

# Nonox Ltd

## Practical Emissions Solutions



# Emissions = Lost profit

Many Oil fired combustion systems are not in compliance with global and local emissions regulations including:

- MARPOL 73/78 Annex VI
- U.S. Clean Air Act
- E.U. Emissions Standards
- Asian Standards

They face:

- Compliance fines
- Restricted market access
- Lack of participation in Green Credits and Carbon Trading
- Cannot legitimately participate in “Green” corporate branding



# Nonox Solution

## Point of Combustion Emulsification

- Nonox created state of the art point of combustion (POC) emulsification plant technology
- Burning POC emulsions *reduces* emissions
- Burning POC emulsions *increases* fuel efficiency



# History

- Eric Cottell Jr. founder of Nonox, is following in the footsteps of his father, Eric Cottell Sr. who discovered and documented the phenomenon of micro explosions during the 1970s, which translated into a series of patented devices and installations resulting in fuel savings and emissions reductions as verified by such agencies as the D.O.E. and the E.P.A. in the United States .
- In 1952,Cottell,Sr. patented a device to break down and emulsify heavy liquids. His process is still widely used to prepare Worcestershire sauce, ketchup, cosmetics and paint.
- Eric Cottell, Jr. has taken his father's work and simplified the emulsion creation process to create easy to utilize reliable point of combustion emulsion plants.



# Applications

Nonox's POC technology was developed for use in:

- Stationary installations
  - Boilers
  - Furnaces
  - Generators
- Mobile installations
  - Ships
  - Locomotive / Rail
  - Trucks
  - Automotive



The  
Efficiency &  
Emissions  
Solution



# Market

- Retrofit
  - Bring existing systems into compliance with emissions regulations.
  - Greatly increased savings over alternatives.
    - Fines
    - Repower ( replacements )
    - Other emissions solutions
  - Older installations equate to greater emissions reductions and efficiency gains.
- New
  - Regulatory areas
    - Stationary
    - Mobile

# Fuel Oils



Nonox emulsion plants create emulsion fuels from:

- Distillate
  - No 1, 2, 3
- Residual
  - No 4, 5, 6
- Bunker
  - A, B, C ( cheapest, dirtiest )

# Emissions & Efficiency

- NOx - Typically 25% to 50% reduction
- PM - Typically 80% to 95% reduction
- CO<sub>2</sub> - Typically 5% to 15% reduction
- CO - Typically 25% to 45% reduction
- Fuel Efficiency Gains - 5% to 15%



- How does burning emulsion reduce emissions and increase fuel efficiency?

