Ted Hector and Gary Macdonald are heading off to Bonneville in a few days. This is the Racer they have been building for the last four months. They've had it out for two test rides and were very happy with the performance.

Ted in racing position on bike…

good angle on his back (maybe 12 degrees = minimal or no flow separation). Sportster gas tank, fibreglass seat and tail-piece. Rear frame stretched out 7" with tubing pieces Dual 32mm Amal carbs featuring alcohol needles and seats in the float bowls for the highest rate of gas flow possible, complimented by 5/16" lines and a Pingel high flow shut-off valve with a cable operated remote shut-off on the handle bar (required for fuel class bikes). We had fuel feed problems with the 45 racer, so we took these steps to alleviate them. And Ted was really crowded up against the fairing on the 45, so we fixed that too!

Two photos of Ted on the 45. In the left one, note the flow-separating angle on his back. Its almost 30 degrees… big turbulence and drag! The right photo shows Ted at speed. He had to stand up on the pegs to get a flatter angle on his back. He said he could feel the bike speed up as the airstream re-attached to his back! Note the big space between his belly and the seat. Try that at 112 mph! He never did get his helmet much behind the windscreen.

Next photo. When Ted gets up to speed he grabs the left fork tube, as shown in the picture. The heel shifter to the back is slammed backwards to upshift… particularly important for not losing too much rpm during the critical 3rd to 4th shift when rear wheel torque goes to its lowest. With our gearing, we expect to shift out of third at ~5200 (120 mph) and drop to 4200 in fourth. If it will pull to our design max HP of 4600 we would be doing ~132 mph (fingers crossed!). Ted incorporated a hand shifter as well, for downshifting after the measured mile. The original foot clutch is replaced by hand lever… with a surprisingly light pull?!

This next photo shows Ted installing the windshield in the heavily modified NSU Sportmax fibreglass dustbin fairing. This time there's some room for Ted's helmet to hide from the airstream. We decided to shift the fairing further back than was originally intended, to bring the centre of pressure back, so Ted made a fibreglass nose-piece to once more cover the front wheel. The rules dictate that the fairing can only cover the front wheel above the axle. The clip-ons did not fit properly in the clearance "pods" so we cut them partially away as well. There will be aluminum streamlining panels all around the lower engine and exhaust pipes, and also panels to direct cooling flow around the cylinders and carbs. They had not yet been installed when the photo was taken. The number plate shows our number (641), and "APS" means "special construction frame with partial streamlining", "VF" is "vintage fuel" and "1650" is our displacement class. Our displacement is in reality only 1368 cc. We were just a bit too big for 1350 class! So here we are giving up a lot of potential displacement in 1650 class, but it couldn't be avoided without going to a big time stroke increase, which would have required way too many other modifications this close to race day.

