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# National Clean Cities Conference

May 4, 2004



# AGENDA TOPICS

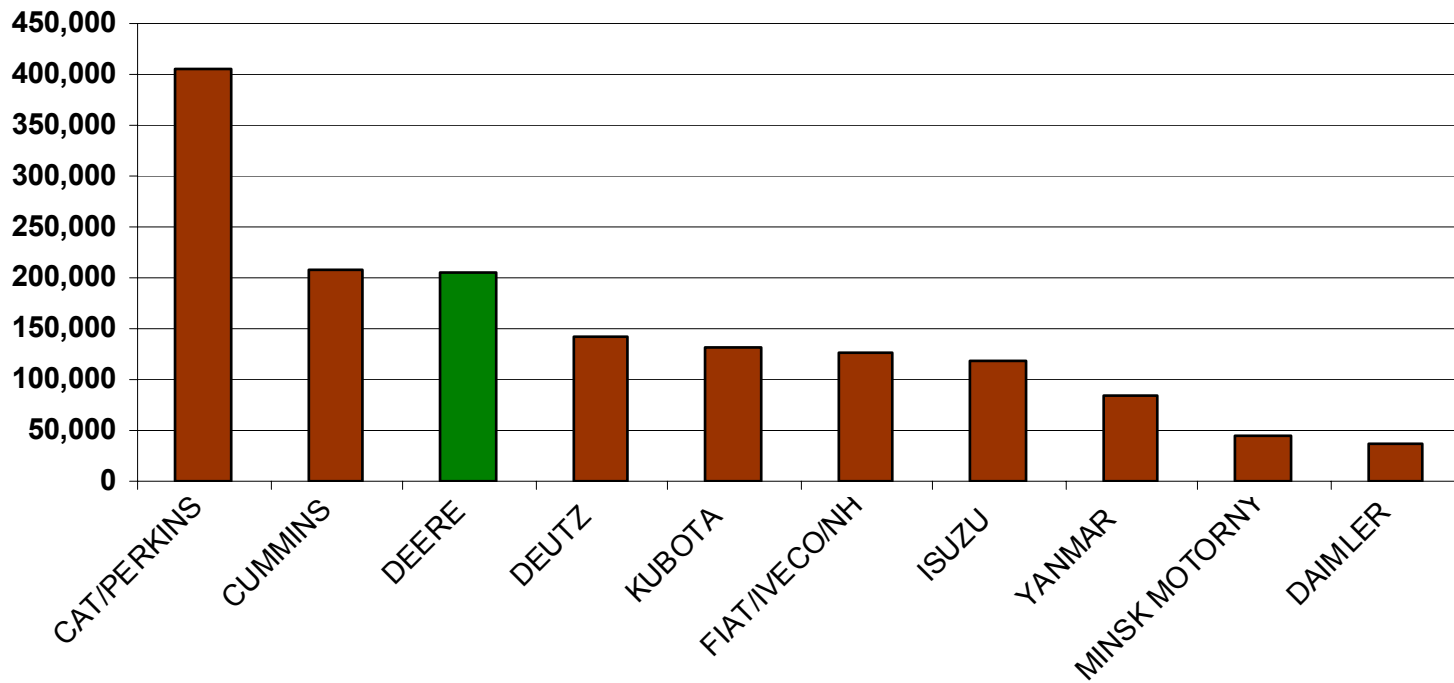
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- Deere CNG Background
- Technology - *Today and the Future*
- Applications
- Product Support



# MAJOR ENGINE MANUFACTURER

2002 Off-Highway Diesel Production  
35 - 600 HP Range



# HEAVY-DUTY DIESEL HERITAGE

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## *8.1L Engine Powers Deere On!!!*



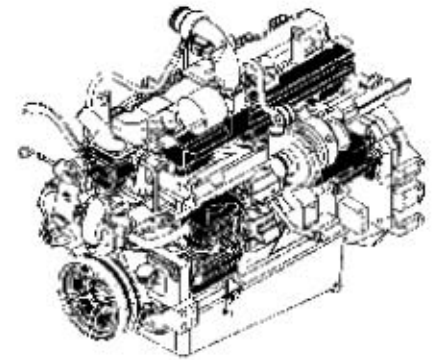
- **Agriculture: 70%+ load factors continuous**
- **Construction: Variability in speed and loading**
- **Current diesel configuration rated over 400 HP**
  - Higher peak firing pressure
  - Higher BMEP

# DEERE NATURAL GAS - ON-HIGHWAY

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*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
  - Focused approach for Transit Style school bus (250 HP @ 800 Lb-Ft)



# DEERE NATURAL GAS - ON-HIGHWAY

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Outstanding customer acceptance drove the release to other key applications!

