

EXHAUST SYSTEMS TEST (Larry Vetterman 3/16/08)

DISCUSSION:

I decided to conduct more exhaust tests using my RV-4 with a standard IO-360 B1B engine. I wanted to see which exhaust would provide Maximum HP in an all out peddle to the medal, get the most power I could out of the engine test. I was not concerned about running Lean of Peak or Rich of Peak, but rather tweak the mixture knob until the highest RPM was gained. The RV-4 is equipped with the Flight Data System APF-35, so I felt it was almost ready for the tests.

PROPELLER:

I remove the Hartzell standard constant speed when the Catto 3 blade, fixed pitch propeller arrived. Craig Catto builds a very good prop and I knew after talking with him that his prop was the one for the test. Now understand that Craig is a very busy man, but some how, he managed to work me in and sent me a beautiful prop complete with spinner. My RV-4 required a 4 inch extension so I ordered one from Saber, Mfg. Again, a beautiful piece of workmanship. Once everything was installed and set-up for the fixed pitch, the actual tests went very well. I found out from the onset of the testing that the Catto prop is very smooth at any RPM, from idle to 2830 RPM. Would I recommend the Catto prop? You bet I would!

EXHAUST SYSTEM

We made an exhaust system to accommodate the 4 into 1 collector, as well as extensions to keep it as a straight 4 pipe system. We made each pipe as close to the same length as possible and still get it to fit inside of the cowl. The merged collector is a standard unit available from any number of aircraft exhaust companies.

AIRCRAFT MODIFICATIONS

Upon installation it was apparent that both the throttle and mixture hook-ups needed to be modified. No problem, I made a number of trips from the shop to the airport and finally got them hooked-up. Next the bottom cowl: I ended up cutting a large V shaped wedge out of the cowl to get the collector pipe to exit. I saved the cut out piece so I can fiberglass it back in place someday if I want to. By the way, the standard 4 pipe system that we produce for the RV-4 does not require the bottom cowl to be modified.

TESTING

I selected 7,500, 8500 and 9500 feet to do the test because I feel that these altitudes are where many RV's spend alot of time. The first test was conducted with the 4 into 1 collector with a 2.25 in. tail pipe. I was somewhat unimpressed with the results of this test so I called Clinton Anderson, owner of Custom Aircraft Parts in El Cajon, Ca. Clinton is extremely knowledgeable and has been in the business along time as well as real gentleman to work with. I immediately sparked Clinton's interest conducting these tests and he sent me a number of parts from his shop, all of which were very high quality items. We, Clinton and I, decided to try different tail pipes after the merged collector. The 3 inch seems to lose power compared to the 2.5 inch pipe. It appears that if the 4 into 1 is the system of choice the 2.5 inch size seems to be the best. I did not weigh the different collectors, etc., but it appears that all of them are at least 3 lbs. heavier than the 4 pipe extensions. Note that in the tests shown below the 4 pipe system and the 4 into 1 2.50 in. collector performed very close to the same.

OVERVIEW

What does all this testing mean? You be the judge when you read the data. It is my personal opinion that it is better to install an exhaust system on the aircraft rather that rely only on dyno test results. The dyno gives a good base line for performance but taking an exhaust to altitude on a real airplane gives a real world picture of performance. As far as I know, I am the only one in the RV world conducting these actual tests to provide the RV builder with real data about how a particular exhaust system will perform on the aircraft.

NEXT TEST

I would like to perform a number of tests using different constant speed props combined with 3 or 4 styles of exhaust systems, but I have not been able to spark the interest of the prop manufactures for these tests.

DATA

Test #1 4 into 1 collector with 2.25 in. collector and tail pipe.
Climb RPM at 120 mph IAS= 2330RPM

	<u>7500 ft. altitude</u>	<u>8500 ft. altitude</u>	<u>9500 ft. altitude</u>
RPM	2750	2760	2760
MP	23.6	22.8	22.1
%HP	82	80	78
IAS	178	177	176
TAS	208	212	213

Test #2 4 into 1 collector with 2.25 in to 3.0 in. cone
Climb RPM at 120 mph IAS= 2330RPM

RPM	2780	2780	2750
MP	23.8	22.9	22.2
%HP	84	82	79
IAS	186	180	178
TAS	215	212	212

Test #3 4 into 1 collector with 2.50 in. collector and tail pipe
Climb RPM at 120 mph IAS= 2330RPM

RPM	2810	2800	2800
MP	23.9	23.1	22.4
%HP	86	84	80
IAS	187	185	180
TAS	216	216	215

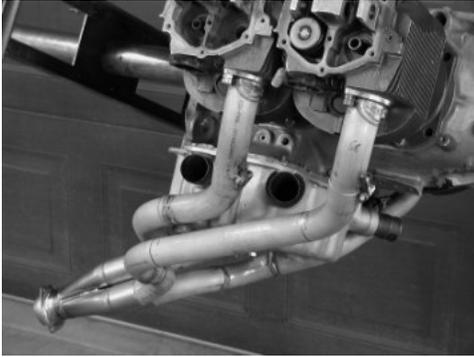
Test#4 4 into 1 collector with 3.0 in pipe
Climb RPM at 120mph IAS=2360

RPM	2780	2740	2750
MP	23.7	22.8	22.0
%HP	84	81	78
IAS	181	173	172
TAS	212	206	208

Test #5 4 pipe system
Climb RPM at 120 mph IAS= 2370

RPM	2830	2810	2800
MP	23.9	23.2	22.3
%HP	86	84	79
IAS	186	184	180
TAS	216	218	216

Four pipe system with 2.25 in. collector.



2.5 in. collector and tail pipe



2.25 in. collector and tail pipe



3 in. collector



2.25 to 3.0 in cone



4 pipe extensions