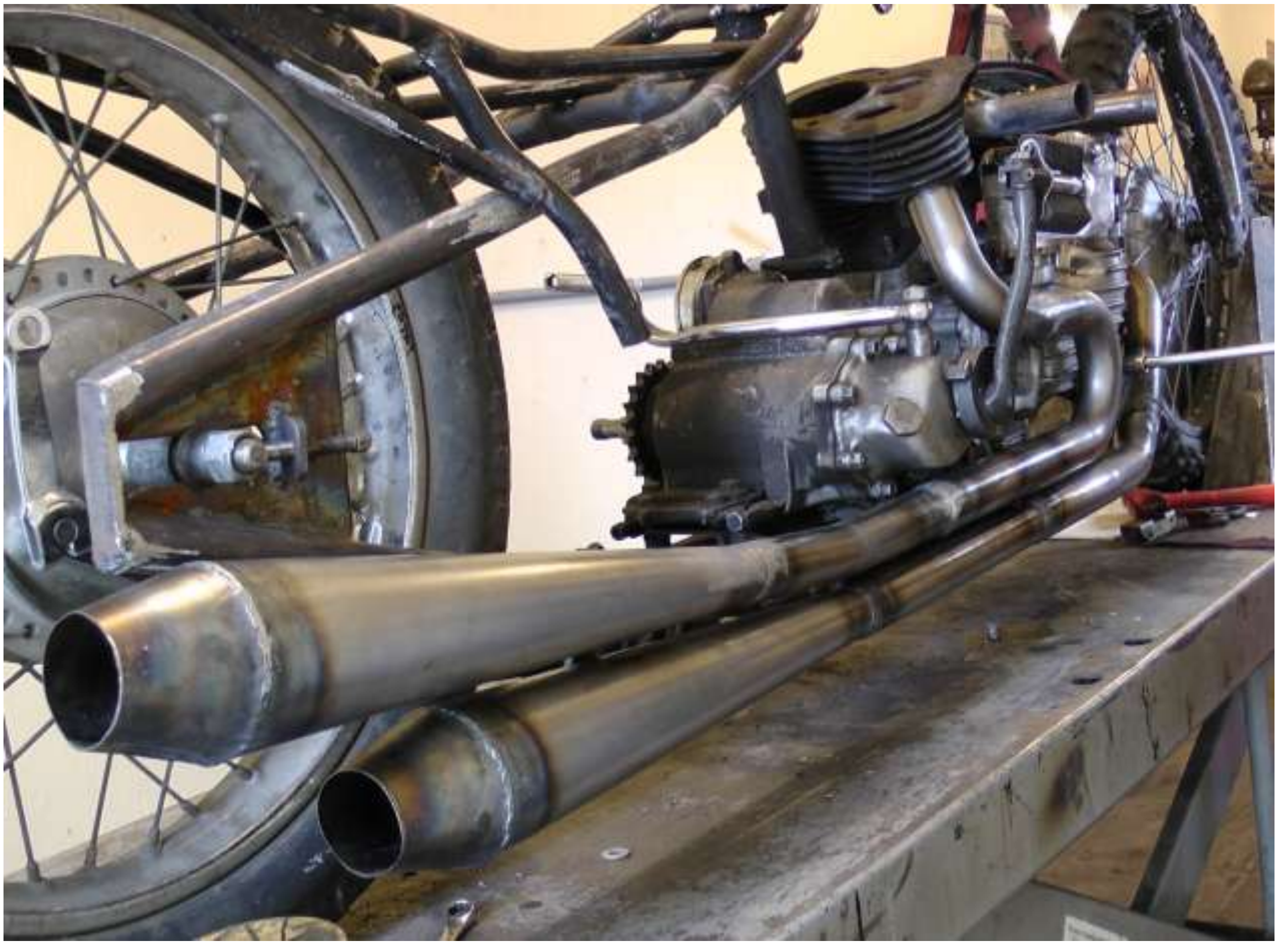
And here's some cruel irony regarding our registration in "fuel" class instead of in "gas" class! This low compression flathead engine (~6:1) should operate best on a non-alcohol, low-octane gasoline. The famous Harley KRTT flathead racers were running only 82 octane gas at Daytona in 1969… they wouldn't even start on the higher octane fuel that was provided at the race! The only gasoline available at the current Bonneville race meet is 100 octane. High octane gas burns slow… as a means to prevent the rapid pressure rise that can cause detonation in modern high compression engines. Their high cylinder pressures are caused by their high mechanical compression ratios, not by fast burning gasolines. (High compression ratios are now used because they were found to reduce hydrocarbon emissions). At a measly 6:1 mechanical compression, our flathead is hardly prone to detonation from low octane gas! We need a rapid pressure rise to make up for our low mechanical compression ratio, and the rapider the better! And while modern engines have compact combustion chambers that are fully enflamed very quickly, the flathead has a vast combustion chamber that needs a fast burning gas to get most of the mixture in that big volume enflamed during the critical period when the piston is dwelling around TDC, and the squish zone is still intact (down to around .060"). This is when the highest potential cylinder pressure can be created, and more pressure created here makes more horsepower. (Sorry about the repetition.) So if we use 100 octane gas, with every power stroke we are throwing away a good percentage of our power because the burn is too slow! A burning flame front chasing a rapidly descending piston down the bore just doesn't add a lot of extra push on the crankshaft (although the slightly higher pressures at greater crankshaft angles do add some low speed torque). And of course we would be polluting more, and we would *never* want to do that! We need a fast burning gas like 85 octane! Unfortunately, all Canadian 85 octane has alcohol blended into it, which could cause lean mixture problems. However, we were able to locate several stations in Sturgis, SD. that sell pure 85 octane gasoline, so we're taking some 5 gal. carboys along with us to fill up there. And herein lies the cruel irony! When you show up at the salt flats with a carboy of gas to put in your bike, even though it is <u>even lower octane</u> than the gas sold there, you are automatically placed in "fuel" class, and are required to go toe-to-toe with bikes running nitro-methane, nitrous oxide and other exotic "fuels". The officials don't know what's in your container, have no way of testing it, and don't care. Bring your own gas… go to fuel class. (hmm.. that could be a tee-shirt). So to gain, we have to lose!