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



**250 HP @ 735 Lb-Ft – 280 HP @ 900 Lb-Ft**

# AGENDA TOPICS

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# DEERE NATURAL GAS ENGINES

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## *Customer Expectations of Deere CNG Engines*

### Diesel-like:

- **Driveability**
- **Reliability**
- **Cost-of-ownership**
  - **Fuel economy**
  - **Maintenance**
  - **Durability**
- **Serviceability**

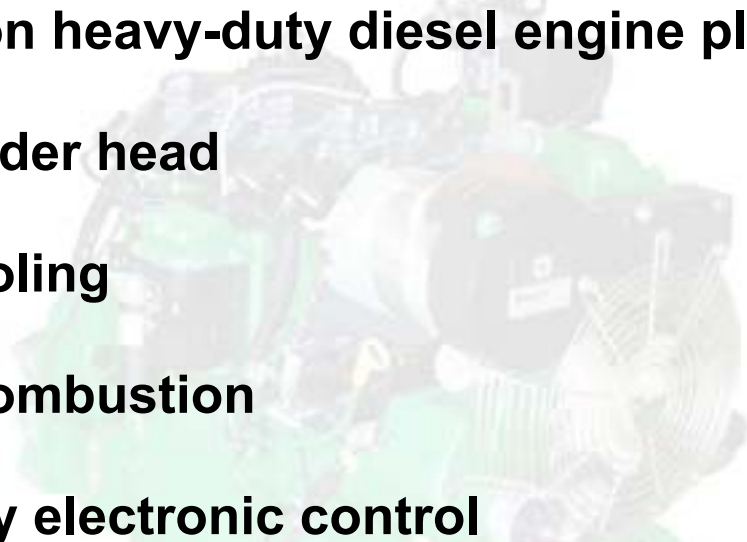




# DEERE PRODUCT FEATURES

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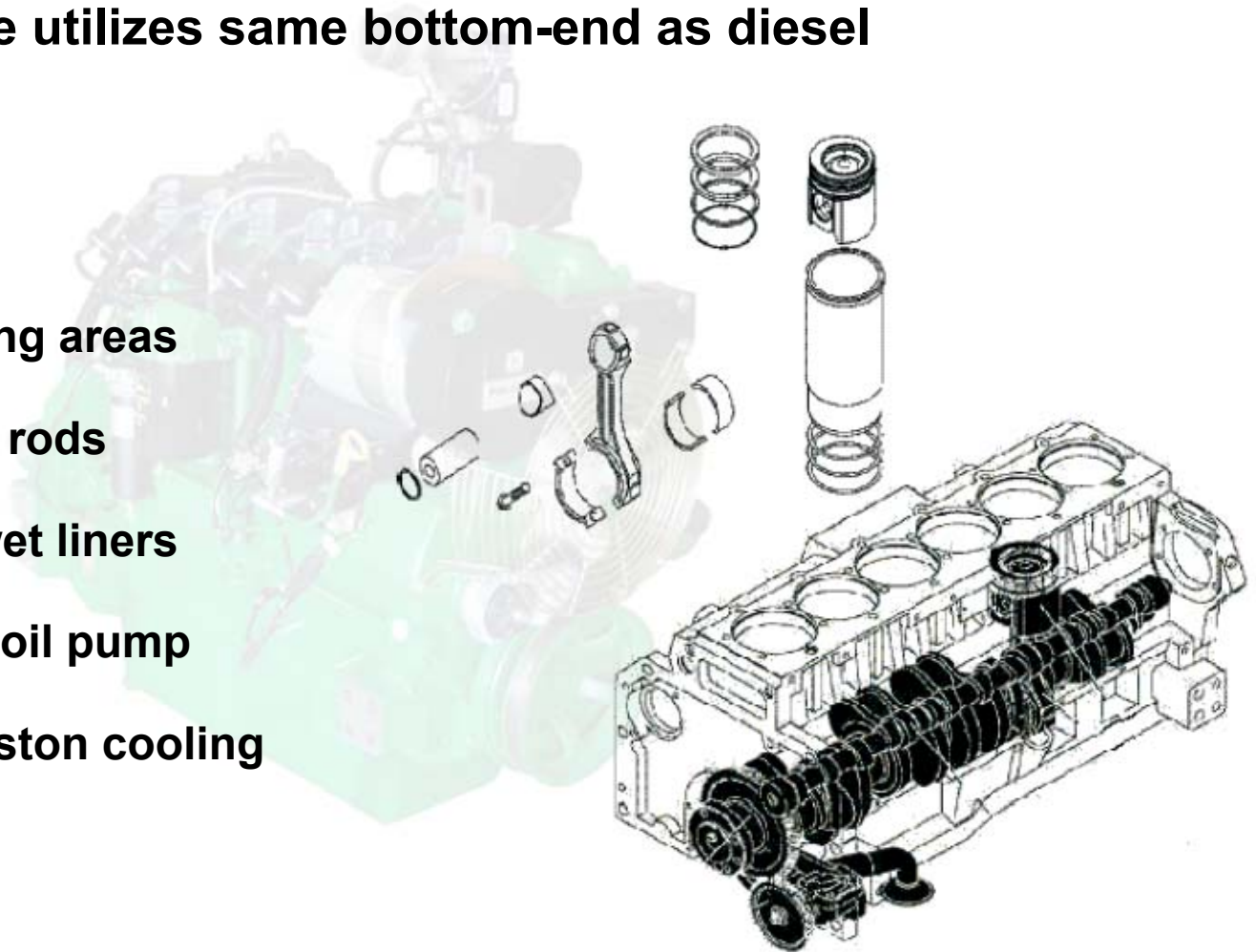
## *Advanced Technology!*

