
ENERGY 2003

12 August, 2003



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POWER SYSTEMS

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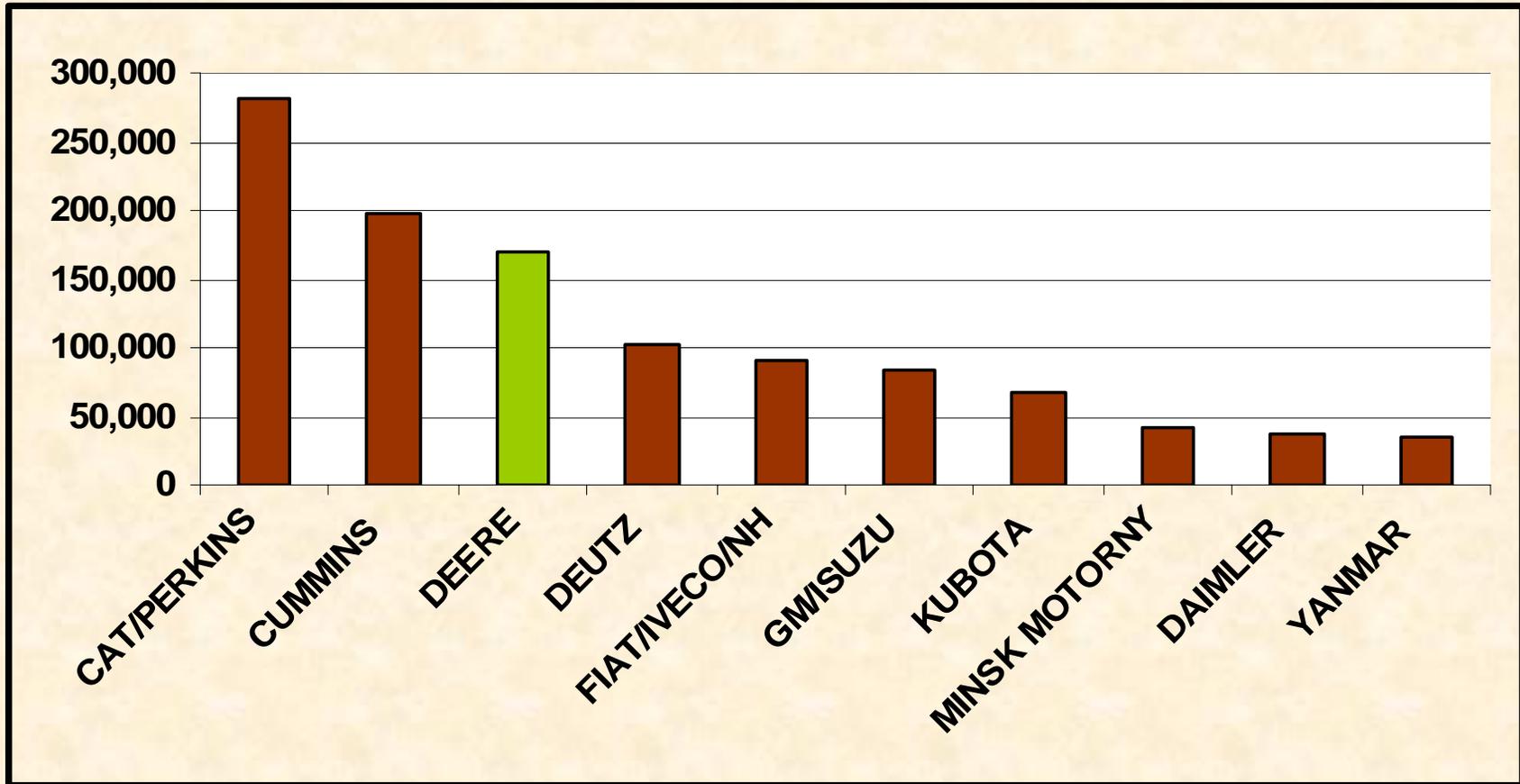
April 2003

AGENDA TOPICS

- **Deere CNG Background**
- **Technology - *today and tomorrow***
- **Applications**
- **Product Support**



