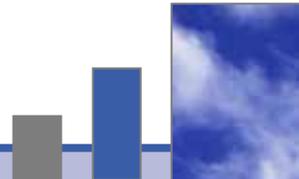


# Emission Control Systems and Components for Retrofit, and First-fit Applications

Bradley L. Edgar  
Cleaire

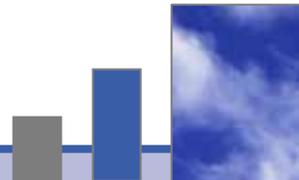
**clēaire**

ADVANCED EMISSION CONTROLS®



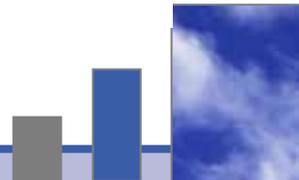
# Objectives

- 1) Design a suite of the highest quality components to be assembled into versatile, state-of-the-art aftertreatment systems for retrofit and first-fit applications.
- 2) Develop, verify, and market “Turnkey” diesel retrofit systems that reduce both NO<sub>x</sub> and PM emissions from in-use diesel engines.

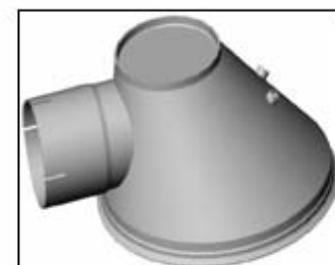
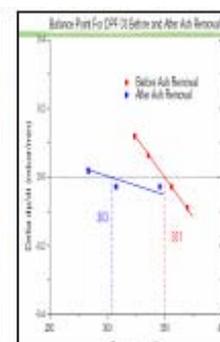
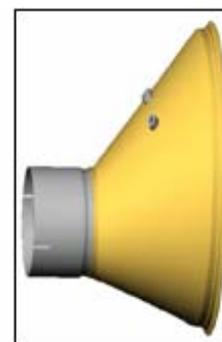
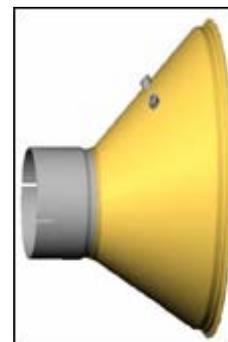


# Outline

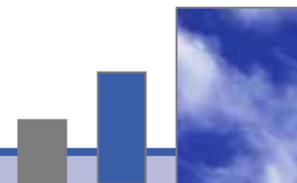
- Components
  - Modular canning system
  - Controls and Sensors
  - HC dosing system
  - NOx Reduction Catalyst (NRC) Module
  - PM Control Module
- Systems
  - Longview®
  - Lonestar™



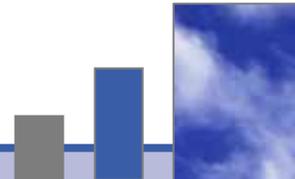
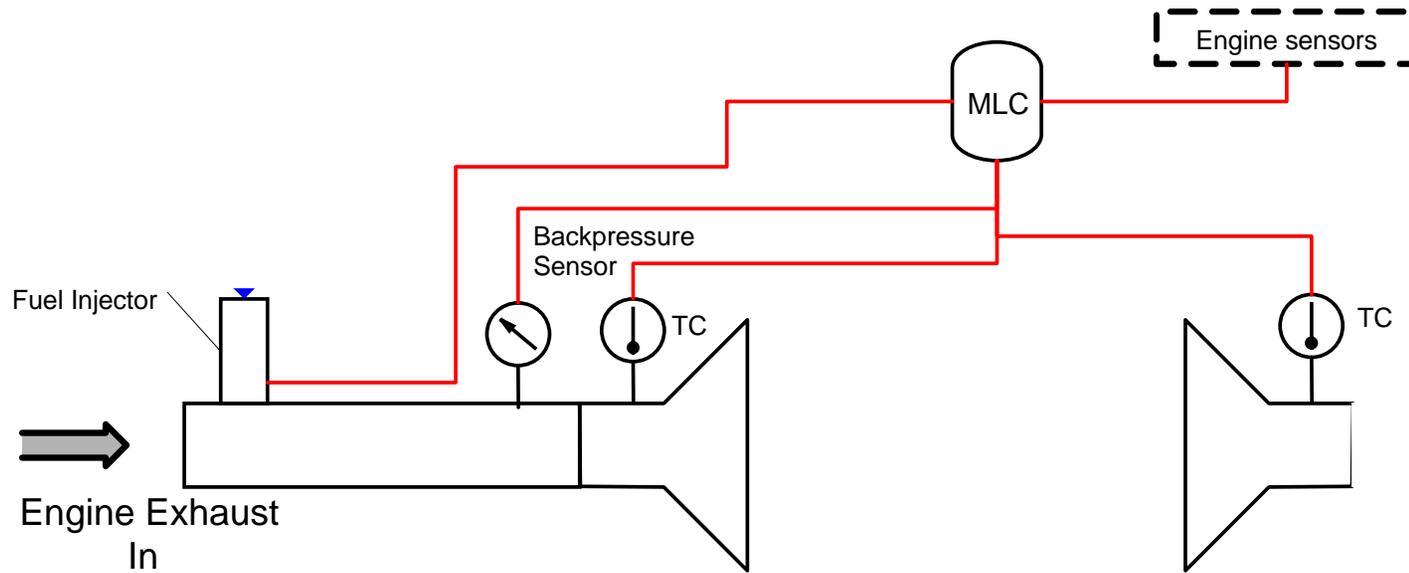
# Modular Canning System



