2007 DEEP POWDER SHOOTOUT

MAKING HORSEPOWER

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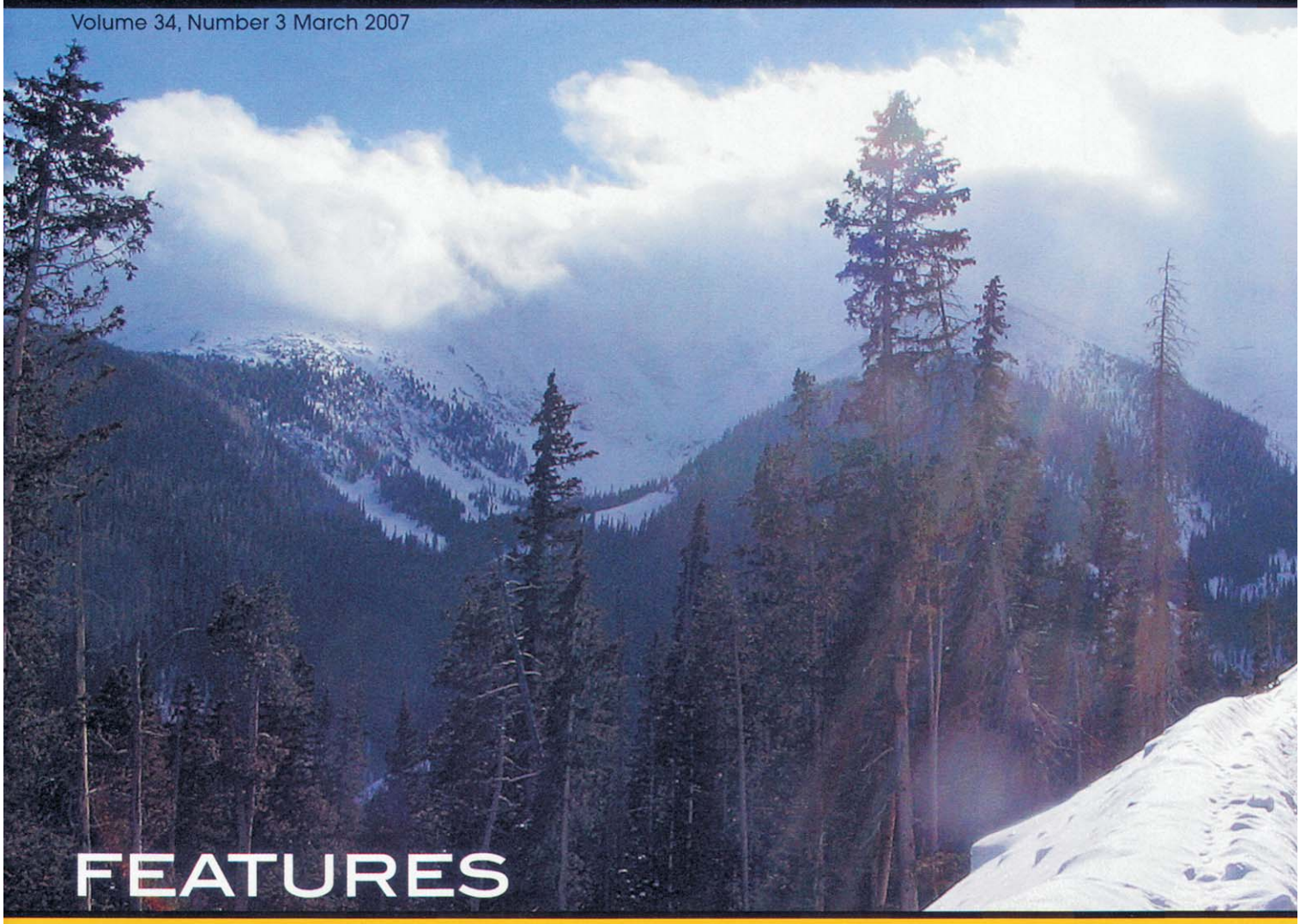
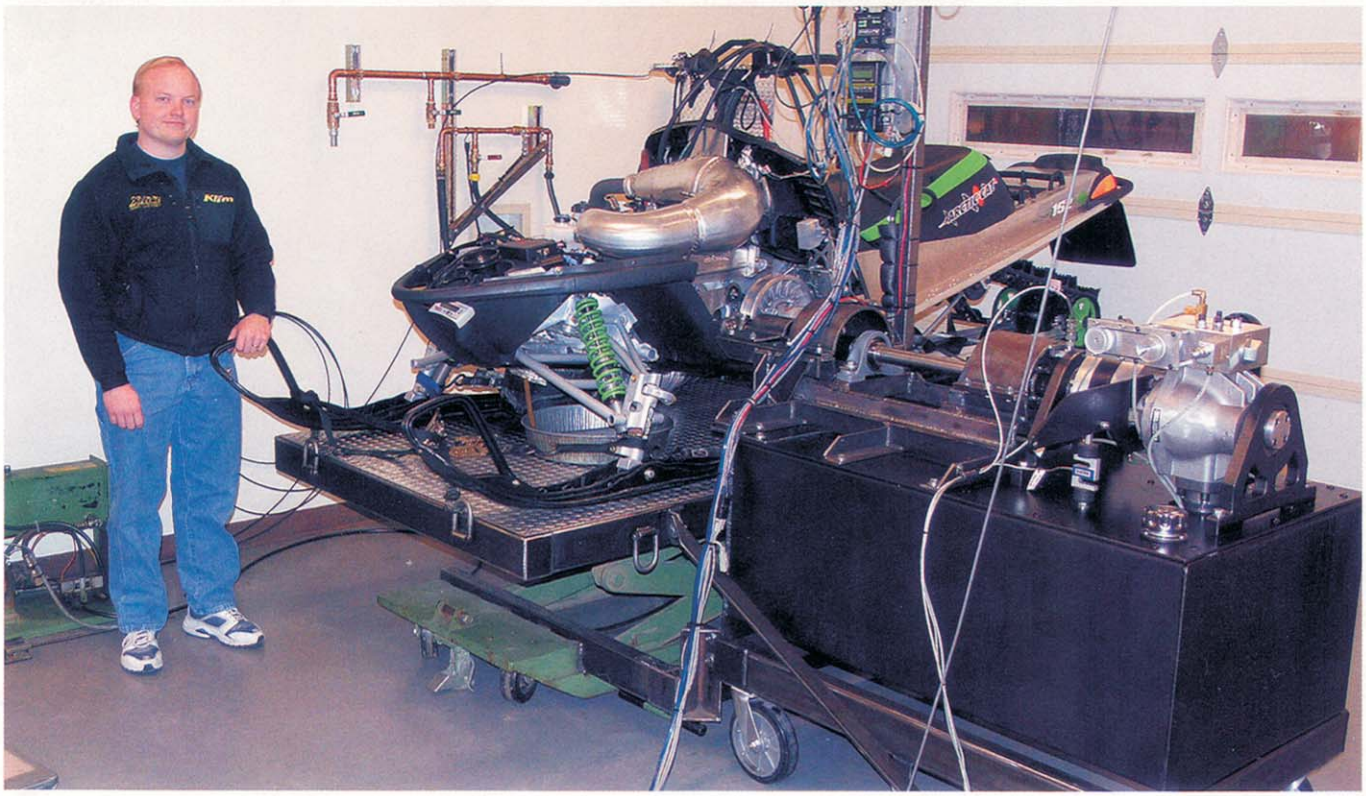