2001 OFF-HIGHWAY DIESEL PRODUCTION (50-600 HP)



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DEERE NATURAL GAS - ON-HIGHWAY

Production released in 1996

- In response to industry need for reliable/high performance NG engine
- Initial product development began in 1994
 - Original design incorporated today's advanced technology
 - Generated 1.6 million test miles prior to production
 - Testing validated design and drove successful product launch



DEERE NATURAL GAS - ON-HIGHWAY

6081 NG engine built off of Diesel Heritage

- Diesel ratings up to 375 HP / 1007 Lb-Ft
- Leader in Agricultural market - 70% plus Load Factor
- Construction equipment (4WD Loaders / Excavators / Skidders)
 - Variability in speed and loading
 - Abusive environment
- Focused approach - transit style school bus only!!!
 - CNG - 250 HP @ 800 Lb-Ft (4 gr NOx)



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DEERE NATURAL GAS - ON-HIGHWAY



Outstanding customer acceptance drove release to other key applications

- **Medium Duty Truck market - 2000**
- **Refuse Truck market - 2001**
- **40' Transit Bus market - 2002**



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ON-HIGHWAY CNG ENGINES



6081HFN
Truck
275 HP @ 800 Lb.Ft.
280 HP @ 900 Lb.Ft.



6081HFN
Bus
250 HP @ 800 Lb.Ft.
280 HP @ 900 Lb.Ft.



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AGENDA TOPICS

- Deere CNG Background
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DEERE NATURAL GAS ENGINES

Customer Expectations of Deere CNG Engines

- Diesel-like:
 - Driveability
 - Reliability
 - Cost of Ownership
 - » Fuel Economy
 - » Maintenance
 - » Durability
 - Serviceability



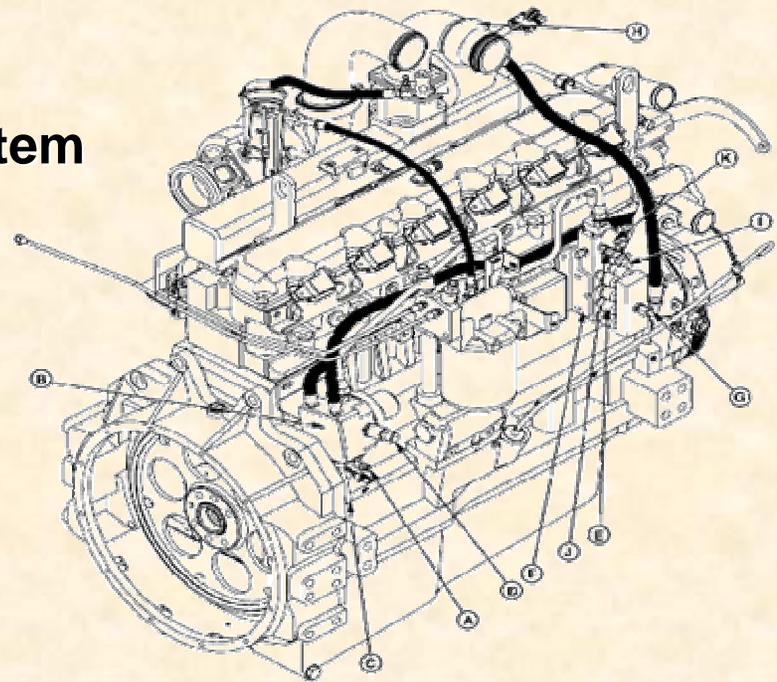
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DEERE PRODUCT FEATURES

Advanced Technology!

