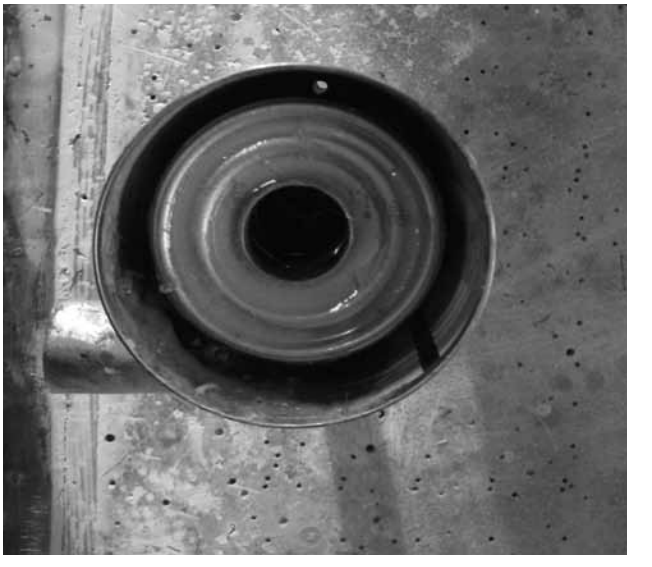
Soup Can Separator

Tom Martin



With each cowling change I make to my Rocket it seems to modify the way the air moves around my crankcase vent. My latest cowling modification, complete with a cowl flap is working very well in regards to engine cooling. I have been able to greatly reduce the cooling air outlet; hopefully with some reduced drag. This modification has also resulted in quite a bit more oil on the belly of the airplane than I have been used to. This has caused me to consider the installation, for the first time, of an Oil/Air separator in the crankcase vent line.

Before I discuss the latest vent line I would like to give a bit of history, in the last 15 years, of vent line installations in the RV world that I am familiar with. Previous to amateur built most commercial aircraft merely have the vent line extending straight down from the cowling into the air stream. This looks bad, from a drag perspective, and also is known to leave little drops of oil on the floor after engine shut down. When I was building my first plane, an RV4, Larry Vetterman was recommending welding a short tube into one exhaust pipe. The vent line was attached to this tube and an automotive one way valve was inserted to prevent back pressure from the exhaust. Mine worked quite well but others reported some issues so Larry quit advocating that idea. Shortly after that someone had the bright idea of dumping the vent line directly over one of the exhaust pipes in the cowling area. This worked great as the few drops were burned off on the pipes. It also reduces the possibility of vent line freezing in the colder months. I adopted this method with good success. Somewhere along the way this has become standard practise for the Van's series of aircraft and is included in their firewall forward kits.

When I first started flying my current plane I noticed a bit more oil on the belly than I was used to. I put it down to this particular engine and although I did not care for it I just put up with it. For the last three

flying seasons I have been constantly chasing the elusive cooling drag reduction with the hopes of increasing speed. Typically I have been creating different outlet ducting and reducing and or changing the shape of the engine cooling air outlet. After one modification I noticed that I was dumping even more oil from the vent line. My theory was that as I was decreasing the outlet air size the air was moving faster and this was creating more suction and thus the increase in oil from the vent line. To test this theory I rigged up a manometer in the cockpit and took some pressure readings from the cowling. I tested the upper plenum, the lower plenum and the crank case itself. The crankcase was done by removing the dipstick and making a little cap that had a nipple attached to for one of my test hoses.

Off I went for a test flight and recorded my data. If my theory was correct I would be getting quite a bit less pressure in the crankcase then the normal static air. What I found was quite the opposite. The crankcase was in fact being pressurised by the lower cowling air. The upper plenum was about 12″ of water pressure, the lower plenum 7″ and the crank case was 8″. At first I was very surprised but after considering it for a while it makes sense. The engine itself created about 1″ crank case of pressure while sitting on the ground at 2000 rpm. That one inch plus the lower cowling 7″, in flight, added up to the 8″.

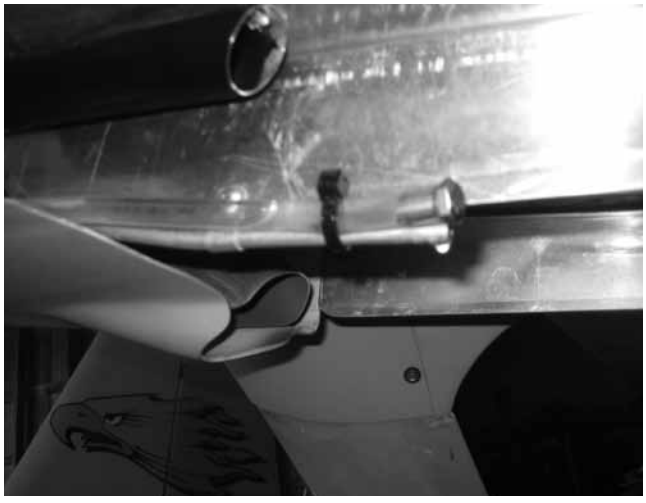
A good friend of mine, Mark Fredrick, had recently spent quite a bit of money trying to increase the power on his engine. One thing that they did was to use a vacuum pump to create a negative pressure in the crankcase. Apparently some of the race cars do this as it reduces the work that the pistons have to do on their way down the cylinder.

My next step was to route my breather tube aft of the cowling outlet. I was not sure how long to make it but I left it about 2″ aft of the cowling. I tested again and noted that I was now getting a 2″ negative pressure on the crankcase. This amounted to a difference of 10″ of pressure difference. Immediately I noticed a decrease in my oil consumption and strangely, a reduction in blow by. Also there we numerous small drips of oil in the engine compartment that completely went away. It would appear the old fashioned certified aircraft had the vent issue right all the time. It may be necessary to move the outlet of your vent line from the high pressure cowling area to reduce the potential of pressurising your crankcase.

This last winter I made even more cowling changes and rerouted my vent line closer to the floor of the aircraft. I have reduced my cowling outlet even more and now I am getting more blow-by again. Although I have not checked the crankcase pressure I am quite sure that I have created too much suction on this tube due to its location.

As I would like to keep some negative pressure in the crankcase, but not dump oil on the belly, I thought that I would experiment with an oil separator. I took a peek in the catalogues and felt that I could make something that would work quite well for considerably less than the $200 to $400 units advertised. Essentially they are an expansion area that lets the air slow so that the oil will fall out of the air stream. The oil is then collected and ducted back to the engine.

I made my unit with a large and a small soup can. The small one has a bunch of half inch holes drilled around the top. It is then inverted and set inside the large can. A one inch aluminium tube is placed through holes drilled in both the bottom of the large can and the bottom of the small can. The top of the tube has a series of holes drilled in it to allow the air out. Another tube is inserted in the top side of the larger can, it is angled in such away that the air that goes into the can is caused to go around the



smaller can. The air goes down between cans, shedding oil as it slows, and then goes through the holes in the bottom of the small can. It then continues up the inside of the small can where it exits through the holes in the inner one inch tube.

I added a drain nipple in the bottom of the large can that will allow me to capture any oil that accumulates. I do not intend on returning this oil to the engine but I will be able, through a short hose, to drain this off periodically.

All the bits and pieces of the separator are held together with glass cloth and resin. A piece of plywood was bonded in the top to complete the seal between the two cans.

Total cost: two fewer cans in our local land fill site!

I installed the unit and went for a couple of quick flights. After letting the oil settle I could clearly see oil in my clear drain tube. There is still a trace of oil getting by the separator so am going to add some steel wool, or fine screen to the inside of the unit.

I would call this project a success!