- “Gasketless” clamping design
- Reusable sealing rings and clamps
- Multiple catalyst configurations
- Library of inlet and exit cone designs



# Controls and Sensors



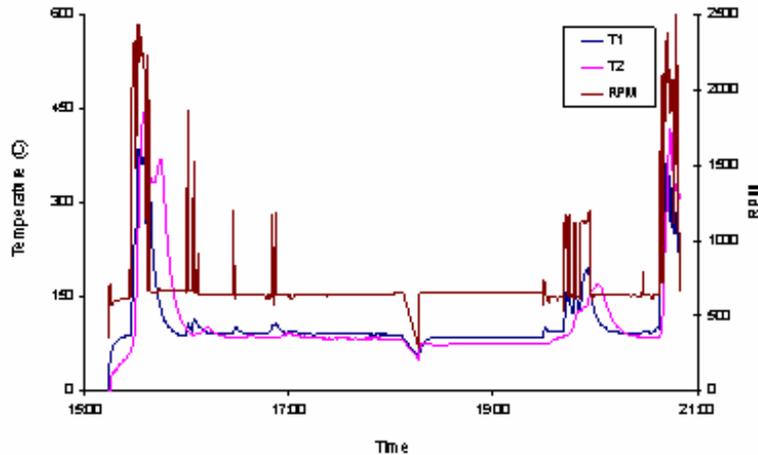
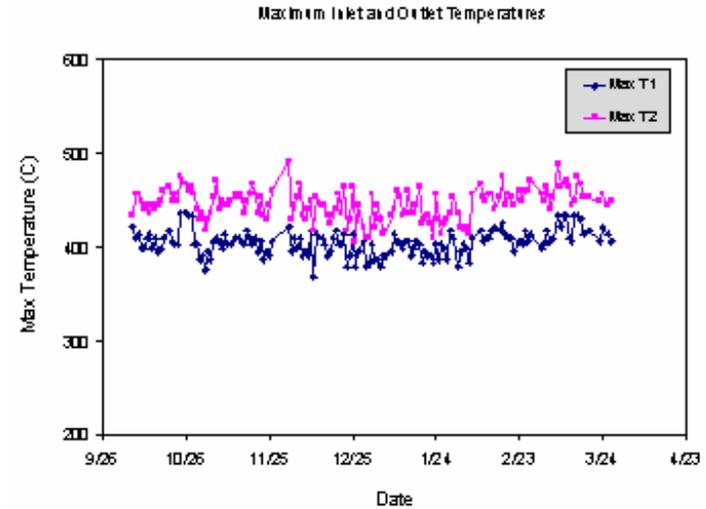
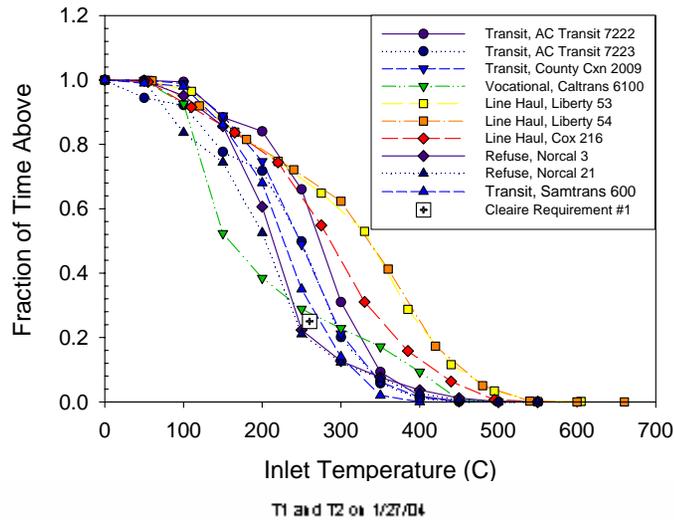
# The Cleaire MLC®