- **8.1L based on heavy-duty diesel engine platform**
  - **Unique cylinder head**
  - **Top liner cooling**
  - **Lean burn combustion**
  - **Full authority electronic control**
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# HEAVY-DUTY ENGINE BLOCK

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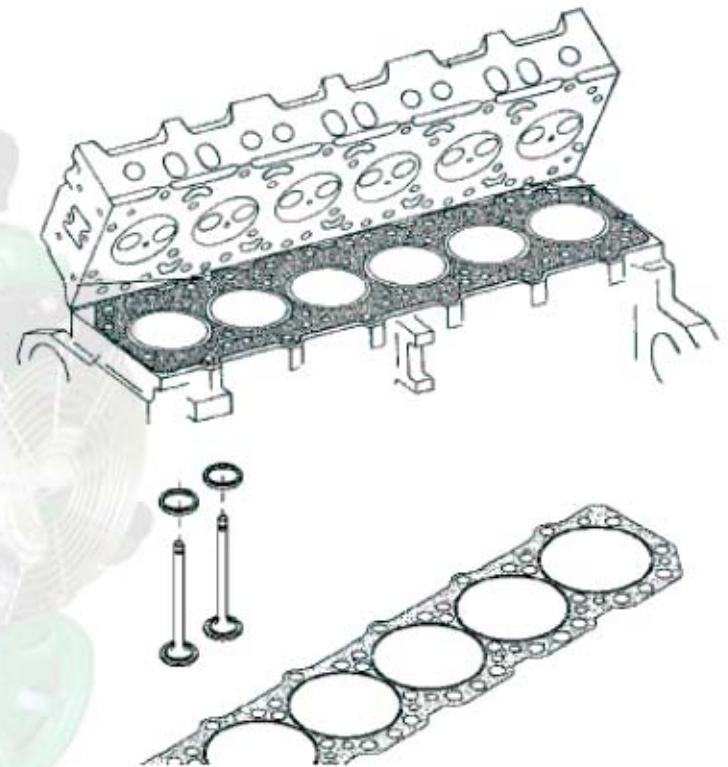
- **8.1 NG engine utilizes same bottom-end as diesel**
  - **Block**
  - **Crankshaft**
  - **Large bearing areas**
  - **Connecting rods**
  - **Hardened wet liners**
  - **Low mount oil pump**
  - **Oil spray piston cooling**



# CYLINDER HEAD

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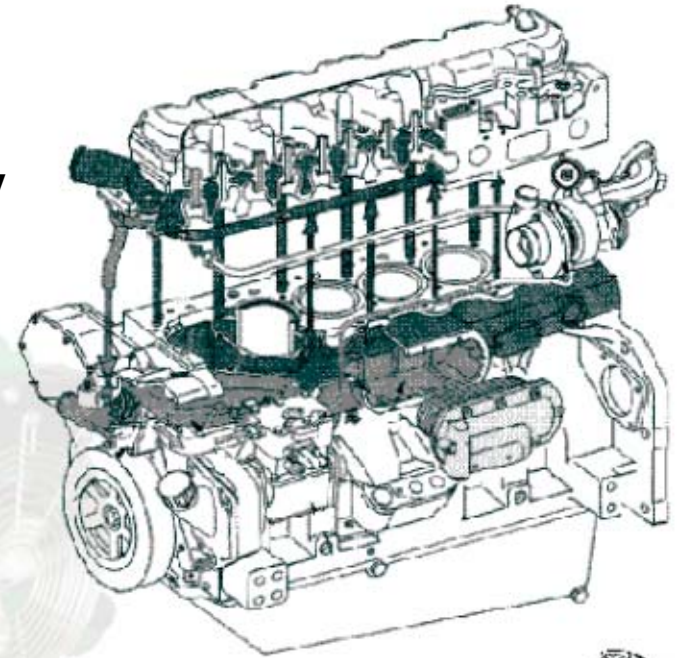
- **Cylinder head porting and configuration optimized for natural gas**
- **Stellite valve seats**
  - Durable for high temperatures and prevents wear
- **Stellite faced valves**
  - Prevents valve recession
  - Extends valve adjustment intervals



