



EAA602 Log Book

Adirondack Chapter Newsletter
December 2006

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HOMEBUILDERS



From The Presidents Desk

by *Tim Cowper*

Well, shockingly, another year has almost gone by. This was a great year for 602. From the Albany Airport Tower trip last January to last months meeting featuring the amazing world traveler CarolAnn Garratt, 2006 has been a lot of aviation fun. And it's not over yet. This months meeting will be a fabric covering demo, presented by several of the most talented members in our club. On November 27th, at the Edinburg Town Hall, following a brief but official meeting at 7PM, Don Leadley will give an introduction, followed by a presentation by Tom Kravis and Don Hisert. Actual up close and personal demonstrations of fabric covering will take place. This should be good. If you have any interest in ever building or restoring an airplane, or you just like to learn about airplane construction, or you just enjoy aviation....be there.

Speaking of building and restoring airplanes, my Zenair is coming along nicely, and steady progress is being made toward getting it in the air. I am so thankful that I have fellow members Art Goodemote and Tom Kravis helping me on this project. The electrical work involved in building this airplane is frighteningly complex, and Tom continually amazes me. And, just about the time I'm thinking...how the heck are we going to do this or that, it's always nice to hear Art say the words "that's no big deal." I'm very happy to have the privilege of working alongside (well, observing anyway, hopefully not getting in the way of) these talented people. And, a special thanks goes out to Fred and Tony for their help on Saturdays.



There is much in store for EAA602 in 2007 and we need input from everybody. I'd like to have a schedule of events for the season established by March so that said events can be well publicized in advance and properly marketed. Consider making a New Years resolution to get more involved with the club, in any capacity. The larger our core group of members who are actually involved and doing things

means that there is less work individually, and more fun for everybody! Trust me, you'll be glad you got involved with 602 because, it's not really work, it's all fun!

As always, we are looking for your articles for our excellent newsletter. Winter is a great time for writing. Whether you have logged 15 minutes or 15000 hours, we want to hear from you. We have the best newsletter because we have people willing to take the time to write great articles and stories. I personally would love to hear some stories from 602 old-timers about 602 old-timers. You know who you are. Maybe a brief history of 602? With pictures maybe? Anyway, please think about your aviation experiences, write something up, and submit it in any form (preferably MS Word format, but even hard copy) to Doug so it can be included in a future issue. Any questions call Doug directly. And please, any suggestions or criticisms regarding the website can be directed to me.

Hope to see you on the 27th!

Tim

P.S. Don't forget the X-mas party on December 3rd! See back page.