- 8.1L based on heavy-duty diesel engine platform
- Unique cylinder head
- Lean burn combustion
- Full authority electronic control system
 - Closed loop fuel control
 - Adaptive learn
 - Knock Detection
 - Humidity Sensor
 - Engine Protection

FUEL CONTROL ON A 6081 CNG ENGINE

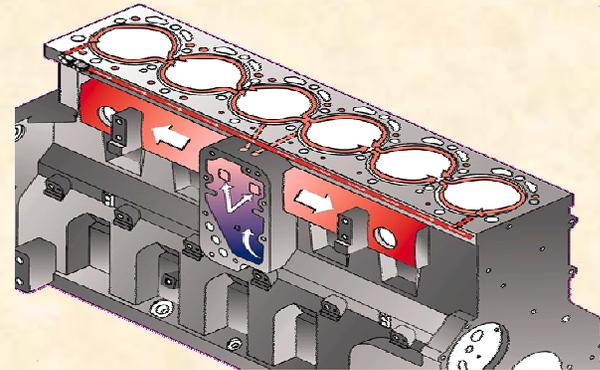


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HEAVY-DUTY DIESEL ENGINE PLATFORM

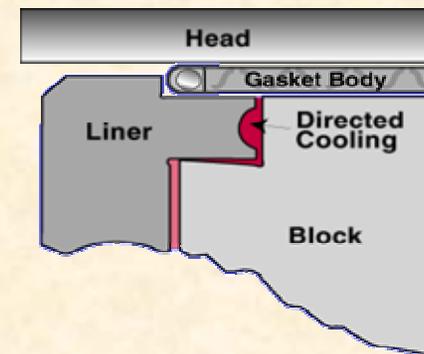
- **8.1 NG engine utilizes diesel bottom-end**

- Block
- Crankshaft
- Large bearing areas
- Connecting Rods
- Hardened Wet Liners
- Low Mount Oil Pump



- **Top Liner Cooling**

- Lowers upper-liner temperature significantly improving life of the power cylinder and head-to-block joint



LEAN BURN COMBUSTION

Delivers diesel-like engine thermal efficiency

- Fuel Consumption (dgc) basis
- Heat rejection similar to diesel
 - Less heat results in less thermal stress!
 - Lower under-hood temperatures
 - Cooling system package size and cost