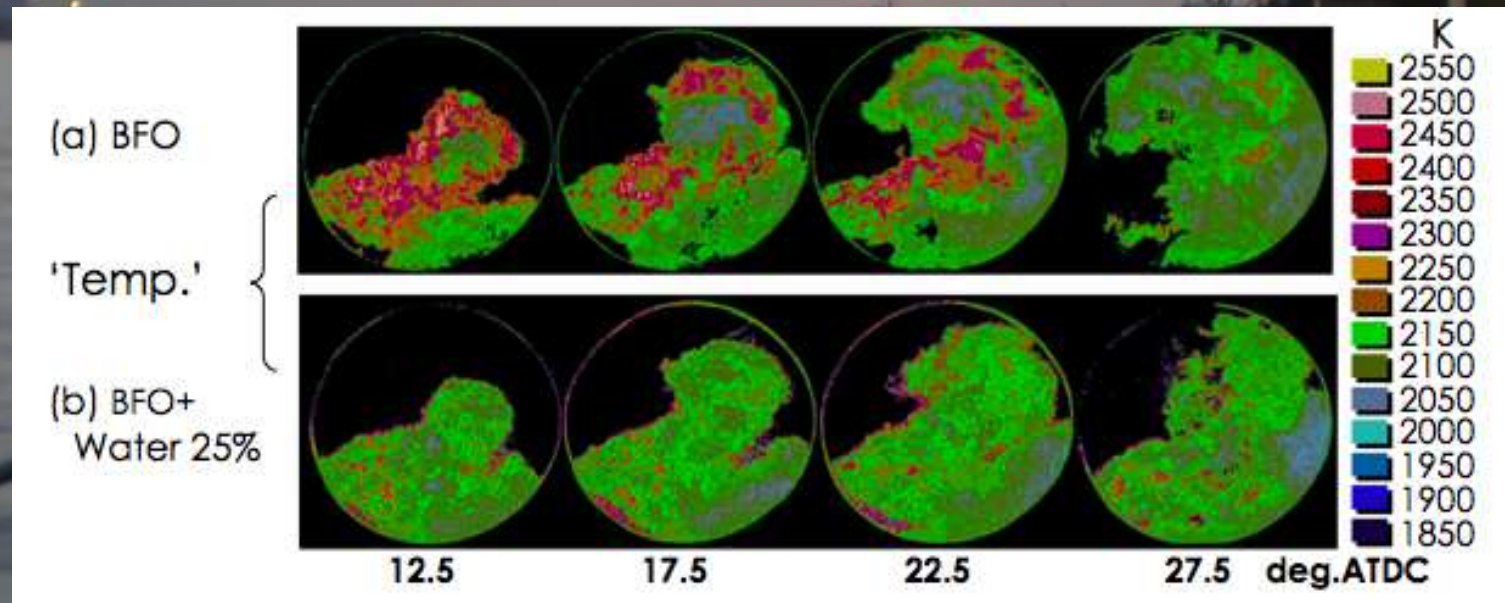


# Secondary Atomization

- Emulsion is initially atomized by a fuel injector as it enters the combustion chamber
- Once inside, heat causes water droplets in the atomized emulsion to turn to steam expanding many thousands of times.
- The expanding steam vaporizes the fuel oil droplets resulting in a more refined total atomization.

# NOx Reduction

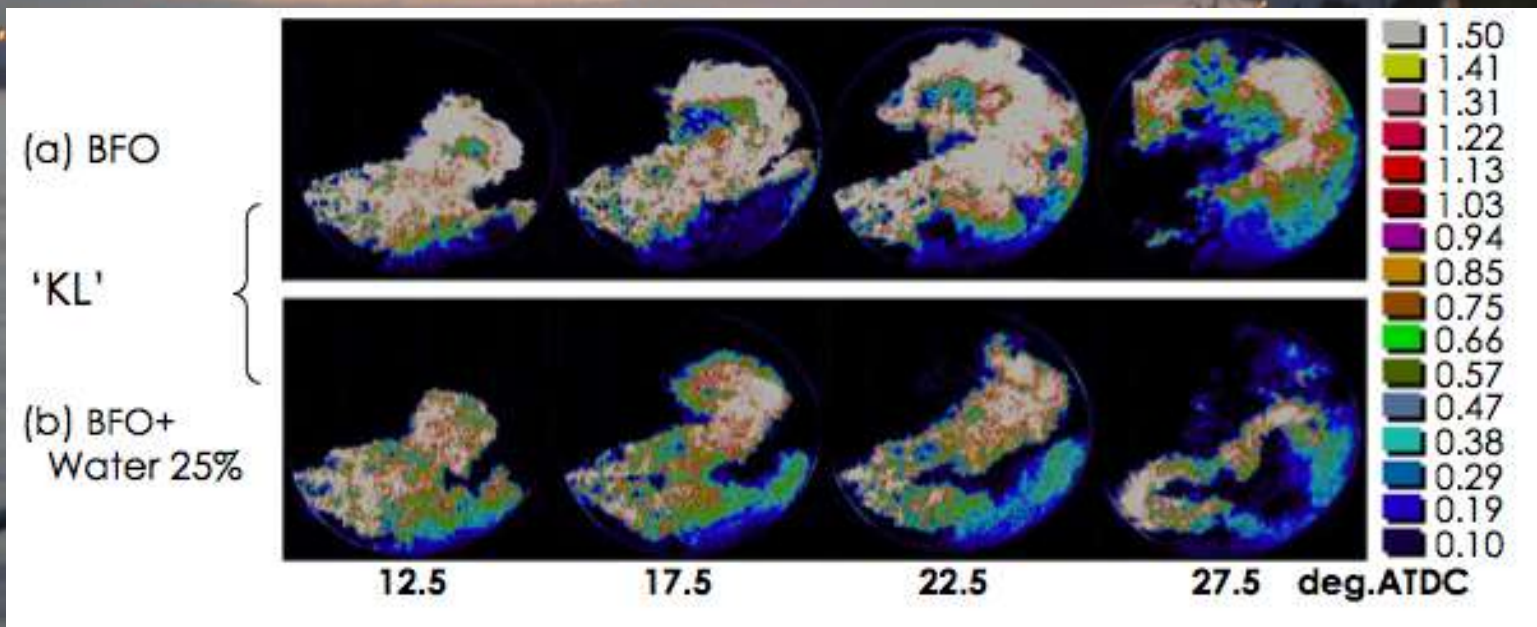
- As combustion temperatures exceed 2000K, NOx forms
- Emulsion burns with a lower initial temperature spike resulting in lower NOx production