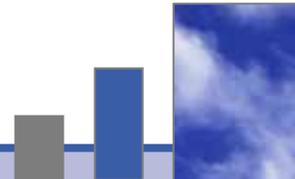
- 8MHz processor
- Multiple Signal Input
  - Thermocouple
  - 0-5V DC
  - Frequency (RPM)
- Multiple Signal Outputs
  - 2 PWM signals
  - LED diagnostics
  - 0-5 V DC
- 8MB on-board FLASH memory
- MLinC™ PC interface



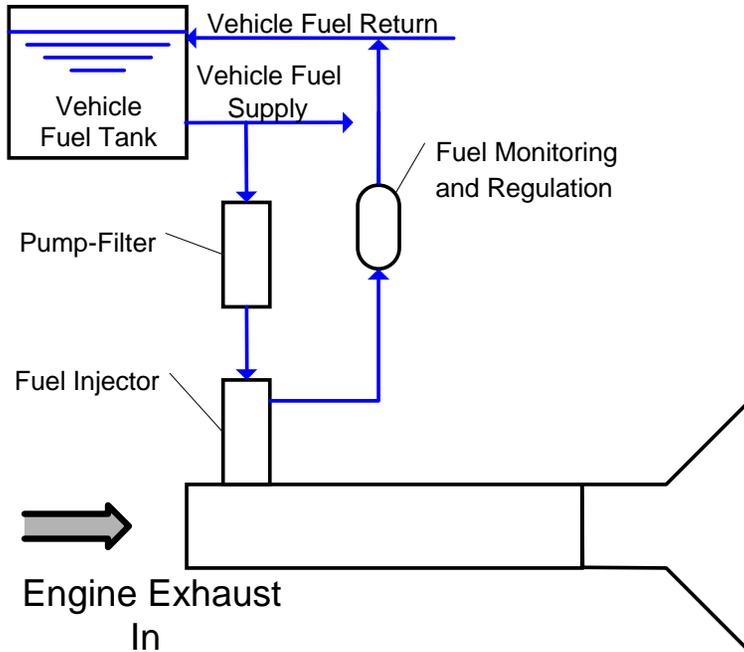
# Data Analysis Tools



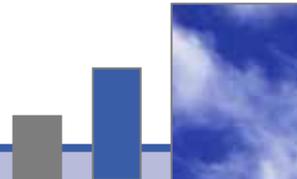
- Temperature profiles
- Duty cycle analysis
- Long term trends
- Warranty analysis



