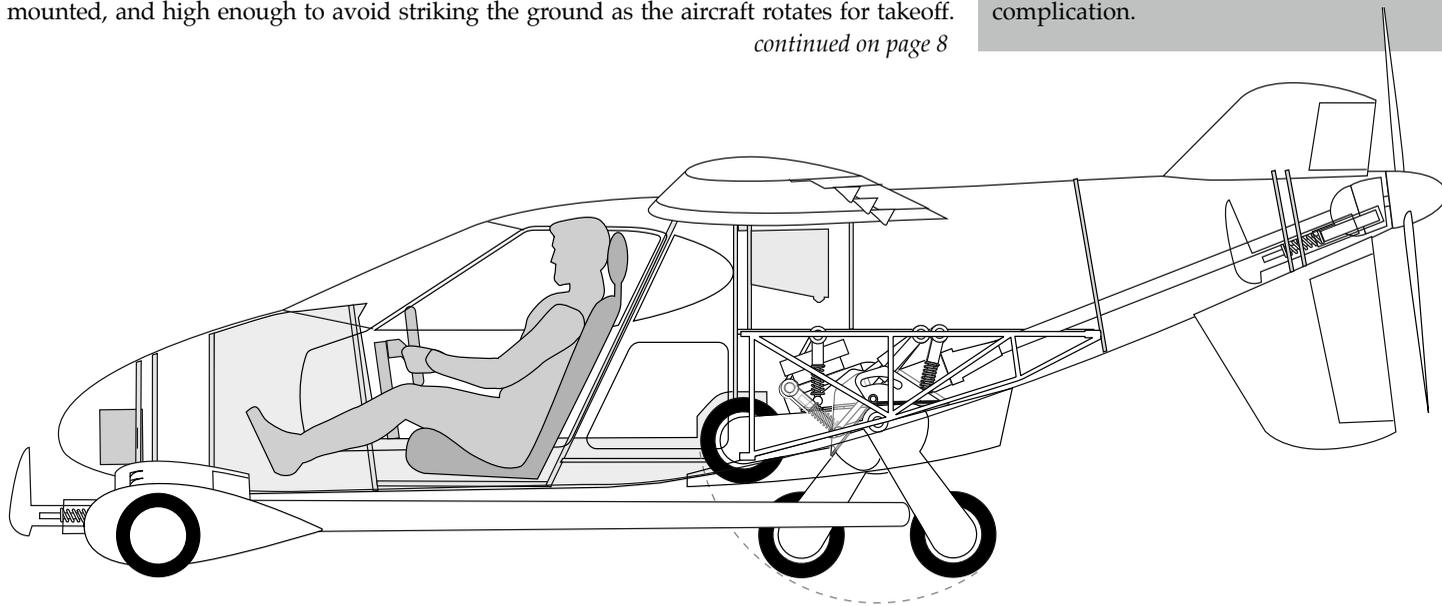
If the body is closer to the ground, the propeller can't be. It must be high enough to not conflict with the ground. It's helpful if it's not in the way on the ground. The solution? rear mounted, and high enough to avoid striking the ground as the aircraft rotates for takeoff.

*continued on page 8*

### Small Wings and Efficiency

Have you ever noticed that the best Lift/ Drag ratio (generally your best rate of climb speed and best glide speed) is a lot lower than your typical cruise speed in a light aircraft? This tells us something about the efficiency of our aircraft; that is, that in cruising flight, it could be doing better. What happens when you make the wings smaller? The glide angle remains the same, but the speed you achieve your best L/D (represented by your best glide speed) goes UP. You glide faster, and therefore come down faster, but your glide angle remains the same (within reason). The closer your cruise speed is to this best glide, the more efficient you are in cruise. Unfortunately, you would land really fast too as your stall speed goes up as well. You have shrunk your operating envelope as cruise and stall speed get closer to one another. That is why light aircraft generally have bigger wings, and are less efficient in cruise: it makes them easier to land and gives a more useful speed range.

Airliners have miniscule wings considering the load they carry, but they have all sorts of high lift devices to wring every bit of lift out of them they can. In our case we would use all the simple high lift devices - slots and almost full span slotted flaps, with spoilers for roll control. A necessary complication.



*Part of resolving the weight transfer problem could be accomplished by storing the wings forward and underneath to keep the driving c of g low and move it forward. By moving the back wheel aft for driving purposes, we effectively lengthen the wheelbase and further improve c of g's location relative to the driving wheelbase. Note the elaborate and unusual suspension such an arrangement would entail.*

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Medically Speaking...

