

Northern Illinois University



2010 Clean Snowmobile Challenge

Snowmobile Selection



2007 Yamaha Phazer

- ▣ Potential for success in multiple categories
 - Exhaust noise
 - Lower emissions
 - Power : Weight ratio
 - Fuel efficiency
 - Ethanol capabilities



Consumer Appeal

- The average snowmobile buyer will be using the snowmobile for recreational use.
- Our team has added the following modifications and will give a brief description of how the modification will benefit the sled as well as appeal to the consumer.



Weight Savings

- Replaced Stock Skid with Custom Skid
 - Weight Savings = 26 lbs
- Replaced Front A-arm Kit
 - Weight Savings = 10 lbs
- By reducing the weight of the snowmobile it improves most aspects of performance, emissions, and fuel economy.



MegaSquirt ECU

- Manage fuel curves, timing curves, boost maps, and alcohol correction
- Full functionality the stock ECU, but with additional capabilities
- Work with the Phazer's engine well (odd-fire, dual trigger, C.O.P)
- Unlike previous years, completely replaces stock ECU controlling all engine systems



Alcohol Sensor

- Using a stock GM alcohol sensor
- Outputs to control boost to adjust turbo
- Works in conjunction with MegaSquirt
 - Adjusts timing to take advantage of higher octane rating with higher ethanol blends
 - This is done all without touching anything on the ecu so the rider can put anything from e10 to e85 in the sled without adjustments





Turbocharger

- Improves power

- Makes it possible to reach higher elevations in parks

- Maintains or improves engine efficiency

- Uses otherwise wasted energy in exhaust to boost performance while having the possibility to increase fuel economy
- Keeps parks clean and allows quick transportation without sacrificing environmental friendliness





Exhaust Design

- **Adapt catalytic converter**
 - Decreases exhaust emissions
- **Equal runner length on exhaust manifold**
 - Allows better exhaust scavenging and even flow
- **Using a two stage approach**
 - Stage One
 - Absorption style – Glass-Pack
 - Stage Two
 - Specific frequency cancellation – Custom designed muffler
- **All done to decrease sound emissions**
 - Won't frighten Bambi





Emission Testing

- Exhaust measurements were taken before and after addition of catalyst.
- The Nova Exhaust Analyzer is relatively new.

Stock Exhaust Readings

	O2 (%)	CO (%)	CO2 (%)	HC PPM	(NO+NO2) PPM
Idle	1.3	1.7	13.5	198	110
Mid- Throttle	0.3	5.9	11.6	161	178





Emission Testing

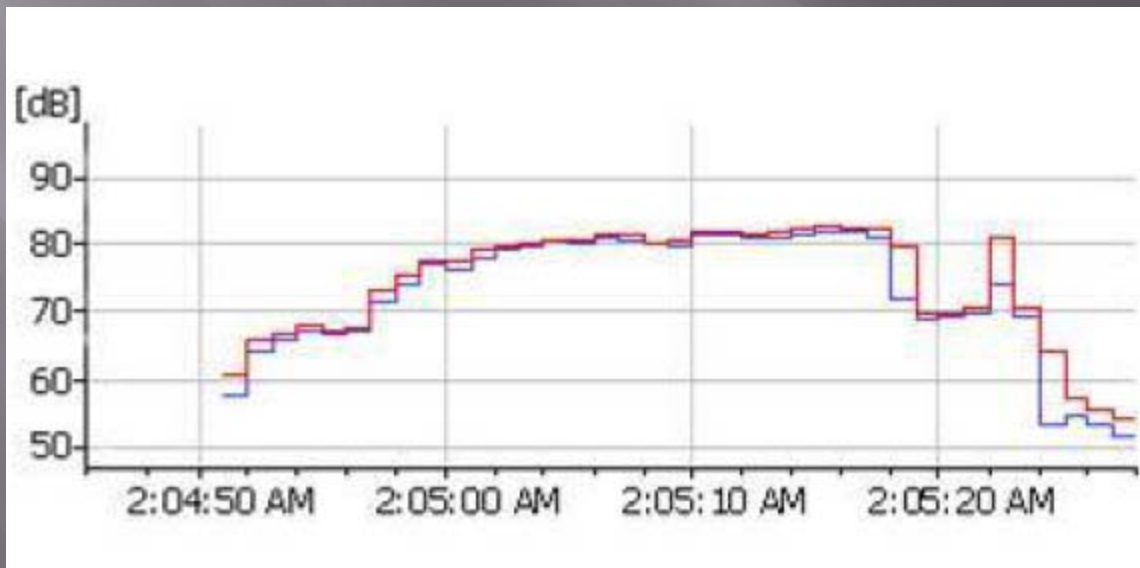
E10	O2 (%)	CO (%)	CO2 (%)	HC PPM	(NO+NO2) PPM
Idle	0.3	1.2	14.7	299	3
Mid-Throttle/ Mid- Load	0.1	3.8	12.9	119	138
100% Throttle/ 100% Load	0.2	8.7	9.7	760	181