# COOLING SYSTEM

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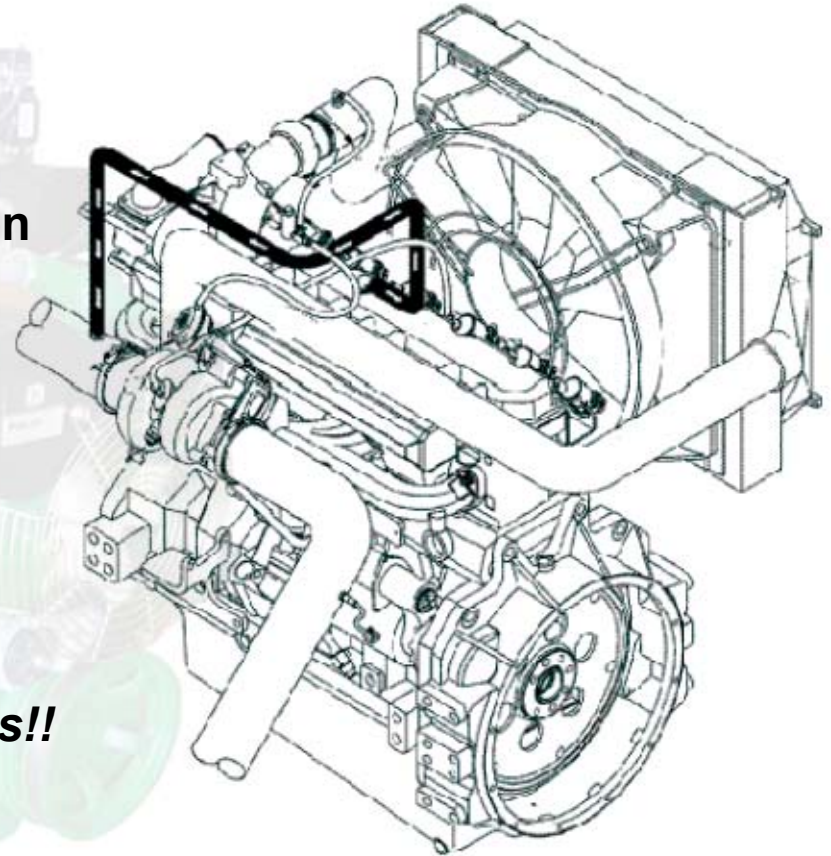
- **Top liner cooling**
  - **Lowers upper-liner temperature significantly**
  - **Improves life of the power cylinder and head-to-block joint ... joint integrity**
  - **Prevents head gasket failures in severe service applications**
- **Gear driven water pump**
  - **Maintenance advantage for key applications (Transit Bus & Refuse Trucks)**



# LEAN BURN COMBUSTION

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- **Lean burn combustion**
  - Very lean air-fuel ratio
- **Lean burn results in higher combustion efficiency**
  - Less wasted heat
  - Lower exhaust temperatures
  - Lower under hood temperatures
- ***Less heat results in less thermal stress!!***

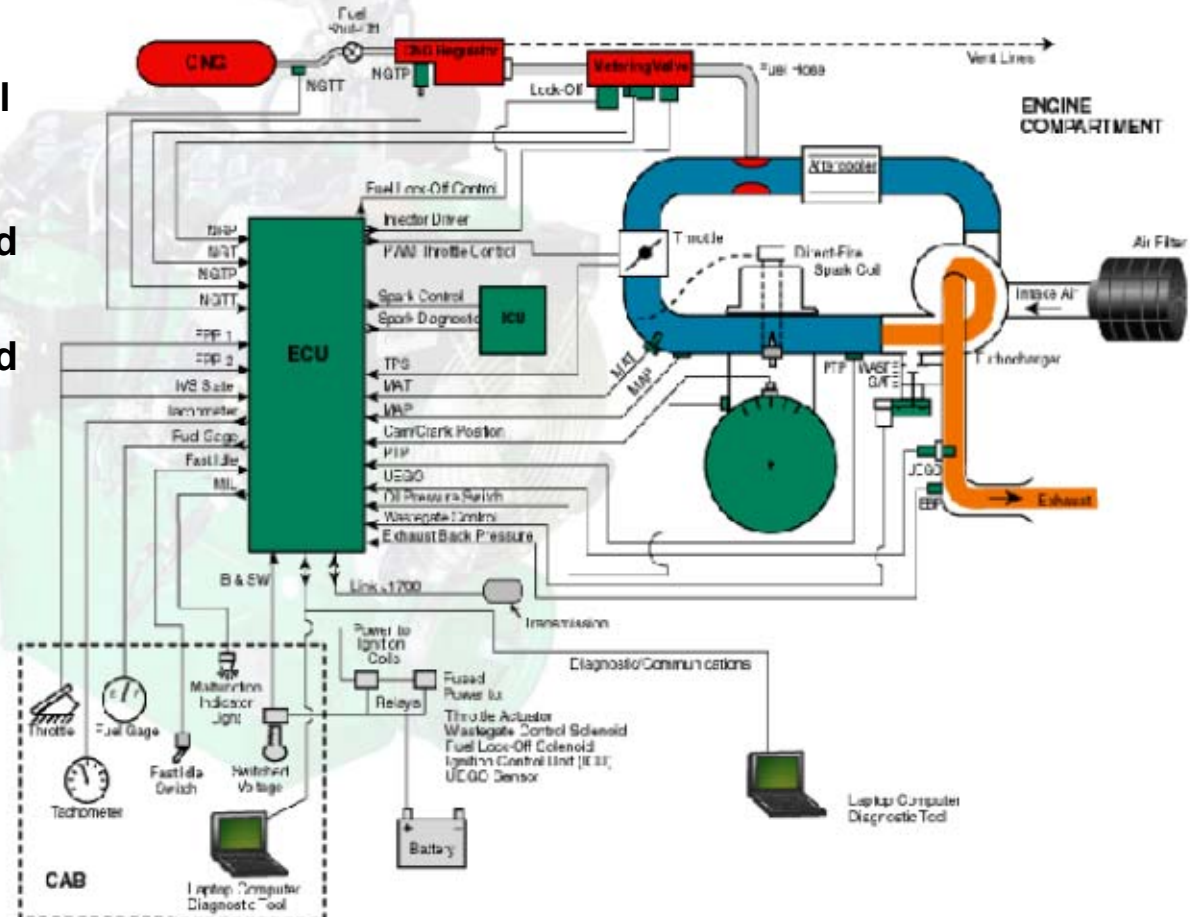




# FULL AUTHORITY ELECTRONIC CONTROL

- **Monitors engine parameters and adapts to variant ambient conditions to maximize engine efficiency.**

