I had every intention of getting an update to everyone a lot earlier, but if you remember in my last update the machine shop that was going to do my heads was unable to do the job. Although I was able to machine them it would have been a great help to devote my time and efforts to producing other parts. So much for outside sources! Instead of using the jigs that I already had in stock, I thought it would be better to take the extra time and improve the machining process of the heads. This would not only be beneficial for machining the current run of engines but would be extremely helpful for future runs of engines. Instead of having 6 separate jigs I now support the head by each end and use a computer controlled indexing fixture to rotate the head. If theory this seamed like a straight forward approach. What I did not know was how complicated the program would be for the CNC machining center. To give you an idea, I started the process on the 12th of January. This gets a little complicated so I will try to explain to so everyone understands. Machining one surface is no problem, but when you rotate the piece the machine must know where the X,Y,Z coordinates will be. The old adage "garbage in – garbage out" is a very real statement. It is not just destroying a piece or breaking a cutter, but it you are not careful, one wrong move or number could do some serious and very costly damage to the machine. I start by machining each of the four sides. Keep in mind when the piece is rotated the holding fixture at each end of the head is in a different position and the cutter comes very close but must not touch them. Sounds simple enough – NOT! Once all surfaces are machine flat and square, then a center drill is used which puts a small starter hole so the next drill will not "walk". Remember all the holes must be exact for everything to align. Now, instead of just four surfaces there are 7 different angles in every head and each must be perfect. If that were not difficult enough some angles have different hole sizes. Once all the initial holes are drilled then four surfaces must be tapped. One infinitesimal misplacement of a number results in a broken tap. Add to this equation, the depth of each tapped hole and you can readily see why it took so long to write and proof this program. By the way, there are 5121 bytes of information and one wrong digit could be the difference between success and absolute disaster. When I saved the program it took 7 pages of paper to print a hard copy. Next week I will show you some additional pictures of the set-up and some further explanations.

Before I started on machining the heads I was intending to show some addition parts that are finished and in stock – not only for the initial run of engines but also for future engines. The first picture shows the finished center sections of the supercharger housing. A special carbide tip boring bar was purchased to make the final boring operation. This is critical because if the bore is too large then the impellers will leak air, it the bore is a little too small then the impellers could touch the side and at 10,000 rpm, this could be a disaster.

Pictures #4 &5 is a good example of what I mean when I said that there so many additional parts that I have not planed for. Because the starter motor is attached only by the front flange and this engine will be used in every conceivable model which could be subjected to some harsh bouncing, I thought it necessary to add some additional support the starter motor. Was it absolutely necessary, probably not, but I would rather spend a little now, than a lot later.

The water pump pictures (#6- #10) are relatively self explanatory. Pictures #9 & #10 shows the bearing and seal support that must be machined and installed in each pump. If you look closely at Pic #10 you can see a small groove machined into the inside, near the

top. The position of this groove is critical and is for a spring retainer which holds all the components in place. Picture #8 shows just how many parts are needed to complete just one item on this engine. Once again, I could have used bushings instead of bearings and probably have eliminated the need for a seal, but “down the road” it was an area that may have problems. This is why I always say “it is easier to explain a delay, rather than apologize for the quality”.

