



# THE PATH TO ZERO EMISSIONS THROUGH PARTNERSHIPS





**ROUSH**

## **ROUSH Industries**

OEM manufacturing, engineering, prototyping and design



## **Roush Fenway Racing**

Dominant NASCAR Sprint Cup racing team



## **ROUSH Performance**

Industry leading high performance vehicles

**ROUSH**  
CLEANTECH

## **ROUSH CleanTech**

Global leader in clean transportation solutions



ROUSH CleanTech is a Ford QVM developer and installer of dedicated propane autogas fuel systems.

Organizations with QVM status from Ford create the engine calibration, complete the on-dynamometer calibration testing, comply with all Ford engineering requirements, and develop a vehicle component package.



# Global Locations



# Markets We Serve



## Mobility

Ford  
FCA  
GM  
Blue Bird  
GAC  
Google  
Toyota  
Honda  
Hyundai  
Isuzu  
Volkswagen  
EcoMotors  
Nissan



## Defense

Navistar Defense  
BAE Systems  
AM General  
SAIC  
Textron  
FAAC  
US Army/TARDEC  
Oskosh Defense  
Hardwire  
Astradyne



## Entertainment

Disney  
Universal Studios  
The Henry Ford



## Aerospace

Bell Helicopter  
Boeing  
Pratt & Whitney  
Sikorsky  
United Launch  
Alliance



## Gas & Oil

Aramco  
Oceaneering  
Conoco Phillips  
Afton  
ProSource  
Weatherford



## Motorsports

Ford  
3M  
Aflac  
Crown Royal  
UPS  
Scotts  
Kellogg  
Vavoline  
Coca-Cola  
Fastenal



# Clean Transportation Scorecard



OVER

**40,000**

VEHICLES ON  
THE ROAD

OVER

**1 Billion**

MILES  
ACCUMULATED

OVER

**2,500**

FLEETS







- Fort Valley, GA
- Est. 1927
- 4,000 employees
- Leading Independent designer and manufacturer of school buses



- Dearborn, MI
- Est. 1903
- 175,000 employees
- American manufacturing icon



- Livonia, MI
- Est. 1976
- 3,500 employees
- Privately held company with a performance heritage



Daimler Trucks North America

- Stuttgart, Germany
- Portland, OR
- Est. 2008
- 34,000 employees
- Owned by parent company Daimler



- Weifang, China
- Wood Dale, IL
- Est. 1996
- Est. 2002
- 1,000 employees
- 91,000 employees
- Weichai buyout of PSI in 2017



- Munich, Germany
- Lisle, IL
- Est. 1831
- 13,000 employees
- Purchased in 2021 by Traton Group, subsidiary of VW

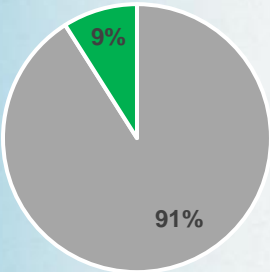




# Disruptive Growth in Alt Fuels

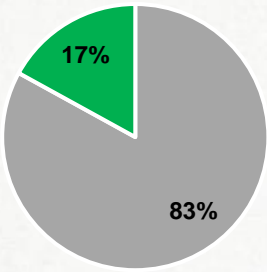


FY 2012



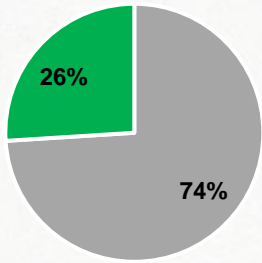
9%

FY 2014



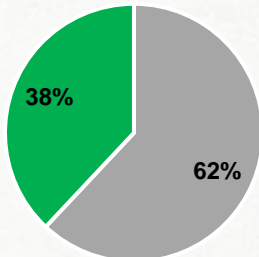
17%

FY 2016



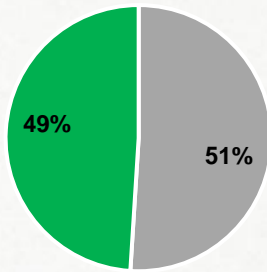
26%

FY 2018



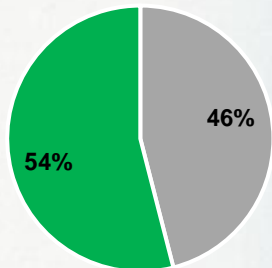
38%

FY 2019



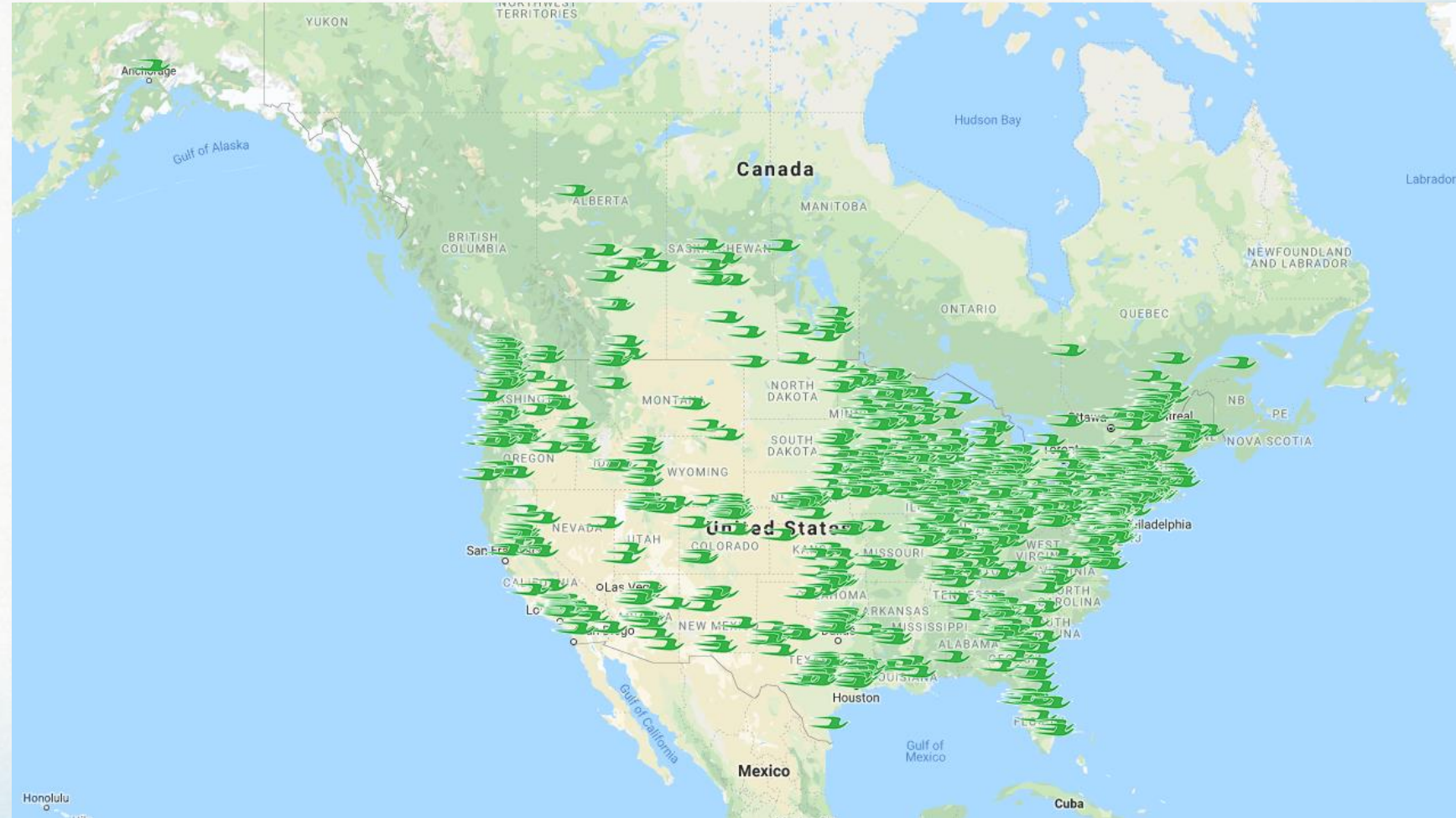
49%

FY 2020



54%









# DELIVERING RESULTS NATIONWIDE

Blue Bird and ROUSH CleanTech's propane autogas transportation solutions benefiting school districts from coast to coast.



Significantly cut operating costs.