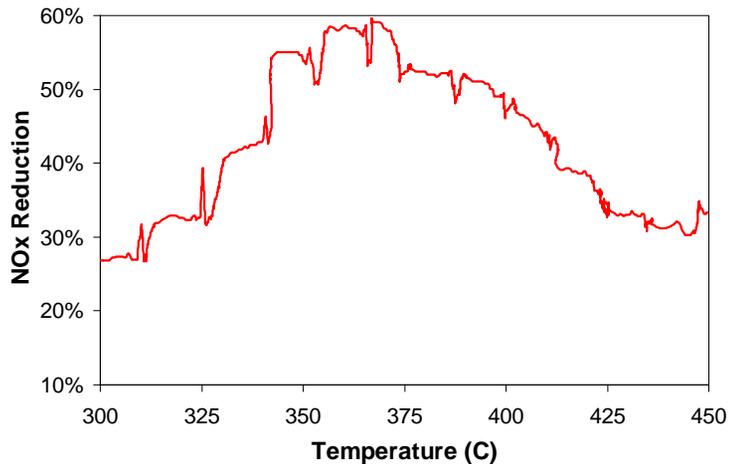
# Fuel Injection System



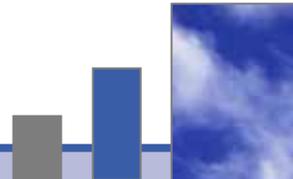
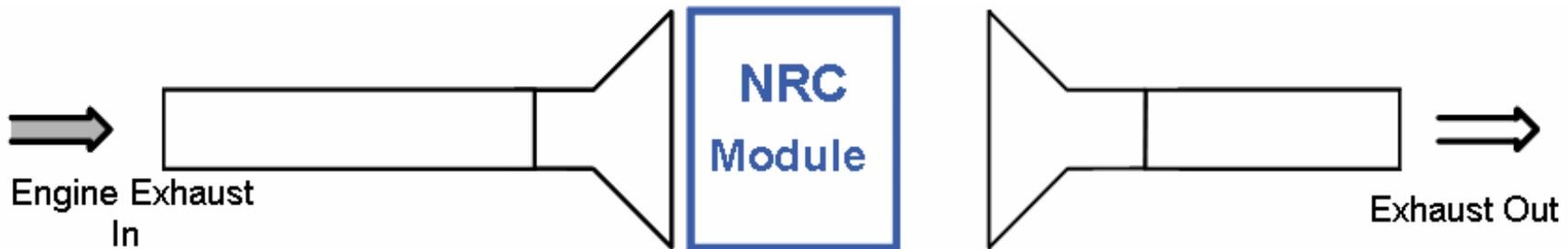
- **Automotive fuel injector**
- **Fuel cooled injector mount**
- **Pulse-width modulated injection**
- **Mixing and flow distribution hardware**



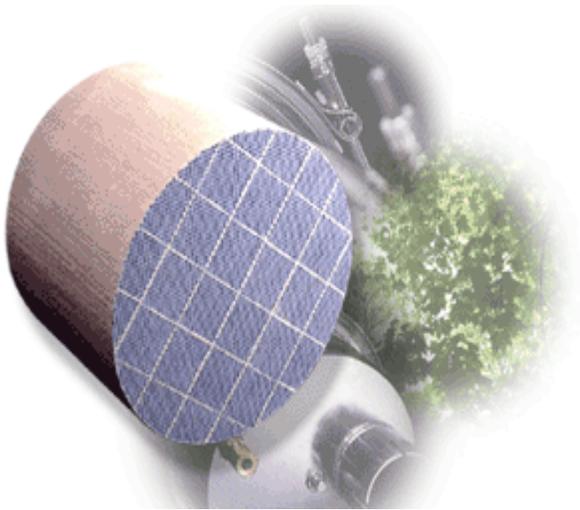
# NOx Reduction Catalyst (NRC)



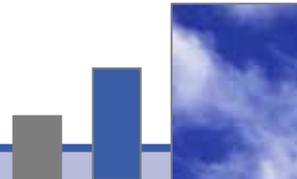
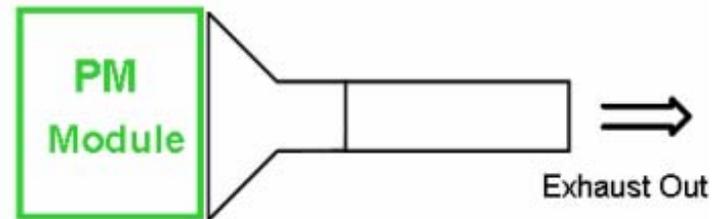
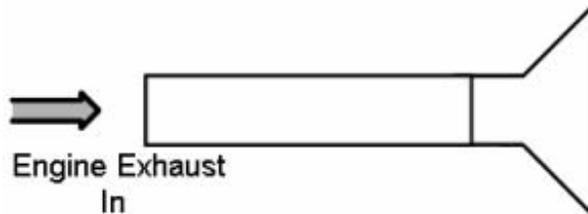
- aka Lean Nox Catalyst, HC-SCR
- High and Low temperature formulations
- Requires active dosing of reagent (diesel fuel)