**The Meeting This Month
Will Be At Edinburg
Community Center
(Old Town Hall)
@ 7:00pm on
MON. NOV. 27th**



Two Stroke Scavenging and Exhaust Systems

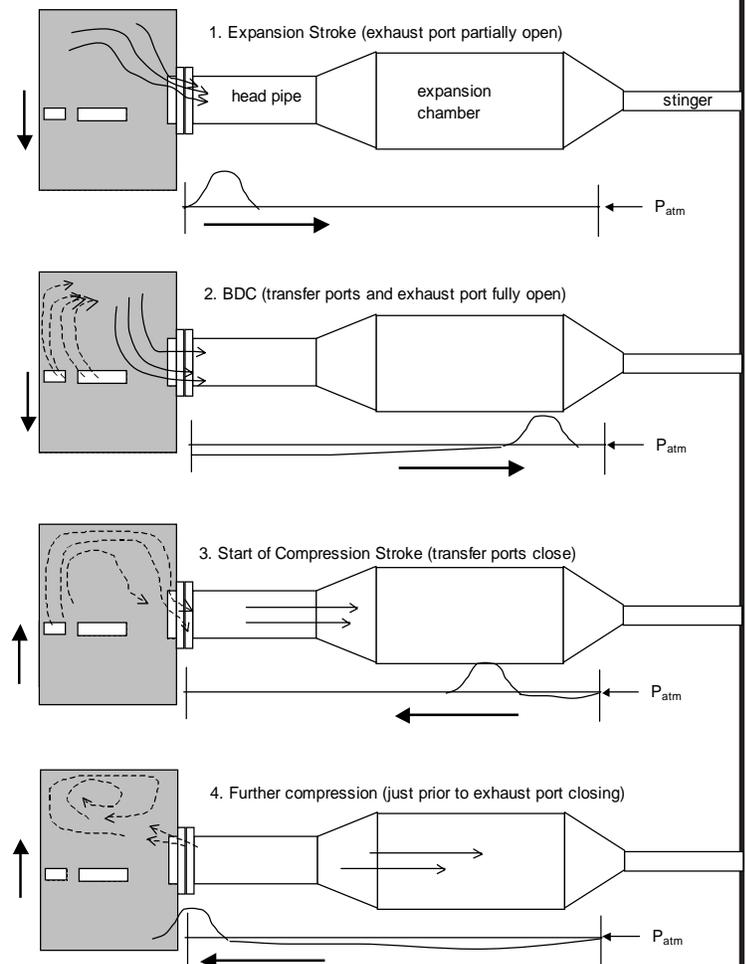
by Larry Saupe

Most of us are quite familiar with Emma's *Suck-Squeeze-Bang-Blow* theory of engine operation. When it comes two stroke engines we find the engines are rather simple devices (when compared to a four stroke), however the internal (and external) flow patterns can be much more complex. This article will focus on the *Squeeze*, *Bang* and *Blow* portions of Emma's model. We find that these three things happen with no explicit valving hardware, yet the incoming fluid and exhaust gases somehow find a way to remain separated, even though they occupy the same chamber simultaneously (in the cylinder above the piston). Any valving in the cylinder is the result of interaction between the piston and various ports contained in the cylinder wall.

For the casual observer it is noticed that when the piston is at BDC (bottom dead center), both the exhaust port and transfer ports are fully open! So... what prevents the fuel/air mixture that is being forced up through the transfer ports from heading straight out the exhaust port? The answer lies in the design of the transfer ports and the size and shape of the exhaust system. The ports in the cylinder walls and the exhaust system work together as a team to send the fluids along their intended path. As the piston is forced down (during combustion) work is done on the piston until it has descended enough to open the exhaust port (Figure 1). At this point in time the exhaust gases start to rush out the exhaust port and fill the exhaust system. Along with this goes a pressure pulse (which is higher than the local atmospheric pressure). This pressure pulse travels at the speed of sound (the speed of sound is a function of temperature – the hotter the exhaust gases are the faster it travels). However, once the piston lowers to about ¾ of the way for a fully open exhaust port, the transfer ports now start to open. At BDC the transfer ports and exhaust port are now fully open (Figure 2). It is also about this time that the earlier pressure pulse reaches the end of the expansion cone. What prevents the new fuel/air charge from escaping with the exhaust flow? This is where

the fun starts. Many things come into play to keep things in sync. First of all, the exhaust gases see the lower pressure zone in the exhaust system and head that way. Secondly, the fresh fuel/air mixture being forced into the cylinder is angle upwards and towards the back wall (opposite of the exhaust port). The speed and momentum of this flow forces it towards the aft section of the cylinder (similar to a jet pump) and then up into the cylinder head. Some of this mixture may get dragged out of the exhaust port (with the exhaust flow) but this will be relatively minor.

The piston now begins its upward travel for the compression stroke and the transfer ports close (Figure 3). About this time, all of the exhaust gases have left (forced out by the incoming fresh charge) and some of the fresh charge may actually get pushed out into the exhaust head pipe. Also at this time, the high pressure pulse wave has recently impacted the

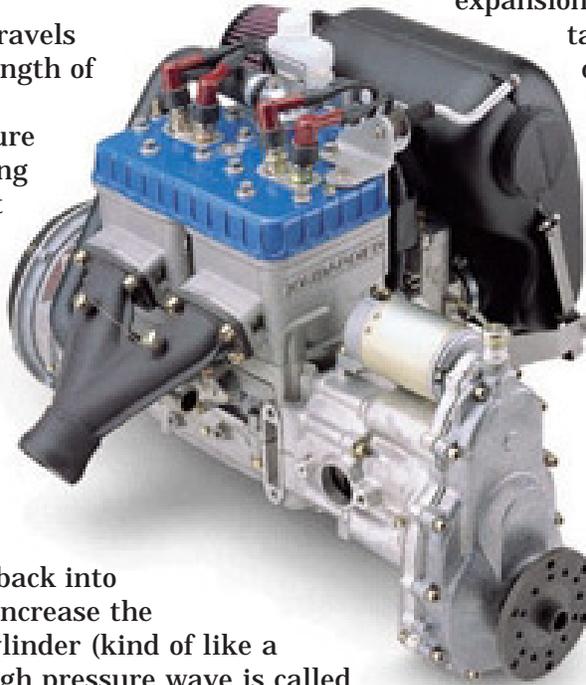




aft wall of the expansion chamber and has been reflected back towards the cylinder (much like surface waves on the water when they encounter an obstacle, or a wave introduced into a stretched rope that is fixed on one end – the wave will travel back and forth).