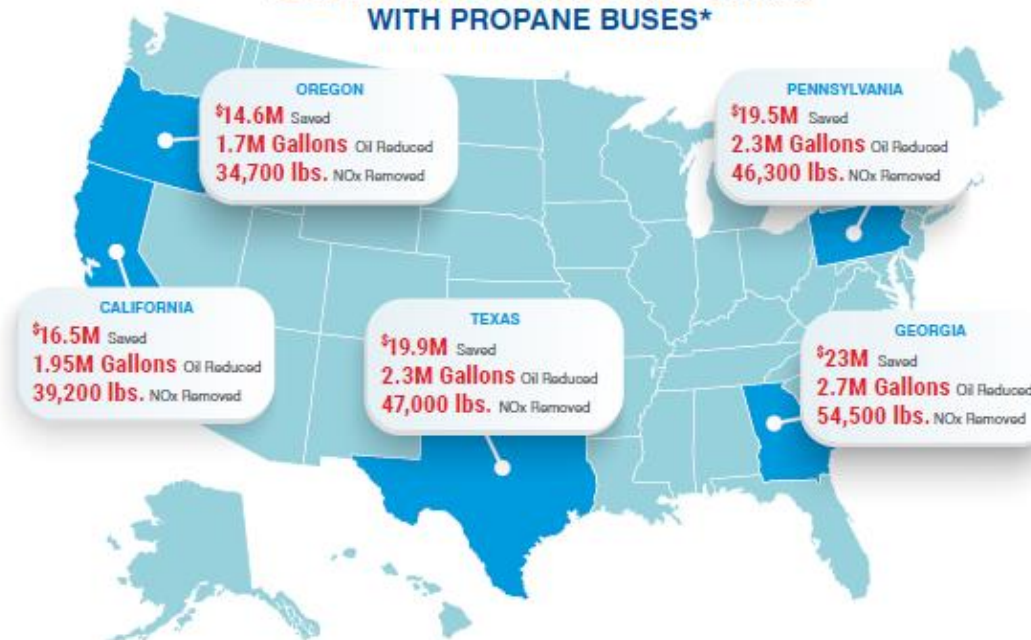


Remove harmful emissions from the air.



Use American-made domestically produced energy.






## SEE HOW MUCH STATES ARE SAVING WITH PROPANE BUSES\*



\*Total number of Blue Bird propane buses in states listed range from 860 to 1,350, with data from 2009 to 2021.



# Your Fuel Options

					
Ease of Adoption	✓	✓	✓		
Energy Independence			✓	✓	✓
NOx Emissions			✓	✓	✓
Fuel Infrastructure	✓	✓	✓		
Cost of Ownership			✓		
Range	✓	✓	✓		
Maintenance		✓	✓	✓	✓
Scalable	✓	✓	✓		
Cold Weather Operation		✓	✓		



# Ford 7.3L V8

Major OEM High-Volume Production Engine  
ROUSH CleanTech Gen5 Propane Fuel System





Meaner



Leaner

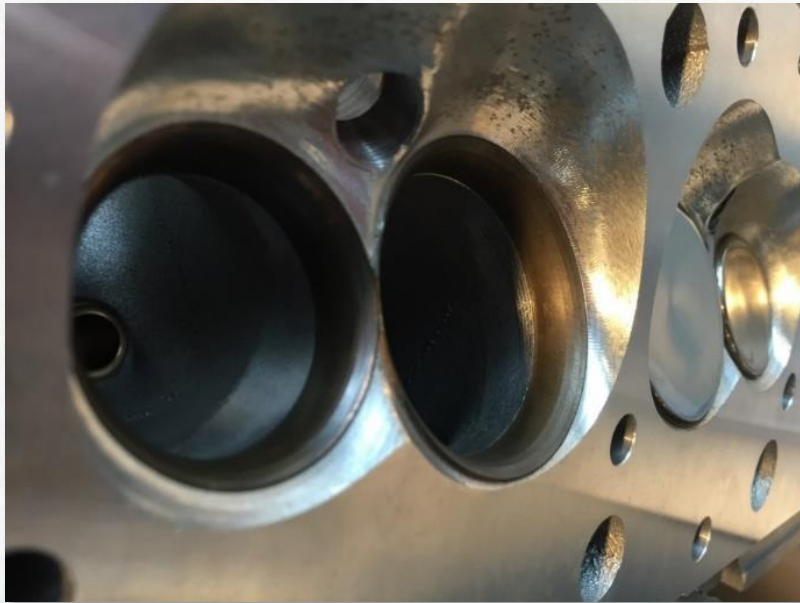
Cleaner



# Ford Purpose-Built for Propane







Inconel is a super-alloy that can withstand the higher temperatures and decreased lubricity of propane autogas



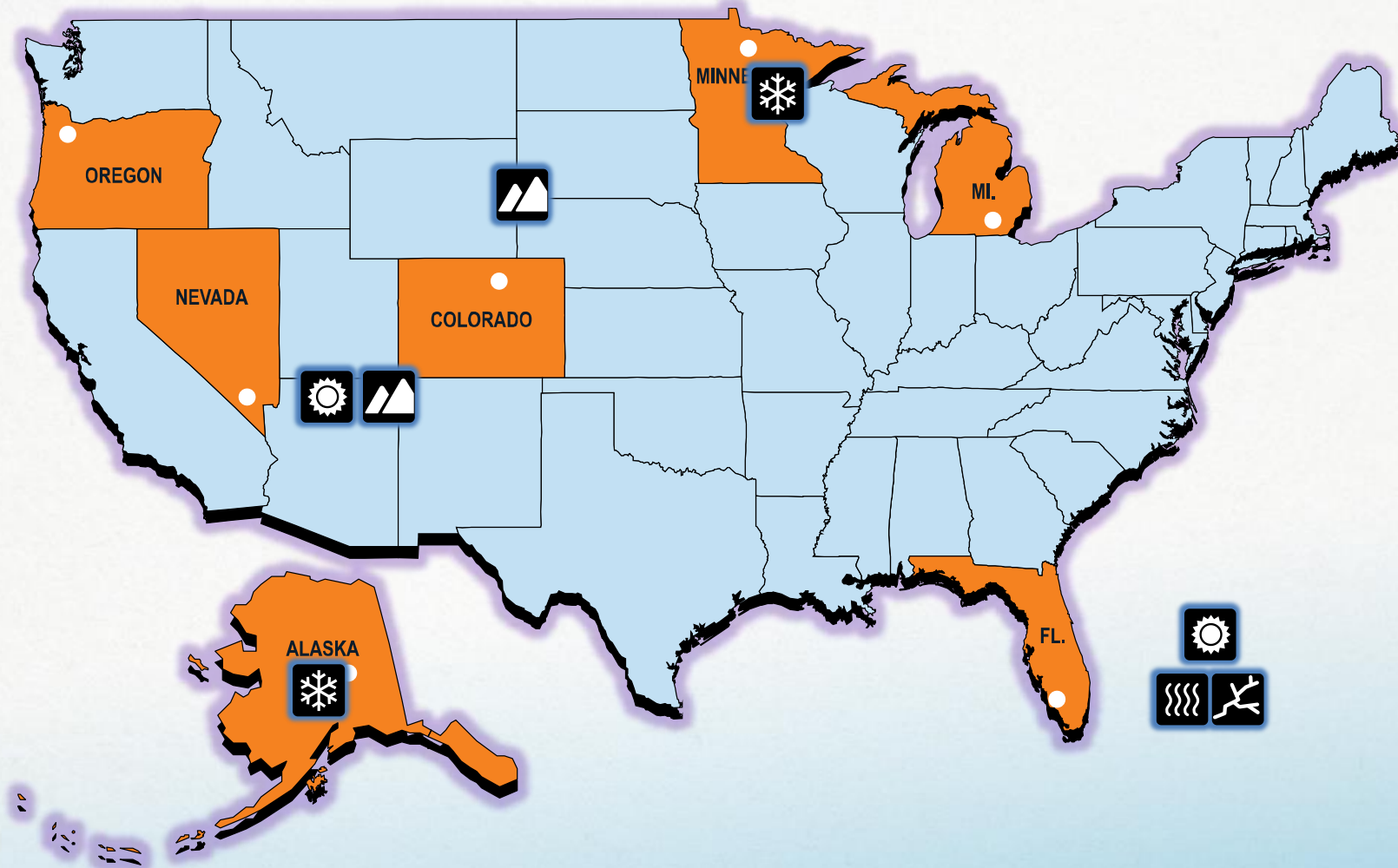
# 7.3L Engine Stats



<b>Engine RPM</b>  Idle: 680 / Max: 4,050	<b>Power</b>  HP: 350 / Torque: 468 ft-lbs. @ 3,900 RPM
<b>Design</b>  90° V8 / 445 CI / Pushrod 2V	<b>Compression</b>  10.5 to 1