E85	O2 (%)	CO (%)	CO2 (%)	HC PPM	(NO+NO2) PPM
Idle	0.3	3.3	12.6	176	1
Mid-Throttle/ Mid Load	0	1.3	14	51	26
100% Throttle/ 100% Load	0.9	5.5	11.1	471	121



Sound Testing

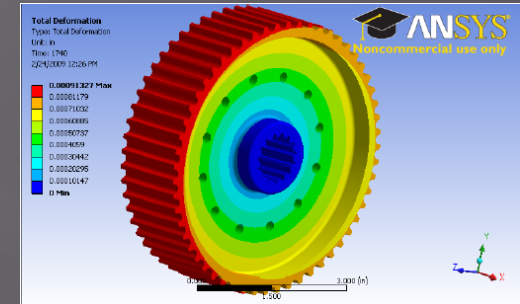
- Using SAE J192 specifications for testing we conducted a sound test with the stock exhaust.





Belt Drive

- Reduce noise emissions
 - Eliminates metal on metal contact
- **NO MORE OIL TO CHANGE**
 - This means no more oil waste
- Reduce weight
- Made from 6061-T6 aircraft aluminum
 - Low weight
 - High durability
- Maintained stock gear ratio 19:41





Trim Models

- The team this year decided to come up with different trim models utilizing combinations of the modifications to better suite multiple peoples wants for a snowmobile.
- There are three trims to choose from the Ethanol RTX or ERTX, the Green RTX or GRTX, and the Green Performance Phazer.



Phazer ERTX

•Phazer ERTX is a Phazer that has been converted over to use ethanol. It also has the emissions items on it to pass the 2012 standards.

Items	Phazer RTX	Phazor ERTX MSRP
2010 Phazer RTX		
Base Price	\$ 8,299.00	\$ 8,299.00
Exhaust System		\$ 215.00
Catalyst		\$ 150.00
Mega-Squirt ECU		\$ 150.00
Studs		\$ 201.95
Backers		\$ 54.95
Alcohol Sensor		\$ 400.00
MSRP	\$ 8,299.00	\$ 9,470.90



Phazer GRTX

•The Phazer GRTX is a Green RTX it runs on ethanol, has emissions equipment, has been lightened, and includes various items like a belt drive and battery box to eliminate spills of fluids.

Items	Phazer RTX	Phazor GRTX MSRP
2010 Phazer RTX *Base Price*	\$ 8,299.00	\$ 8,299.00
Battery Box		\$ 20.00
Exhaust System		\$ 215.00
Catalyst		\$ 150.00
Mega-Squirt ECU		\$ 150.00
Studs		\$ 201.95
Backers		\$ 54.95
Timbersled Front End kit		\$ 600.00
Belt Drive		\$ 150.00
Alcohol Sensor		\$ 400.00
MSRP	\$ 8,299.00	\$ 10,240.90



GP Phazer

•The GP Pazer stands for Green Performance Phazer. This sled is for the enthusiast who like to go fast and have fun but yet cares about the environment. This sled features:

- Capability to run ethanol
- Turbo charger increasing the power of the sled
- Catalyst for emissions
- Exhaust tuned to the motor for reduced noise emissions
- Custom tune to give the best fuel economy
- Battery box and Belt drive to help cut down spills
- Weight reduction

GP Phazer Cont.

Items	Phazer RTX	GP Phazer MSRP
2010 Phazer RTX *Base Price*	\$ 8,299.00	\$ 8,299.00
53-Series VATN Aerocharger		\$ 2,000.00
Intercooler		\$ 200.00
Piping and Fittings		\$ 100.00
Turbo Manifold		\$ 55.00
Throttle Body Intake		\$ 70.00
Battery Box		\$ 20.00
Exhaust System		\$ 215.00
Catalyst		\$ 87.00
Mega-Squirt ECU		\$ 150.00
Studs		\$ 100.00
Backers		\$ 40.00
Timbersled Front End kit		\$ 600.00
Belt Drive		\$ 150.00
Stronger Clutch		\$ 200.00
Alcohol Sensor		\$ 400.00
MSRP	\$ 8,299.00	\$ 12,686.00