As the piston travels further upward, the length of the exhaust pipe and exhaust gas temperature determine when (during the piston stroke) that the high pressure wave will meet the exhaust port (Figure 4). If designed properly, this high pressure wave will hit the exhaust port just before it closes. This high pressure wave will force any unburned fuel charge back into the cylinder and also increase the pressure within the cylinder (kind of like a supercharger). The high pressure wave is called a *plugging pulse* in the 2 stroke engine world and is one of the key performance parameters used in tuning 2 stroke engines.

So what does this mean in a practical sense to the 2 stroke pilot. First of all, proper scavenging is crucial to the life and power output of your engine. If you were to remove your exhaust system and start the engine, you would find that the engine would run, but would be seriously lacking in power. On a lesser extreme, a seemingly minor exhaust leak (such as a crack or a loose or missing EGT probe) will lower the power and efficiency of your engine (as a portion of the plugging pulse will escape there). Have you ever noticed that when you have an exhaust leak on a two stroke you often end up with fuel and oil all over the place, but when you have a tight system and open it up for inspection everything appears very dry? A good plugging pulse helps keep the fuel/oil where it needs to be (in your cylinder). The timing of your plugging pulse is also affected by your EGT. The higher your EGT, the faster the wave travels. So an optimum pipe tuning at say 1000 °F EGT may not provide the best plugging pulse timing at say 800



°F. In this case, the pulse will arrive later than it would have for a higher temperature (effectively tuning your pipe for a lower engine RPM).

Modifying your exhaust system, by say changing the length of your header pipe or expansion chamber will also change the time it takes for the plugging pulse to travel out and back. Increasing the length of the header pipe will force the pulse to arrive later and decreasing the length will force it to arrive sooner (ultimately changing the performance curve of your engine). Extreme caution must be used when altering any parts of the exhaust system (especially in an airborne environment).

Some keys to a happy and healthy scavenging system:

1. Keep a tight and leak free exhaust system. Minor leaks may cause more problems than just an oily mess.
2. Never alter the manufacturers dimensions on exhaust components (unless approved by them prior). Along this same line, using an exhaust system from one particular model of engine and trying to adapt it to another model can be quite risky (unless approved by the manufacturer for this particular use).
3. A proper engine warm-up also includes a proper pipe warm up for best performance (and this should hopefully happen by default).
4. Proper EGT's are also a key element in scavenging performance.

This is a brief introduction to a few of the flow patterns within a 2 stroke engine. More information can be found in the following literature:

1. *Design and Simulation of Two-Stroke Engines*. G. P. Blair ISBN 1-56091-685-0
2. *Internal Combustion Engine Fundamentals*. J. Heywood ISBN 0-07-028637-X

What a great article. I always wondered how that worked.

Doug

From Our VP's Desk

by *Tony Rizzio*

Hanger flying

It's that time of the month, so I'll jot down a few thoughts.

I have been thinking we might like to caravan to Windsor Locks air museum, come to the meeting and we will see how much interest there is and maybe pick a date.

I've visited Art Goodamote and found him and Tom Kravis working hard on Tim's 601 witch is

coming fine. Should be ready to run by the time you read this.

Rick France is almost ready to solo his koala (all we need is good weather).

Bob Walsh is making airplane noises in his Koala. He was questioning me about the button on the stick (we tell everyone it's for guns)

Then I stopped up to see Doug's new project. Was I impressed; can't wait to see it in the air.

Judy is picking out the color scheme as we speak

I don't have much more news at this point see you at the meeting.

Tony

EAA602 TRADING POST FOR SALE

Gauges & Other

Many brand new left over Gauges for sale. Tach, Dual CHT, Dual EGT, Water Temperature (All Westach 2 1/4" with probes) Combo EGT-CHT. Tapered air filters for 447-582. 5" Matco wheels & brakes. Flightcom Model IIsx portable intercom. Complete Stainless Exhaust for Rotax 912 pusher arrangement. **Call Doug 863-2409**

Cont. A-65

fresh rebuild no logs & Rotax 277 with gear box 14 total hours ,contact **Fred Blowers 518 661-5623**

ANNUAL EAA 602 CHRISTMAS PARTY!



Chris Brown said that he'd like to have anybody who wants to come over to his place after the X-mas party, for and after-party-party, for music and pool and snacks, beverages, & more hangar flying. See him at the party.

EAA602

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