D&D F1200 twin, N2O engine, dyno test session with Glenn Hall

Here is Jason Stoviac's F7 chassis with D&D nitrous F1200 engine installed, and twin Boondocker N2O systems (two nitrous solenoids and regulators). A custom D&D supplied motor mount plate and twin pipes complete the package. Fresh VP C16 gas is used here. Before coming to dyno, sled tuner/ racer Glenn Hall ran 8.56 @158mph at his local track in WI, and we decided to run our first dyno test just as he ran at the strip.

To accommodate lots of N2O that the sled was intended to use, the 1200 engine is tuned mildly compared to the D&D F1200 tested earlier on this site. Lower compression, stock ignition timing, possibly less restrictive pipes would sacrifice NA HP in favor of safely dealing with higher airflow and cylinder pressure of the engine when boosted with N2O. The other wildcard tuning issue is the unobtainable race shop ECU without revlimiter. Unlike the F7 500ft and 1000ft programming deal AC had for privateers, it's reportedly highly unlikely that high revs will be available for Cat F1000 dragracers and hotrodders.

Off the trailer, the engine made 295 HP at 7900 as Glenn had clutched it at the track. But his trap speed indicated higher HP than 295. A fresh higher base pressure N2O cylinder improved that, bringing HP up to 321.7 at the 7900 RPM track RPM but leaning out to an elusive 343 at 8500 that surprised Glenn since his track dyno showed best HP at 7900. We discovered that the fuel flow was flatlining at 180 lb/hr or less, indicating injectors are wide open, fuel pressure at stock 44-45psi. Note base fuel pressure is set via adjustable regulator at 65psi, but as soon as revs climb pressure drops to stock. Here, the fuel pump capacity is the limiting factor and fuel flow is extremely lean, surely saved by C16 gas.

baseline F1200 N2O as run at dragstrip

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	BSFA-B lb/hph	FulA+B lb/hr	TsTim2 second	FuelP psig
7200	204.2	279.9	0.55	144.6	0	55.4
7300	214.8	298.6	0.64	181.2	3.1	46.1
7400	216.3	304.8	0.63	182.6	3.5	46
7500	214.0	305.6	0.63	181.9	3.7	46
7600	215.9	312.4	0.61	180.0	3.9	46.2
7700	214.7	314.8	0.61	180.0	4.1	45.9
7800	214.5	318.6	0.60	181.2	4.3	45.9
7900	213.9	321.7	0.58	176.8	4.6	45.8
8000	213.9	325.8	0.57	176.7	4.9	45.8
8100	211.4	326.0	0.57	177.2	5.0	45.8
8200	212.1	331.2	0.57	177.0	5.3	45.7
8300	212.2	335.3	0.56	177.9	5.5	45.8
8400	211.2	337.9	0.56	177.8	5.7	45.7
8500	212.2	343.5	0.55	180.0	5.9	45.6

We installed a Walboro EFI fuel pump sized for 600hp, and the engine's electrical system failed to keep up with the amperage draw of the big pump. Fuel pressure sluggishly climbed to 16 psi and that was it. So we fed the big pump with the dyno 12vdc switched ignition source, and everything was dandy. Now we had 60+ psi fuel flow from idle to peak revs with N2O energized. Now BSFC is much safer .60 plus, pipe center section temp is cooler as indicated by high rev drop in HP.

F1200 N20 with high flow fuel pump

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	BSFA-B lb/hph	FulA+B lb/hr	TsTim2 Second	FuelP psig
7600	219.4	317.5	0.61	184.1	0	61.8
7700	218.1	319.8	0.59	178.2	0.2	61.8
7800	221.8	329.4	0.59	181.5	0.5	61.9
7900	218.2	328.2	0.59	181.7	0.6	61.8
8000	218.6	333.0	0.60	189.8	1.0	61.4
8100	217.6	335.7	0.63	200.5	1.2	61.1
8200	215.4	336.3	0.65	205.8	1.4	60.8
8300	213.1	336.8	0.65	205.5	1.6	60.9
8400	211.8	338.8	0.66	210.2	1.8	60.9
8500	203.4	329.2	0.67	205.4	2.2	60.9
8600	168.3	275.6	0.79	205.5	3.0	60.9
8700	168.3	278.8	0.78	205.5	3.1	60.9

Glenn then drilled out the Boondocker N2O nozzles with a subsequent dyno test showing no change in apparent nitrous flow and no change in HP. Now the Boondocker pressure regulators appeared to be limiting nitrous flow. So for an experiment, Glenn removed the regulator from one of the two systems. Leaving the fuel settings the same, the added nitrous flow from one unregulated system bumped HP up to an incredible 368 CHP. Fuel flow remained constant, and the higher N2O flow resulted in DTR record-breaking twin cylinder HP.

