2004 POLARIS PRO X 700 STAGE TUNING
dyno testing/ text by Jim Czekala

DTR subscriber Jim Machado (aka ProX2) offered his stock 04 ProX 700 to do stage dyno tuning. The 04 ProX has detonation protection which we expect would allow safe operation with max HP timing, compression and jetting on pump gas. We've still not heard of anyone detonating any 04 ProX's. To be extra cautious and try to ensure that ECU reaction to light deto on the dyno would not skew our results (since we couldn't observe the deto indicator light on the sled while dyno tuning), one gallon of VPC12 leaded gas was added to our four gallons of 93 octane unleaded in the dyno fuel tank. We also had a Hot Seat ProX700 Ypipe and single pipe, but it turned out to be an '03 ProX700 pipe and chassis difference prevented dyno comparison. That may come later.

Jim had run the sled like this all winter, and never once saw the deto light flicker. His setup included Tempaflow float bowl venting and device for altering fuel flow based on air temp—a dandy looking setup that we've never tried before, and the promise is that A/F ratio we saw at 55 degreesF would be the same at zero degrees F.

This was sort of a backwards stage tuning, starting with a few of the add-ons/ mods we would usually do, add some more tuning and components, then backing off parts/ mods/ adjustments, one step at a time back to stock. While gains/ losses from individual testes are modest, this is a textbook example of why it pays to use DynoTech test results to model a setup, and/ or to dyno tune anywhere you can obtain repeatable (within a few tenths of a HP) and honest numbers. An engine will usually repeat if coolant, air and pipe temp remain constant. Good control of dyno room coolant and air temperature and quality (ie: zero exhaust gas getting back into the intake) is critical if you're looking for fractions of HP's, which we usually do. If you find enough ½ horsepower add-ons, that can add up to a very noticeable increase in sled performance.

Here is Jim Machado's last winter's setup we began the session with: Stock ProX700 engine, ceramic coated SLP single pipe/ Ypipe/ canister muffler (90dB here), stock compression, stock timing, VForceIII reed cages, TempaFlow venting of float bowls w/490 mains, gutted stock airbox w/ SLP oversize inlet. After this test we will list only what was tuned differently or changed.

04PX7SPA JIM M'S LAST WINTER SETUP

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF
6600	74.7	93.9	0.76	69.6	12.1	185	56
6700	75.3	96.1	0.76	71.7	11.8	185	56
6800	78.9	102.1	0.74	74.1	11.7	189	56
6900	79.8	104.8	0.72	74.3	11.9	194	56
7000	82.3	109.7	0.73	78.5	11.9	204	56
7100	81.9	110.7	0.76	81.8	11.6	208	57
7200	82.1	112.4	0.75	82.3	11.7	210	58
7300	81.5	113.3	0.76	83.8	11.5	210	58
7400	82.8	116.7	0.77	88.1	11.2	215	58
7500	82.4	117.7	0.77	88.2	11.3	218	57
7600	86.4	125.1	0.75	91.1	11.3	226	57
7700	85.5	125.3	0.74	90.6	11.4	226	58
7800	87.1	129.2	0.71	89.7	11.8	230	58
7900	85.1	127.9	0.73	91.8	11.6	232	56
8000	80.9	123.2	0.75	90.8	11.7	232	55

Since most owners don't have TempaFlow, we reverted to standard jetting for the rest of the day. We started with 390 mains, vent hoses plumbed to the stock hose fittings on the airbox, which might be OK for this temp and deto sensors. This gave us about max HP A/F ratio at 55 degrees 29.4 in. HG baro.