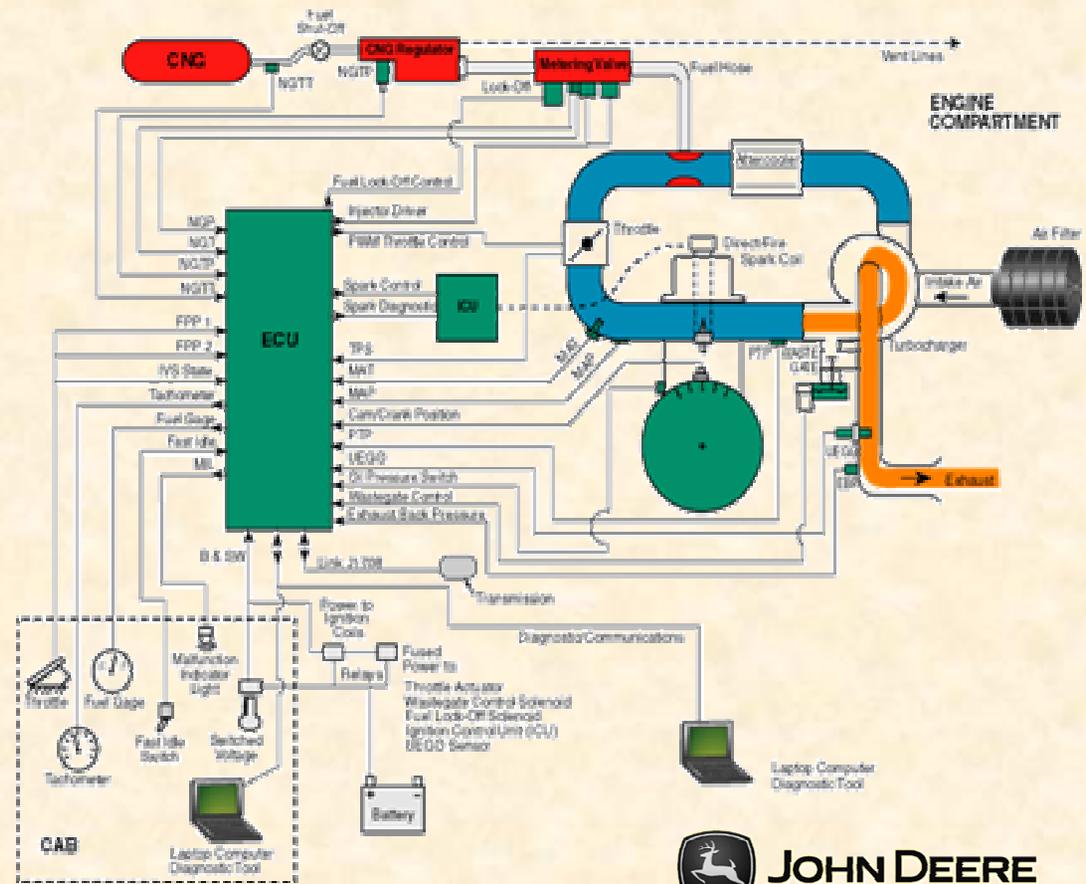


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FULL AUTHORITY ELECTRONIC CONTROL SYSTEM

- Adapts to variant ambient conditions – monitors engine and parameters to maximize engine efficiency

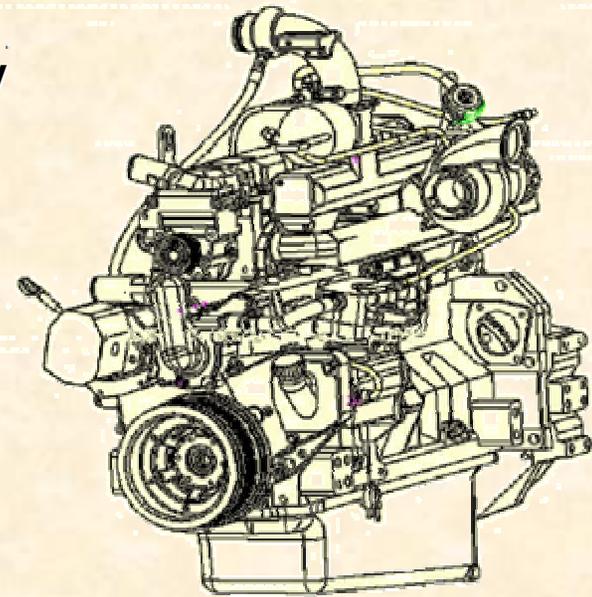
- Closed Loop Fuel Control
- Adaptive Learn
- Knock Detection
- Humidity Sensor
- Electronic Features



DEERE PRODUCT FEATURES

HFN04 – *Next Generation Technology!*

- Deere proprietary controller
 - Processing speed – calibration flexibility
 - Electronic features demanded by on-highway applications
- Combustion design improvements
 - Piston
 - Air management
- Incorporates new high volume/reliable engine components
- Engine performance enhancements
- LNG / CNG Capable
- Platform for emission reduction



