POLARIS ULTRA 680/ HTG 1080 MOUNTAIN MOTOR UPGRADE
by Jim Czekala

This is the final chapter of John T. Cowie's Polaris Ultra that has been the DynoTech mule engine for all of our previous pipe/ engine mod/ etc. articles.

After many years of fast trail use, with less than satisfactory reliability on pump gas (see next article "rethinking BSFC"), John decided to convert the Ultra into an Ultra Lake Racer. Originally, we added 40+ HP to the stock 680 engine just by adding triple pipes (see all previous Ultra evaluations). Riding the sled on premium pump gas at 150 HP proved a difficult challenge; mysterious detonation was the bane of this setup, even jetted to what has historically been an "ultra" safe .70+ lb/hphr BSFC. Wide Open Throttle time on trail gas had to be limited to $1/8^{th}$ mile or less—running hard on the Lakes was always best with 100+ octane gas, but that wasn't really practical since the Lakes are often in the middle of the trail system, far from John's supply of good gas.

To attempt to alleviate the annoying (and expensive) deto, we experimented with
1) redirecting coolant flow around the combustion chambers with epoxy filler
2) larger needle and seats
3) installing a PSI 750cc big bore setup.
4) installing DynoPort high volume, higher flow pipes

The net result of all this was, incredibly, 170+ HP and continued semi-reliability at .70+ lb/hphr. Seizing big-bore nickasil cylinders caused additional headaches and downtime, since you can't get piston/ cylinder replacements off the Polaris dealers' shelves.

In retrospect, instead of being so greedy, we should have targeted the 750 big-bore setup with high-flow pipes at 150+ HP. This "detuning" could have been accomplished by a combo of retarding timing, reducing compression, and adding fuel to lower the BMEP and horsepower to a level that could be reliable on pump gas. Probably, .80 lb/hphr+ (like the stock Firecat 700) would have done the trick. But there is understandable frustration for power-hungry guys like John T when asked to leave 20 HP on the table just to be able to run high speed on pump gas on the Lakes with his pals.

So, John T opted to buy himself [and of course hotrod] an XC600 for trail riding and convert his Ultra to a racegas only Lakeracer. And, as long as it was going to be 110 octane fun, the decision was made to replace the 750 cylinders with HTG Racing's custom cast 1080cc cylinders. The HTG 1080 kit came with 48mm power-jet Megatron (Lectron) carbs (our favorite for cold engine dyno pulls since fuel atomization is so excellent), Vforce 2 reed cages and hand-fitted Jaws stamped triple pipes with a very quiet 3-1 cannister muffler.

These cast HTG 1080 cylinders have XC600 exhaust valves, with triple exhaust ports and colliding stream transfer ports that are timed to open at a moderate 78 degrees and 115 degrees ATC, respectively. The compression ratio is a conservative 12.6-1 uncorrected,

and results in about 155 psi hand cranking (no, make that two-arm cranking) compression. Squish clearance is .055".

The following dyno data is with stock Ultra CDI, stator cranked to full advance position. Regardless of what is seen in ads, 250 real HP in an OEM crankcase/ stock crankshaft engine is excellent output. There are plenty of 1000cc+ setups out there that can't reach 200 HP. Plus, the HTG 1080's top end HP is delivered in a broad, forgiving powerband that should be reasonably easy to clutch.

HTG Ultra 1080

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	AirTmp degF	BSFC lb/hph
7000	102.4	136.4	42	0.8
7100	101.7	137.4	43	0.86
7200	106.6	146.1	43	0.85
7300	111.1	154.2	43	0.75
7400	111.9	157.6	43	0.71
7500	115.5	165.1	43	0.74
7600	117.6	170.2	43	
7700	117.4	172.1	43	
7800	117.5	174.5	44	
7900	119.1	179.1	44	
8000	120.2	183.1	44	
8100	121.6	187.5	44	
8200	122.6	191.3	45	
8300	123.1	194.3	45	
8400	124.1	198.4	44	
8500	122.7	198.6	43	
8600	124.9	204.5	42	
8700	129.2	214.1	43	0.69
8800	128.8	215.8	44	0.71
8900	132.2	223.7	44	0.63
9000	134.1	229.7	43	0.61
9100	135.4	234.5	43	0.58
9200	134.1	234.8	43	0.58
9300	137.4	243.3	43	0.55
9400	136.9	245.1	43	0.54
9500	136.2	246.4	43	0.52
9600	134.8	246.3	43	0.53
9700	131.1	241.9	42	0.55
9800	123.2	229.9	42	0.61