04PX7STC INSTALL STANDARD VENTING, 390 MJ

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF
6300	65.2	78.2	0.64	49.1	14.8	160	55
6400	65.7	80.1	0.64	50.4	14.7	162	55
6500	67.2	83.2	0.63	51.4	14.5	163	55
6600	72.7	91.3	0.62	55.4	14.2	172	55
6700	73.1	93.1	0.64	58.3	13.7	174	55
6800	75.9	98.3	0.61	59.3	13.7	178	55
6900	79.1	103.9	0.68	69.8	12.3	187	56
7000	80.5	107.3	0.66	69.6	12.6	192	56
7100	81.2	109.8	0.65	70.6	12.7	195	56
7200	82.7	113.4	0.64	71.5	12.8	201	56
7300	84.4	117.3	0.61	69.9	13.6	208	56
7400	83.1	117.1	0.62	71.7	13.5	211	56
7500	85.1	121.3	0.61	73.2	13.4	214	56
7600	85.4	123.5	0.62	74.9	13.3	217	56
7700	87.5	128.3	0.62	78.8	13.0	224	55
7800	87.5	130.1	0.62	78.8	13.1	225	55

7900	88.7	133.5	0.62	81.1	12.9	228	55
8000	89.1	135.8	0.62	83.1	12.8	231	55
8100	88.5	136.6	0.61	82.1	12.9	232	55

We decided to enrichen the mixture as we would if deto protection was not present. 410 mains dropped the HP and increased the fuel flow, mid .60's BSFC was the result:

04PX7STD 410 MAIN JETS, STANDARD VENTING

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	AirTmp degF
6400	71.1	86.5	0.65	55.1	14.4	173	53
6500	72.6	89.9	0.61	53.4	15.1	175	53
6600	74.5	93.6	0.61	55.5	14.7	178	53
6700	76.5	97.6	0.61	57.4	14.4	181	53
6800	80.3	104.1	0.65	66.2	13.1	188	54
6900	82.6	108.6	0.67	71.8	12.6	197	54
7000	82.7	110.3	0.67	73.1	12.6	200	54
7100	82.7	111.7	0.69	76.3	12.2	204	54
7200	85.2	116.8	0.67	77.3	12.5	211	54
7300	84.8	117.8	0.69	80.1	12.2	214	54
7400	84.6	119.2	0.68	79.4	12.4	216	54
7500	85.8	122.5	0.66	80.1	12.5	218	54
7600	88.9	128.7	0.62	79.1	12.9	224	54
7700	88.7	130.1	0.66	84.5	12.3	228	54
7800	88.9	132.1	0.64	82.7	12.7	229	54
7900	88.9	133.8	0.66	86.4	12.2	231	54
8000	87.4	133.2	0.64	84.7	12.7	234	52
8100	81.9	126.4	0.67	82.9	12.8	231	55

Next we changed CDI's to one that had been reprogrammed to add three degrees of timing up to 7000 then two degrees above stock beyond that. A very similar result can be achieved by rolling the stator plate 2 degrees, which requires partial removal of engine from the chassis to access the mag side. Note that there wasn't a huge top end HP increase, but the midrange looks like it was happier by several HP at each point.

04PX7STE ADD TWO DEGREES OF TIMING

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	AirTmp degF
6300	70.5	84.6	0.79	65.6	11.8	169	56
6400	70.4	85.8	0.78	65.8	11.9	171	56
6500	70.5	87.3	0.77	66.1	11.9	172	56
6600	73.4	92.2	0.76	68.9	11.6	175	56

6700	80.1	102.1	0.72	72.6	11.8	187	56
6800	81.2	105.1	0.72	74.2	11.9	193	56
6900	83.3	109.4	0.70	75.1	12.1	197	56
7000	83.6	111.4	0.71	77.3	11.9	201	56
7100	84.3	113.9	0.72	80.6	11.8	209	56
7200	84.9	116.4	0.72	82.5	11.7	211	56
7300	85.1	118.2	0.71	81.8	11.9	213	55
7400	86.7	122.1	0.71	85.4	11.7	218	55
7500	87.4	124.9	0.68	83.8	12.2	223	55
7600	89.8	130.1	0.66	84.6	12.3	228	55
7700	89.1	130.6	0.66	85.2	12.4	230	55
7800	89.1	132.3	0.66	85.7	12.3	231	55
7900	89.1	134.1	0.64	85.1	12.6	233	55
8000	86.5	131.8	0.66	85.4	12.5	234	56
8100	80.9	124.8	0.72	87.8	12.1	231	56

We installed a HotSeat billet head w/ 702-13EV combustion chamber inserts (3-6000ft pump gas). Stock squish clearance (about .068”), and slightly tighter chambers gave us more top end HP (not a lot but remember these will all add up), about the same midrange as the stock head.