DEERE EMISSION REDUCTION

EMISSION STANDARD

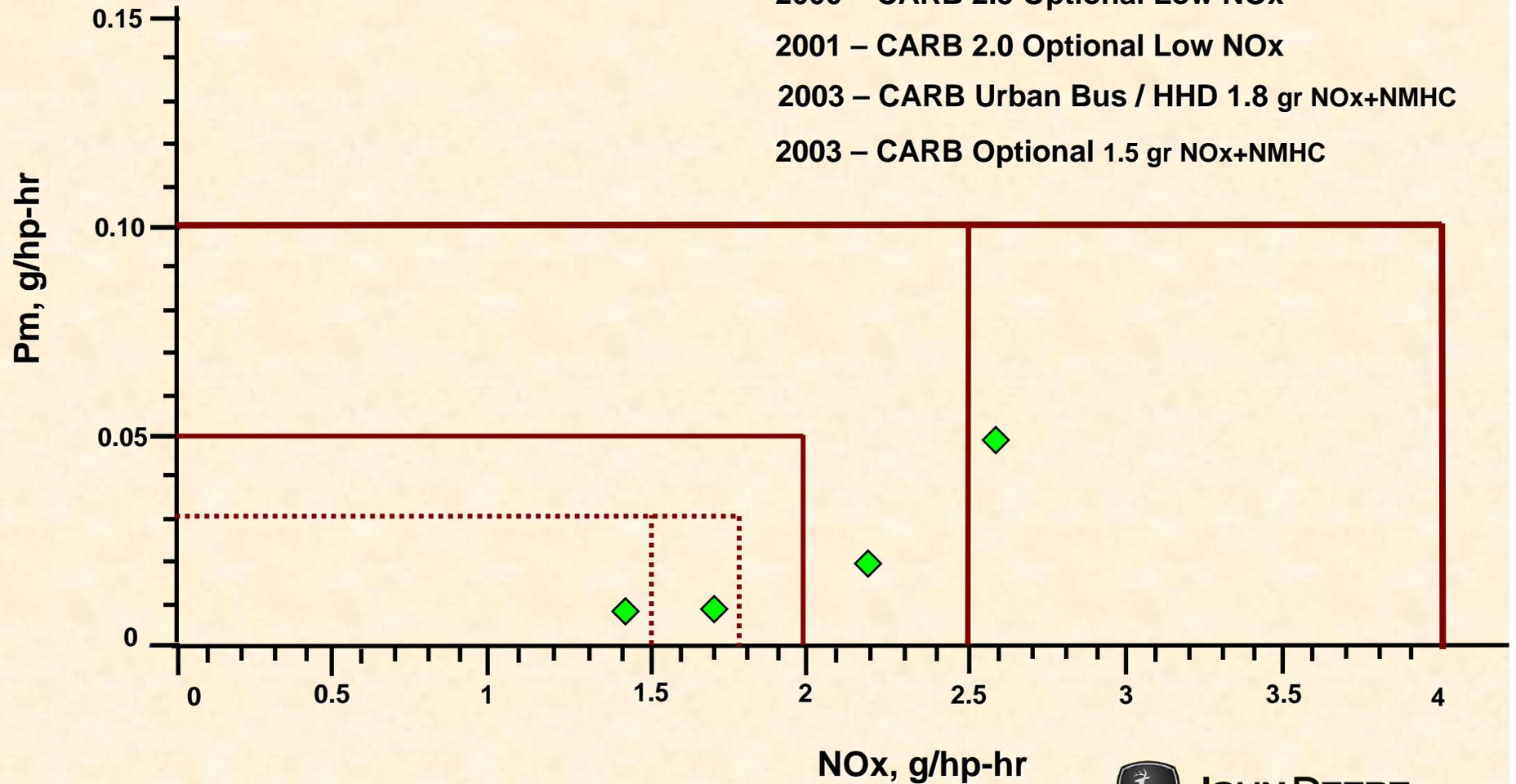
1996 - 1998 – thru 2003 EPA

2000 – CARB 2.5 Optional Low NOx

2001 – CARB 2.0 Optional Low NOx

2003 – CARB Urban Bus / HHD 1.8 gr NOx+NMHC

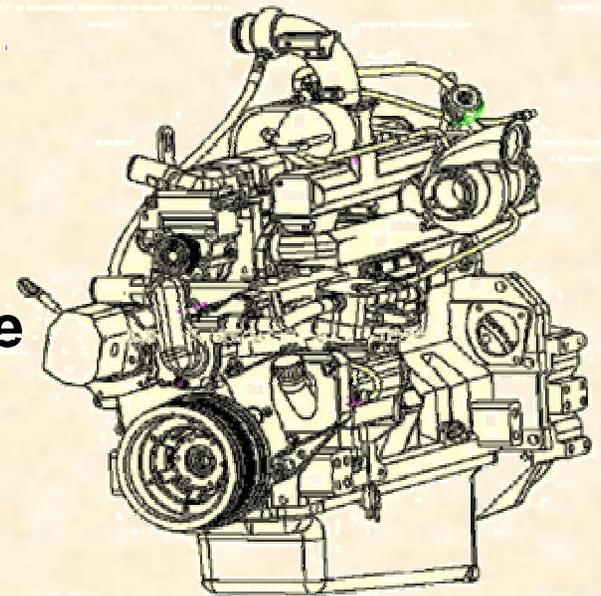
2003 – CARB Optional 1.5 gr NOx+NMHC



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TECHNOLOGY CONCLUSIONS

- **Deere NG engines utilize comparable sized diesel engine installation accessory components**
 - Heat rejection comparable to diesel
 - Intake and exhaust flows comparable to diesel
- **When properly geared, Deere CNG engines provide outstanding performance**
- **Deere NG engines have demonstrated diesel-like operating economics**
 - Reliability
 - Fuel economy
 - Maintenance costs