Dynamometer Testing

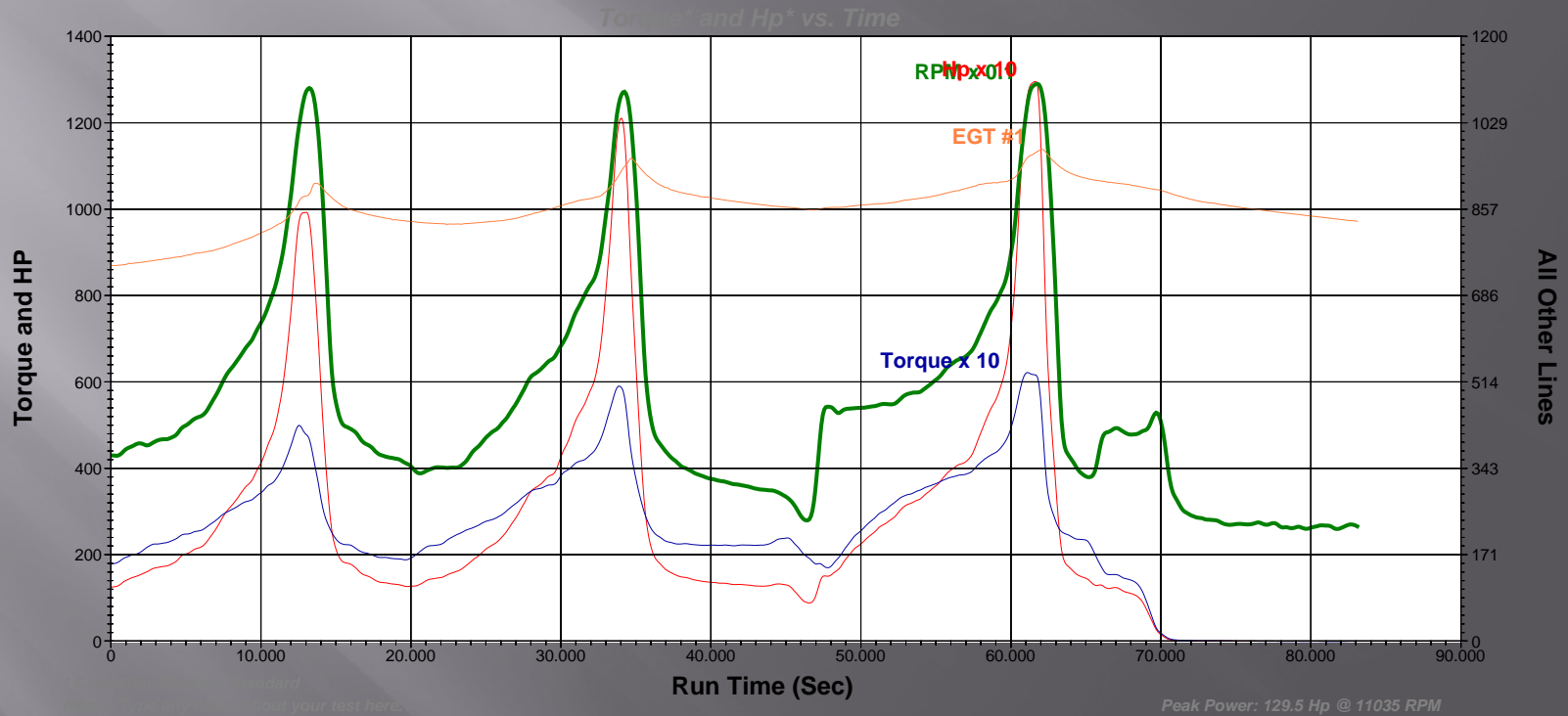
- Simulates Real World Loading
 - The water-break absorber resists the rotation of the engine.
- We are able to monitor most diagnostics of the engine.
 - RPM
 - Horsepower
 - Torque
 - Exhaust Temperature
 - Air Intake Flow
- Horsepower with Stock Exhaust = 88 HP





Dynamometer Run on E10

DYNomite test "Yamaha Phazer on 2009-03-14 @ 18-44-54" by Northern Illinois University



