Arctic Cat Z1 w/ D&D Powersports' Lakeracer package

dyno test/ text by Jim Czekala

D&D Powersports of Loweville, NY (315-376-8013) created this "Lakeracer" package of parts/ modifications for the Arctic Cat Z1. Their target was 450 HP, which they said has allowed reliable operation with the stock bottom end (crank, rods, pistons) with appropriate octane (116+ motor octane) and accurate fuel tuning.

Owning/ operating a sled like this is only for the most experienced tuners and riders! 2 ½ times the stock Z1 HP level means that everything from fuel freshness/ octane to fuel tuning to clutch setup must be perfect. The Z1's deto protection is helpful, but goofing on fuel tune can result in severe leanout with no deto and meltdown can occur! Everyone tuning a 450 HP+ lakeracer must use a good wideband A/F ratio meter to ensure safe, proper fuel tuning. Seat-of-the-pants fuel tuning will be way more expensive than a good wideband. D&D customers have access to D&D's experienced engine tuning/ clutching tech support crew, but that support must be spread around many hundreds (thousands?) of customers during the peak season. Glenn Hall's voicemail is usually full by 9 AM every Monday in the winter. For serious racers some measure of self-reliance is imperative.

Here is the list of stuff/ modifications in the D&D Z1 Lakeracer sled tested here, available individually or as a complete package:

- "Magic" 63mm custom ball bearing turbo w/ Tial stainless exhaust housing and billet compressor wheel.
- MVS external wastegate
- Stage 1 turbo cams w/ adjustable cam sprockets
- CNC cylinder head porting with special springs and retainers, inconel exhaust valves and "contour epoc" valve seat shaping.
- ARP head studs
- Machine/ weld stock exhaust manifold to accept the larger turbo and separate wastegate.
- Machine/ weld stock intake manifold to accept two additional injectors.
- Custom straight exhaust pipe combining wastegate and turbine outlet.
- D&D/ Boondocker Big Intercooler/ charge tube kit.
- Higher capacity fuel pump
- Hijacker fuel controller
- Reprogram ECU to raise rev limit

The day Glenn Hall scheduled to tune the Z1 lakeracer, it was going to be in the 90's F so he came by the evening before and we set the sled up on the dyno, working until 10pm do we could hopefully get our power tuning done early AM. Glenn planned to "roll" the cams around to obtain the most desirable HP curve which would take some time, so we started at 5:30 AM (to the chagrin of one neighbor who lives within eyesight and earsite of the dyno—that huge turbine outlet pipe must have made an excellent alarm clock for him at 5:46 AM!). Rolling cams in fourstroke engines is great fun and educational. We

learned about that here about 20 years ago with Kevin Cameron, who used our dyno to optimize the stock cams' timing on a Suzuki streetbike for a Cycle World article.
After dialing in boost and fuel flow, Glenn spent most of the morning rolling the intake and exhaust cams back and forth until he was pleased with the HP level and the shape of the HP curve. By that time the evil humid, hot outside air was maxed out, at 90+ degrees F, and air inside the dyno room—even with 80mph "cooling" air—was 95-100 degrees F!

Turbo engines seem to suffer more than NA engines in hot, humid air. Correction factors in hot air seem to be perfect for normally aspirated engines, but not for turbocharged or nitrous injected engines. N2O engines have intake temp –50 to –100 degrees F regardless of outside temp so hot summer air correction (up) is sort of pretend (we usually pay most attention to observed HP on N2O engines). But turbo engines get a double whammy in hot air—intake temps are hot to begin with, but then even big intercoolers don't cool much with 90 degree air blowing on them! In extreme heat with typically low cooling air volume, intercoolers can become interheaters! So it takes more boost in the summertime to match the corrected HP that a turbo engine makes in cold air.