Dr. Brian Thick  
(as borrowed from Brampton Flying Club's Newsletter)

One of the amazing things about we human beings is that the majority of us pay no attention whatsoever to our body until we find that a part of it is not functioning properly. We pay little attention to our nose till we lose our sense of smell. We accept our vision till we see someone who is blind and we take our stomach for granted till we get heartburn. This all brings me to my medical subject for this issue. I want to talk about our urinary system. Somewhat indelicate, I know, but most important to all especially when its function is impaired.

Picture this because it has happened to you in the past and will undoubtedly occur again. You are late. You drive like mad to the flying club and hurriedly park your car. Your passenger is late, so you wait. He arrives and apologizes. You both roar out to the plane. If it is a rental it too is late. You

do your walk around and run-up. Then you taxi to number 5 position for takeoff. Your turn comes when a whole squadron of students turn final and base. You wait. Finally you are aloft. You climb to preferred altitude, set your VOR's, tune your loran, dial your ADF [this was written in 1994, remember - ed] and confirm with your chart and supplement. Then you smile at your passenger, snug your seat belt, settle back and suddenly realize you need to take a wizz. "Oh my god, I forgot to go at the club." What now? Suddenly your urinary system becomes the only part of your anatomy. Panic not: for medically speaking you can do no harm by holding back as long as you can stand it. You can't flood your kidneys and you won't drown. But you will suffer a lot of bladder discomfort and even pain.

The bladder which is located behind your pelvic bone is an expandable bag that can hold up to about 500 cc. When it holds 300 cc then you really have to go. At 400 cc you are in pain, but you still have 100 cc to go, though most can't tolerate holding that much. You can kind of time yourself

because the kidney manufactures about 1 cc per minute which runs into the bladder. I met some farmers out west who carried honey pails in the planes in case any male or female was caught short. There are kits you can purchase here at the Brampton Flying Club that cause urine to turn into scented gel when one urinates into the kit container. No, they are not re-usable.

A pal of mine, a doctor in the Bahamas, had a 182. He and his nurse would fly to patients in the outer islands. One time on such a flight she was caught short and had to go real bad. She is a very shy, sensitive lady, quiet and correct and was humiliated by her state. But my pal reassured her and promised not to look. He turned his head and she wizzed into a pail kept for such an emergency. Before he could speak a word the embarrassed lady opened her window to toss the urine overboard and you know what happened. They landed on a beach and washed the plane with sea water. She couldn't look him in the eye for days afterwards and to this day, years later, we dare not mention the subject.

*Design Considerations continued from page 6*

Witness Taylor's IMP and Aerocar: rear mounted, high propellers. Besides, it looks cooler. A car with a prop on the front looks like it has a moustache.

#### **Main Compromises (besides the usual...)**

-High, rear mounted propeller (high thrust line) means an undesirable thrust couple; you goose the throttle and the nose pushes down like a BD-5 or an amphibious aircraft. Amphibious drivers live with it: so would we. This could be minimized by adjusting the thrust angle, at some small loss of propeller efficiency.

-Small wings requiring fairly exotic high lift devices, and small-ish ailerons augmented by spoilers for roll control.

-Not as well protected by bumpers as a car would be; we are more like an enclosed, side by side motorcycle. Deal with it: you are not going to meet automotive crash requirements. Too heavy! As a three wheeler we escape the usual automotive certification requirements; but even as a four wheeler, homebuilt CARS are exempt from these requirements.

-Poor rear visibility; this would be handled by side mirrors and perhaps an aft-looking mini-cam with an LCD screen where a rear

view mirror would be.

-The wings are vulnerable to rock chip damage if stowed underneath the fuselage; some sort of cover would prevent minor damage. Major damage? You wouldn't fly it anyways if someone creamed you during the rush hour. In this case perhaps the wings be made to protect the occupants (I'd rather break a wing spar than my pelvis).

There's still so much to learn. Only recently I discovered the importance of moving weight REALLY forward for a two-wheels-in-front tricycle; about 35% back from the front wheels is optimal. Right now, even with all the fancy doo-dads, I'm more at 60% back. Better than it was, but more needs to be done. Ballast? Yucch. Dead weight. Perhaps a spoiler to download the front? Research is in progress. I'll get back to you. And Keep Those Articles Coming. Or Else...

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