04PX7STG INSTALL HOTSEAT HIGH COMPRESSION HEAD

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF
6300	69.1	82.8	0.74	60.4	12.6	167	52
6400	70.2	85.5	0.74	62.3	12.5	170	52
6500	71.1	88.1	0.72	62.7	12.6	172	52
6600	72.5	91.1	0.71	63.7	12.6	175	52
6700	77.1	98.3	0.71	69.2	12.1	181	53
6800	78.7	102.1	0.69	70.5	12.1	185	53
6900	81.8	107.4	0.72	75.8	11.8	196	54
7000	82.9	110.5	0.69	74.7	12.3	200	54
7100	83.6	113.1	0.69	77.4	12.1	204	54
7200	83.6	114.6	0.69	77.4	12.2	207	54
7300	84.4	117.3	0.67	77.5	12.4	210	54
7400	87.8	123.7	0.68	82.3	12.2	219	53
7500	87.8	125.3	0.67	82.5	12.3	221	53
7600	88.8	128.5	0.65	82.6	12.4	223	53
7700	90.1	132.1	0.63	81.7	12.7	227	53
7800	89.5	132.9	0.61	80.4	13.1	230	53
7900	90.1	135.5	0.62	82.6	12.9	233	53
8000	86.3	131.5	0.61	77.5	13.7	232	54

After trying to fit the HotSeat single and discovering it wouldn’t match the ‘04 chassis (we’ll keep that pipe and try it on an ’03), we installed a stock 82

dB Y pipe single pipe and muffler. Note that the airflow was lower than the SLP single, meaning that the SLP pipe makes more HP with higher airflow, a good attribute for a trail performance pipe (likely less chance of deto-producing active radicals being pumped back into the cylinders from the exhaust).

04PX7STJ INSTALL STOCK EXHAUST

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	AirTmp degF
6300	69.4	83.2	0.78	64.2	12.1	168	53
6400	69.6	84.8	0.77	64.1	12.1	170	53
6500	71.1	87.8	0.74	64.1	12.2	171	54
6600	73.1	91.9	0.73	65.9	12.1	175	54
6700	75.7	96.6	0.73	69.9	11.8	180	54
6800	79.1	102.4	0.69	69.8	12.2	185	54
6900	83.1	109.1	0.68	73.1	11.9	190	54
7000	84.1	112.1	0.66	72.9	12.3	196	54
7100	83.8	113.3	0.69	77.3	11.7	198	54
7200	83.8	114.9	0.68	77.1	12.1	201	54
7300	85.5	118.8	0.67	78.7	11.9	204	54
7400	85.7	120.7	0.66	78.7	12.1	206	54
7500	87.1	124.2	0.65	79.1	12.2	211	54
7600	87.6	126.8	0.68	84.5	11.7	216	53
7700	87.2	127.8	0.69	87.8	11.3	217	53
7800	87.4	129.8	0.66	84.1	11.9	219	53
7900	86.8	130.5	0.65	83.4	12.1	220	53
8000	79.3	120.8	0.71	84.8	11.8	218	53

Next we reinstalled Jim's stock head, and interestingly the peak HP was unchanged (even a few tenths *better*) but midrange suffered most (the opposite effect we experienced with the SLP pipe?). I have to ask Kevin Cameron about this. This was so strange we ran four repeats of this test (instead of the usual two), and it repeated as follows:

04PX7STL INSTALL STOCK HEAD

EngSpd RPM	STPTrq Clb-ft	STPPwr CHp	BSFC lb/hph	Fuel B lb/hr	A/F Ratio	Air 2 scfm	AirTmp degF
6300	68.1	81.6	0.77	62.1	12.3	166	54
6400	67.6	82.4	0.78	63.3	12.1	167	55
6500	69.1	85.6	0.76	64.4	12.1	169	55
6600	72.1	90.6	0.75	66.5	11.8	172	55
6700	76.2	97.2	0.72	68.6	12.1	182	55
6800	76.5	99.1	0.72	70.1	12.1	184	55
6900	80.3	105.5	0.69	71.7	12.1	188	53

7000	82.5	110.1	0.68	74.3	11.9	194	53
7100	83.4	112.8	0.69	77.2	11.8	198	53
7200	83.7	114.8	0.68	76.7	12.2	201	53
7300	85.1	118.1	0.69	79.9	11.7	204	53
7400	85.1	119.7	0.69	81.1	11.6	206	53
7500	85.8	122.5	0.69	83.5	11.5	210	53
7600	86.6	125.3	0.68	84.5	11.6	214	53
7700	85.9	125.9	0.72	89.2	11.1	216	53
7800	87.5	129.9	0.69	88.5	11.3	218	54
7900	87.1	130.8	0.64	82.1	12.2	220	54
8000	84.7	129.1	0.64	81.1	12.5	221	54

Another mystery for Kevin to help us with—we next reinstalled the stock CDI and with the stock exhaust, less timing = more midrange HP and identical top end HP. Once again, the opposite affect was seen with timing bump w/ SLP single (??)

04PX7STO INSTALL STOCK CDI

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF
6300	68.8	82.5	0.79	64.8	12.2	170	56
6400	68.8	83.8	0.77	63.7	12.3	171	56
6500	71.8	88.9	0.72	63.1	12.6	173	56
6600	74.1	93.1	0.73	67.1	12.1	178	54
6700	77.1	98.4	0.71	68.4	12.2	182	55
6800	80.8	104.6	0.69	71.5	12.1	189	55
6900	82.6	108.5	0.71	75.6	11.8	195	55
7000	83.4	111.1	0.71	76.5	11.8	198	56
7100	83.9	113.4	0.71	78.3	11.7	200	57
7200	84.1	115.3	0.69	77.6	12.1	203	57
7300	85.3	118.6	0.67	77.5	12.1	204	57
7400	86.5	121.9	0.71	83.7	11.5	211	57
7500	86.2	123.1	0.71	86.1	11.4	213	57
7600	85.7	124.1	0.72	87.8	11.2	215	57
7700	85.6	125.5	0.69	86.8	11.4	216	57
7800	87.7	130.3	0.68	87.5	11.5	219	57
7900	86.9	130.8	0.71	90.7	11.2	222	57

Now we went after the reeds and boots—something that we should have done when we maxed out our stock setup with compression and timing. But Here is a cheap mod that Sean Ray originally tried on his Dad's XC800 to pick up over one HP at peak (and we should have tried on Shylock's ProX800). Tony Spicola from North Collins NY (fast1956@msn.com) does this carb boot mod commercially—the reed stuffers are removed from the

cages, and the rubber carb boots are ground out to match the larger more rectangular opening of the VForce reed cages. This sinus-plugging dirty-to-perform $50 mod added 2% to top end airflow and 1% to top end HP. But notice the even greater increase in midrange airflow and HP.