7.3

# On-Road Vehicle Testing



**U.S. testing  
locations**



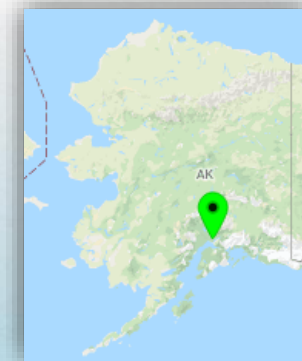
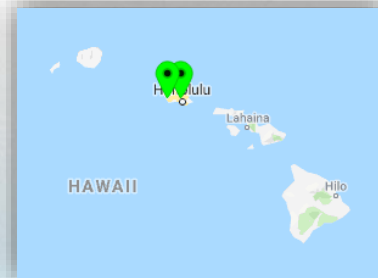
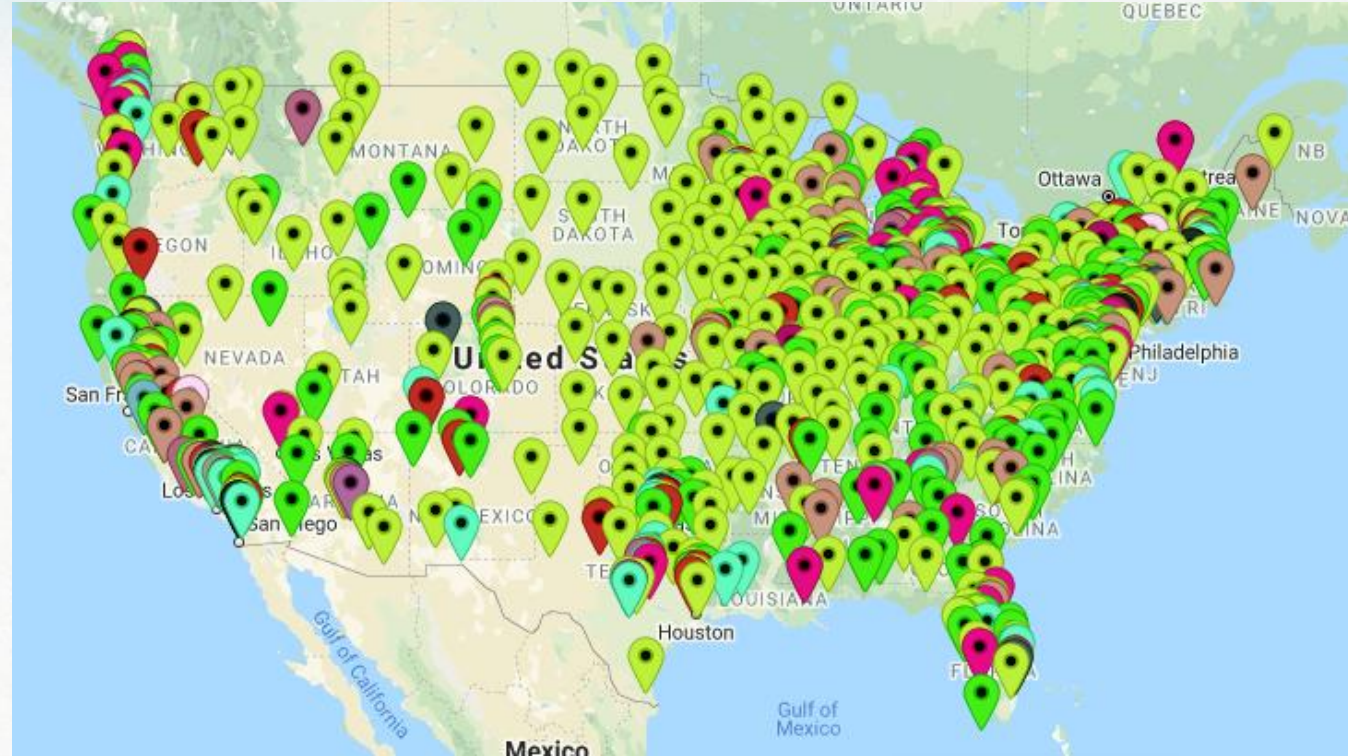
# 7.3L Scale

- Class 2 – 7
- High Volume
  - >1000 / day
  - 6X Competition
- Wide Vocational Usage
  - Parts
  - Support
  - Experience

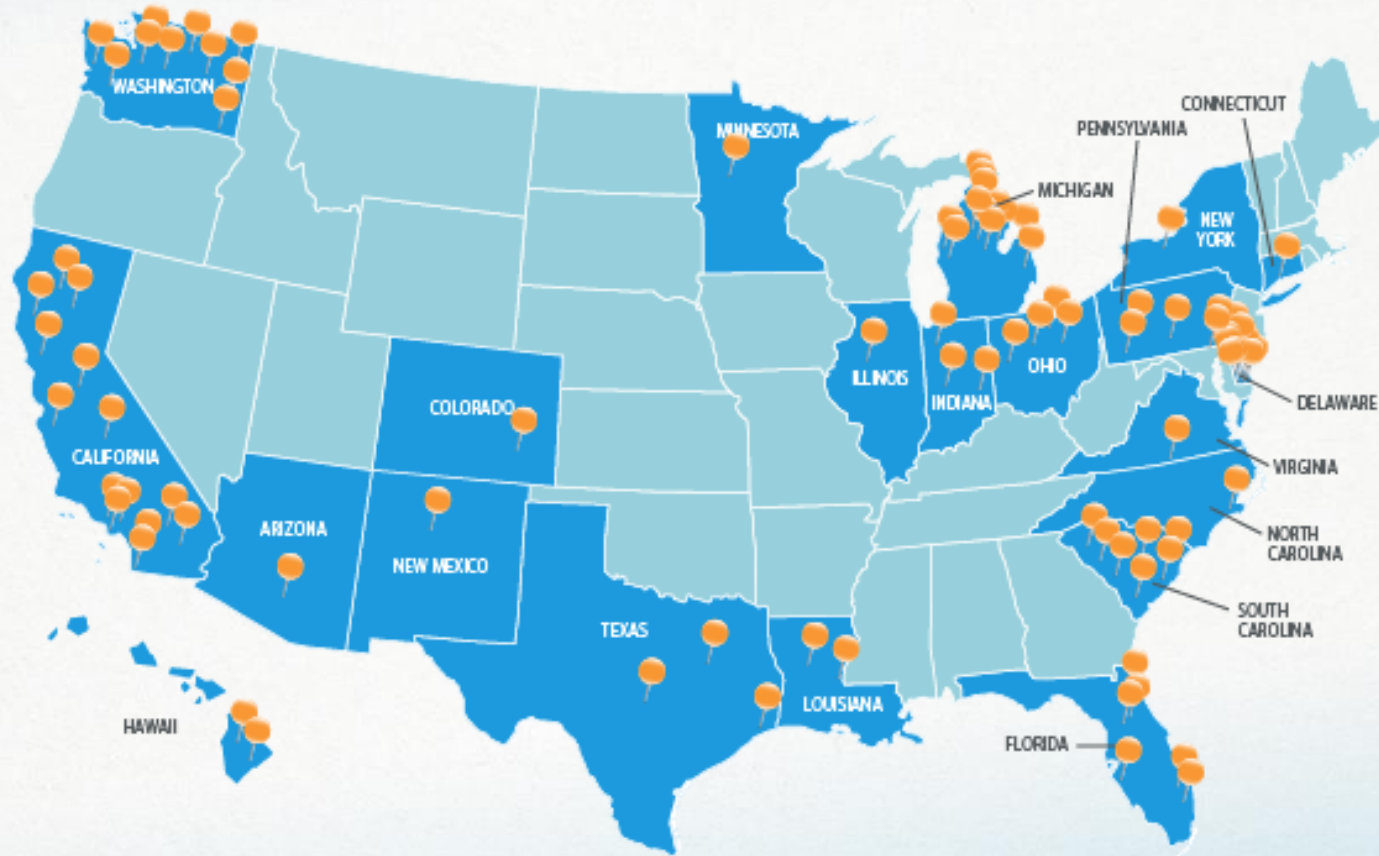




# ROUSH Commercial Deployments



# Transit Deployments





# San Diego Metropolitan Transit System

**Industry:** Paratransit

**Location:** San Diego, CA

**Vehicles:** 101 Ford F-550 / E-450 Buses



## By The Numbers:

- Reduce emissions by **2 million pounds** per year.
- Will save **\$5.8 million** over lifecycle of vehicles.
- Reduce carbon intensity by **71%**.



