Chasing a moving target—your two-stroke HP peak.

Most diligent DTR followers will agree that any sled will accelerate best if it is clutched to its' HP peak. Some will argue that you should get your engine clutches to shift at torque peak then slide up to HP peak. But that peak HP RPM is constantly shifting.

We can be fooled by looking at any dyno sheet posted here or anywhere else because each dyno run is a snapshot of a horsepower curve at a particular pipe center section temperature. Most dyno tests I post are long hot runs with the pipe center section about as hot as anyone would get it in a half mile lake blast.

On most good trail pipes on any particular dyno run the torque peak is several hundred revs below the particular run's HP peak. Years ago we discovered multi-angle helixes that pulled revs down to the dyno sheet torque peak RPM, then gradually slide up to that dyno sheet's HP peak. Those new helixes made our sleds accelerate better so we thought that we needed torque to get the sled moving.

What we know now thanks to 20 years of dyno testing and lots of smart people who've explained thing like this to, is that the HP peak RPM constantly changes as your ride your sled, depending upon the average temperature of the exhaust gas throughout the pipe.

Kevin Cameron suggested a test program to us to show this phenomenon that is printed in the DTR archives on this site. I fitted a Yamaha Exciter 570 pipe with temp sensors at the Y pipe, divergent cone, center section and rear cone, and did repeat dyno acceleration tests one after another. We saw the exhaust gas temperature throughout the pipe gradually climb along with the peak HP RPM.

Last week Steve Cottone tuned his BMP single pipe/ Cudney billet head/ Vforce otherwise stock Rev 800 for trail riding on scary Tug Hill bar gas. After tuning we ran three different acceleration rate tests to show cool, warm, and hot pipe center section temp. Here are his three tests along with test time in seconds. Each test is shown after the engine and pipe was warmed up, then loaded at WOT for ½ seconds at just below the test lower RPM, then accelerated at various rates to beyond the HP peak.

THREE FULL THROTTLE ACCELERATION TESTS AT VARYING RATES

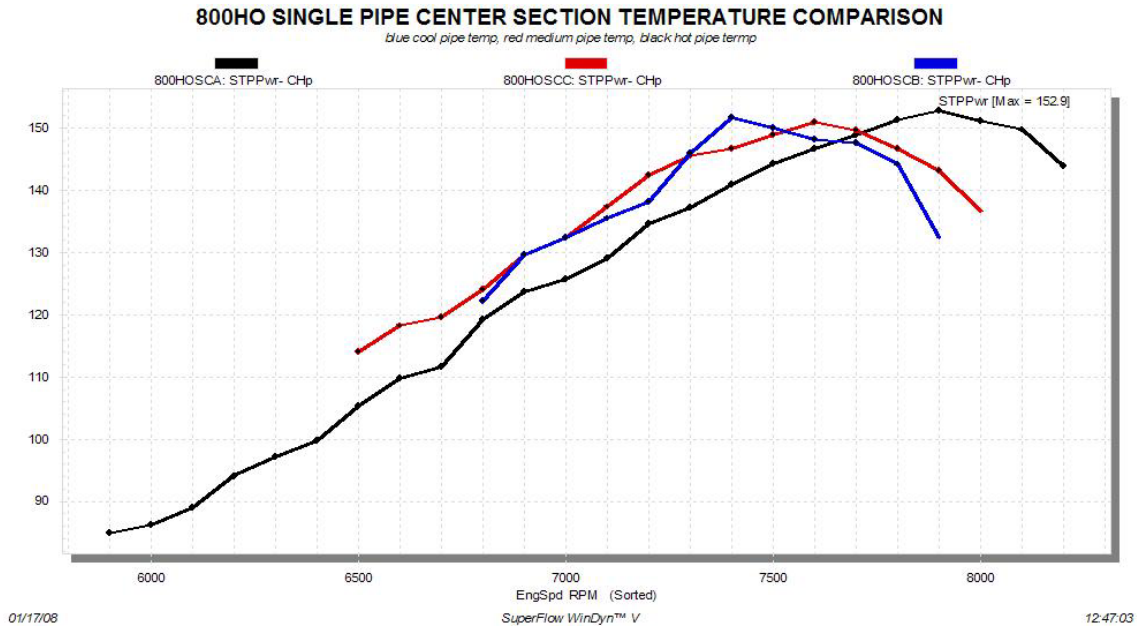
TsTim2	EngSpd	STPTrq	STPPwr
second	RPM	Clb-ft	CHp
0	6800	94.4	122.2
0.5	6900	98.7	129.7
0.8	7000	99.3	132.4
0.9	7100	100.2	135.5
1.0	7200	100.8	138.2
1.3	7300	105.1	146.0
1.8	7400	107.7	151.7
2.2	7500	105.1	150.0

