Texas City Wings

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Converting Oil and Air into Rotating Torque (Part 3)

By: Harvey Cappel

This is going to be about how the atmosphere (weather) affects the way internal combustion engines burn fuel and why we often want or need to change the engine (turn the carburetor screws) to match the weather conditions.

SOME HARD ENGINE FACTS

1) The engine needs Oxygen molecules to run.

2) Some if not all of the Oxygen molecules must come from the atmospheric air.

3) The amount of Oxygen molecules in a given volume is not always the same.

For ease of understanding let's assume a brown grocery bag is about one cubic foot of volume. So for example if we have an engine that is sucking air in at the rate of one cubic feet per minute this means that for each minute of operation one bag of air goes into the engine. What's in the bag could make a big difference in how the engine runs. Remember each molecule of fuel must find a molecule of Oxygen to mix with and burn.

SOME HARD ATMOSPHERIC AIR FACTS ABOUT OXYGEN

1) Oxygen molecules can't fit in spaces where water or steam molecules are filling the space. A bag of wet air cannot have as many Oxygen molecules as a bag of dry air.

2) An Oxygen molecule's size is a function of its temperature. Hotter Oxygen molecules are bigger than cold ones so a hot bag of air (now that sounds familiar) cannot have as many Oxygen molecules as a cold bag of air. This may not apply to some humans I know. You know who you are. Read this again without the funny part at the end.

3) An Oxygen molecule's size is also a function of the pressure it sees. Oxygen molecules get bigger when the pressure goes down so low pressure Oxygen molecules are bigger than high pressure Oxygen molecules therefore a low pressure bag cannot have as many Oxygen molecules as a high pressure bag. This makes sense if you think about it in reverse. Starting with a full bag of air, if we force more air into the bag the bag's pressure will increase and obviously everything in the bag had to get smaller to fit. The only other expatiation is just magic.

So what does all this mean? It means that for a given volume of air flow into the engine (basically set by the RPM) which will draw a given fuel flow, any change in the atmospheric conditions of the air will change the air to fuel ratio. This will obviously affect the way the engine runs.

What about the fuel; won't it change the same way and keep the fuel to air ratio the same? No. Actually the fuel will change with the conditions stated above and in the

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Inside this issue:

Meeting Reminder-

The June meeting will be at 9AM at the field

Texas City Radio Club Meeting Minutes May 2009—

These are the minutes for the Texas City Radio Control Club meeting, May 30, 2009. The meeting at the TCRCC flying field was called to order at 9:00am by President Michael Grassmuck. A quorum was met with 21 members in attendance.

Visitors: none

Secretary's Report - David Gatling: A motion was made, seconded, and passed to accept the April members meeting minutes as written in the April newsletter.

Treasurer's Report – Ray Saenz: Ray reported the treasury status for April and May . (see emailed newsletter for details).

President's Report – Michael Grassmuck: Mike reported that a committee was now in place to study and recommend what will be needed to build a new club house at the flying field. He asked members with any input related to the proposed club house to direct it to the building committee. Harvey Cappel will chair the committee and report progress and needs to the Board of Directors.

Mike stated that he is planning to have a work day at the field on Saturday June 13th to install Hardee board to the side of the concession stand and improve the appearance of the building. Volunteers are needed and should contact Mike.

Event's Section Report – Randy Brown: A Big Bird organization meeting for the volunteers to help with the event will be held at the Faith Lutheran Church, Dickinson, on Thursday, June 11th at 7:00pm.

The Fun Fly – Swap Meet attendance was not what was expected probably due to the poor weather conditions. Randy expressed his appreciation to the volunteers helping with the event.

The Mall of the Mainland show and tell was considered a success and resulted in several new member potentials. Having the event at the center of the mall and the big screen flight simulation helped in the success. Randy gave the volunteers an AMA mall show pin for their help.

Mark Weiss requested to have a Club 40 race open to all clubs July 11th to replace the event cancelled in April. Mike requested that Mark make arrangements for the event.

Newsletter Editor Report – Kyle Tupin: Mike asked the membership to show Kyle their appreciation for the great newsletter.

Safety Officer's Report – Kevin Furman: Mike stated that the midair collision of two Club 40 races pointed out that good communications that day probably prevented a more serious accident. Also, some procedural changes are in order to reduce the potential of midair collisions.

