



**VIENNA** 2018



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solutions for society, economy and environment

# THE HERCULES-2 PROJECT OF R&D ON LARGE ENGINES FOR SHIPS

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Hosted and organised by:

*Austrian Ministry  
for Transport,  
Innovation and Technology*



**austriatech**

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Together with:



# HERCULES is developing **new technologies** for marine engines:

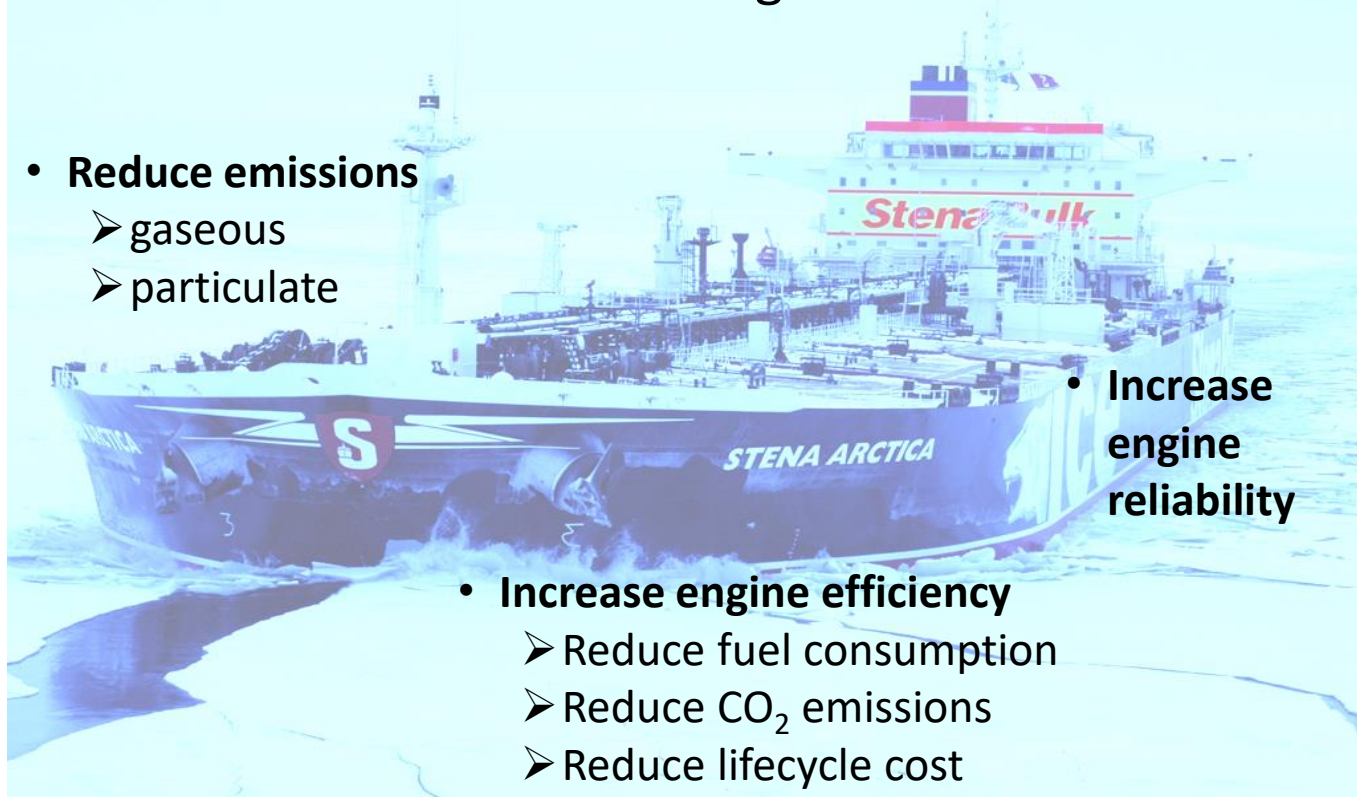
- **Reduce emissions**

- gaseous
- particulate

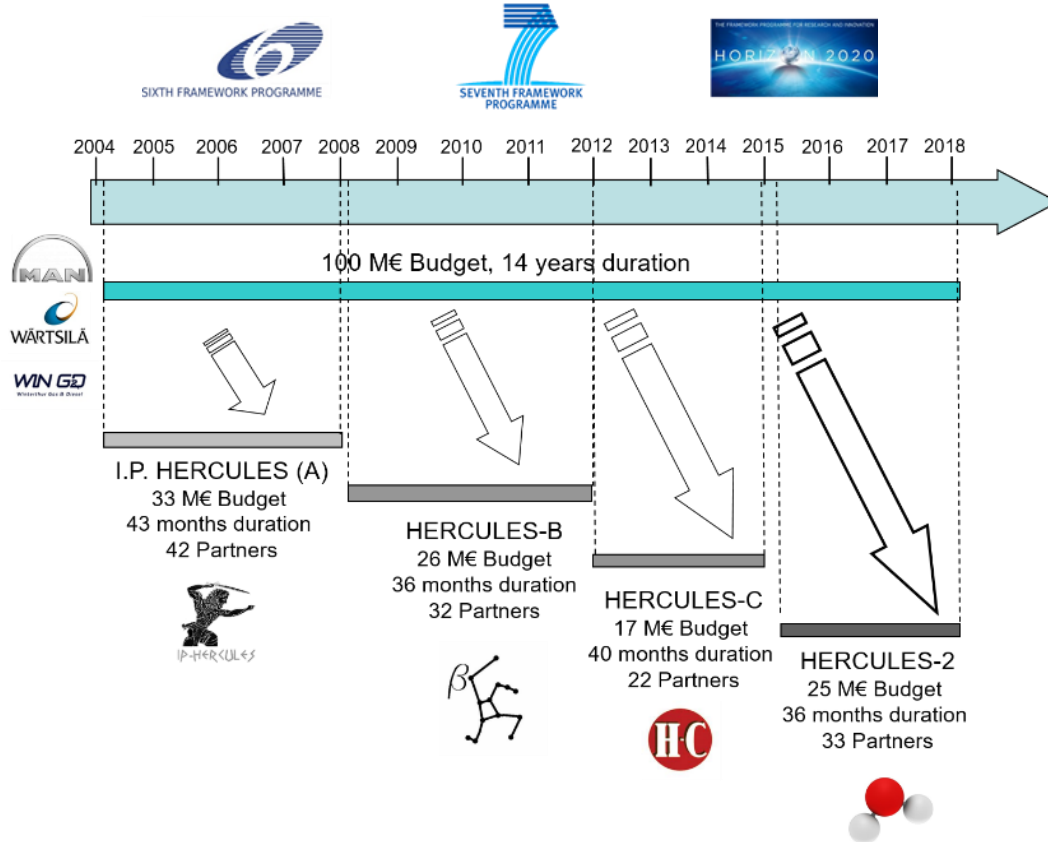
- **Increase engine reliability**

- **Increase engine efficiency**

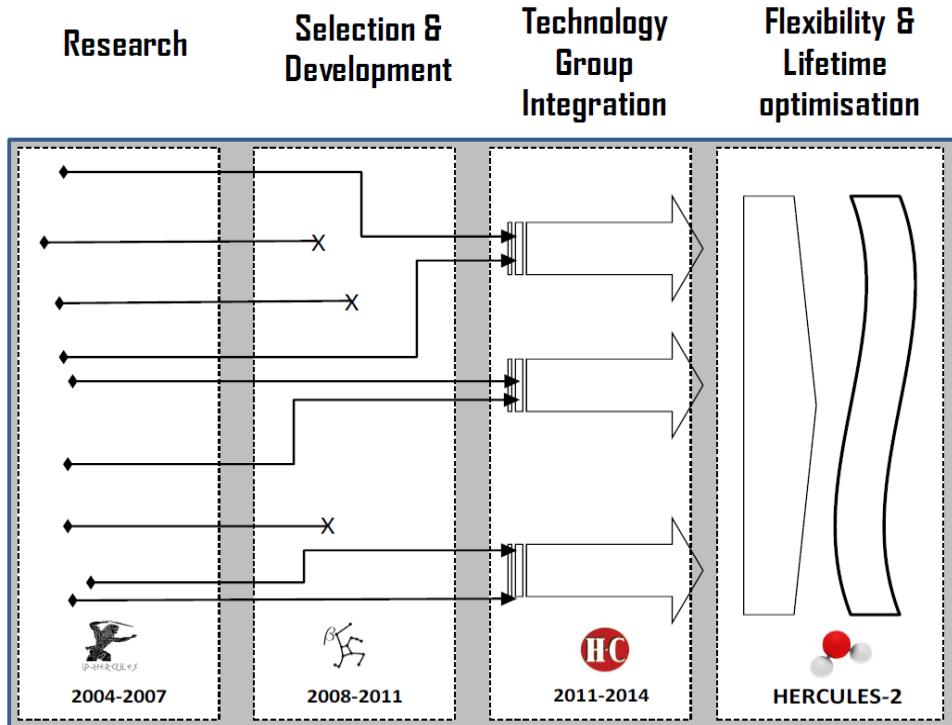
- Reduce fuel consumption
- Reduce CO<sub>2</sub> emissions
- Reduce lifecycle cost