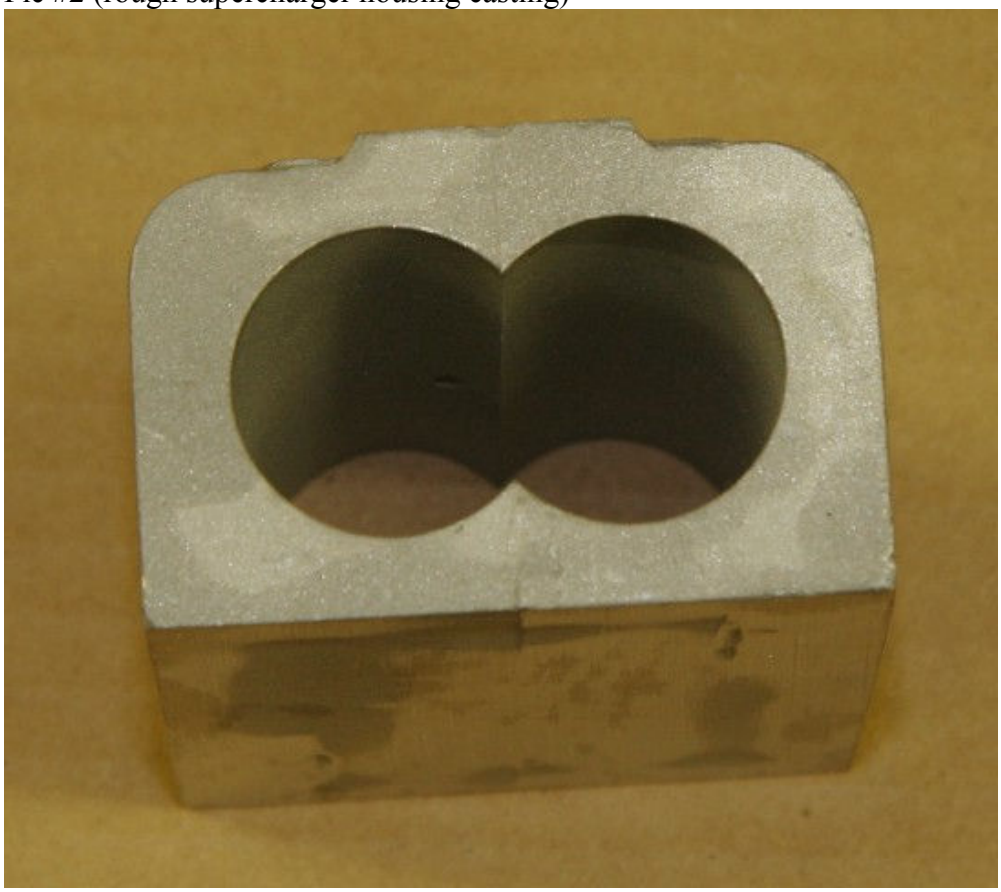
I am very excited about the items in pictures #11 - #14. In my test engine I made a one piece steel flywheel. Whereas this worked perfectly well, I now make the flywheel hub and clutch drive in two separate pieces. When I was explaining this to one of my customers over the phone, he said asked if it was really necessary. I said no, but this allows me to change the flywheel weight and configuration depending on the model it will be used in. To give you an idea of what I am talking about – in a large boat you may want a little smoother slow speed, whereas in a top fuel dragster, you may want a the engine to rev faster. This gives me the flexibility to change the flywheel as needed. Pretty neat, don’t’ you think. This is how the full sized engines are designed and I thought if it was good enough for them, it was certainly good enough for me.

Pictures # 15 & #16 show the never ending additional parts that are needed. And the final picture is of the large number of special collets that are needed to hold all of the round parts in the CNC lathe.

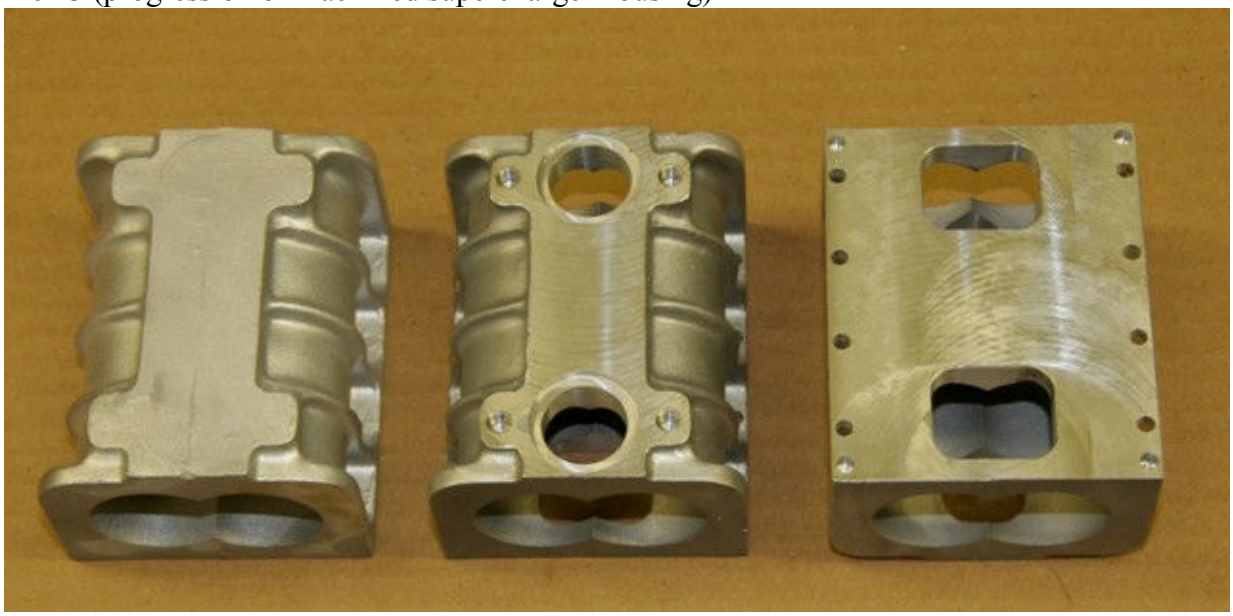
For what it is worth, I started this update at 6:42am and it is now 9:47am. See what I mean about how much time is needed to do everything. Not complaining, but I would much rather be making parts and finishing these engines. Getting closer every day!