- Closed loop fuel control
- Adaptive learn
- Electronically controlled wastegated turbo
- Electronically controlled throttle
- Knock detection
- Humidity sensor

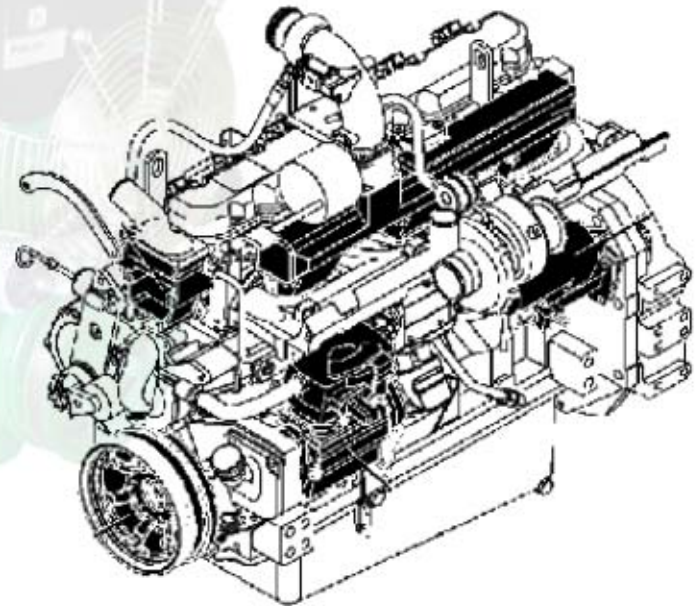


# JOHN DEERE PRODUCT DEVELOPMENT

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## *Next Generation Technology!!!*

- Released July 2003
- Takes the 8.1L NG engine to the next level of capability!!
  - Reliability
  - Performance
  - Application flexibility
  - Platform for emission reduction

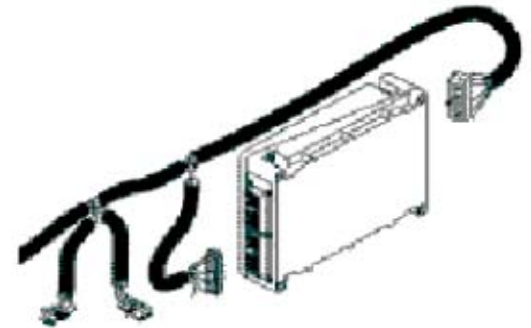




# JOHN DEERE PRODUCT DEVELOPMENT

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- **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**
- **CNG and LNG capable**
- **Emission Certification**



# EMISSION CERTIFICATION

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- **8.1 certified to new aggressive levels**

	<u>gr NOx+NMHC</u>	<u>PM</u>	<u>CO</u>
– <b>MHHD</b> <ul style="list-style-type: none"><li>• (250 HP @ 735 Lb-Ft) &amp; (250 HP @ 800 Lb-Ft)</li><li>• School Bus, Commercial Bus, and Medium Duty &amp; Refuse Truck</li></ul>	<b>1.5</b> (1.2)	<b>.01</b>	<b>15.5</b>
– <b>HHDD</b> <ul style="list-style-type: none"><li>• (275 HP @ 800Lb-Ft) &amp; (280 HP @ 900 Lb-Ft)</li><li>• Medium Duty &amp; Refuse Trucks</li></ul>	<b>1.8</b> (1.5)	<b>.01</b>	<b>15.5</b>
– <b>URBAN BUS</b> <ul style="list-style-type: none"><li>• (250 @ 735 Lb-Ft) &amp; (280 HP @ 900 Lb-Ft)</li><li>• Transit Bus 30 – 40'</li></ul>	<b>1.8</b> (1.5)	<b>.01</b>	<b>15.5</b>

- **All certifications require a simple oxidation catalyst muffler**

# AGENDA TOPICS

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- Technology - *today and tomorrow*
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# JOHN DEERE APPLICATIONS

