Near Zero Emission
Propane Autogas Engines

September 18th, 2017
Roush at a Glance

- Michigan-based
- Privately held
- Founded in 1976
- Over 3,700 employees
- Over 2.8 million sq. ft. office/development space

Primary activities:
- Engineering
- Testing
- Prototype Development
- Manufacturing
- Motorsports Management
Enterprise Brand Portfolio

ROUSH Industries
OEM manufacturing, engineering, prototyping and design

Roush Fenway Racing
NASCAR racing team(s)

ROUSH Performance
Industry leading high performance vehicles

ROUSH CleanTech
Propane autogas powered commercial vehicles
• Founded in 2010.

• Dedicated to developing quality alternative fuel solutions.

• Propane autogas focus.

• EPA and CARB certification.

• Platform customization to suit customer needs.

• Reduces operating costs, carbon footprint.

• OEM support through Ford and BPN dealers.

• Creating opportunities for partner companies.

• Using American fuel and American technology.
It’s A Marathon…Not A Sprint

- Technology Innovation
- Manufacturing Process
- Supply Chain Development
- Sales & Marketing Process
- Product Offering
- Service Network
Our Scorecard

17,000 VEHICLES ON THE ROAD
400 MILLION MILES
750 SCHOOL DISTRICTS

OVER 600 MILLION GALLONS OF PROPANE
Why The Hockey Stick?

- Reliable Technology & Robust Service Program
- Strong OEM Partners/Ford & Blue Bird
- 1,000 Customers & 400 Million Miles of Data
- Low Cost Infrastructure
- Plentiful Fuel
- Emerging Low NOx Certifications
- Easy to Scale
Propane Autogas Product Lineup

- Medium duty Ford trucks, chassis cabs, cutaways, and stripped chassis; and Blue Bird Type A and C school bus.

- Factory Ford warranty maintained.

- No loss of HP / torque / towing capacity.

- Serviceable with existing diagnostic equipment.

- EPA & CARB Certified.
ULTRA LOW NO\textsubscript{x} EMISSIONS
Drive for Reduced NOx

- ARB is encouraging all Manufacturers of Record (MORs) to overachieve on the NOx standard to support smog reduction.

- ARB has issued alternative standards at 0.1, 0.05 and 0.02g/bhp-hr for NOx.

- The VW settlement also includes funding that supports NOx reductions across all 50 states that offsets the increase in NOx caused by their diesel emissions.
Production Powertrain

Achievement of Ultra Low NOx starts with a high quality production engine

At Roush CleanTech, we start with:

- Ford 6.8L V10 3V Spark Ignition
- Used by Ford in all HD Vehicle applications
- F 450/550 Chassis Cab
- F 650/750 Chassis Cab
- F 53/59 Stripped Chassis
- 320 HP/460 Lbs. Ft
- Close to 2 Million in operation
- Started production in 1997
- For gasoline, meets or exceeds all emissions standards presently through 2017.
RCT Status of Low NOx

June 7th 2017 ROUSH CleanTech announces achievement of very low NOx with the 6.8L V10 Engine.

- For the 2017 MY RCT LPG Blue Bird Buses and applicable Ford Truck upfits are now certified to **0.05 g/bhp-hr NOx**.

- This is achieved with **no extra hardware or increased variable cost**.

<table>
<thead>
<tr>
<th></th>
<th>CO</th>
<th>CO2</th>
<th>NOx</th>
<th>NMHC</th>
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<tbody>
<tr>
<td>Full Useful Life STD</td>
<td>14.4</td>
<td>627</td>
<td>0.05</td>
<td>0.140</td>
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<tr>
<td>Actual Cert Level</td>
<td>2.7</td>
<td>614</td>
<td>0.03</td>
<td>0.04</td>
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</table>

- The low NOx levels were achieved through careful, significant calibration changes and a CSSR (cold start spark retard) approach.
STUDENT TRANSPORTATION
Propane School Bus Deployments
A Growing Trend