Pic #1 (finished supercharger housings)

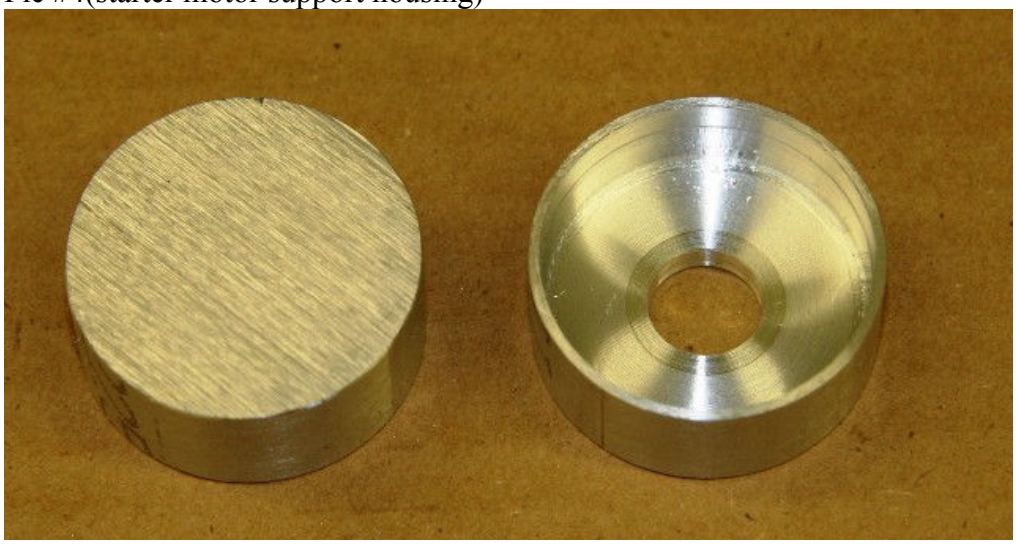
Pic #2 (rough supercharger housing casting)



Pic #3 (progression of machined supercharger housing)



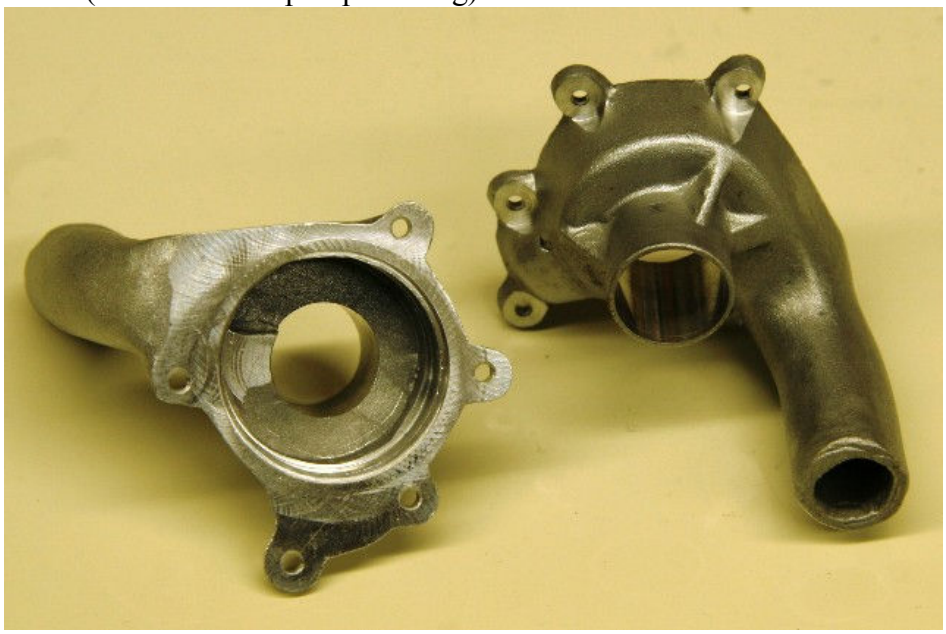
Pic #4(starter motor support housing)