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COMMERCIAL APPLICATIONS

Transit Style School Bus



Commercial Bus



40' Transit Bus



Class 6 / 7 / 8 Trucks



Refuse Trucks



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SCHOOL BUS APPLICATIONS



BlueBird



Thomas

. Type D Transit style school bus was first on-highway market for Deere CNG engines

- Production released in 1996
- 8.1 250 HP @ 800 Lb-Ft (Optional 1.5 gr NOx+NMHC)
- Overwhelming customer acceptance
 - » Deere CNG engines have built a strong reputation for delivering diesel-like fuel economy and cost of ownership
 - » Deere currently enjoys ~100% NG share of this market



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COMMERCIAL BUS



Blue Bird Q-Bus
29' and 35' Configurations



Thomas Bus - Transit Liner

- **8.1 (250 HP @ 735 Lb-Ft)** Optional 1.5 gr NO_x+NMHC / 1.8 gr NO_x+NMHC Urban Bus standard



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HEAVY-DUTY TRANSIT BUS

250 HP @ 735 Lb-Ft // 280 HP @ 900 Lb-Ft) 1.8 gr NOx+NMHC Urban Bus standard



MetroLink – Rock Island



Atlanta Metro Transit



Washington Metro Transit



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CLASS 7 / 8 TRUCKS

Freightliner FL 70



- Utility, Dump, P & D Applications
 - 8.1 (250 HP @ 800 Lb-Ft) Optional 1.5 gr NOx+NMHC July 2003



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REFUSE TRUCKS

Crane Carrier LCF & LET2



- Front Loader / Side Loader / Rear Loader applications
 - 275 HP @ 800 LB-FT Allison MD Optional low 1.8 gr NOx+NMHC
 - 280 HP @ 900 LB-FT Allison HD Optional low 1.8 gr NOx+NMHC
- **CNG and LNG Capable!!**