10,000 School Buses

QUALIFIED VEHICLE MODIFIER

Over 750 School Districts
FOOD & BEVERAGE
PUBLIC TRANSIT
WHERE ARE WE HEADED.....
**Blue Bird Vision Propane**

**The Most Cost-Effective Solution to Reduce NOx Emissions from School Buses**

School buses transport 25 million children across the U.S. to and from school each year. Because of the stop-and-go driving conditions, diesel buses emit increased exhaust emissions filled with tiny soot particles and toxic gases. Using the Volkswagen Environmental Mitigation Trust (EMT) to fund propane buses enables states to meaningfully reduce this harmful exposure, which benefits our nation’s children.

**PROPA**

- **Purchase price:** $85,000
- **NOx reduced:** 537 lbs.
- **Cost per pound of NOx reduced:** $177

**DIESEL**

- **Purchase price:** $90,000
- **NOx reduced:** 331 lbs.
- **Cost per pound of NOx reduced:** $272

**ELECTRIC**

- **Purchase price:** $300,000
- **NOx reduced:** 565 lbs.
- **Cost per pound of NOx reduced:** $506

- **35%** more cost-effective than diesel school buses
- **65%** more cost-effective than electric school buses

**The Union of Economic and Environmental Sustainability**

The Blue Bird Vision Propane offers unmatched ROI for school transportation fleets. States can feel confident that the investments made with the Volkswagen EMT funds will lay the foundation for schools to continue deploying low-emission buses.

**Low-Emission Engine**

The ROUSH CleanTech engine is certified to the optional low NOx level 0.05 g/bhp-hr, making it 75% cleaner than the EPA’s current emissions standard.

**Best Total Cost of Ownership**

By switching from diesel to propane, fleets can lower their fuel costs up to 50% and enjoy increased up-time with reduced maintenance.

**Uncompromised Safety**

The Blue Bird Vision Propane is noticeably quieter than a diesel bus, enabling the driver to remain focused on both the children and the road ahead.

**Clean American Energy**

Propane autogas burns far cleaner than diesel. And, because it is domestically sourced, fleets are protected from the fuel price fluctuations that frequently occur with diesel.

“With today’s tight school budgets, using a transportation fuel like propane autogas that saves taxpayers’ money, keeps the environment clean, and keeps jobs within our national borders is a win-win for everyone.”

— William Schofield, Superintendent
Hall County Schools, Gainesville, Georgia

For more information on how to successfully develop a clean school bus program in your state, contact:

**Chelsea Jenkins**
Executive Director of Government Affairs
chelsea.jenkins@roush.com
734.812.1965.

ROUSHcleantech.com
Blue-Bird.com
2016 AFLEET Emissions Tool

<table>
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- Propane is 35% more cost effective at reducing NOx than diesel
- Propane is 65% more cost effective at reducing NOx than electric
2017 AFLEET Changes

Blue Bird Vision Propane
The Most Cost-Effective Solution to Reduce NOx Emissions from School Buses

School buses transport 25 million children across the U.S. to and from school each year. Because of the stop-and-go driving conditions, diesel buses emit increased exhaust emissions filled with tiny soot particles and toxic gases. Using the Volkswagen Environmental Mitigation Trust (EVT) to fund propane buses enables states to meaningfully reduce this harmful exposure, which benefits our nation's children.

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92% more cost-effective than diesel school buses
60% more cost-effective than electric school buses

Argonne AFLEET 2017 w Diesel In-Use Multipliers

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750+ School transportation fleets in operation
10,000+ School buses in service across North America
2021: Units in Operation

- Units Introduced
- Total Accumulation

*Graph showing the units in operation from 2010 to 2021.*
WHY?

- Significant cost per mile reduction vs diesel based on lower fuel and maintenance costs
- Low cost of infrastructure
- Ample supply
- Cleaner
- Domestic
- Evidence manual grows
- Path to renewable propane
- 0.02g NOx engine in development

Best NOx reduction per dollar spent in the class 4-7 market
THANK YOU

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