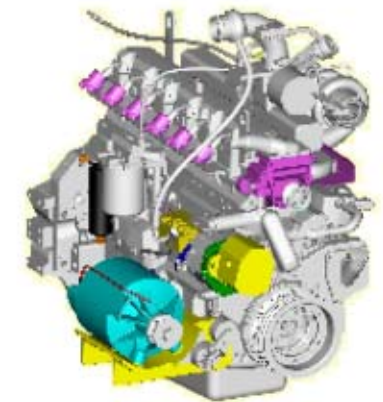
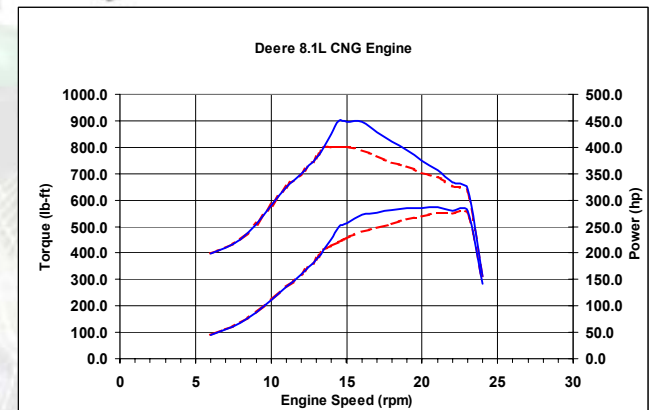
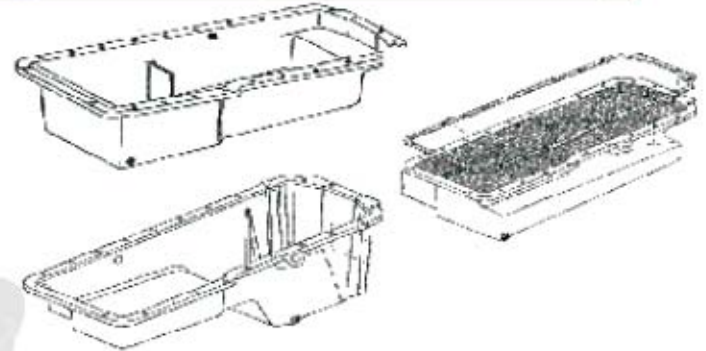
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**OUT HERE IT'S SURVIVAL  
OF THE FITTEST**



# APPLICATION TAILORED OPTIONS

- Oil pans
  - Front sump, continuous, and Transit specific
- Transmission adaptation
  - Allison MD / HD and B300R /B400r
  - ZF
  - Voith
- Auxiliary gear drives SAE A & B
  - 13.2 & 16.5 CFM A/C
  - Air Conditioning A/C
- PTO, torsionally from crank pulley
- Fan drive, clutch
- Remote oil dipsticks
- Optimized Power Curves
- Programmable electronic features



# FOCUS ELECTRONIC FEATURES

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- Road Speed Governor
- Cruise Control
- Auto resume
- Elevated High Idle Control (for A/C)
- In-cab idle adjustment
- Remote PTO
- Dual Throttle
- ABS with Traction Control
- Engine brake interlock/ Decel Light
- Foot Pedal Inhibit/ Throttle interlock
- Engine protection (De-rate)
  - Coolant level input
  - Coolant temperature input
  - Oil pressure input
  - Intake air temperature input
  - Exhaust temperature input
  - Oil temperature input
- PWM fan control
- A/C input
- Coolant temperature input
- Throttle charge temperature
- Transmission sump temperature
- Engine protection (hard shutdown)
  - Coolant level input
  - Coolant temperature input
  - Oil pressure input
  - Intake air temperature input
  - Exhaust temperature input
  - Oil temperature input
  - Auxiliary Input
- Shutdown override switch
- Shutdown reset
- Shutdown alarm
- J1939 CAN
- J1587 w/bridge



# JOHN DEERE

## *Type D – Transit Style School Bus*



**250 hp @ 800 lb ft**  
**Certified to CARB 1.5 gr NOx+NMHC Standard**





# SCHOOL BUS DEALERS

## Blue Bird: All American RE



- **A-Z Bus** - Sacramento and Colton, CA
- **Auto Safety House** - Phoenix, AZ
- **Atlantic Transportation Eqp.** - Beltsville, MD
- **Bryson Sales & Service** - Bountiful, UT
- **Zia Bus Sales Inc.** - Albuquerque, NM
- **M.A. Brightbill Body Works** - Lebanon, PA



# SCHOOL BUS DEALERS

## Thomas Bus: Saf-T-Liner HDX



- **California Bus Sales** - Fresno, CA
- **Bus West** - Los Angeles, CA
- **Nesco** - New Windsor, NY
- **Lewis Transportation Sales** - Salt Lake City UT



# JOHN DEERE

## *Transit/Commercial Bus Properties*



250 hp @ 735 lb ft  
280 hp @ 900 lb ft  
Certified to the CARB 1.8 gr NOx+NMHC Standard



# JOHN DEERE COMMERCIAL BUS

## BlueBird: Xcel 102



- **A-Z Bus** - Sacramento and Colton, CA
- **Auto Safety House** - Phoenix, AZ
- **Atlantic Transportation Eqp.** - Beltsville, MD
- **Zia Bus Sales Inc.** - Albuquerque, NM



**Powered by 8.1 L CNG**

• 250 hp @ 735 Lb-Ft



# JOHN DEERE TRANSIT BUS

**Eldorado National:** EIDorado National 

- EZ Rider II
- HFX
- Axess 35' & 40'