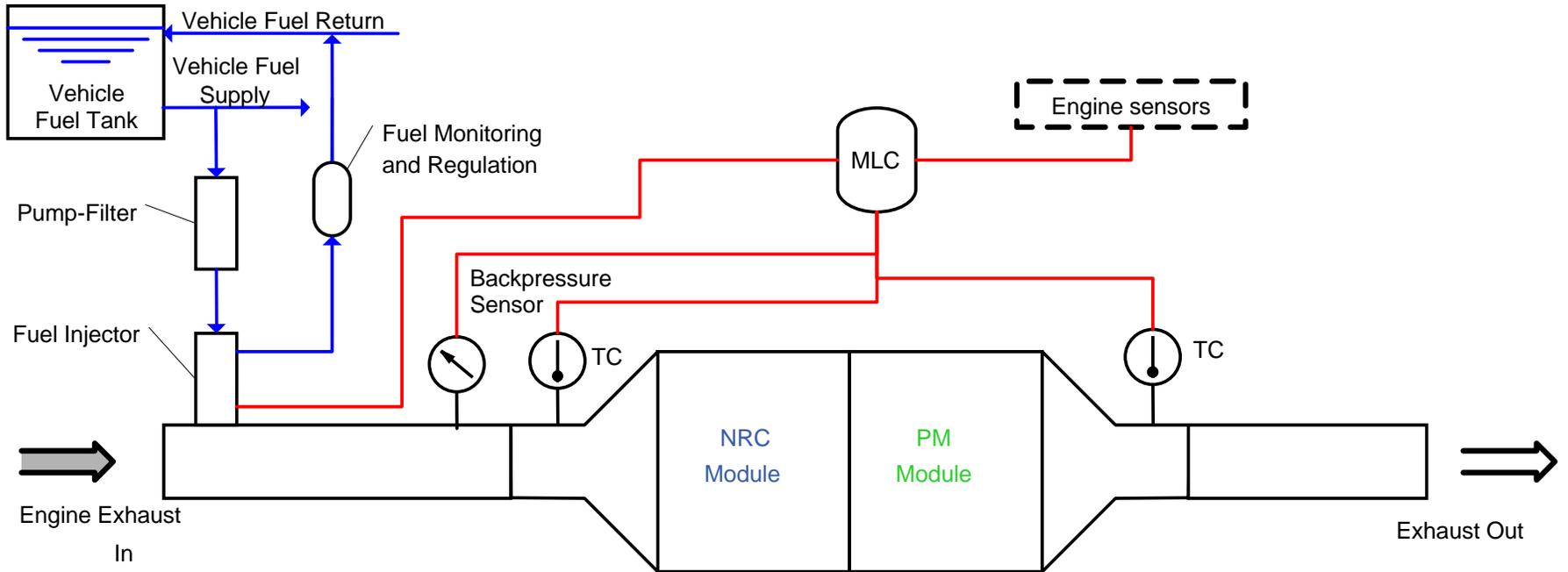
# PM Control Module



- Catalyzed DFP, or
- Flow through DOC
- Serves to control HC slip



# System Architecture

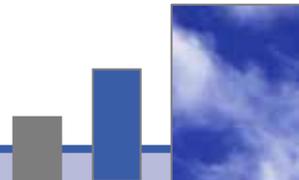


# Longview®/Lonestar™



# Integrated “Turnkey” Systems

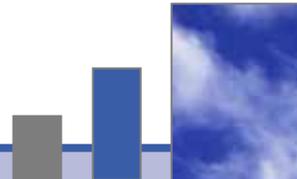
Name	Configuration	NOx Reduction	PM Reduction
 Longview®	NRC + DPF	25-35%	>85% (w/ULSD)
 Lonestar™	NRC + DOC	25-35%	10-50% (fuel dependent)



- Cleaire's flagship product
- Proven, solid retrofit platform
- Verified for on-road 1994 – 2002 engines, all makes
  - 5 to 15 L engines
  - ULSD required
- Over 500 in daily service



The screenshot shows the Forbes.com website interface. At the top, the Forbes logo is displayed with 'COM' and 'U.S. | EUROPE | ASIA' below it. To the right, there is a search bar and a 'Jump | Free Trial Issue' link. Below the logo, a navigation menu includes 'HOME', 'BUSINESS', 'TECHNOLOGY', 'MARKETS', 'WORK', and 'LISTS'. The main content area features a news article titled 'Cleaire Receives California and EPA Approval of Diesel Emission Reduction Technology for Use on Wide Range of Heavy-Duty Engines', dated 08.17.04, 12:17 PM ET. The article text states: 'California and Federal officials have approved the Longview(R) diesel emission retrofit system for use in all 50 states on virtually all on-road heavy-duty diesel engines manufactured between 1994 and 2002, officials of Cleaire Advanced Emission Controls(R), LLC announced today.'



# Longview Installations



# Conclusions

- Components and sub-systems have been developed to support integrated aftertreatment systems, both retrofit and first-fit.
- The Cleaire Longview and Lonestar are examples of integrated aftertreatment systems
- The Longview is now CARB and EPA verified to reduce both Nox and PM emissions from in-use engines.
- Cleaire has over 500 systems installed with many more to come.