FEATURES

IN SEARCH OF REAL HORSEPOWER

Xtreme Performance extensively dynos sleds it sells

By Donavon W. Facey



Xtreme Performance Center owner Donavon Facey shows off his hop up shop's dyno, which is the result of years of testing and designing.

"Horsepower? Torque? How does it run?"

As snowmobilers, any talk about our favorite sleds is sure to include a discussion about power. While chassis design has greatly improved over the last few seasons and we're now lucky enough to ride sleds that more intuitively go where we point them, a huge portion of what makes riding fun for most of us is what happens when you smash the loud handle against the bar and hang on.

It's also very interesting that even though the question of power is so important for snowmobilers, accurately measuring it is not an easy or routine task. For the most part, we're stuck with racing across a meadow or trading marks on a hill to try and determine if one sled has more power than another. Of course, with the complexity of our CVT drive systems, gear boxes, tracks and suspensions, isolating the one variable of crankshaft horsepower is nearly impossible.

When we got started with Xtreme in 1994, it was the era of the Polaris XLT. For the first couple of years, we sold truckloads of XLTs and they generally worked fairly well. Eventually, customers began asking us about making their sleds faster.

In those days, you could call the aftermarket, buy some pipes, turn the tach up about 1000 rpm and go quite a bit faster. In 1996, the days of simply bolting on go-fast parts disappeared when Polaris dropped the Ultra RMK and the 600 XCR Special in our laps. As most folks know, the Ultra was too heavy for the amount of power that it made and the XCR 600 Special never ran right at all at altitude.

Throwing Stuff At Sleds

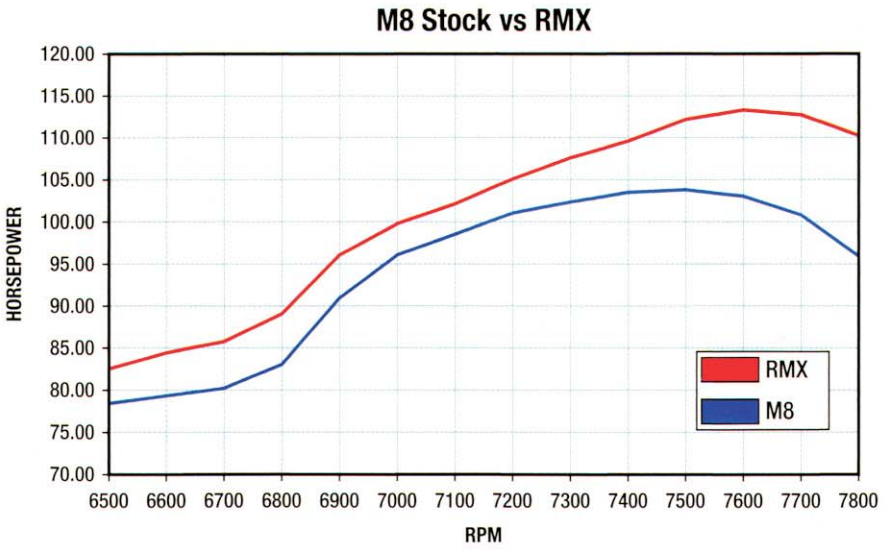
Throughout that winter, we tested by simply throwing stuff at the sleds and observing what happened. After days of not making much progress or being able to definitely tell what happened, I thought we needed to try and quantify performance changes. Our first attempt at instrumented testing was the purchase of a Stalker radar gun along with the software that recorded acceleration. As

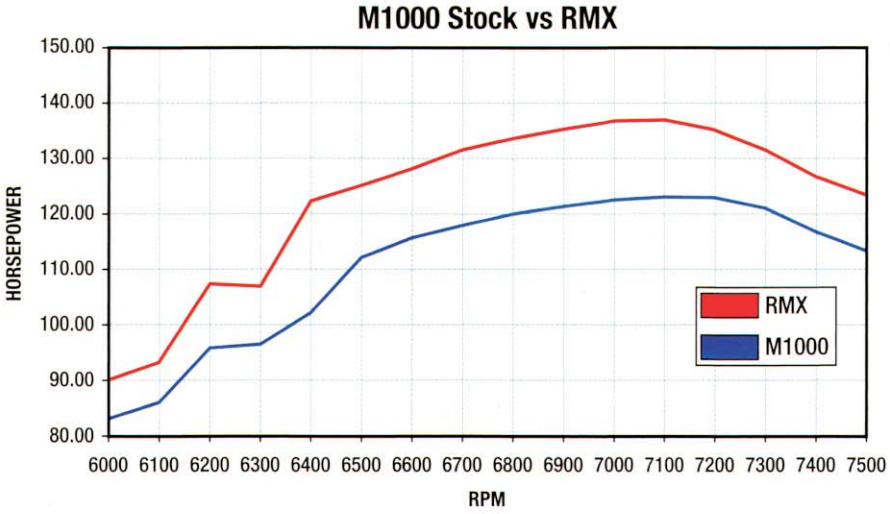
well as that worked, though, after days more of standing around in the snow bank putting every conceivable clutching combination in the XCR 600, it never would outrun a stock XLT. Although Polaris claimed that the machine was making 120 plus horsepower, it ran so poorly on the hill that we began to wonder if it really made any more power than the XLT. Unfortunately, we had no way to prove or disprove that theory.