**Powered by 8.1 L CNG or LNG**

- 250 hp @ 735 Lb-Ft
- 280 hp @ 900 Lb-Ft



# JOHN DEERE TRANSIT BUS

## Orion Bus:



- Orion V & Orion VII



**Powered by 8.1 L CNG or LNG**

- 250 hp @ 735 Lb-Ft
- 280 hp @ 900 Lb-Ft



# JOHN DEERE TRANSIT BUS

## New Flyer: **NEW FLYER**

- 35' and 40' LF Transit Bus



### Powered by 8.1 L CNG or LNG

- 250 hp @ 735 Lb-Ft
- 280 hp @ 900 Lb-Ft





# JOHN DEERE

## TRUCK FLEETS



250 hp @ 800 lb ft

275 hp @ 800 lb ft

280 hp @ 900 lb ft

Certified to the CARB 1.5 & 1.8 gr NOx+NMHC Standard

# JOHN DEERE TRUCK FLEETS

## Crane Carrier Corporation:



- LCF & LET2



**Powered by 8.1 L CNG or LNG**

- 275 hp @ 735 Lb-Ft
- 280 hp @ 900 Lb-Ft



# JOHN DEERE TRUCK FLEETS

## Freightliner FL 70



**Powered by 8.1 L CNG or LNG**

• 250 hp @ 800 Lb-Ft



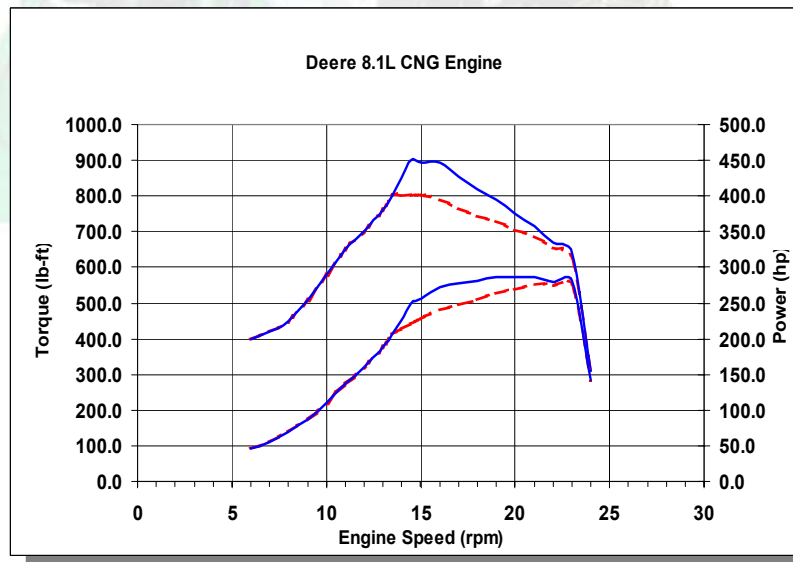
# APPLICATION CONCLUSIONS

- Hardware and software specifically tailored to the application
- Power curves matched to the transmission/application for optimum performance
- All OEM installations meet Deere's stringent application engineering standards



**6081HFN**  
**Truck**

250 HP @ 800 Lb.Ft.  
280 HP @ 900 Lb.Ft.



**6081HFN**  
**Bus**

250 HP @ 735 Lb.Ft.  
280 HP @ 900 Lb.Ft.

# AGENDA TOPICS

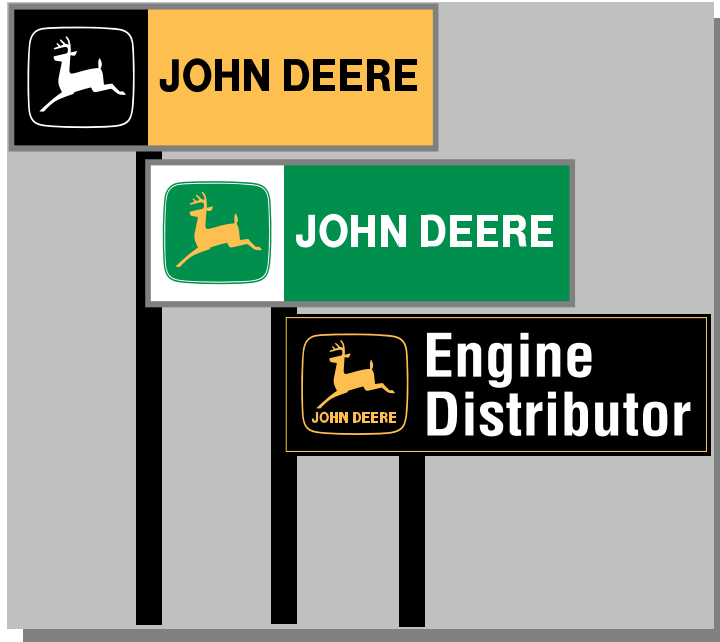
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- Deere CNG Background
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# **“PROVIDING GENUINE DEERE VALUE WITH OUTSTANDING PRODUCT SUPPORT”**