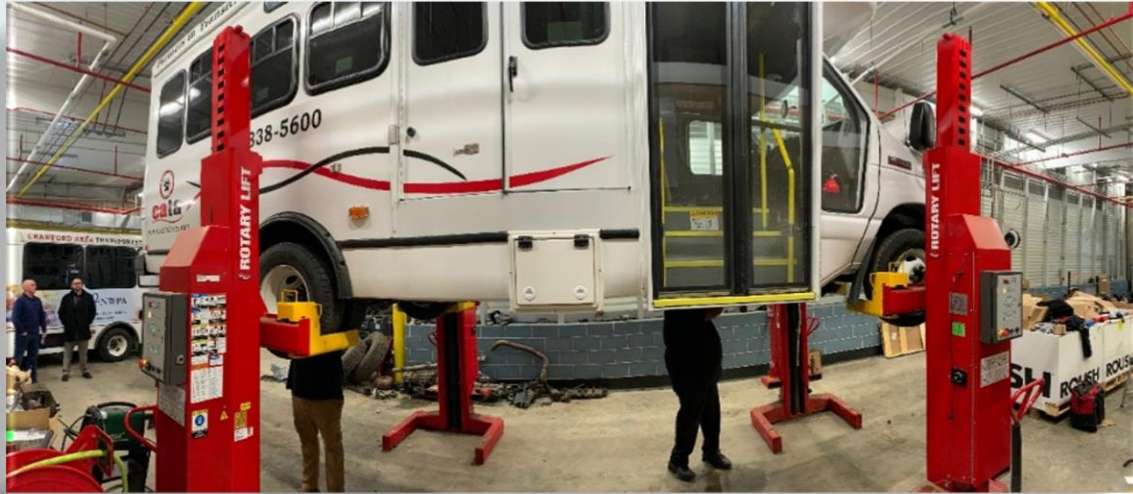
# Suburban Transit/TransNet, PA

In our continued commitment to optimize sustainability, TransNet applied for and received a grant to include additional vehicles to our fleet. This grant allowed us to purchase 14 new propane vehicles and retrofit 7 existing vehicles in our fleet. Studies have shown the overall performance of propane vehicles is better for the environment because the engines burn cleaner, making it unnecessary to change the oil as frequently, using less fossil fuel. TransNet continues to strive to do their part in reducing the carbon footprint in order to protect our environment.





## CATA – Meadville, PA (Onsite Install Capable)





# You may have seen us..





# ...rolling around your community





# Battery Electric Commercial Application



- "...[Y]ou will most likely have to pry that truck out of [the drivers] hands when you try to take it. It's a Roush...what do you expect?" – Eric McCann, Fleet Manager
- Would like to purchase 70 trucks as early as next year, but are willing to wait until 2023

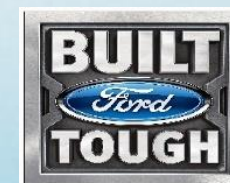
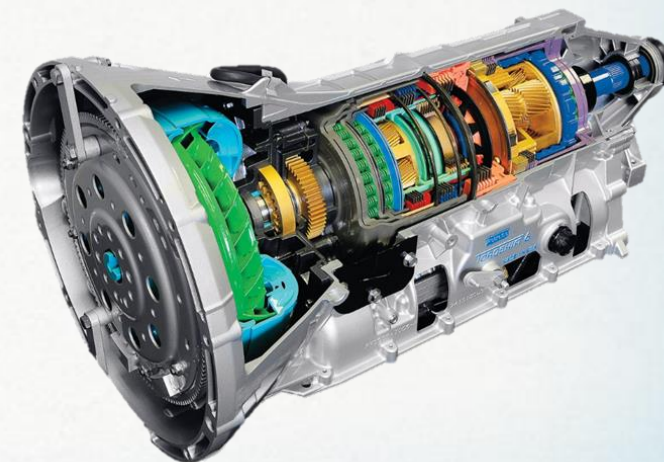






