



Blue Conference

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Thomas Eefsen, Senior Project Manager

Danish Centre for Maritime Technology / FORCE Technology

'Green Ship of the Future'

1. *Introduction*
2. *Shipping and Air Emissions*
3. *'Green Ship of the Future'*
4. *Projects*
5. *Energy efficiency*
6. *Questions*



Division for Maritime Industry



Simulator
Training



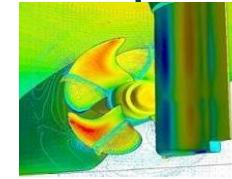
Simulation
Technology



Aerodynamics



Hydrodynamics



Computational
Fluid Dynamics



DCMT and
Green Ship

A formalised co-operation between



- Strengthening of the technology 'chain'
- Attraction and education of new engineers
- Applied research in Safety, Environment and Operations
- Innovation
- Technical services and products to the Blue Denmark

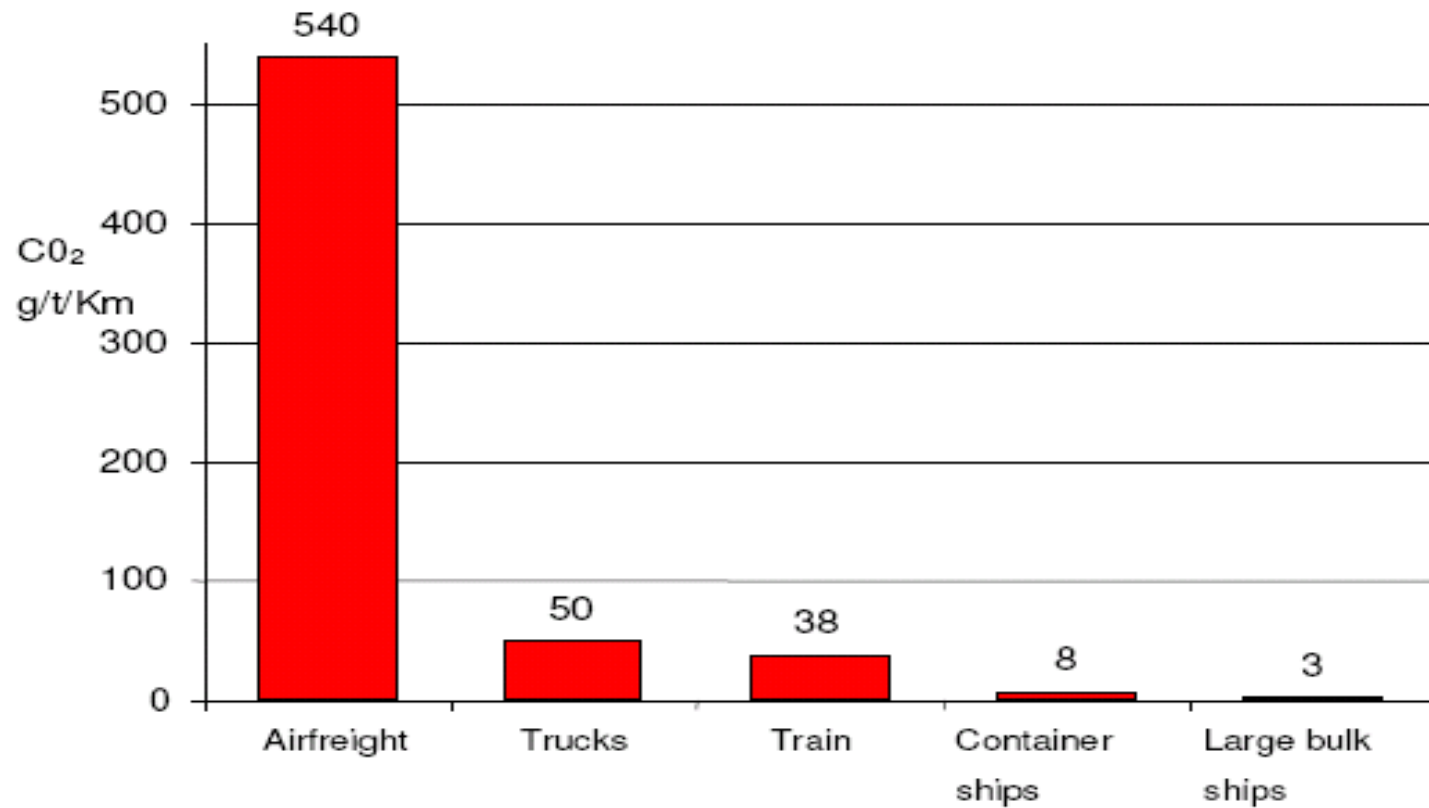
DCMT is funded by Danish Maritime Foundation

Shipping and Air Emissions



- Shipping is probably the most international of all the world's industries, carrying up to 90% of global trade by weight in a cost and energy efficient way.
- The international shipping industry is the life blood of the global economy.
- Without shipping, it would simply not be possible to conduct intercontinental trade, to transport raw materials in bulk or to enable the import and export of affordable food and manufactured goods.