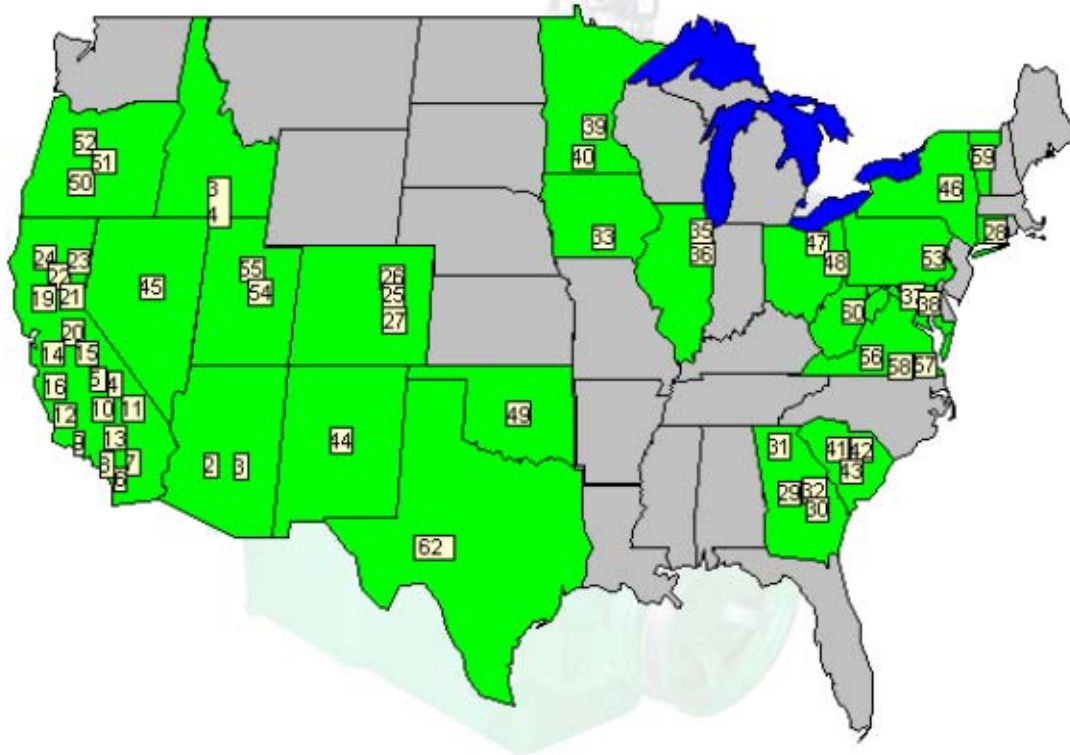


- Capable customer support network
  - Over 4000 Dealers worldwide
  - Qualified third-party
  - Fleet or Property
- Technical Assistance
  - DTAC’s provide 24 hour assistance
  - Technical publications
- Comprehensive product training
  - Waterloo, IA
  - Fleet or Property site
  - Other local facilities
- Parts availability
  - Communication system providing delivery within 24 hours in the U.S.
  - Recommended spare parts list



# 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



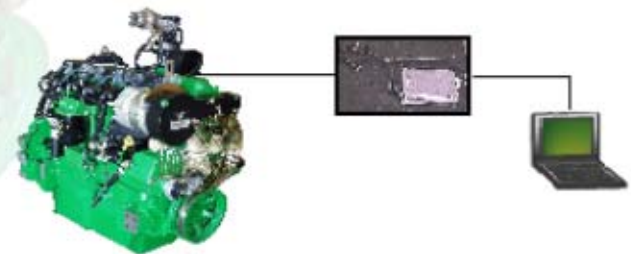
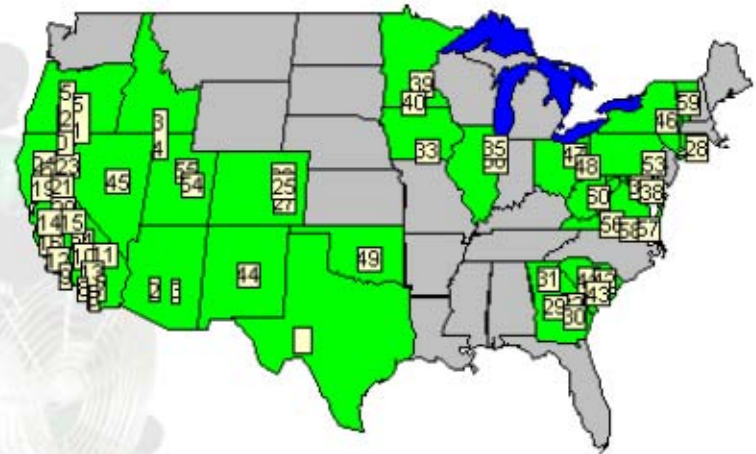
- 36.) Midwest Transit Eqp. Inc.
- 37.) Atlantic Trans. Eqp. LTd.
- 38.) Standard Eqp. Co.
- 39.) Grande Amercian
- 40.) RDO Eqp. Co.
- 41.) North American Engfine. Co.
- 42.) R.W. Moore Eqp. Co.
- 43.) R.W. Moore Eqp. Co.
- 44.) Tom Growney Eqp.
- 45.) Empire Eqp.
- 46.) Five Star Eqp.
- 47.) Mahnen 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



# PRODUCT SUPPORT

## *After Sales Support!*

- Deere trademark value is a result from providing outstanding after sales support
- Maximized vehicle uptime...
  - Maintenance intervals
  - Serviceability
  - PC based diagnostics (Deere proprietary control system)
  - Extended warranty coverage options up to 6 yrs / 300,00 miles



***DEERE QUALITY CONTINUES LONG AFTER YOU TAKE DELIVERY!!***



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

**Genuine  
Value**