In the fall of 1996, when the 700 RMK was introduced, we had a bunch of stuff to test, including a turbo kit. It was also at that time that I got introduced to *Dynotech* Magazine and Jim Czekala. After talking to Jim and reading his work in *Dynotech*, the notion of being able to accurately measure horsepower in a controlled test environment seemed like a far more efficient way to test. After losing a couple of pistons in the turbo 700 RMK and spending more long days on the mountain testing pipes that didn't seem to do much, the fantasy was even more appealing.

After not enough research, we ordered up an entry-level dyno, purchased a 38-foot gooseneck trailer and built a rolling shop. What ensued next is a sad tale of a multitude of wasted time. Unfortunately for us, that dyno was not a well engineered piece of equipment. At the time, we really didn't understand all of these issues and spent a lot of time wondering why we couldn't ever repeat our numbers any closer than about 3 hp. If we were testing pipes that made 10 hp, we knew they were better than stock, but we wanted to be able to fine tune things like timing or pipe dimensions. For a couple of winters, we continued to try and get numbers out of that dyno, along with a lot of time spent on the hill making sure that the performance packages we were selling actually worked.

As the frustration mounted with having a dyno but not the results we wanted, along with spending more than six full weeks a year on the mountain, we thought that there still had to be a better way. In the spring of 2000, we purchased a track dyno. We spent that spring and the next fall diligently working with the track dyno trying to get some meaningful data out of it. Unfortunately, when you're trying to mod the engine for more power, it's almost as difficult to test with the track dyno as it is in the field because you still have the entire drivetrain to contend with. When you bolt that shiny new set of pipes on, it's impossible to know where peak power occurs so you end up trying 18 clutching combinations to see if you can happen onto any more power.





You Would Think ...

You would think that the track dyno would at least be helpful in setting up clutching. As it turned out, we didn't have enough inertial load in the unit that we bought, so the clutches never shifted the same on the dyno as they did in the real world. The problem was that if you took that killer setup off the dyno and went and rode the sled, it didn't work.

In order to make sure our stock sleds and mod packages worked well, we managed to glean some data from the track dyno and continued to do a lot of testing on the hill. As usual, though, we were still frustrated by the fact that we had no definitive way to test what modifications were actually doing. We were still having success bolting a lot of high compression heads and single pipes on snowmobiles, all the while wondering if we really knew where peak power was and how much power we were actually gaining. We knew they ran better and we could prove that on the hill, but that testing paradigm was hard to quantify.

We were also still spending days in the snow bank bolting on lots of whiz bang products that never made the sled any faster or climb any better. We could only conclude that they didn't make any more power, but we really wanted to know for sure. We had continued to talk to Jim throughout all these trials and tribulations with our dyno and finally decided to make a trip back to New York.

We really began to wonder if anyone's dyno was actually capable of producing repeatable and accurate data. Against her better judgment, Mindy (my wife) had given me tacit approval to build another dyno, but she told us that she didn't want us spending any more

IN SEARCH OF REAL HORSEPOWER

money until we were sure it was actually going to work this time. In the spring of 2002, we jumped on a plane headed for Buffalo. We ended up spending a full week with Jim and had the opportunity to watch Jim's dyno in action, as well as spend some time with Joe Dispirito. Between Joe and Jim, we left New York reconvinced that we needed a real dyno in order to get real numbers. We took a couple more shots at improving the dyno we had, but never got the results we needed.

Finally, in the fall of 2003, we had truly had enough and decided the only solution was to build a completely new dyno. Given what we had seen in New York, we felt the best option was a Huff Hydraulic absorber mated to Depac data acquisition software. As it wasn't possible to fit this dyno in a trailer, we located it in a dedicated test cell at 6,500 feet elevation. That way, by regulating the air temperature in the cell or using spring, summer or fall ambient air gives us density altitudes very similar to what we ride in during the winter. Basically, we trade temperature for atmospheric pressure to get similar atmospheric conditions.