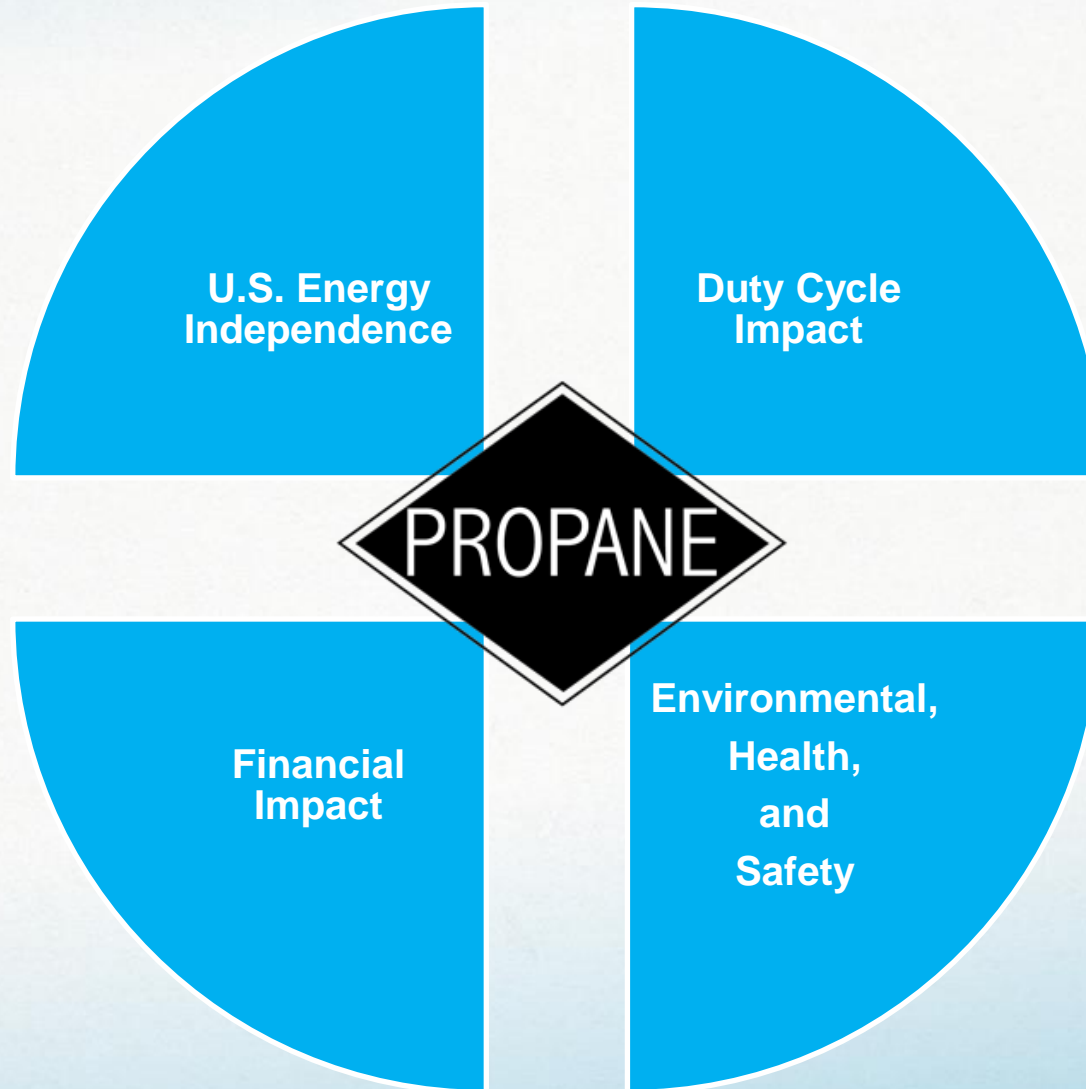
# 7.3L V8 ROUSH GEN 5



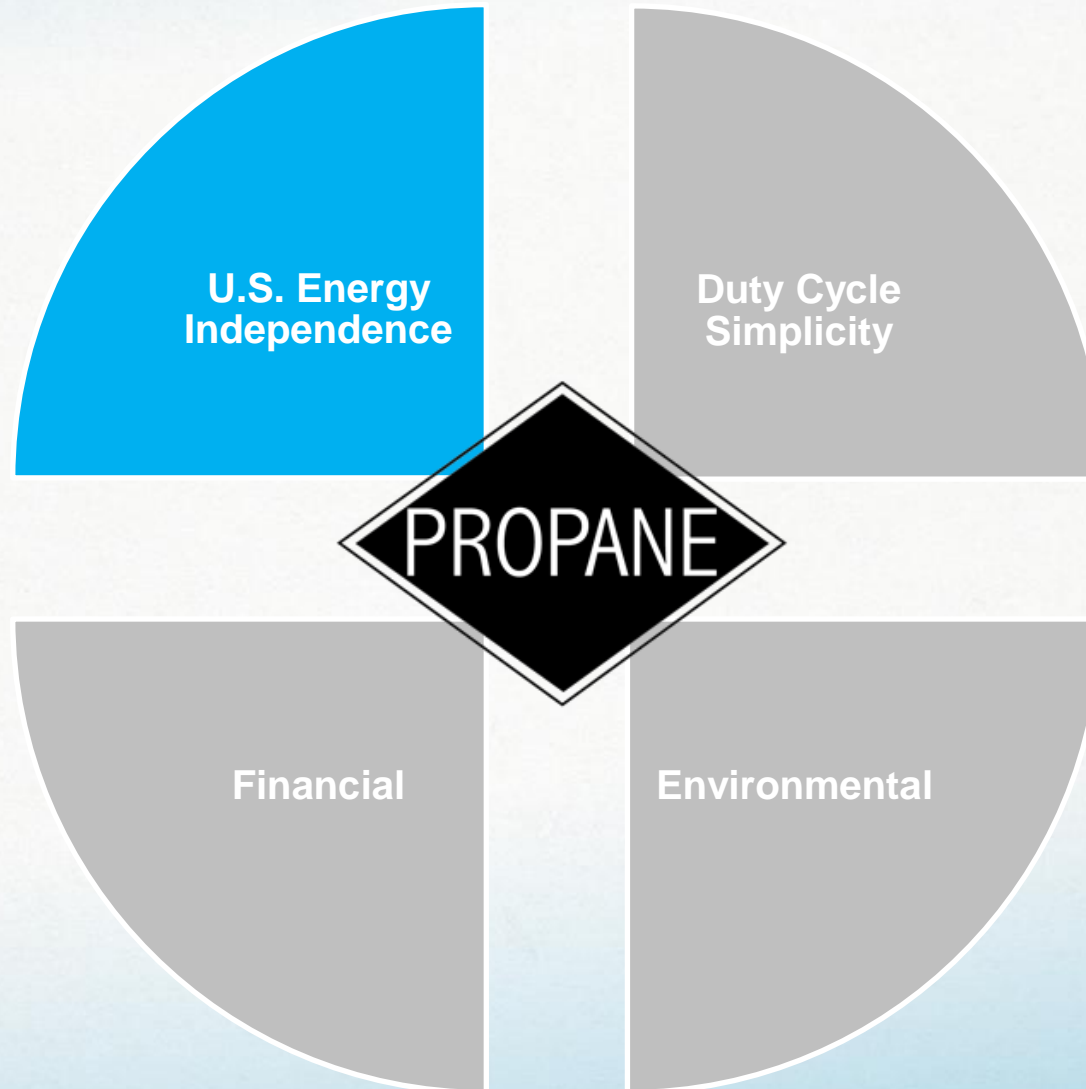




# Alternative Fuel Choices



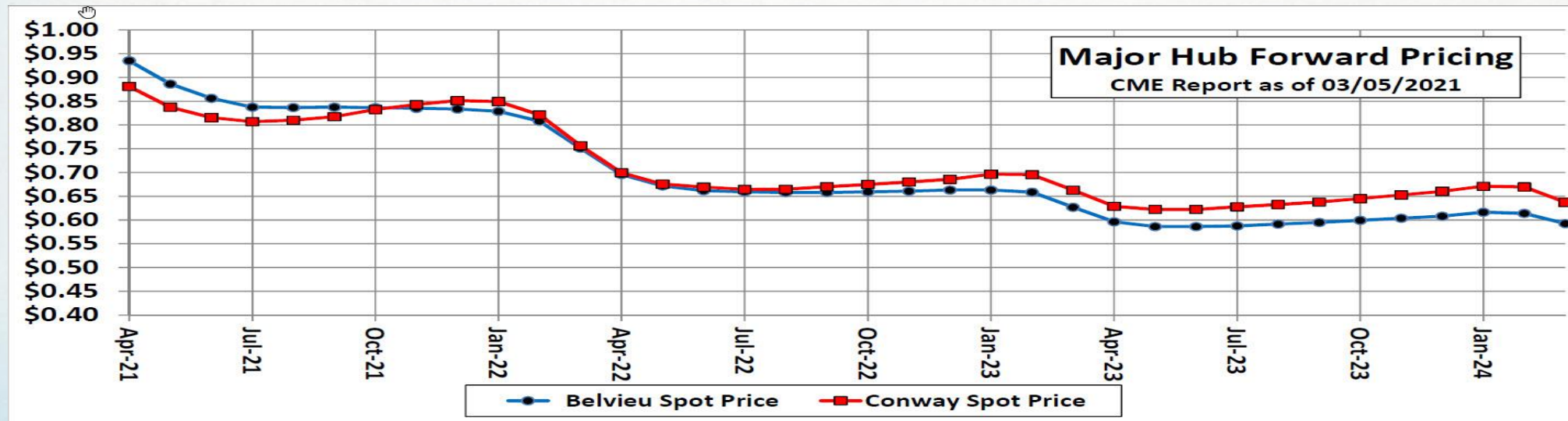
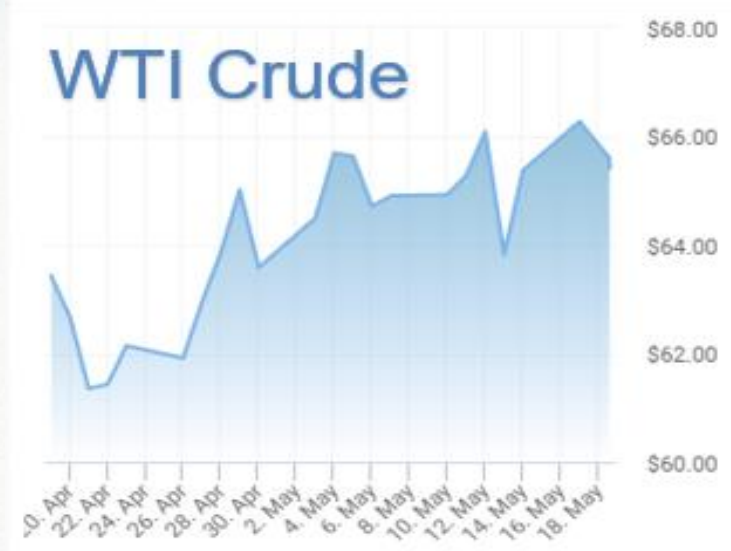
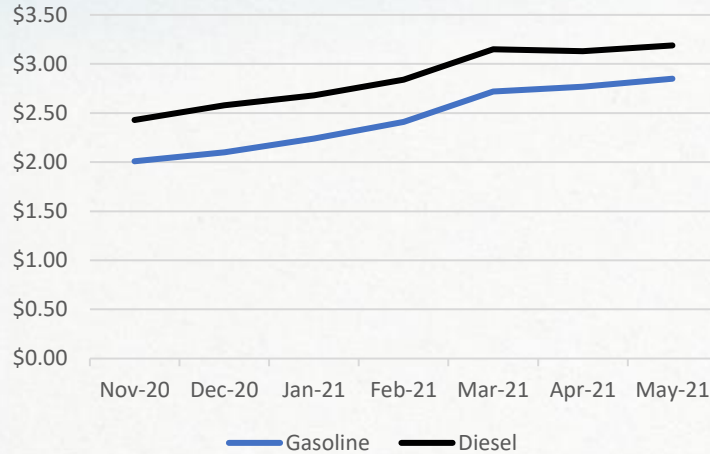
# Consideration Summary