Pilot Instruction – Harvey Cappel: Harvey stated that he has two students for pilot instruction. He requested that members training pilots should use the buddy boxes since responses to any trainee error is much quicker, just a flip of the switch.

Field Marshall's Report – Field is being kept in great shape thanks to the mowers. Mike expressed his appreciation to the mowers for their dedicated work.

Show and Tell Mike Grassmuck had his Touro flying lawnmower on display. He has flown it several times.

Meeting was adjourned at 9:45 am.

Next members meeting will be Saturday, June 27th at 9:00am.

Converting…..(cont'd)

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same direction but to a much much lesser extent. Think about a coke bottle full of water. You can get more water in it by forcing it in but you ain't going to get enough to measure before the bottle breaks. Gases are compressible but liquids are considered non-compressible. The atmospheric effects on the liquid fuel are negligible.

Now let's do some math to see just how atmospheric changes can potentially affect the operation of our engine:

PRESSURE:

The volume of a gas is directly proportional to the ratio of the absolute pressures. Standard absolute pressure at sea level and 60 deg. F is 14.7 psia. This pressure can range form 13.78 to 14.94 on days where we don't have to evacuate.

The low pressure problem is 13.78/14.7 or 0.94 or about 6 % below normal.

The high pressure excitement is 14.94/14.7 or 1.02 or about 2% above normal.

The meaning of this is that the barometric pressure at sea level and 60 degrees F can change the Oxygen intake to the engine by about -6% to + 2%. This will affect the fuel to air ratio and the power output of the engine. Note this can be a total of 8% from one extreme day to the other. Not an insignificant amount.

TEMPERATURE

The volume of a gas is directly proportional to the ratio of the absolute temperatures.

Standard absolute temperature is 520 deg. R or as we read it on a thermometer 60 deg. F. This temperature can change from let's say 500 deg. R (40 deg. F) to 560 deg. R (100 deg. F).

The high temperature problem is 520/560 or 0.93 or about 7 % below normal.

The low temperature excitement is 520/500 or 1.04 or about 4% above normal.

The meaning of this is that the temperature can change the Oxygen intake to the engine by about -7% to + 4%. This will affect the fuel to air ratio and the power output of the engine. Note this can be a total of 11% from one extreme day to the other. Not an insignificant amount.

HUMIDITY

This one is much more complicated and analyzed differently. The full blown calculations are too much for this short article so I'll start with work already done by someone else and use a simplified chart. The chart shows partial pressures of water vapor for different humidities and temperatures. In our example bag of air each component exerts its own partial pressure which among other things determines the mixture percentages. So starting with a standard pressure of 14.7 psia in the bag, if some part of that pressure is caused by water vapor (which isn't usable oxygen) we can by subtracting out the water vapor partial pressure then calculate the amount of Oxygen left in the bag.

The worse case for example (100 deg F and 100% humidity) shows a water partial pressure of 0.98 psi. This must be subtracted from the total pressure in the bag to determine that part of the volume which contains the Oxygen. Another way to look at it is in the reduction of Oxygen by a percentage calculation 0.98/14.7 or about 7% less Oxygen. The best case obviously would be with zero humidity and the reduction would be 0%. Realistically however our best case would be more like 60 deg. F and humidity at about 50%. or about a 1% reduction in Oxygen content. Overall we can expect humidity to cause about a 6% variation in Oxygen content of the inducted air. Still significant.

Let's pause here a moment to see just what this can mean. Barometric pressure can be an 8% problem, temperature an 11% problem and humidity a 6% problem. From the best day of high pressure, low temperature and low humidity to the worse day of low pressure, high temperature and high humidity the change in Oxygen intake can be as much as the approximate sum (not exactly for NASA types) of all the above, roughly up to about 25%. This can in some cases be enough to make your engine gurgle (rich) (drowning in unburned fuel) or die from starvation (lean) of fuel.

Now it should be obvious that for peak engine performance of an internal combustion engine one must make adjustments to the fuel flow to match the Oxygen content of the inducted air. So why doesn't everyone do it; why don't they have problems? Remember the term peak performance and remember from the first article how little time is available to burn the fuel in each revolution of the engine. If you don't care about peak performance and you engine runs at low RPM making it easier for the fuel to burn then you don't need to do anything once you get the engine running on some average day. However if you want the best performance and you are running a very high RPM engine then you will have to turn the screws every time the

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weather changes and maybe even (like the racers) every time you start the engine. On the other hand slow running gassers once set up properly may never have to turn the screws again.