\*Image Kyushu University

# PM Reduction

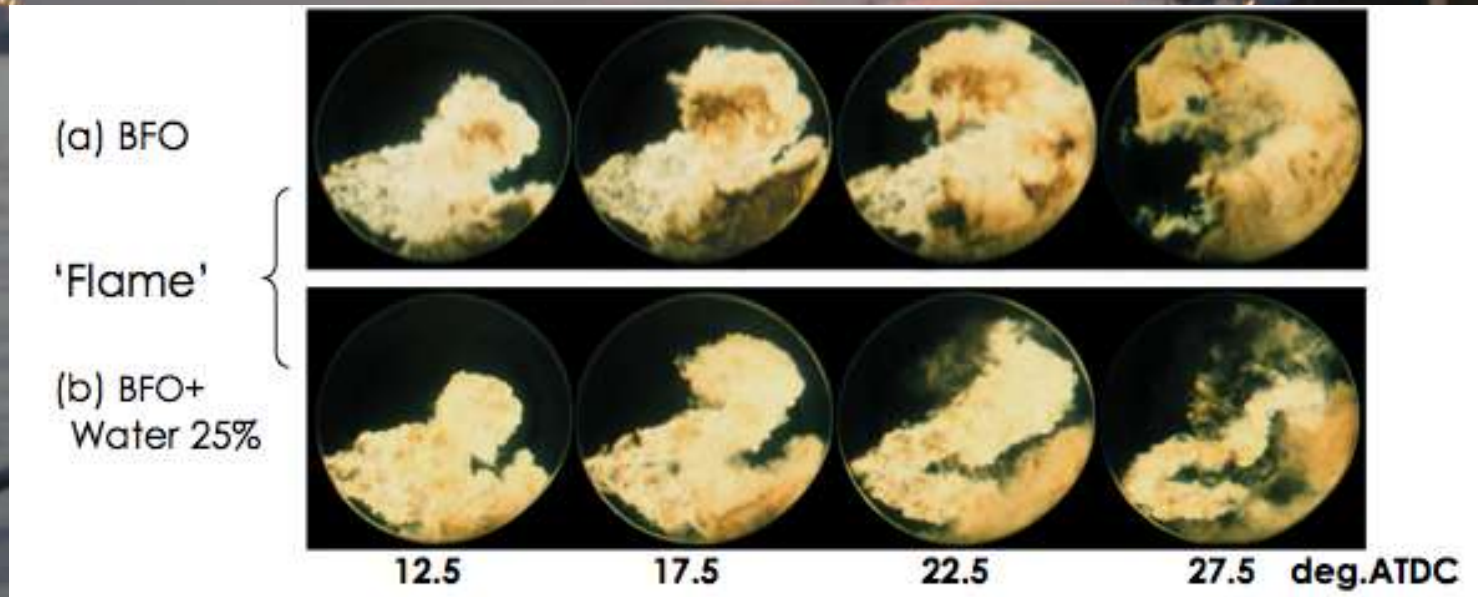
- Emulsions more even and complete burn results in lower Particulate Matter production