2.4	7600	102.4	148.2
2.6	7700	100.7	147.7
3.0	7800	97.1	144.2
3.1	7900	88.1	132.5

TsTim2 Second	EngSpd RPM	STPTrq Clb-ft	STPPwr CHp
0	6500	92.2	114.1
0.4	6600	94.1	118.3
0.9	6700	93.8	119.6
1.1	6800	95.9	124.1
1.5	6900	98.7	129.7
1.8	7000	99.3	132.3
2.1	7100	101.6	137.4
2.8	7200	103.9	142.5
3.1	7300	104.7	145.6
3.3	7400	104.1	146.7
3.5	7500	104.3	148.9
4.0	7600	104.4	151.0
4.4	7700	102.1	149.6
4.8	7800	98.8	146.8
5.2	7900	95.2	143.2
5.4	8000	89.7	136.6

TsTim2 Second	EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr
0	5900	75.7	85.0	0.884	74.7
0.3	6000	75.5	86.3	0.888	76.2
0.5	6100	76.6	89.0	0.879	77.8
1.8	6200	79.7	94.1	0.850	79.6
2.3	6300	81.0	97.2	0.848	82.0
2.6	6400	81.9	99.8	0.815	80.8
3.3	6500	85.2	105.4	0.844	88.5
4.3	6600	87.4	109.8	0.812	88.7
4.6	6700	87.6	111.7	0.810	90.0
5.5	6800	92.1	119.2	0.779	92.3
6.6	6900	94.2	123.8	0.753	92.5
6.9	7000	94.4	125.8	0.742	92.8
7.2	7100	95.5	129.1	0.737	94.5
8.3	7200	98.2	134.7	0.741	99.0
8.7	7300	98.7	137.3	0.723	98.5
9.1	7400	100.1	141.0	0.719	100.6
10.0	7500	101.1	144.3	0.713	102.1

11.0	7600	101.4	146.7	0.699	101.7
11.4	7700	101.6	148.9	0.696	102.9
12.0	7800	101.9	151.4	0.692	104.2
13.0	7900	101.6	152.9	0.705	107.2
13.4	8000	99.2	151.2	0.708	106.4
14.0	8100	97.1	149.8	0.704	105.0
14.7	8200	92.2	144.0	0.732	104.8



Not counting the warmup and short WOT hold time before each test, we can see that in two seconds HP peak is at 7400, in two more seconds it the HP peak slides up to 7600, then in a long nine seconds later peaks at 7900. 7900 occurs at 13 seconds at WOT.

So if we try to rev the cool pipe engine to 7900 immediately based upon the last long dyno run we would lose 20 HP until the pipe temp catches up with revs (at which time it would probably ovverev to beyond 8000 and still lose).

What is Steve's single pipe center section temp during each of the three HP peaks? Im guessing roughly 400, 600, and 900 deg F if a fast acting open element probe were placed inside the midpoint of the fattest part of the pipe. But for trailrider Steve he knows that he should clutch to 74-7500 initially then gradually slide up to 7900 after ¼ mile. And since we found his particular tack reads 200 RPM high, he must add 200 to the shift-shiftout RPM. But if he was a lakes madman that wanted to run for five miles at WOT, like some do, his peak HP RPM might climb to 8300 or more.

The most savvy dyno tuners benefit from knowing the range of CS temperatures that they experience in the field before going to a dyno. Trailriders need to know what temp they have during typical riding and also after the longest lake or mountain uphill runs. Dragracers and SnoX racers need to know what CS temp just at takeoff they have after

“cleanout” and staging, then what temp they have at the end of the dragrace or the first straightaway. Then going to the dyno with the same temp gauge fitted to the pipe center section one can easily find exactly where the HP peak is all the time.

Peaky pipes are surely more critical for monitoring center section temps than are broad flat HP curve pipes with good overrev HP. I have a HTG 1000 triple that I fitted Digatron 4- readout open element (SHOULD BE OPEN ELEMENT FOR QUICKEST RESPONSE) EGT, three in the header pipes to perfectly balance the 44 Megatron carbs, and one in a center section (doesn’t matter which one). From my dyno testing this engine here with Digatron open element dyno CS probe I know EXACTLY where engine revs should be during acceleration. The Digatron can recall RPM/ CS temp so you know where you are. This way I can whine to my clutch guy Tripod Dan (Sean Ray is way too busy) and complain that revs are 68 and 1 HP too high at half track then 27 and 1/2HP too low at the end. Just kidding about that, but it can’t hurt to know exactly where your HP peak is every moment at WOT.

Some time as we get caught up here I will instrument some sled/ pipe combo with center section probe and report exact results like we did some 20 years ago with that 75 HP Exciter. Even though HP levels have quadrupled since then, we still deserve to know where that quadruple HP peak is.