Time for spring break now and let someone else write for a while. Thanks for reading this and the kind compliments I have received for it.

A Note From AMA's Technical Editor

A short time ago, a modeler wrote Ed McCollough (your humble technical editor) the following:

"Noticed and noted on the foot of page 66 of March Model Aviation *underneath the picture of the Spektrum/JR flight logger, it is recommended that six-volt battery packs be used on ALL 2.4GHz receivers.*

Called Horizon Hobby on the phone; they confirmed this statement. It was suggested the same six volt usage for other brands also.

Would like to suggest the general membership be made aware of this when 2.4 GHz receivers are used in glow/gas airplanes/helis to preclude possible in-flight loss."

When I read this, I agreed with him and wrote him I would get on the problem. Please, read what he wrote and consider it very, very carefully. Unfortunately, the answer to his question hasn't been that quick or easy, but for the time being, here it is:

If you are flying a 2.4 GHz system, follow the manufacturers' specifications for the voltage. If you are using a separate voltage pack for the receiver, be absolutely sure it has enough voltage to run the receiver. A common 5.0-volt receiver pack may not have sufficient voltage to run your particular receiver. Actually, if you used a six-volt pack and it was adequately charged, it should be sufficient, regardless of the manufacturer.

There is one problem, when using a six-volt pack if it isn't required by the manufacturer of your system. That problem will likely happen if you are using digital servos. If you drive some digital servos with six volts, there is a high probability you will damage the servos because of the higher voltage. Remember, if the servos fail, it won't make much difference that your receiver is still working.

You always need to be flying with a functional receiver pack, one that is as close to fully charged as possible. Remember, insufficient volts to the receiver and you crash.

Lastly, as in all things, and in all cases, read the instructions.

ON THE SAFE SIDE

101 Ways to Stop a Spinning Propeller

By Don Nix, Insider Safety Column Editor

Unfortunately, we are limited to only a single safe one: Stopping the engine.

Yeah, yeah. Everyone knows that. Right? Well, if so, then why are more than half of all model accidents caused by model propellers—while turning? Because we do very stupid things sometimes. Because we get careless. Because we get too casual. Because we are inexperienced. Because we are so experienced we think common sense safety is for beginners. Because, because, because.

Well, that be the cause!

K&B engines might not be very familiar to newcomers to the hobby, but oldsters will remember that K&B was the leading American manufacturer of model engines for decades, having been started by Johnny Brodbeck back in 1946.

About 20 years ago, I was flying at the pilot's station next to one occupied by my good friend, John Brodbeck; the "B" of K&B engines, and son of Johnny, the founder. John was test flying an engine sent in by a customer seeking a solution to a puzzling problem. (Yes, company owners really used to do such things.) John had made a couple of laps around the field, but felt the engine was too lean, so he landed and taxied to the front of the pit to change the needle setting.

Now here's a fellow who is the owner of a model engine company, who had probably been weaned from Mama Brodbeck to a baby bottle filled with glow fuel, and had been around and using model engines since the earth cooled. One would think he would be extra careful; be sure the model was secure and tune the engine from behind. Instead, wanting to get on with the test, he reached across the propeller from the front. I can tell you it stopped the engine. However, flying was over for the day

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for both of us because I had to drive him to the emergency room to have a deep 3-inch gash in his forearm neatly stitched.

Yes, he was hurt, but said the worst pain was the embarrassment of being an engine manufacturer who would do such a dumb stunt (his words, not mine) at Southern California's busiest flying field in front of about 60 modelers.

My guess is, there are very few modelers who have been flying more than a couple of years who have not donated a little blood and possibly flesh to carelessness with propellers. For some of us, once is enough. Others have a little slower learning curve. It would be bad enough if their carelessness just injured themselves, but all too frequently an innocent person is hurt; sometimes more than just stitches.

I think I'll cut this column shorter than I had planned to allow you faithful readers (all six) to submit some of your own experiences that might quite possibly make others think twice before doing something stu … er, ill-advised.

Always glad to hear from you: flyerdon@aol.com or flyerdon@ yahoo.com. You will get a reply. ✈

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