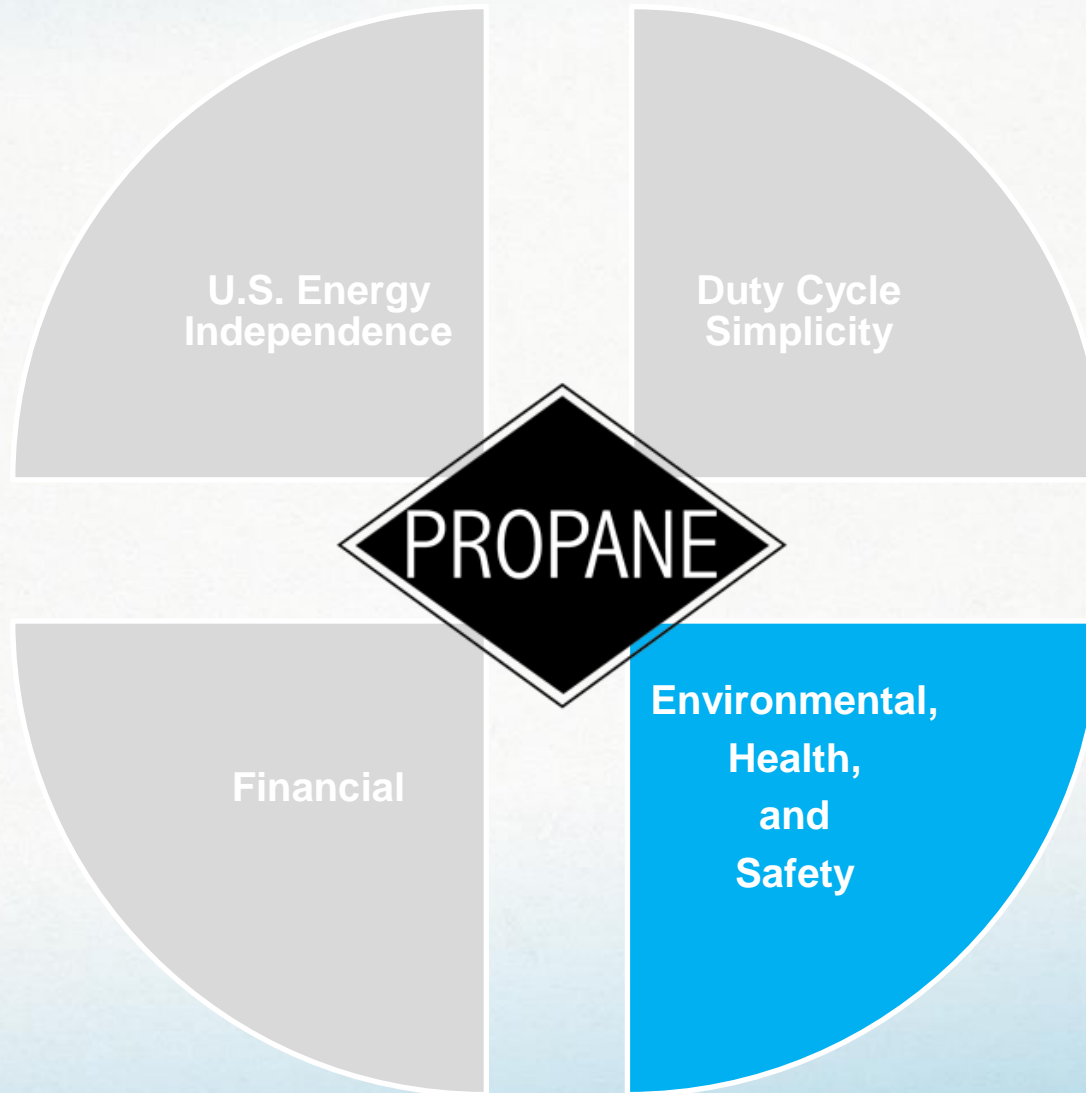




# Fuel Landscape & Trends

Gasoline & Diesel Price Trend







# LOW SCHOOL BUS EMISSIONS LINKED TO IMPROVED ACADEMIC PERFORMANCE



A first-of-its-kind 2019 study released by Georgia State University links low emission on school buses to improved academic performance.

The study found students who rode to school in alternative fuel buses like propane autogas had higher test scores in math and English compared to students who rode to school in diesel buses.



Emission Constituent	Blue Bird Vision 7.3 LPG
NOx (Nitrogen Oxides)	0.021
HCHO (Formaldehyde)	0.00
PM (Particulate Matter)	0.002
NMHC (Non-Methane Hydrocarbons)	.051
CO (Carbon Monoxide)	5.85
Greenhouse Gas Emissions	
GHG Carbon Dioxide (CO <sub>2</sub> )	545
GHG Methane (CH <sub>4</sub> )	0.032
GHG Nitrous Oxide (N <sub>2</sub> O)	0.02

- Approximate average: 70% cleaner than federal emission standards
- Meaningful impact now, without the need for grant funding



# #1 Priority IS Safety:



## Crash Testing

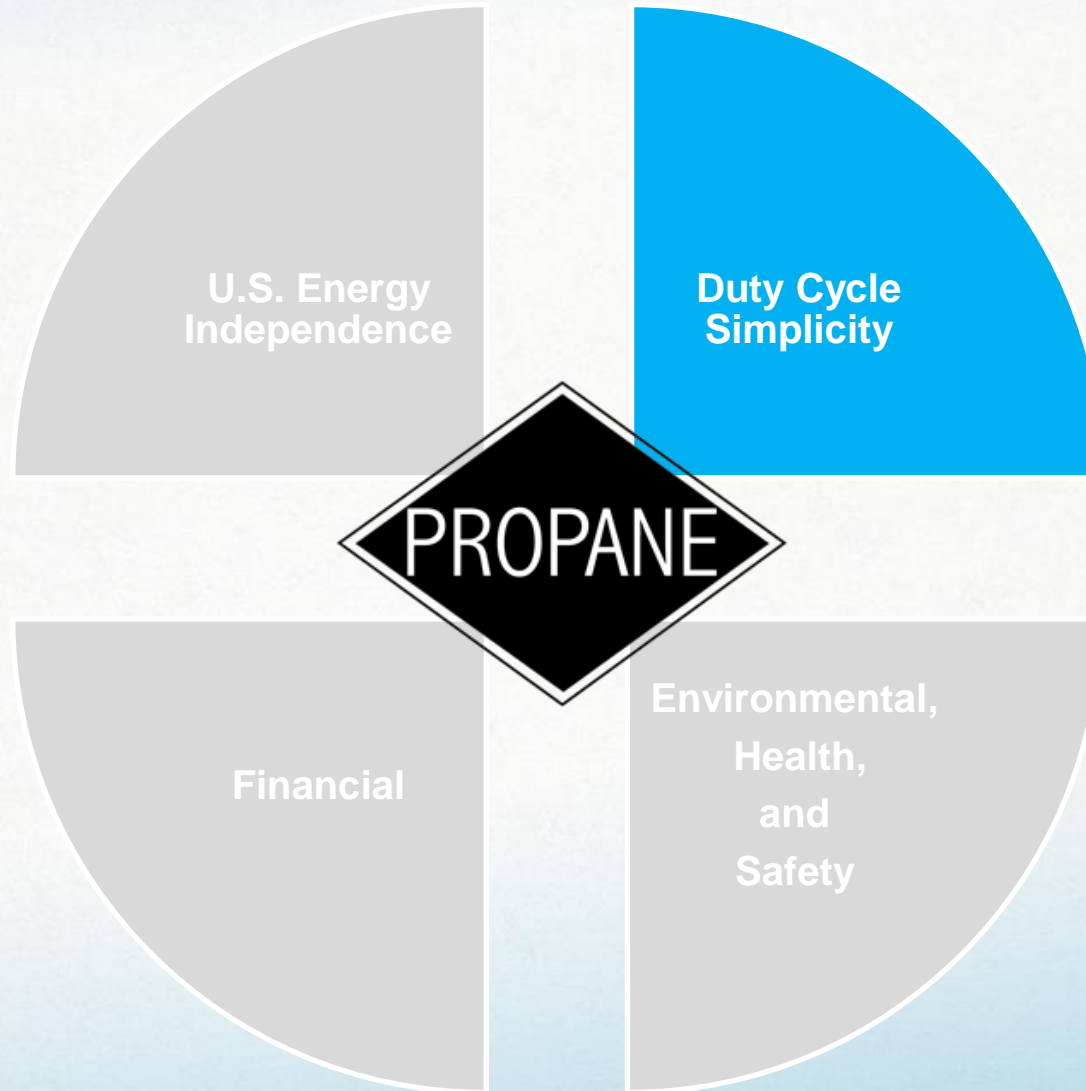
- ✓ Blue Bird is certified to Canadian Motor Vehicle Safety Standard **CMVSS 301.1** testing protocol, higher than US
- ✓ 4,000 lbs. @ 30 MPH
- ✓ Angled side and rear impact
- ✓ 220 PSI – No leaks or drop in PSI for 30 mins post crash



## Other Features

- ✓ **Colorado Rack Test and the Kentucky Pole Test**—Blue Bird is the only school bus OEM that has both tests as an engineered specification standard on all buses
  - *Colorado Rack Test: Ensures that the structural integrity of the bus remains intact in the event of a rollover accident*
  - *Kentucky Pole Test: Ensures the strength of the school bus roof in case of a pole, or another sharp object impacts the bus during a rollover*

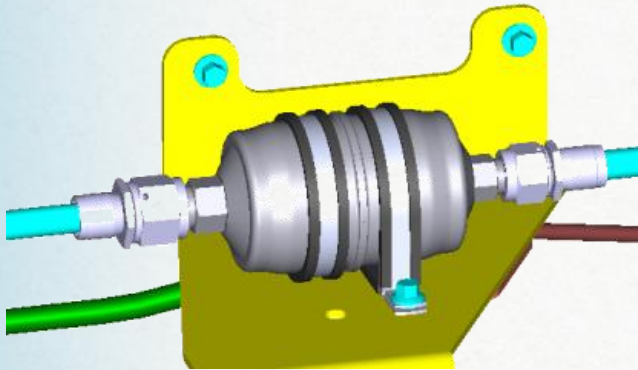
# Duty Cycle Simplicity





# Propane Maintenance – Common

Fuel filtration is the only  
unique maintenance item

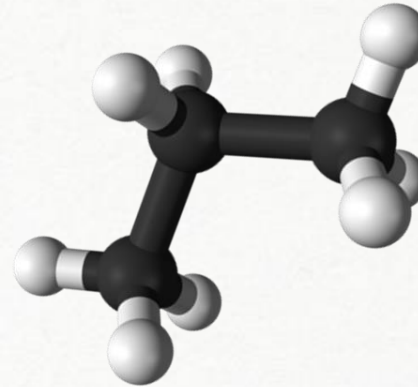


Fluids

Spark  
Plugs

Parts

Software  
IDS / RDT



Warranty  
5yr/UNL





# What is next for Diesel



## THE NEW PHASE II INTEGRATED SYSTEM CONCEPT

### HOW IT WORKS

- The integrated Rotary Turbine Control enables exhaust gases to bypass the turbine stage and enter the Close Coupled Unit after the gas has been injected with urea by the new Cummins UL4 injector.
- When combined with the Single Module™ chassis mounted aftertreatment, the concept Integrated System has the potential to improve emissions, particularly for cold start and urban driving operations.