# The HERCULES Programme Timeline



# The HERCULES Programme evolution



## ○ HERCULES A

*High-Efficiency Engine R&D on Combustion with Ultra Low Emissions for Ships*

## ○ HERCULES-B

*Higher-efficiency Engine with Ultra-low Emissions for Ships*

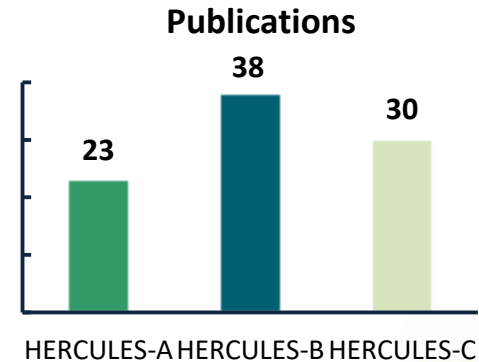
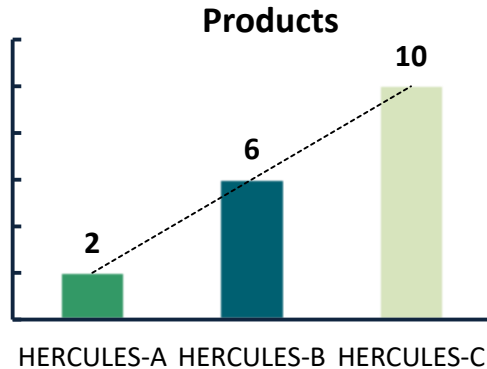
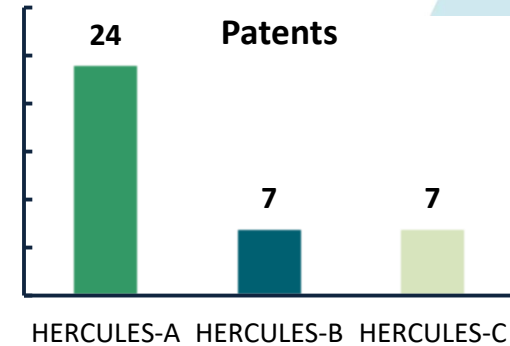
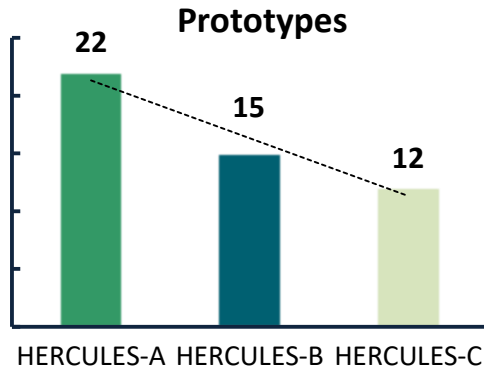
## ○ HERCULES-C