04PX7STQ REMOVE VFORCE REED STUFFERS, ADD PORTED CARB BOOTS

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF
6300	71.9	86.2	0.75	63.9	12.6	176	56
6400	71.7	87.3	0.79	67.5	12.1	178	56
6500	72.5	89.7	0.76	67.2	12.2	179	56
6600	74.3	93.4	0.74	68.1	12.2	182	56
6700	77.8	99.2	0.71	67.8	12.5	186	56
6800	83.4	107.9	0.73	77.9	11.4	195	55
6900	84.2	110.6	0.71	76.8	11.8	199	54
7000	84.7	112.9	0.67	74.3	12.4	202	54
7100	85.5	115.6	0.68	79.4	11.8	204	55
7200	85.5	117.2	0.68	78.2	12.1	207	55
7300	87.8	122.1	0.71	83.6	11.7	213	55
7400	86.9	122.4	0.69	83.9	11.8	215	56
7500	87.7	125.3	0.71	87.7	11.4	219	56
7600	87.9	127.2	0.71	88.4	11.4	221	55
7700	89.7	131.6	0.71	90.1	11.5	225	55
7800	88.1	130.9	0.69	90.1	11.5	226	55
7900	78.7	118.4	0.76	88.3	11.6	224	55

We next removed the Vforce Delta III reeds, and installed Vforce Delta II reeds with Tony's boots. Similar top end HP, but a bit more midrange on this particular engine.

04PX7STS INSTALL DELTA II REEDS W/ PORTED BOOTS

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF
6300	70.6	84.7	0.74	61.5	13.2	177	55
6400	71.9	87.6	0.78	67.1	12.1	177	55
6500	74.7	92.5	0.74	67.3	12.3	181	55
6600	75.8	95.3	0.71	66.3	12.7	184	55
6700	80.1	102.1	0.71	71.1	12.2	190	55
6800	83.5	108.1	0.73	77.7	11.5	196	56
6900	84.5	111.2	0.73	79.7	11.5	200	56
7000	84.9	113.2	0.72	80.1	11.6	203	57
7100	85.3	115.4	0.71	80.3	11.7	205	57
7200	85.7	117.5	0.74	85.7	11.1	208	57
7300	86.8	120.6	0.74	88.1	11.1	211	57
7400	87.3	123.1	0.74	88.9	11.2	214	56

7500	88.8	126.8	0.72	90.1	11.2	221	56
7600	89.1	128.8	0.69	87.5	11.7	223	56
7700	88.5	129.7	0.71	91.2	11.3	225	56
7800	88.5	131.4	0.67	86.9	11.9	227	56
7900	80.1	120.5	0.76	90.6	11.4	226	55

The Vforce reeds were replaced with the stock reed cages w/ Tony's boots. Unlike our ProX800 which saw little airflow/ HP change with reeds, the 700 lost 3% airflow and 3 HP pretty much throughout the powerband when we reverted to stock reeds.

04PX7STT INSTALL STOCK REED CAGES W/ PORTED CARB BOOTS

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp	WtrOut
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF	degF
6400	67.8	82.6	0.74	60.5	12.82	170	56	95
6500	68.1	84.2	0.74	61.3	12.66	170	56	95
6600	68.8	86.5	0.75	63.8	12.27	171	56	95
6700	70.2	89.5	0.74	65.2	12.08	172	56	95
6800	77.3	100.1	0.73	72.1	11.31	178	56	95
6900	82.1	107.9	0.69	72.1	12.32	194	55	95
7000	83.5	111.2	0.71	76.8	11.85	199	55	95
7100	82.6	111.6	0.72	78.9	11.67	201	54	95
7200	84.3	115.5	0.71	81.1	11.51	204	55	96
7300	84.6	117.6	0.74	85.1	11.22	209	55	96
7400	85.1	119.7	0.73	85.9	11.21	211	55	96
7500	85.7	122.4	0.69	80.5	12.17	214	56	97
7600	85.4	123.6	0.69	84.6	11.64	215	56	98
7700	86.9	127.4	0.71	89.1	11.21	218	56	98
7800	86.4	128.3	0.71	89.8	11.16	219	56	98

The final reed assessment was to put the stock reed stuffers back in the stock cages, and the stock boots were reinstalled. The stock reed cages liked the stock stuffers and boots—note the slight increase in airflow and HP from low end to midrange. Though HP at 7800 was down on this run, overall the stock cages were happiest w/ stock boots and stuffers.