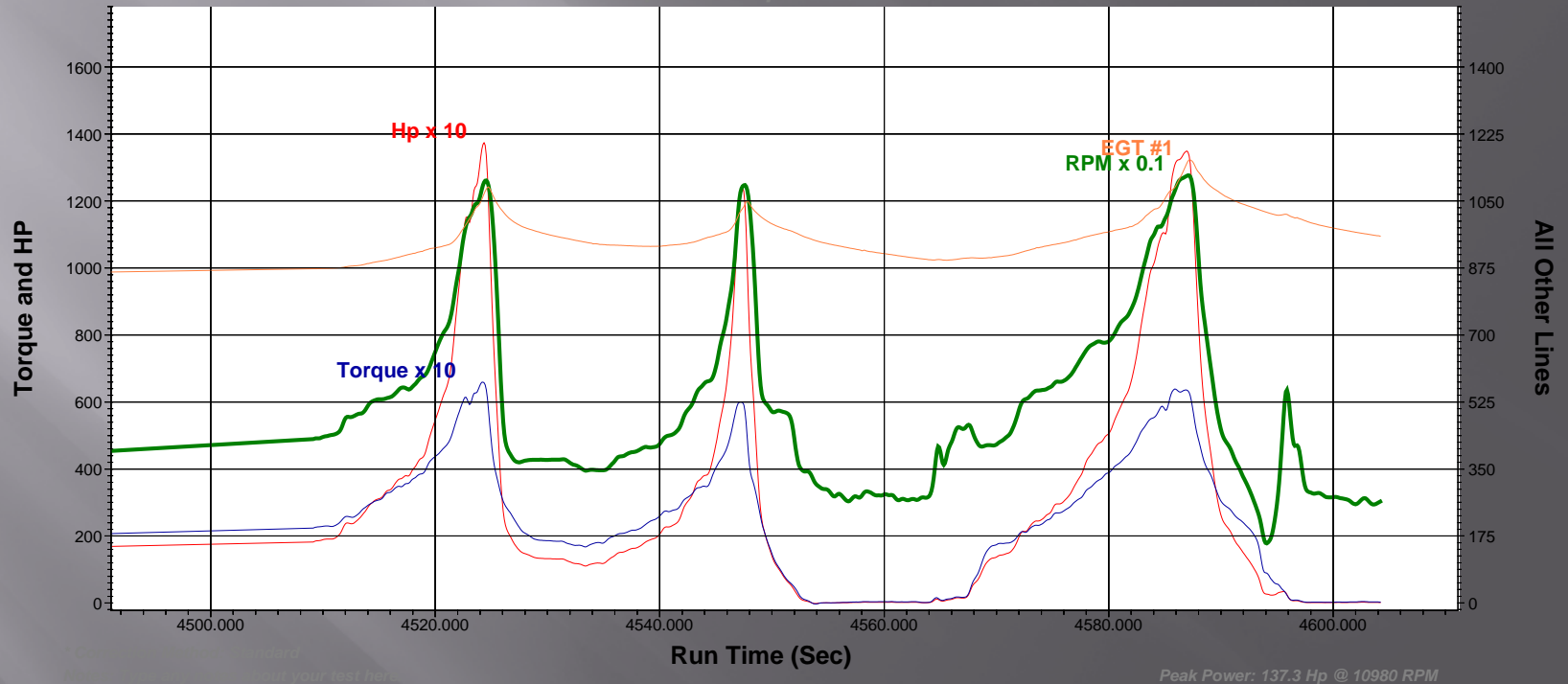
Peak Power: 129.5 hp around 11000 RPM



Dynamometer Run on E85

DYNomite test "Yamaha Phazer on 2009-03-14 @ 18-47-50" by Northern Illinois University

Torque* and Hp* vs. Time



Peak Power: 137.3 hp around 11000 RPM

Dealer Benefits

- ▣ These trim models will be additional to what Yamaha offers they will be available at dealers who choose to run the Green Program.
- ▣ With the different Trims offered each trim increases the amount of profit for the snowmobile sale.
 - Think of these trim models as the accessories but for the snowmobile.

Price vs. Profit

- ▣ The profit increases are stated below. These numbers were calculated by taking what we paid for the parts, which was usually dealer price, and doubling it then added to the base MSRP of a 2010 Yamaha Phazer GTX.
- ▣ All of the modifications to the sled maintained the stock rider position.

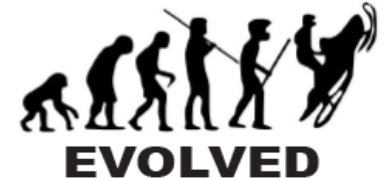
Items	Phazer RTX	Phazor ERTX	Phazor GRTX	GP Phazer
MSRP	\$ 8,299.00	\$ 9,470.90	\$ 10,240.90	\$ 12,686.00
Profiet	\$ 1,299.00	\$ 1,964.94	\$ 2,359.94	\$ 3,642.54



Questions?



NIU MotorSports CLEAN SNOWMOBILE TEAM



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