Combining Engineering Expertise to Help Customers Address Future Emissions Control Standards

2010

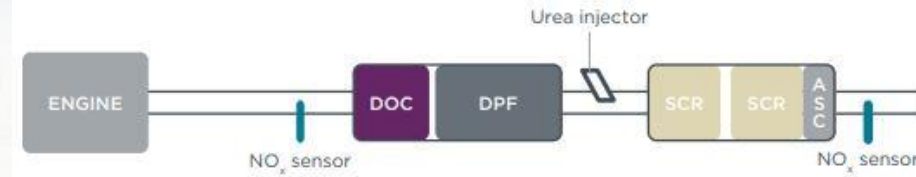


Figure 1. EPA 2010 aftertreatment system layout.

.2 NOx

2024

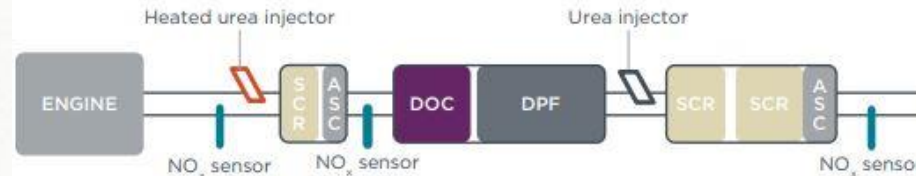


Figure 3. Potential aftertreatment configuration (No. 2) of a CARB 2024 compliant system.

.05 NOx

2027

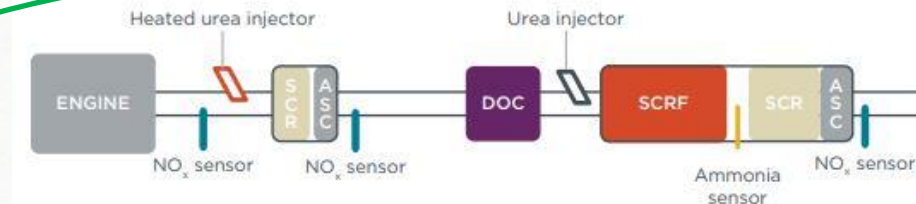


Figure 5. Aftertreatment configuration 2 to meet CARB 2027 standards under FTP and supplemental low-load cycle. Adapted from SwRI (Sharp, 2019).

.02 NOx

Source: "ESTIMATED COST OF DIESEL EMISSIONS-CONTROL TECHNOLOGY TO MEET FUTURE CALIFORNIA LOW NOX STANDARDS IN 2024 AND 2027"  
<https://theicct.org/sites/default/files/publications/HDV-emissions-compliance-cost-may2020.pdf>

LPG Meets This Today

# Preventative Maintenance

\$200.00  
Less than  
diesel

## Ford 7.3L V8

Part	Quantity	Price	Total	Total \$74.68
Element Air Cleaner	1	\$15.75	\$15.75	
Oil Spin On Filter	1	\$4.11	\$4.11	
Element, PSR, 510 Filter	1	\$24.90	\$24.90	
Mobil Special 5W-20	8	\$3.74	\$29.92	

## Cummins ISB 6.7L

Part	Quantity	Price	Total	Total \$277.15
Oil Filter	1	\$13.75	\$13.75	
Fuel Spin-On Filter	1	\$37.90	\$37.90	
Power Steering Spin Filter	1	\$9.86	\$9.86	
Fuel Filter	1	\$20.53	\$20.53	
Allison Control Filter	1	\$8.49	\$8.49	
Mobil Fleet 15W-40	18	\$2.59	\$46.62	
Cleaner, Air Element	1	\$140.00	\$140.00	



# Engine Components: Diesel

## Cummins ISB 6.7L

Part	Quantity	Price	Total
NOx Sensor	1	\$480.00	\$480.00
NOx Sensor	1	\$560.00	\$560.00
Pressure Sensor	1	\$140.00	\$140.00
Doser Injector	1	\$290.00	\$290.00
Catalyst Assembly w/ DPF	1	\$10,554.11	\$10,554.11
Temperature Sensor	1	\$78.90	\$78.90
Temperature Sensor	2	\$84.90	\$169.80
Turbo	1	\$2,731.20	\$2,731.20
Injector	6	\$755.56	\$4,533.36
EGR Valve	1	\$590.15	\$590.15
EGR Cooler	1	\$923.72	\$923.72

**Total**  
**\$21,051.24**

You will not find  
 any of these parts  
 on the Propane-  
 powered Blue Bird  
 Vision



## Ford 7.3L V8

Part	Quantity	Price	Total
PCV Hoses (2)	1	\$43.68	\$43.68
Vapor Management Valve	1	\$65.00	\$65.00
Gasket	1	\$5.99	\$5.99
Injector Assembly	8	\$215.00	\$1,720.00
Converter Assembly	1	\$910.00	\$910.00
Spark Plugs	8	\$7.08	\$56.56
O2 Sensors (all 3)	1	102.57	\$102.57
			<b>Total \$2,903.80</b>