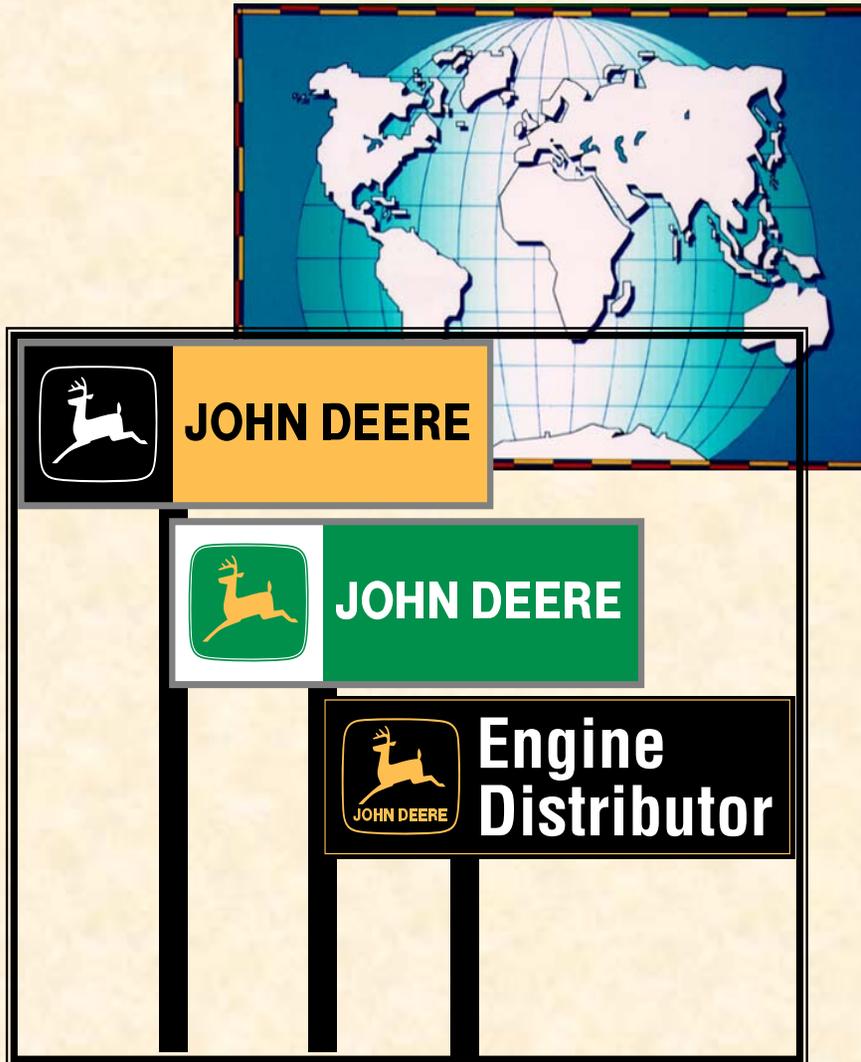
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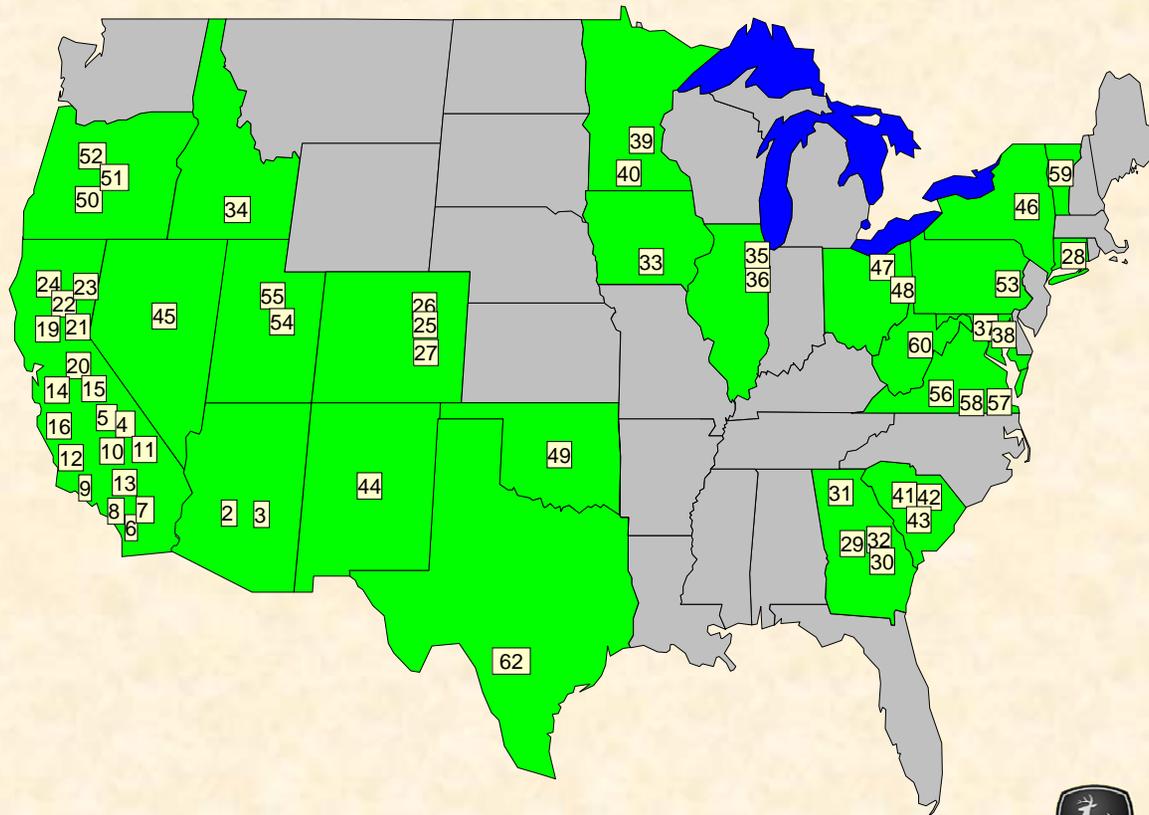
“Providing Value to Customers Through Product Support”



