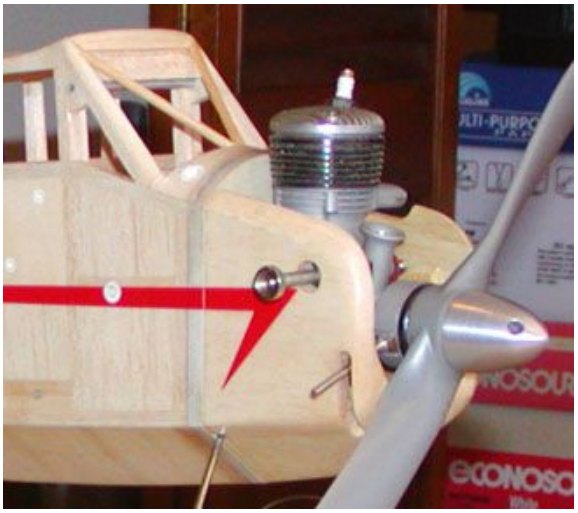
From: "Tandy C. Walker" <tandyw@flash.net>
To: Undisclosed-Recipient:
Date: 6/26/2009 9:32:52 AM
Subject: 121b Sailplane Some Final Thoughts on Cowl Exit Air Venting

I am updating this report for the third time since I have received some late, but very relavent feed back information.

Comet Sailplane Project

Before I leave the issue cowl exit air venting, I want to discuss the rationale to my approach on the Sailplane's cowl summarize some of my thoughts on this subject. Engine cooling inside a model's cowl is probably the most least understood facet of modeling. I think that maybe back in the early days of control line speed, the die hard speed modelers figured out how to build a cowl with venting to keep a racing engine at satisfactory operating temperature for many revolutions around the speed circle. However, that skill/ art has been pretty much lost today.

For the most part, very few SAM or free flight models have completely cowled engines. For those that do have, the engine's cylinder is exposed as shown below and engine cooling simply does not have to be addressed.



There is one thing in our favor, our engine run times are comparatively short (less than one minute).

Probably none of us know very much about engine cooling inside of a cowl except that "more exit area is more cooling". As you know I have been faced with addressing the issue of engine cooling inside the Sailplane's cowl as shown below.

Having no real guide lines on how to go about this, I decided to use the modeler's age old approach of "Gut Feel". I selected a hole diameter of .8" because that provides a hole area of 1/2 sq. in. I also selected a

location for the holes well aft of the engine, but about a fourth of the way forward from the cowl's aft bulkhead in order not to weaken the back portion of the cowl too much. I tried to put as many evenly spaced holes as possible in a ring around the cowl, but without cutting through any of its internal structure. Therefore, the hole spacing ended up some what irregular as is shown below.

This resulted in nine 1/2 sq. in. holes as shown below. These nine holes provide a total area of 4.5 sq. in., not counting the additional area around the cylinder head or exhaust.

The key question of course is this amount of exit airflow area sufficient to keep the engine from over heating during the relatively short power climb out? Since I did not know, I decided to ask for the opinions of several life long experienced model builders. Their responses to my question were most interesting and I think it is instructive to share their various views with you, which are presented below.

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Bob Angel

Looks workable to me Tandy. The only thing I might have done differently by "gut feel" would have been to place them almost all the way back inside the cowl to eliminate possible stagnant air behind the vents.

Gene Wallock

You should have plenty of venting. The only way to really tell is in the air. Remembering back to the McCoy 60 powered speed ships, I'd guess you've got a lot more venting.

Larry Kruse

You are verging on overkill and should not be worried about proper ventilation. Check out some of the old speed models that used McCoy 60s. You'll find that you probably have three or four times as much cooling as they had.

Bob Beecroft

Didn't most get run for short FF motor runs with no vents with no ill effects? Probably not an issue.

Jim O'Reilly

Only time will tell for sure, but they look adequate to me.

Bob Holman

All I know is that it looks good. Should be good enough to get the model almost out of site.

Gerald Martin

I thats plenty of exit holes and you wont have any cooling problems especially with the exhaust ducted outside.

Bill Taylor

I think you have more than enough venting. Don't worry any more.

Charlie Reich

I must say I'm not qualified to answer this quandary. It appears to me that you have more than adequate venting. As I recall most enclosed cowls in the old days have few, if any additional vent holes. It seems the old-timers left the cyl. head out in the breeze but the cylinder itself was pretty well enclosed in a tight cowl.Yours looks good to me. Plenty of air exits!

Thomas Ryan

Ed Shilen used to say, the exiting area should meet or exceed the air coming in. I don't know how big the front of the cowl is but I would say it is reduced by the size of the engine.

Jack Hiner

Many moons ago I was told or read that 4 times the intake is what to use for exhaust when cooling engines and batteries. Not sure of validity of this info?