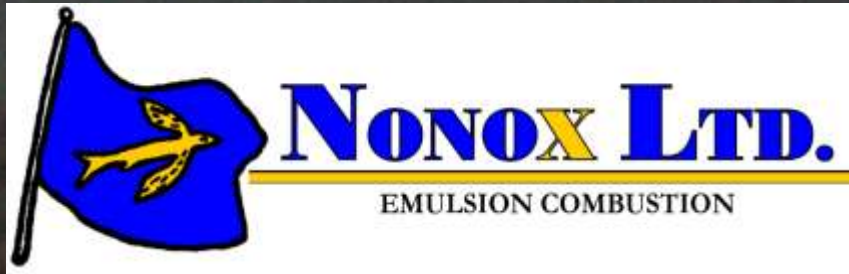
\*Image Kyushu University

# Fuel Efficiency

- Secondary atomization results in a more complete burn
- More fuel burned, less fuel discharged as pollution, higher efficiency



\*Image Kyushu University



# SWIFT RESOLUTE PROJECT

October 2009

The Vessel: MV Swift Resolute  
Class: Cape Class Bulk Carrier  
Year Built: 1982  
Tonnage: 132,049 DWT



Engine: Mitsui/B&W 6L80GFCA

Horsepower: 15,800

Fuel Consumption: 50 MT/Day





## Challenges:

- Fuel Temperatures above the boiling point of water.
- Possible water contamination of return fuel.
- Time consuming switch over from HFO to Emulsion
- Loss of revenue per to pull ship out of service.
- Maintaining consistent emulsion without the use of surfactants.

## Solutions:

- Emulsion Distributed and maintained under pressure to prevent water boil off.
- Emulsion looped so as not to contaminate existing fuel storage.
- Majority of installation can be completed without removal of vessel from service.



System operation requires minimal operator input.



## The Unit:

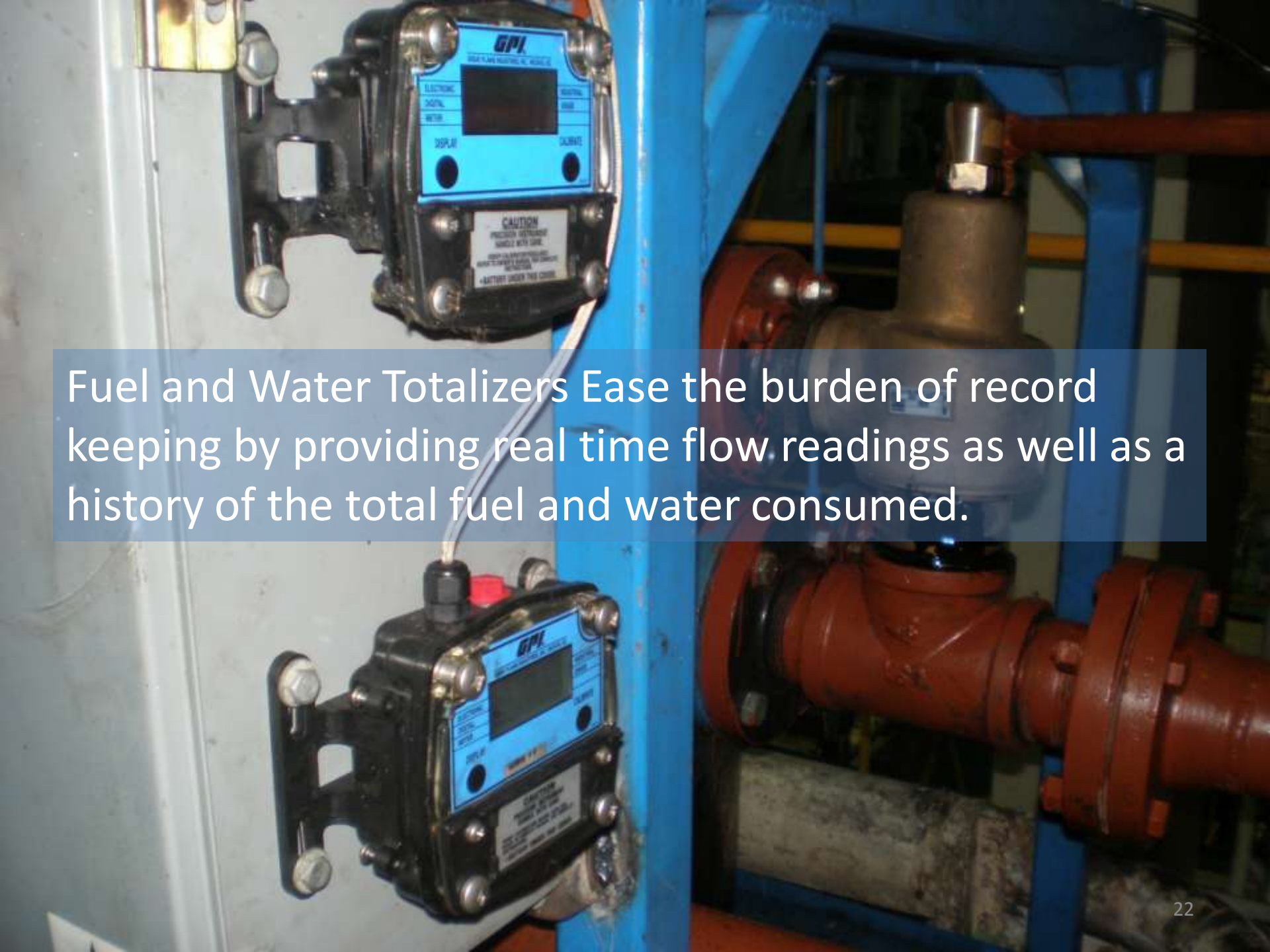
- Compact design requires minimal space
- Continuous emulsification requires no surfactants and maintains a stable emulsion.