A Dyno To Be Happy With

Around the first of the year in 2004, we finally had the dyno up and running and we've been correlating dyno data and field testing ever since. I've heard too many times that you can't race dynos, but you sure can race sleds when you know how much power you have. We have not seen a case yet where something worked in the field and didn't work on the dyno or vice-versa. As for repeatability, getting three or four runs within a quarter horsepower is not uncommon. The final piece of the puzzle for the new dyno came together last fall when we spent another couple of weeks adapting a massive hydraulic die table to hold an entire sled, instead of having to remove the engine to dyno it. That way, with the advent of the new fuel injected sleds, we can run the engines in their native environments. With ECUs, high pressure fuel pumps in the tanks, etc., it's a lot easier to test that way. We also now have the option of using the dyno as a diagnostic tool if we have a sled that doesn't run quite right in the snow.

One of the big challenges with dyno installations at altitude is that you have to decide which set of numbers to look at. Generally, dyno software will report observed data and then correct that data to a standard set of sea level conditions. Unfortunately, correcting high altitude modified engines all the way back to sea level is really not a useful practice since what you did at altitude may or may not work at sea level. For the purposes of uniform testing, we correct all of our data back to 23.80" Hg, 60 degrees and dry air. That way, to get from our numbers to theoretical sea level, you simply multiply by 1.257 (29.92/23.80).

Now that we've used the dyno for

(right) All this elaborate equipment is in the name of finding that extra bit of horsepower for your sled. Xtreme Performance does extensive testing on the new models it sells to find out where best to add that horsepower.

multiple seasons and have had multiple sleds strapped to it, it's interesting to note that the numbers never really calculate back to sea level correctly. There's a lot of banter when people talk about dynos that every dyno could be a little different. While that's true, the dyno truly only measures two things: torque and rpm. If two dynos both measure those items correctly, physics dictates you'll get the same horsepower. Since we know the dynos are right in both places, it seems that the horsepower of our high performance snowmobile engines actually degrades faster at higher altitudes than the correction factor would normally predict. However, since all of these engines are designed and optimized for sea level, it doesn't take a big leap of faith to believe that they could become progressively more out of tune as the air gets thinner.

So just how much horsepower do we actually have in the mountains? Since Xtreme became an Arctic Cat dealer this fall, we wanted to get an idea of how the new M8 and M1000 compared and if Suzuki had left us some room to improve them. The M8 falls solidly in the middle of where we've seen factory 800cc engines and gives you an idea of how little horsepower we really have on the mountain. That 140 plus factory number is actually only 104 REAL horsepower at 6,500 feet (at standard temperature and humidity). Even the mighty M1000 only makes about 124 hp, about what a good 600 would do in the flatlands. It's really no wonder we all like to mod our stuff in the West.

How well do those mods actually work? Over the years, we have built a product we call the RMX kit which is designed to be a reasonably priced kit that makes the sled more fun to ride and gives our customers a few extra horsepower. Generally, the kits start with a modified head that raises the compression. At altitude, more compression almost always makes more power. More importantly, though, it gives us back our throttle response and stops the sled from feeling like the engine has morphed into a high altitude marshmallow.

For the M8 and the M1000, we found that adding a better flowing exhaust manifold and a modification to the stock pipe also helps them breathe better. As you look at the data, you'll see the kit makes about 9.5 hp on the 800 and 13.5 hp on the 1000. On the M8, BSFC stayed safe with the mods (BSFC is the ratio of fuel flow to horsepower) but the M1000 needed a Boondocker box to supply extra fuel for that extra horsepower.

How much better will they work with exhaust systems, nitrous kits or even more compression? It's hard to say … that's why we keep testing and looking for more of that elusive REAL high altitude horsepower. ❄

(Facey is the owner of Xtreme Performance Center, which has two Colorado locations, one in Dacono 303-654-0867 and one in Castle Rock 303-660-5302. Or log on to www.xtreme-performance.com.)