*Higher-efficiency, Reduced Emissions, Increased Reliability and Lifetime, Engines for Ships*

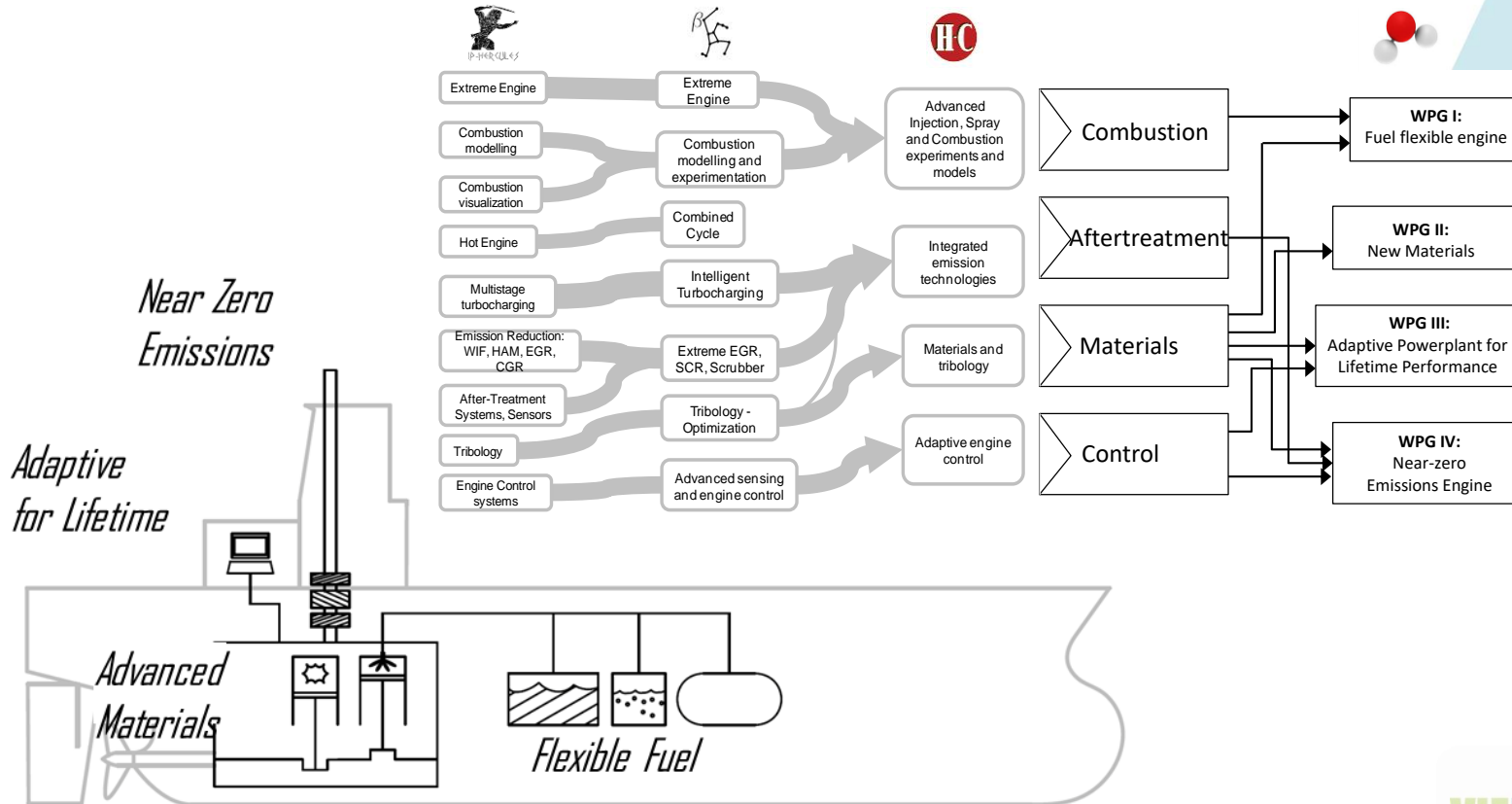
## ○ HERCULES-2

*Fuel flexible, near-zero emissions, adaptive performance marine engine*

# Metrics of HERCULES



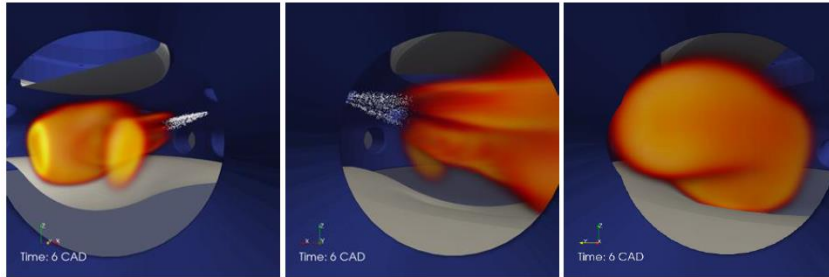