- **Over 4000 Dealers Worldwide**
- **Parts Communication System Providing Delivery Within 24 Hours in the U.S.**
- **Dealer Technical Assistance Centers Provide 24 Hour Assistance (DTAC)**
- **Training Facilities and Materials**
- **Extended Warranties For Guaranteed Reliability**

NATURAL GAS SERVICING DEALERS

- 1.) RDO Eqp
- 2.) Auto Safety House
- 3.) Empire Eqp.
- 4.) California Bus Sales
- 5.) Coastline Eqp.
- 6.) RDO Eqp.
- 7.) A-Z Bus
- 8.) Western Engine Dist.
- 9.) Coastline Dist.
- 10.) South Kern Machinery
- 11.) Western Engine Dist.
- 12.) Coastline Eqp. Co.
- 13.) Coastline Eqp. Co.
- 14.) Nortrax West
- 15.) Nortrax West
- 16.) Nortrax West
- 17.) Nortrax West
- 18.) Nortrax West
- 19.) CN Power Systems
- 20.) A-Z Bus Sales Inc.
- 21.) Nortrax West
- 22.) Nortrax West
- 23.) Mid Valley Tractor Co.
- 24.) Nortrax West
- 25.) Honnen Eqp. Co.
- 26.) Colorado Machinery
- 27.) Colorado Machinery
- 28.) Bell Power Systems Inc.
- 29.) Blue Bird Co.
- 30.) Blue Bird Co.
- 31.) Metrac Inc.
- 32.) Metrac Inc.
- 33.) Northstar Power
- 34.) Idaho Bus Sales
- 35.) Westside Tractor Sales



- 36.) Midwest Transit Eqp. Inc.
- 37.) Atlantic Trans. Eqp. LTd.
- 38.) Standard Eqp. Co.
- 39.) Grande Amercian
- 40.) RDO Eqp. Co.
- 41.) North American Engfine. Co.
- 42.) R.W. Moore Eqp. Co.
- 43.) R.W. Moore Eqp. Co.
- 44.) Tom Growney Eqp.
- 45.) Empire Eqp.
- 46.) Five Star Eqp.
- 47.) Mahnen Machinery Inc.
- 48.) Mahen Machinery Inc.
- 49.) Harley Power
- 50.) Hessel Tractor & Eqp. Co.
- 51.) Western Bus Sales
- 52.) Hessel Tractor & Eqp. Co.
- 53.) Plasterer Eqp. Co. Inc.
- 54.) Bryson Sales & Service
- 55.) Scott Machinery Co.
- 56.) James River Eqp.
- 57.) Coastal Eqp. Corp.
- 58.) Coastal Eqp. Corp.
- 59.) Grappone Industrial Inc.
- 60.) Matheny Motor Truck Co.
- 61.) NGVEcotrans
- 62.) RDO – San Antonio



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NATURAL GAS TRAINING



- **1250+ students trained!!**
- **3 trainers on staff at JDPS**
 - **On-site with property/ fleet vehicle**
 - **Waterloo (factory)**
 - **Third party facility with mobile stand for hands-on training**



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DEERE NATURAL GAS ENGINE

Service Intervals

Oil/ Filter change:	12 months / 25,000 miles (Low sulfated ash oil 0.5 to 1.0%)
Clean & Gap Plugs	12 months / 25,000 miles
New Spark Plugs:	24 months / 50,000 miles
Adjust Valve Lash:	24 months / 50,000 miles
Water Filter	Not Required

Diagnostics

Computer Aided: Trouble-shooting simplified

Warranty

School Bus - 5 years / 100,000 miles

Transit Bus - 2 years / unlimited miles

Trucks - 2 years / 150,000 miles

Extended Warranties Available!



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Our Commitment to Natural Gas Technology Advancement, Customer Satisfaction, and a Cleaner Environment

Genuine

Value



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