James Lollar

My gut feeling, nothing scientific, says you have plenty of airflow in and around the engine. Smart move on the irregularly spaced vent holes. I see no reason to believe there will be heat build up of any significance in the cowl. 4.5 sq. inches of vent should more than handle venting of all input air. Airflow across the McCoy should be quite good.

Marvin Stern

An old rule of thumb is that the area of the cooling air exit should be about 4 times the inlet hole. I've used that for 60 years and never had a problem.

Jerry Burk

I didn't comment on your cowl cooling holes because I have no basis on which to judge them. But it sure looks like enough to me! Any way to instrument it? There are some little stick-on gadgets I have seen that have heat ranges on the. I'll try to get more info on them.

Woody Bartelt

I do know that most Sailplanes I have seen flying do so without the cowl. I suspect that Goldberg had the cowl to make the ship look more attractive and for selling purposes was not concerned either. All I can say is try it. If the engine seizes up from over heating, you will know that id did not work. Personally, I would probably put the cowl on for show and take it off for flying. I think the cowl is less attractive with all of those holes in it.

Alfredo Herbon

(Late Comment)

I didn't want to make any comment to you, because my experience with cowled engines is really poor and it is a very complex subject. I suppose the outlet area is enough, but my unique concern with those holes distribution at some distance forward (I don't know how much), from the firewall, is the possibility of the generation of a localized air vortex that could alter the air inlet into the venturi and alter the smooth running of the McCoy when the model gains speed, but please take this just as an "imaginative suspect", just that. As English men says : "The proof of the pudding .... " Surely your flying test will have the last word, and in the worst case of a malfunction with the cowl on, you could try some elongation backwards in a pair of holes ...

Charlie Reich

(Second Comment)

In all the responses I found it unusual that no one mentioned fuel. In the old days 3 to 1 gas/oil mix was a given. In this day and age, in the LMR events, most contestants use a mix of methanol and oil or Klotz 100, in which the engines running methanol based fuel runs much cooler, which would require less venting. So, the type of events the model flies in could also have some effect on the amount of venting required.

Thomas Ryan

(Second Comment)

Some Sailplane flyers you may not have contacted:

Bob Oslan (Dooling 61)
Bruce Augustus (McCoy 60)
Larry Davidson (K&B)
Bill Schmidt (ST)

Furthermore, all of our comments seem to be starting with the presumption that the cowl impedes cooling which may or may not be true. When getting my private license, I saw some mechanics testing an engine with the cowl off and assuring all that this would be limited to avoid overheating. Their thought was that a properly designed cowl would channel the air and result in more cooling. Probably a lot more going on there than here.

Tandy Walker

(Late Comment)

I read through a couple of my college propulsion books on engine cooling the other evening. As it turns out, aircraft designers configure cowl exits to generate a pressure drop relative to the incoming air. This results in a venturi effect that draws or sucks the air through the cowl and out into the free stream as illustrated in the figure below. Therefore, in hind sight it might have been better on the Sailplane to have put a radius around the outside edge of the firewall in conjunction with an opening all the way around the rear of the cowl structure. The cowl attachment to the firewall would have had to be different for this type of an implementation however. At any rate, I think this approach is something to consider on future projects.

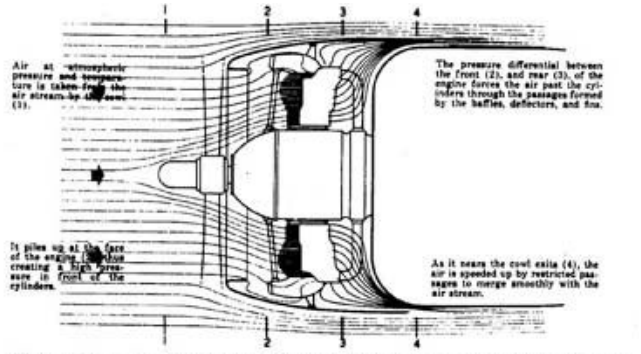

Figure 362 - The effect of engine cowling in creating a pressure drop around the cylinders of a radial engine. *(Courtesy Pratt & Whitney Aircraft)*

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As you can see, the opinions varied quite a bit, which was to be expected. However, taken collective, one gets a feeling that there is probably enough exit airflow area to keep the engine from over heating. So I will leave the cowl as it is for the present time. However, after I get the new McCoy 60 broken in on the bench, I will start the Sailplane's initial flight testing without the cowl. Then once consistently good runs are achieved during the 35 second climb out, I will install the cowl and evaluate the engine's performance with the cowl. As Gene Wallock said, **"The only way to really tell is in the air."** I realize that this discussion has little to do with the Sailplane's construction, but maybe it will be of some help to you if you ever completely cowl in an engine on one of your models.....Tandy