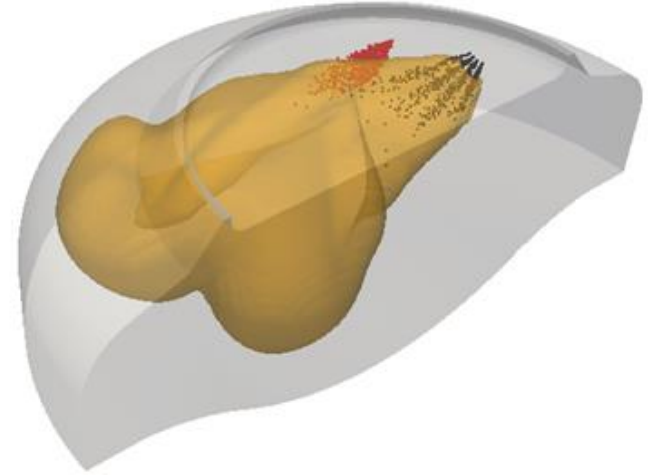
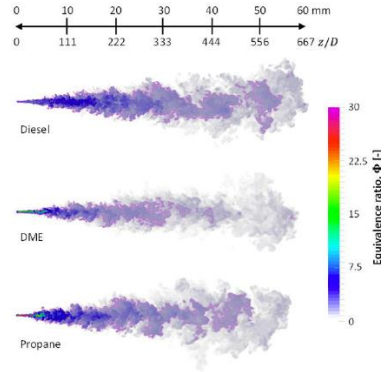
# Links among HERCULES Projects



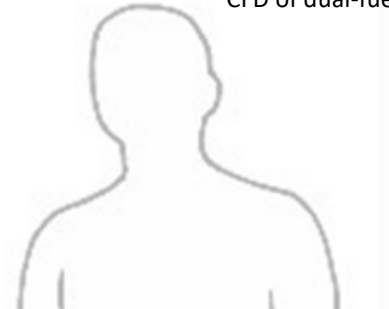


# WPG I: Fuel flexible engine

Large Eddy Simulation (LES) of evaporating fuels: Diesel, dimethyl ether (dme) and propane