Pic #5 (finished starter motor support housings)

Pic #6(finished water pump housing waiting for bearing and seal support installation)

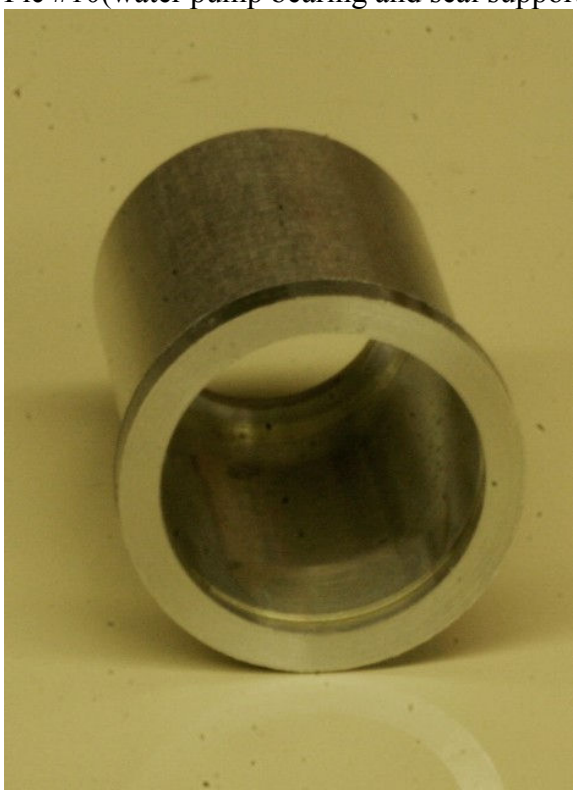
Pic #7(finished water pump housing)



Pic #8(components in each water pump)

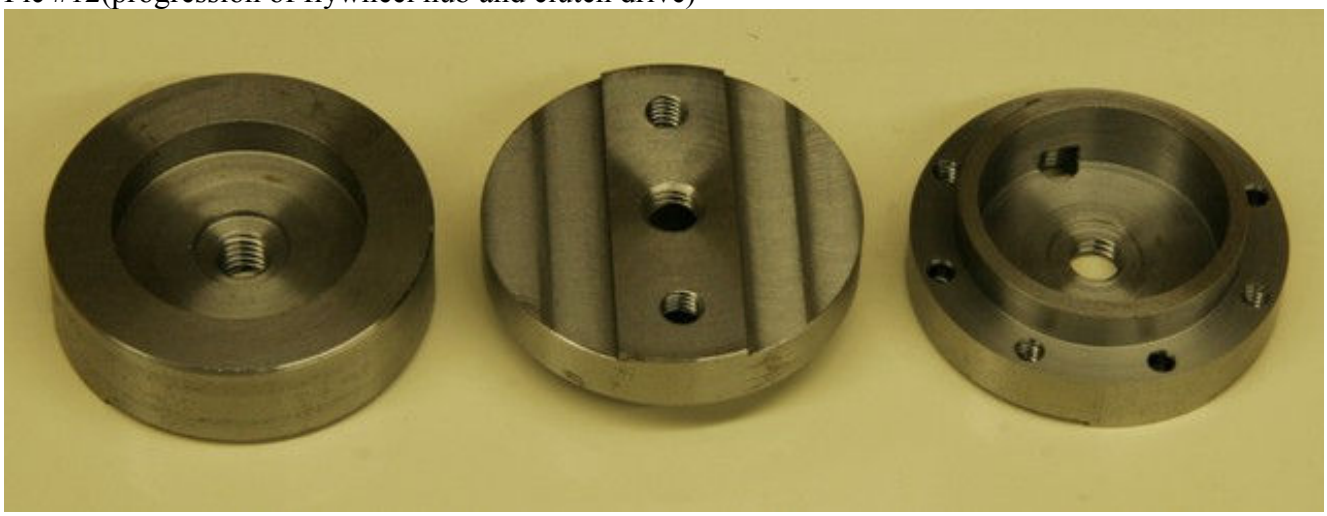
Pic #9 (water pump bearing and seal support)

Pic #10(water pump bearing and seal support)



Pic #11(flywheel hub and clutch drive)

Pic #12(progression of flywheel hub and clutch drive)



Pic #13(finished flywheel hub and flywheel)

Pic #14

Pic #15(serpentine belt idler)

Pic#16(serpentine belt idler spacer)

Pic #17(special collets needed to machine all the round parts)