… a slightly different view showing off the velocity stacks. Note scoops for cooling air.

Last photo. A good fairing to hide behind. Here' hoping its stable… (fingers and toes crossed… but hopefully not eyes!)

Here’s some pics of the racer. The first one highlights the exhaust that Ted fabricated. The header pipes are equal length at 44”, which should provide the biggest acoustic hit at ~4600 rpm. Note the contortions that the rear pipe goes through to remain an equal length to the front. Both beautiful and functional… nice job Ted!

The next pic shows the megaphones. It is estimated that they will spread the acoustic wave effect down ~1000 rpm, so that the engine will start to come on the pipe at about 3600 rpm. However, the greatest wave action will remain at 4600 (reflecting from the entrance to the megaphone / end of the straight pipe). To maximize inertial tuning, the curved part of the headers are 1.625” ID while the straight portions are 1.525” ID. Ted incorporated the smaller diameter straight portions to accelerate the exhaust gases before they enter the megaphones. Although the megaphones were bought items, the reverse cones were hand fabricated by Ted.



The next photo shows the intake ports.

Note the welded-up stubs of the original ports pointing towards each other in the centre of the photo. In the original configuration a large "Y" manifold (~36 mm) connected these two ports to a single carb laying between the cylinders and opening to the left side of the engine. The intake mixture had to take this torturous route, essentially turning 180 degrees to get to the back of the valves, and the ports were so large that the speed was low enough to allow widespread mixture separation in the entire intake tract.

The new ports are much more direct… they turn gently toward the back of the valve heads, and essentially point the mixture toward the cylinder with a mild amount of swirl caused by the gentle turn. The ports (and carbs) are 32mm, which for the displacement and the design engine speed are capable of a max flow of 300 ft/sec… which is ideal. These ports should display minimal mixture separation and high flow (for a flathead). Both Ted and I believe that they are the best ports we have ever implemented! There is enough added clearance in the cylinder heads to allow intake flow around the entire valve at low lifts (the exhaust/intake overlap period and the late intake period), but it is expected that the intake flow will "window" through the 2/3 of the valve nearest the cylinder at higher lifts/greater flows (the curse of all flatheads). To accommodate for this, our intake cams provide .075" higher lift than stock (.450" total). The intake cams also feature much earlier opening and later closing events than stock. The exhaust cam opening and closing events were also modified, and valve overlap is much greater than we have ever attempted. These features were required to increase the rpm of greatest horsepower (stock = 4200, our intended design = 4600). Ted did all of cutting and brazing on the ports, welded the cams, and I ground the cam profiles.

One other major thing we did was install a second plug in each head (sorry, no picture). The original stock 18mm plugs hover over the centre of the intake valves. We installed additional 12mm plugs in the heads such that they hover over the broad shelf between the exhaust valve and the adjacent cylinder edge. Each individual cylinder's two plugs fire simultaneously, creating two flame fronts and much quicker combustion. Using flame speed data from scientific reports, we estimate that at high rpm the mixture should be almost entirely inflamed before the end of the piston-dwelling period at TDC (= greater cylinder pressure and hence more power). Expansive squish zones in the heads (.047" tight at TDC) occupy the outer half of the area over the pistons (approximately the areas lying just out of view at the top of the picture). This is the best thing about a flathead! As the pistons approach TDC, the mixture is violently squished between the lower head surface and the piston crown toward the pocket area over the valves, creating an "energetic" and homogenous mixture that burns rapidly and completely when the plugs light up. Once more… faster burn = earlier and greater peak cylinder pressure = more power!

Stock and modified intake cams. Our intakes not only provide much higher lift, but much greater valve openings on both opening and closing ramps.

Ted welding the intake port stubs.