CFD of dual-fuel combustion in two-stroke marine engine

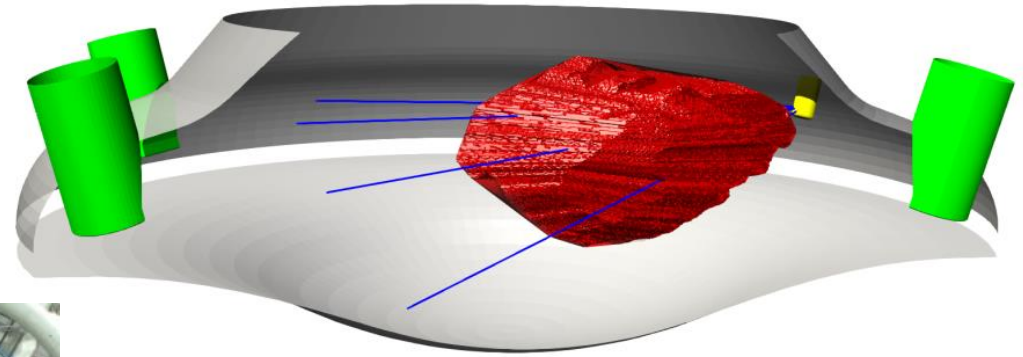
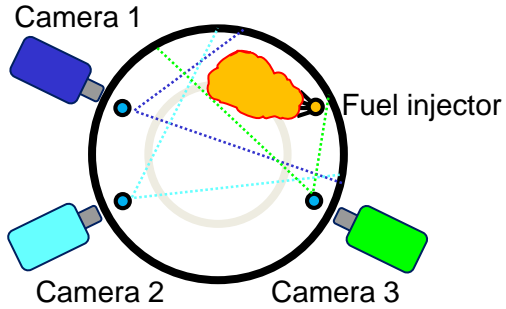