Today, here is the D&D Z1 Lakeracer with 35 psi of boost:

EngSpd	STPTrq	STPPwr	BSFA-B	FulA-B	LM1w/b	AirTmp	FuelP	BOOST
RPM	Clb-ft	CHp	lb/hph	lb/hr	A/F	degF	psig	psig
8000	260.0	394.4	0.55	197.6	11.82	99	61.9	33.8
8100	261.2	402.8	0.54	199.2	11.80	99	62.1	33.5
8200	260.8	407.2	0.55	202.7	11.78	99	62.2	33.5
8300	263.6	416.6	0.54	203.8	11.82	100	62.5	33.9
8400	263.9	422.0	0.53	203.8	11.85	101	62.7	34.3
8500	265.2	429.2	0.52	201.7	11.90	101	63.0	34.6
8600	264.5	433.0	0.52	204.7	11.92	101	62.9	34.7
8700	265.3	439.4	0.52	207.6	12.02	102	62.5	34.9
8800	264.2	442.7	0.53	211.0	12.12	101	62.0	35.4
8900	263.8	447.0	0.52	211.4	12.22	101	61.5	35.6
9000	262.0	450.3	0.52	212.1	12.26	100	61.2	35.6
9100	260.0	450.5	0.52	212.9	12.29	101	61.2	35.3
9200	258.2	452.6	0.52	213.6	12.36	101	61.2	35.3
9300	255.5	452.4	0.52	216.1	12.44	101	61.4	35.6

Here is the dyno result with boost added and fuel reduced slightly to offset the hot intake temperatures:

EngSpd	STPTrq	STPPwr	BSFA-B	FulA-B	LM1w/b	AirTmp	FuelP	BOOST
RPM	Clb-ft	CHp	lb/hph	lb/hr	A/F	degF	psig	psig
7200	243.6	332.4	0.53	160.2	11.20	93	59.1	30.5
7300	258.8	359.7	0.50	163.9	11.39	92	61.6	32.7
7400	266.8	375.9	0.49	168.3	11.48	91	62.9	33.9
7500	270.3	385.9	0.49	175.1	11.51	91	63.8	34.5
7600	270.2	390.9	0.50	180.4	11.54	91	64.2	35.1
7700	270.3	396.3	0.51	185.2	11.58	92	64.5	35.6

7800	270.7	402.0	0.51	188.9	11.61	92	64.3	35.8
7900	273.8	411.8	0.51	190.8	11.63	93	64.7	36.5
8000	277.3	422.4	0.50	192.2	11.65	93	65.3	37.1
8100	281.9	434.8	0.48	190.1	11.73	94	66.1	38.2
8200	285.5	445.7	0.47	189.6	11.97	95	66.7	38.9
8300	285.4	451.1	0.45	186.6	12.26	95	67.2	39.5
8400	283.4	453.2	0.45	186.2	12.46	95	67.5	39.7
8500	279.6	452.5	0.45	185.3	12.53	95	67.4	39.6
8600	278.3	455.7	0.45	186.5	12.60	95	66.8	39.6
8700	277.7	460.1	0.46	195.2	12.70	94	65.7	39.9
8800	275.7	461.9	0.48	204.6	12.80	94	65.2	40.3
8900	273.5	463.5	0.48	210.8	12.85	93	64.6	40.7
9000	272.8	467.4	0.49	209.3	12.87	93	64.9	40.8
9100	272.0	471.3	0.49	204.6	12.84	93	64.7	41.0

I currently have a small crew working on a cold air system for the intake air of our engines. Wayne Stoutner provided me with four walk-in freezer compressors and evaporators. They are being ducted in series into a 180 cubic foot insulated box that should provide enough dry cold winter air to the intakes of the biggest engines like this one (allowing accurate EFI tuning for winter use even in hot August air!). Now I plan to duct this same cold air to the turbo sleds' intercoolers to make things even more accurate. Glenn Hall has a customer's Z1 full mod racer that he plans to bring here to tune in mid-late August. I'm cautiously optimistic that we can provide winter air to the engine and intercooler by then.