# Control of Fuel Intake and Return

3-Way Valves ease the transition from normal operation to emulsion





Fuel and Water Totalizers Ease the burden of record keeping by providing real time flow readings as well as a history of the total fuel and water consumed.

More favorable engine temperature allow for higher available power settings while running the Resolute on emulsion.



CAMSHAFT POSITION  
凸 輪 軸 位 置



AUX. BLOWER

SHAFT REVOLUTION COUNTER

COOL. S. W. INLET  
冷 却 海 水 入 口

# Consumption Test Data

Start Date/Time	Start Fuel Reading (Liters)	Start Water Reading (Liters)	End Date/Time	End Fuel Reading (Liters)	End Water Reading (Liters)	Elapsed Time (Minutes)	Ave Fuel Flow (L/M)	Ave Water Flow (L/M)	Water %	Engine RPM	Fuel Temp C	% Savings Over Baseline
10/18/2009 7:21	42303	0	10/18/2009 9:11	45986	0	110	33.48	0	0.00	89	135	
10/18/2009 9:11	45986	1853	10/18/2009 11:24	50235	2378	133	31.95	3.95	11.00	89	130	-4.58
10/18/2009 11:35	50576	2422	10/18/2009 13:17	53810	2889	102	31.71	4.58	12.62	89	131	-5.30
10/18/2009 13:22	53997	2915	10/18/2009 14:43	56552	3313	81	31.54	4.91	13.48	89	132	-5.79
10/18/2009 14:49	56738	3341	10/18/2009 16:50	60671	3939	121	32.50	4.94	13.20	89	132	-6.71
10/18/2009 17:05	61216	0	10/18/2009 17:37	62331	0	32	34.84	0.00	0.00	89	136	



# Experience and Confidence

Nonox's current technology, represents over 30 years innovation and development in the lab and field, to refine processes and reduce complexity

The Swift Resolute has logged many thousands of trouble free miles at sea running on the Nonox Fuel emulsion system. This allows Captain Nagpal to devote more time to his many responsibilities to ensure the safe delivery of his cargo.



## Getting the Job Done

- Simple inexpensive solution
- Pays for itself with increased fuel efficiency
- Increase your profits while reducing emissions

# Further Information

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