Flame rendering from CFD, as it would appear from the three cameras





# WPG I: Fuel flexible engine

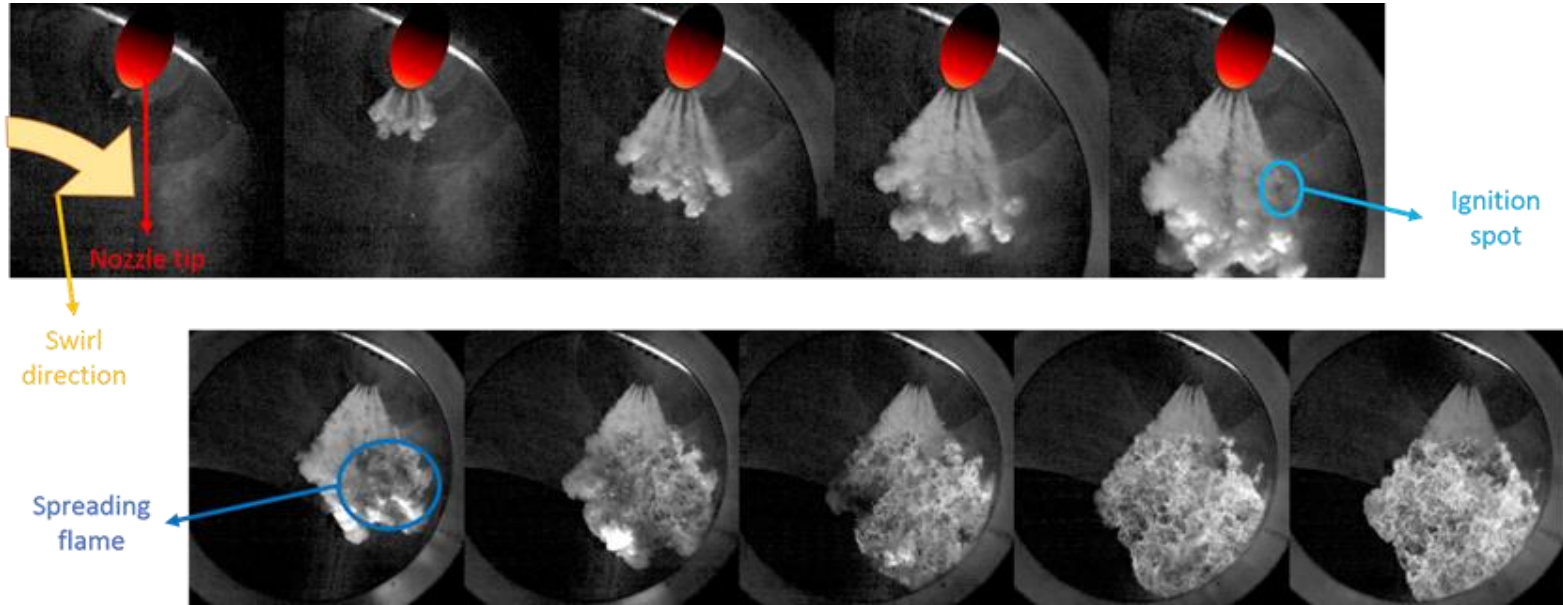


Triple-camera high-speed imaging on two-stroke dual-fuel engine  
reconstructed 3D flame kernel





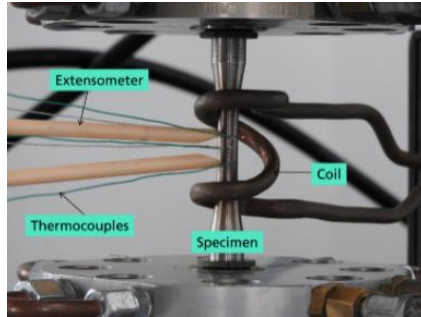
# WPG I: Fuel flexible engine



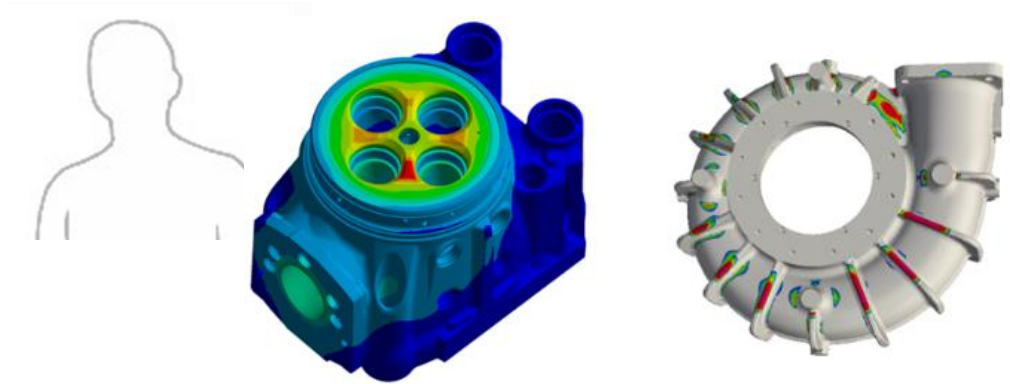
Multi-camera mapping of 3D flame shape in two-stroke dual-fuel engine



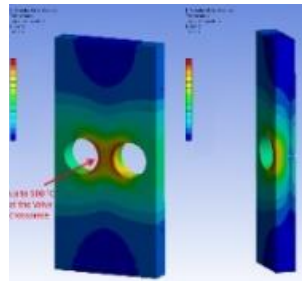
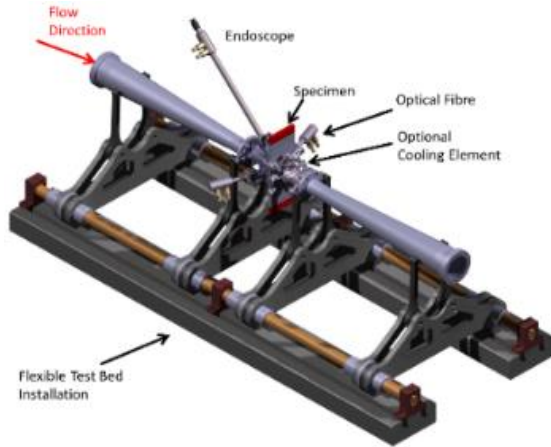
# WPG II: New Materials (Applications in engines)