04PX7STU INSTALL STOCK BOOTS/ STUFFERS IN STOCK REED CAGES

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF
6300	69.9	83.8	0.81	67.1	11.7	172	54
6400	69.5	84.7	0.81	67.1	11.8	173	54
6500	71.8	88.9	0.81	70.6	11.4	175	54
6600	73.9	92.9	0.81	74.1	11.0	178	54
6700	77.3	98.6	0.76	73.9	11.3	183	54
6800	80.1	103.7	0.72	73.5	12.1	193	55
6900	82.6	108.5	0.71	74.9	12.1	196	54
7000	83.9	111.8	0.71	77.4	11.9	200	54
7100	84.1	113.7	0.71	79.6	11.7	203	54
7200	84.1	115.1	0.71	79.6	11.8	205	55
7300	84.2	117.1	0.72	82.5	11.6	209	55
7400	84.3	118.7	0.72	84.1	11.5	212	55
7500	85.1	121.4	0.72	86.4	11.4	215	55
7600	87.1	126.1	0.69	85.6	11.7	219	55
7700	87.1	127.6	0.67	83.9	12.1	221	55
7800	85.6	127.1	0.69	86.4	11.8	222	55
7900	61.1	92.1	0.98	88.5	11.2	216	56

Finally, the gutted airbox was removed and a stock box was fitted. This dropped airflow on top end and even more in the midrange. I believe that there must have been a fitment issue with the stock box since BSFC was the same, HP dropped 5% so I expect that airflow also dropped 5% not the 10% as shown, and A/F ratio should have been constant.

04PX7STW INSTALL STOCK AIRBOX, BACK TO BONE STOCK

EngSpd	STPTrq	STPPwr	BSFC	Fuel B	A/F	Air 2	AirTmp
RPM	Clb-ft	CHp	lb/hph	lb/hr	Ratio	scfm	degF
6400	68.2	83.1	0.81	66.1	10.9	157	52
6500	68.2	84.4	0.79	66.1	11.1	159	52
6600	69.7	87.6	0.75	65.1	11.2	160	52
6700	70.7	90.3	0.74	65.2	11.2	161	52

6800	74.5	96.4	0.71	67.1	11.3	166	52
6900	78.9	103.7	0.71	71.6	11.4	178	52
7000	79.3	105.7	0.69	72.1	11.3	179	53
7100	80.6	109.2	0.71	75.9	10.9	181	53
7200	82.1	112.5	0.72	79.9	10.6	185	52
7300	82.3	114.4	0.69	77.4	11.3	190	52
7400	82.1	115.5	0.66	75.5	11.6	192	53
7500	82.1	117.2	0.71	81.2	10.9	194	52
7600	83.1	120.2	0.73	86.9	10.4	197	52
7700	82.9	121.5	0.71	85.1	10.7	199	52
7800	84.2	125.1	0.69	84.6	10.9	202	52
7900	83.4	125.4	0.71	87.5	10.6	203	52
8000	78.1	119.1	0.71	82.1	11.2	201	52

EPILOGUE

It was interesting to see how helpful the Vforce reeds were on the stock ProX700, considering how the 800 didn't seem to care what reeds were installed. And the low-buck boot mod was great to see, one of the best bangs for anyone's buck. Just don't do it with stock reeds—at least on the ProX700 engine. What if we had tried the ported boots w/ Vforce reeds on the 800? Also the bewildering flip-flop of the results of added timing and compression on stock and SLP pipe was interesting. Bottom line, I believe Jim ProX2 will add that timing, probably add some compression (maybe a .015" swipe off the stock head) and for sure run the leaner jetting. And Tony already sold him the port job on his boots. So he's looking at very close to 140hp at low .60's BSFC. If I owned one of those, I would only be happy if I saw that deto indicator light come on at least once in a while. Then I would be sure there was nothing left on the table. That is assuming those knock sensors do their job.