Shipping and Air Emissions



Source: Danish Association of Shipowners

'Green Ship of the Future'



Photo: Former Danish Minister of Economic and Business Affairs, Bendt Bendtsen at the launch of Green Ship of the Future' on 9th April.

Provide technology to obtain and demonstrate:

- 30% reduction of CO₂
- 90% reduction of SO_x
- 90% reduction of NO_x

Focus areas:

- Machinery
- Propulsion
- Operation
- Logistics

'Green Ship of the Future'



Proud co-operation of partners in the Blue Denmark:





'Green Ship of the Future'

Machinery

Propulsion

Operation

Logistics

Coordination, workshops and new projects (DCMT)

Marketing and Communication (DTU/v HOK)

Dual / Multi MCR Certification



Development of main engines with dual or multi certification for easy change of MCR rating for any trade route or speed

- Optimal running conditions for different ship speeds eg Turbocharger cut-out, Variable Turbine Area, fuel system equipment, engine settings etc.
- MCR ratings based on current needs & future expectations
- Potential: 3% reduction in CO₂



MAN Diesel



MAERSK

CO₂

NO_x

SO_x

Waste Heat Recovery Systems



Further development of Waste Heat Recovery (WHR) systems

- Optimisation of WHR system in close cooperation with partners
- Determination of vessel operation profile and optimisation of engine for improved exhaust gas data.
- Installation of new exhaust gas fired boiler, turbo generator (steam/gas turbine and generator)
- Optimisation of WHR system given the available space constraints
- Potential: 20% reduction in CO₂ combined with other emission reduction methods



Odense Lindo
Odense Steel Shipyard Ltd.



MAN Diesel



MAERSK



CO₂

NO_x

SO_x

EGR Systems

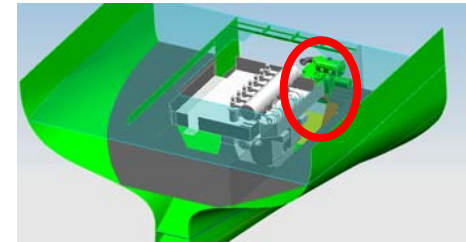
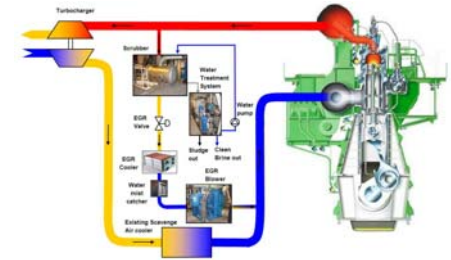


Development of an Exhaust Gas Recirculation (EGR) system

- Specification and design of an EGR system, including system integration with engine room and other auxiliary systems
- Installation and verification test on vessel, including EGR system optimisation
- EGR scrubber selection and specification
- Potential: NO_x by 50%

- Alexander Maersk identified as ship for the first EGR installation
- EGR Installation planned to be ready for testing early 2010

- A prototype EGR system has been set up on the test engine in Copenhagen, with very positive results



CO₂

NO_x

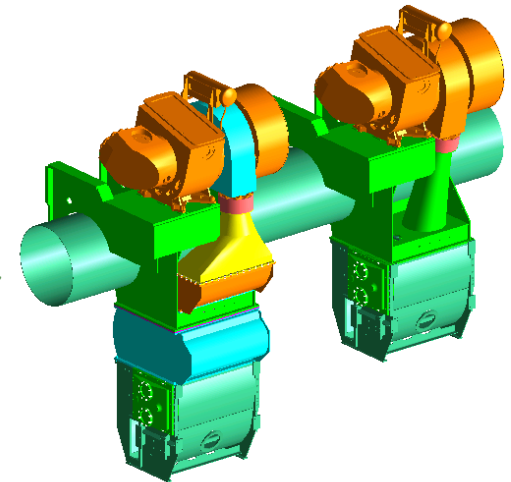
SO_x

Wet Methods of NO_x reduction

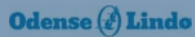


Development & installation of Scavenging Air Moistening system (SAM) and a Fuel/Water Emulsion system (WIF)

- Find the maximum NO_x reduction achievable from these 'wet methods', without jeopardising engine reliability
- Potential: NO_x reduction in excess of 60% is expected when SAM & WIF are used together
- Minimise increase in fuel consumption resulting from 'wet methods'
- Quantify potential of waste heat generated from SAM system
- A WIF system is already installed on a large container vessel (APL)
- The first test is expected to be finished early September
- Maersk and MAN Diesel will evaluate expansion of the the test on Sovereign Maersk



MAN Diesel



Odense Steel Shipyard Ltd.