A fraction the cost of diesel emissions parts



# Full Engine Replacement



## Ford 7.3L V8

Part	Price	Labor	Total
Ford 7.3L Engine	\$6,728.91	\$2,640.00	\$9,368.91

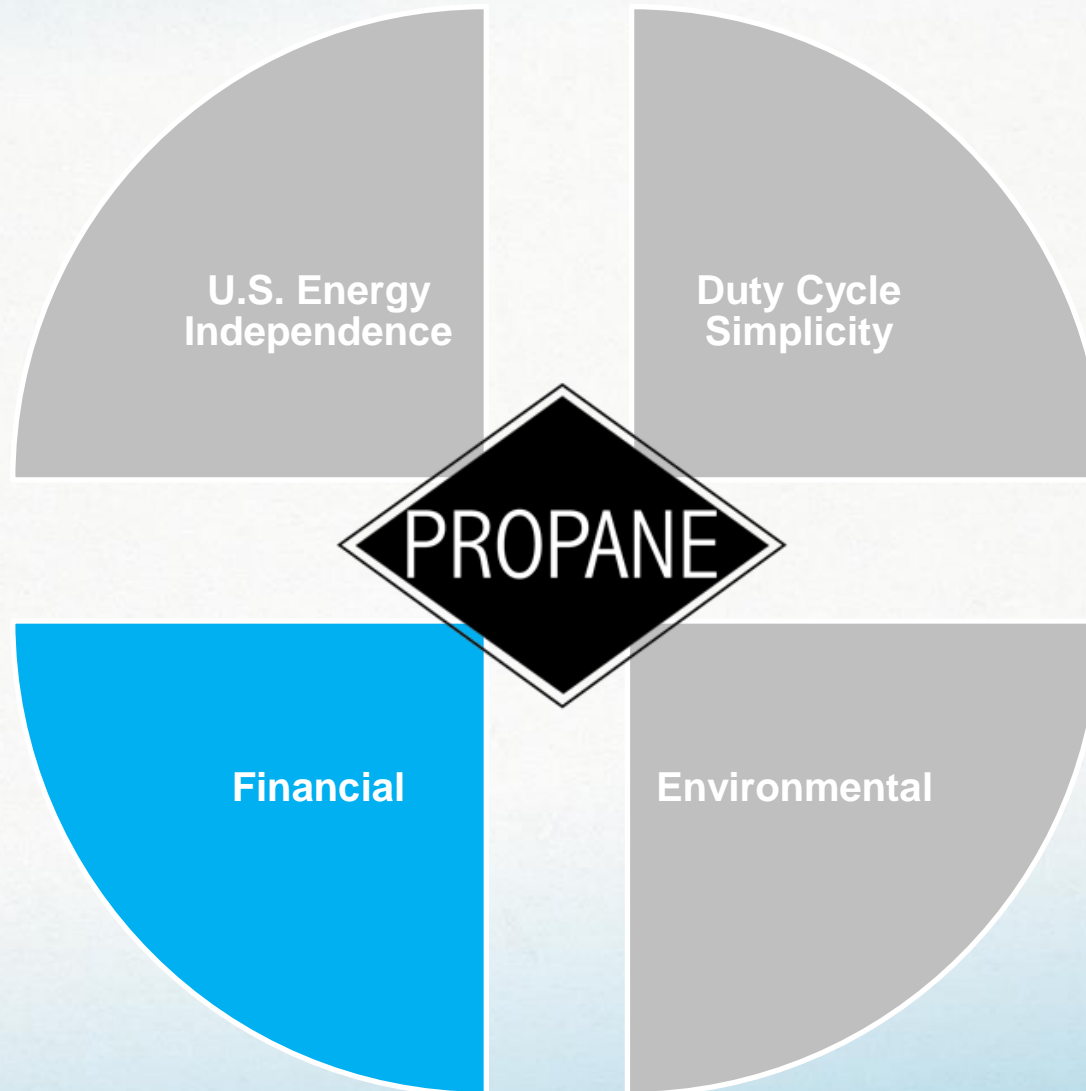
## Cummins ISB 6.7L

Part	Price	Shipping	Total
Cummins ISB 6.7L	\$18,521.98	\$400.00	\$18,921.98

## PSI 8.8L

Part	Price	Core	Total
PSI 8.8L	\$17,014.29	\$3,850.00	\$20,864.29








# Consideration Summary





## Savings Calculation (vs. Diesel)

<https://www.roushcleantech.com/school-bus-calculator/>

									
<b>FUEL</b>								<div>Propane Fuel Price</div> <div>\$1.00</div> <div>Gasoline Fuel Price</div> <div>\$2.79</div>	<div>Diesel Fuel Price</div> <div>\$2.99</div> <div>Electricity kWh</div> <div>\$0.13</div>
Annual Miles per Bus		15,000		15,000	15,000	15,000		Propane MPG	Gasoline MPG
Years Operated		15		15	15	15		4.50	6.00
Total Miles Lifetime Miles per Bus		225,000		225,000	225,000	225,000		Diesel MPG	EV Efficiency kWh/Mile
Fuel Economy (mpg)		4.50		6.00	8.00	1.40		8.00	1.40
Gallons Used Annually per Bus		3,333		2,500	1,875.00	558			
Gallons Used Total per Bus		50,000		37,500	28,125.00	8,365			
Fuel Price / Gallon		\$1.00	\$0.64	\$2.79	\$2.99	\$4.90			
<b>PREVENTATIVE MAINTENANCE</b>									
Oil Interval		5,000		5,000	7,000				
Oil Capacity (Quarts)		7		7	21				
Oil Filter Cost		\$5.00		\$5.00	\$9.36				
Cost per Oil Change		\$22.50		\$22.50	\$61.86				
Lifetime Oil Change Total Cost		\$1,012.50		\$1,012.50	\$1,988.36				
DEF Lifetime Cost					\$2,126				
Fuel Filters Change Interval		50,000			15,000				
Fuel Filters Cost		\$160			\$12.99				
Total Filters Changes		4			15				
Fuel Fiter Cost Lifetime		\$640			\$194.85				
<b>Total Cost</b>		<b>Propane</b>	<b>Propane</b>	<b>Gasoline</b>	<b>Diesel</b>	<b>EV</b>		<b>LPG Fuel Rebate</b>	<b>EV Bus Grant</b>
Lifetime Cost		\$151,653	\$133,653	\$193,638	\$181,403.21	\$190,000.00		\$0.36	\$150,000.00
Lifetime Savings		\$29,751	\$47,751	-\$12,234		(\$8,597)			
Cost per Mile		\$0.67	\$0.59	\$0.86	\$0.81	\$0.84		<b>LPG Bus Grant</b>	<b>Diesel Bus Grant</b>
			<b>Grants</b>			<b>Grants</b>		\$0.00	\$0.00

# Alternative Fuel Tax Excise Credit



Annual tax credit included in federal budget to promote alternative fuel adoption

Currently approved for 2018, 2019, and 2020, 2021 calendar years

Propane is funded at \$.36 per gallon

Included in federal budget since 2008



Credit for infrastructure also included, propane and natural gas are eligible for 30% of the cost, not to exceed \$30k per property.



More information available

<https://afdc.energy.gov/laws/319>



# CUSTOMER SUCCESS

Delivering on the ROUSH CleanTech Promise



# How We Deliver Our Promise

## Order Management



Bridge between sales and operations

Timely processing of orders

Communication of status to key stakeholders

## Service Network



The right partners in the right locations

Trained technicians

Smooth on-boarding process

## Technical Publications



How to use and service the product

Guidelines for maintenance and repair

## Training



Interactive web-based courses

Factory workshops

On-site, hands-on

## Warranty & Tech Support



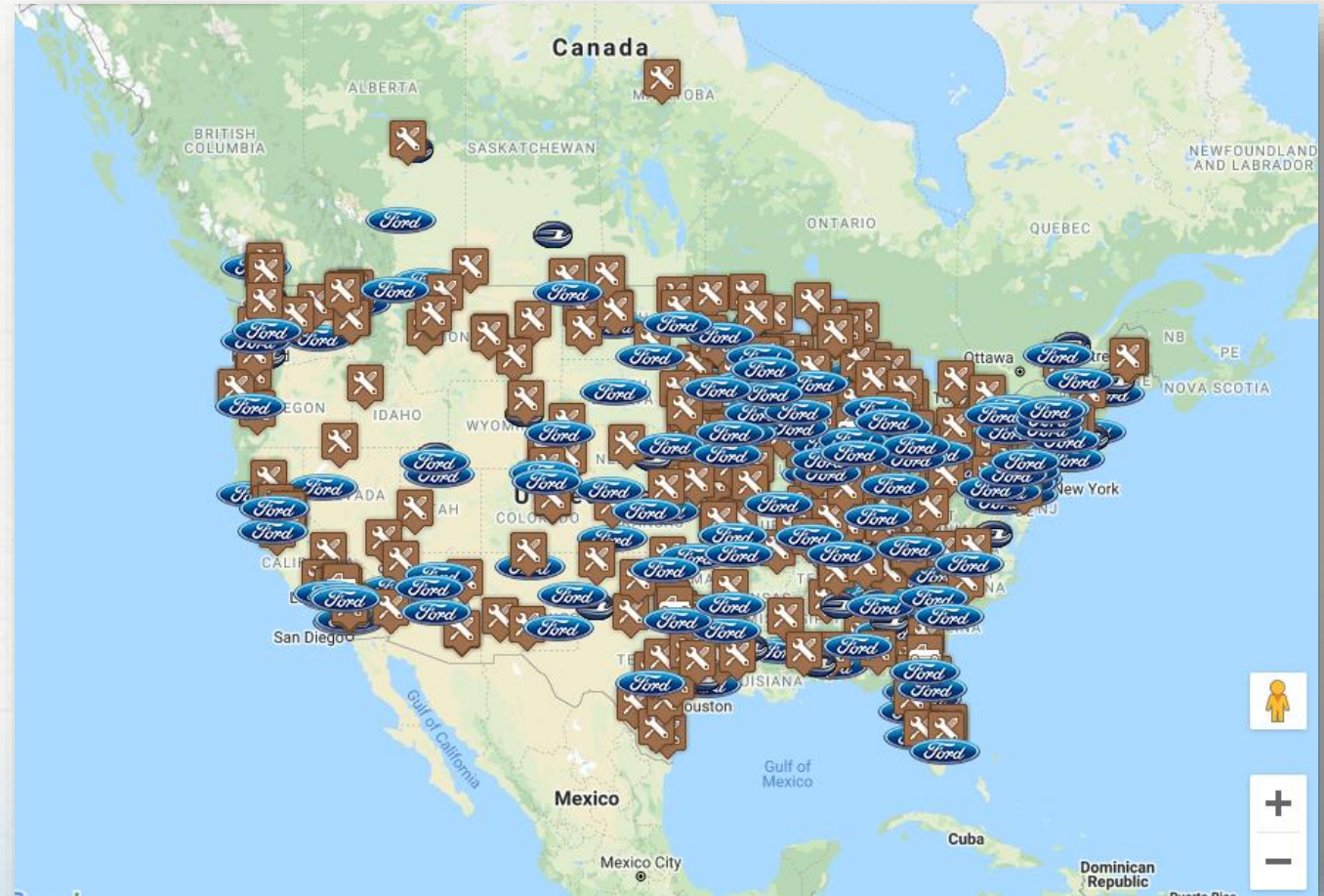
Guided diagnostics and troubleshooting

Quick replacement part identification and delivery

# Service Network Coverage



Independents:	446
Ford Dealers:	236
Blue Bird Dealers:	76
Mobile Service:	5
<b>Total:</b>	<b>763</b>







THANK YOU

Derek Whaley  
Business Development  
(734) 780-4418

[Derek.Whaley@ROUSH.com](mailto:Derek.Whaley@ROUSH.com)