F1200 N20 remove one Boondocker N2O regulator

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	LAMAF1 Ratio	BSFA-B lb/hph	FulA+B lb/hr	TsTim2 second	FuelP psig
7900	229.6	345.4	8.7	0.64	207.6	0	60.6
8000	230.6	351.3	8.8	0.63	207.8	0.2	60.7
8100	231.0	356.2	8.8	0.61	204.6	0.6	60.6
8200	231.4	361.2	8.8	0.62	207.8	0.7	60.9
8300	228.6	361.2	8.7	0.61	204.1	1.1	60.7
8400	227.4	363.7	8.7	0.61	206.2	1.3	60.7

8500	223.1	361.1	8.7	0.61	206.2	1.6	60.7
8600	218.7	358.1	8.8	0.62	207.5	1.8	60.8
8700	212.8	352.5	8.8	0.62	204.9	2.0	60.5

Next, for discussion purposes here is the big HP observed (actual) torque and HP. Since the N2O enters the engine here in huge volumes at –88.5C (-127F), ambient temp of the airbox inlet makes little difference in observed HP. Small squirts of N2O can benefit more from cold outside air and high baro, but big load engines like Glenn and Jason have here live primarily on vaporized N2O so it matters little if outside air is 20 degrees F or 100 degrees F, hence the problem with CHP with big load N2O engines. Conversely, NA engines and turbo engines can starve for oxygen at 90 degree F humid air. But cold N2O ingesting engines are happy as long as their bottles (cylinders) are warm enough to deliver the necessary pressure.

F1200 remove one Boondocker N2O regulator observed HP

EngSpd RPM	EngTrq lb-ft	EngPwr Hp
7900	215.2	323.7
8000	216.1	329.2
8100	216.2	333.4
8200	216.3	337.7
8300	213.4	337.2
8400	212.5	339.9
8500	208.7	337.8
8600	204.3	334.5
8700	198.9	329.5

*
*
*
*
*
*
*
*
*
*
*
*
*
*
*
*

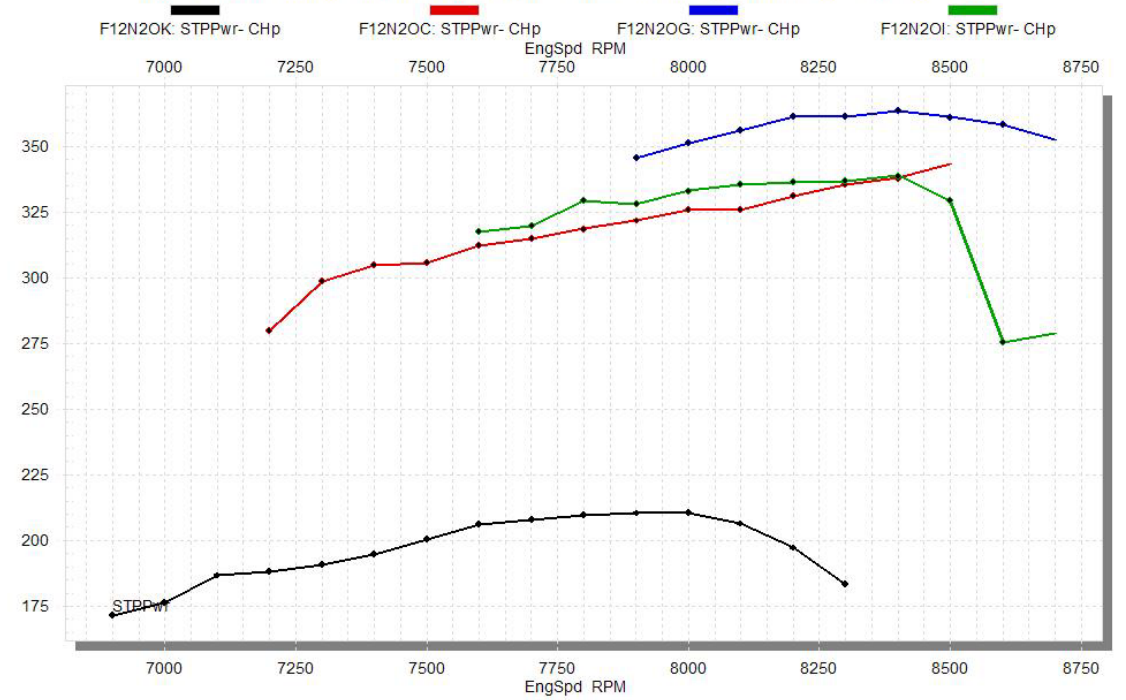
Baseline HP of the mildly tuned big engine is as follows—adding compression and timing would surely push HP peak back down below the magical 8000 RPM rev limit and increase torque and HP. But here it is as tuned safely for the big load of N2O.

D&D F1200 nitrous engine baseline

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	BSFA-B lb/hph	FulA+B lb/hr	WtrOut degF	TsTim2 second	FuelP psig
6900	130.5	171.4	0.64	102.6	70	0	63.7
7000	132.2	176.2	0.63	104.9	69	1.2	63.6
7100	138.1	186.7	0.63	110.5	70	2.1	63.4
7200	137.4	188.3	0.62	110.8	70	2.5	63.4
7300	137.4	191.0	0.63	112.8	70	3.1	63.3
7400	138.1	194.6	0.63	115.6	70	3.9	63.2
7500	140.3	200.4	0.61	115.9	70	4.5	63.2
7600	142.5	206.2	0.59	115.5	71	5.7	63.2
7700	141.8	207.9	0.58	113.6	70	6.3	63.3
7800	141.1	209.6	0.58	115.8	70	6.9	63.2
7900	139.8	210.3	0.60	118.3	70	7.3	63.1
8000	138.1	210.4	0.62	122.1	69	7.8	63.0
8100	133.8	206.4	0.64	123.9	70	8.4	63.0
8200	126.3	197.2	0.67	124.7	70	9.1	62.9
8300	115.9	183.2	0.72	124.9	70	9.8	62.9

D&D F1200 nitrous engine w/ Boondocker N2O

Black motor only, Red stock fuel pump as run before dyno, Green increase fuel pump capacity, Blue remove N2O regulator



04/18/07 *SuperFlow WinDyn™ V* *19:15:42*