MAERSK



CO₂

NO_x

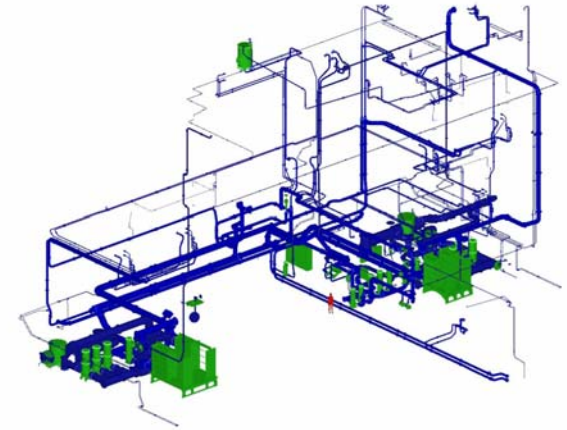
SO_x

Pump & Auxiliary Systems



Optimisation of pump and auxiliary systems

- Re-design systems with a focus on power consumption
- Introduce automated systems that continuously control the power demand
- Potential: 1% CO₂ reduction for a large container ship



CO₂

NO_x

SO_x



Pump- and cooling water systems

Optimisation of pump and cooling water systems on a 34,000 DWT Bulk Carrier Design:

- Overall vessel CO₂ emission reduction of 1.5%.
- Corresponding to 20% of the daily auxiliary generated power.



CO₂

NO_x

SO_x

Automated Engine Monitoring



CO₂

NO_x

SO_x

Optimisation of engine settings by automated monitoring and information system

- Introduce an automated control system that monitors engine operating parameters and adjusts engine settings accordingly for optimal fuel consumption
- Auto-tuning algorithms successfully being verified at full scale field test (electronically controlled engines).
- System design outline in progress
- System requirement specification & project planning initiated
- Full scale test on APM demonstrator vessels (MC engines) prior to december 2009



Air Lubrication System (ACS)

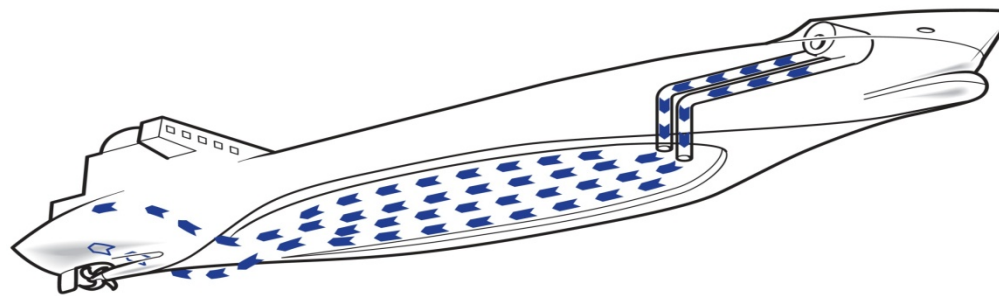


Development and verification of Air Lubrication System (ACS):

- Up to 15% fuel reduction with ACS stand alone design
- Up to 15% CO₂ reduction with ACS stand alone design
- Ship is build and sea trial performed. Service test in progress
- Pay-back time 2-4 years



DK GROUP
MARINE INDUSTRY INNOVATORS



CO₂

NO_x

SO_x

Scrubber Systems



Development of scrubber systems for removal of SO_x and particles

- Investigate and utilise exhaust gas scrubber technology to clean the exhaust gas
- Full design, development, and installation of the scrubber
- Removal of particulate matter, SO_x, HC, and heavy metals
- 90% SO_x reduction and at least 90% reduction in particulate matter
- Service test on vessel to be finalized 2009!



MAERSK

CO₂

NO_x

SO_x

Innovative Propeller



New innovative Propeller design with twin blades

The aim of the propeller project is to increase the velocity and expand the water flow area on the propeller blades, by implementing the Injector effect on each propeller blade . The Injector channels will make the whole area of each single propeller blade to generate thrust due to the Injector.



CO₂

NO_x

SO_x

Invitation ...



Alle companies, Organisations and R&D Institutes are invited to join
'Green Ship of the Future'

Contacts

DCMT: Thomas Eefsen

E: tef@force.dk T: +45 2269 7562

DTU: Hans Otto Kristensen

E: hohk@tdcadsl.dk T: +45 4045 9020

Thanks for your Attention



Provide technology to obtain:

- 30% reduction of CO_2
- 90% reduction of SO_x
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Focus areas:

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