Test set-up for thermomechanical fatigue



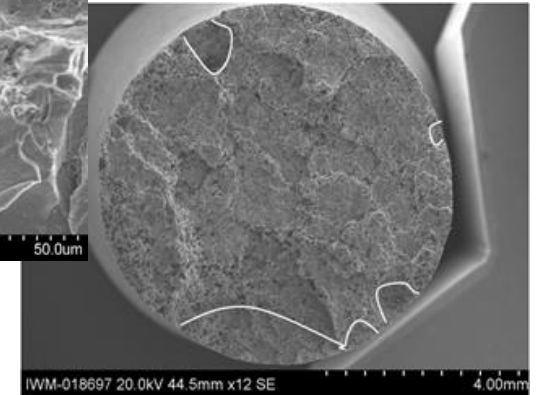
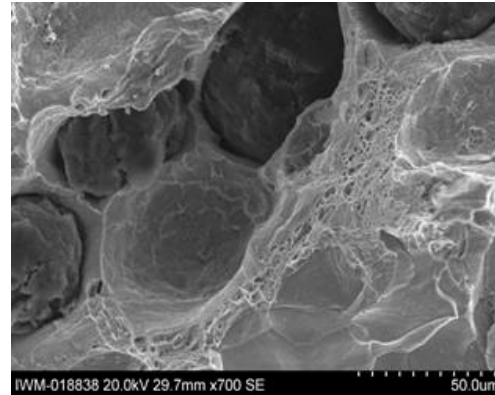
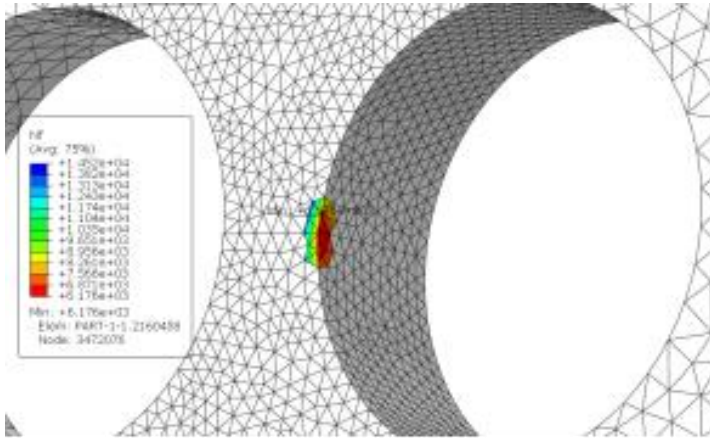
New materials investigation for cylinder head and turbine casing



TMF test rig and specimen



# WPG II: New Materials (Applications in engines)

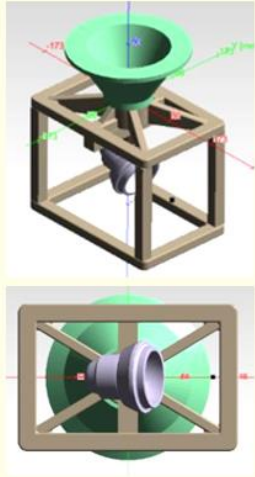




# WPG II: New Materials (Applications in engines)



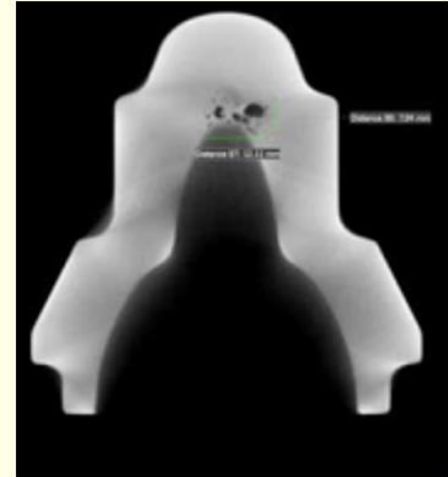
**Casting simulations**



**Investment casting**



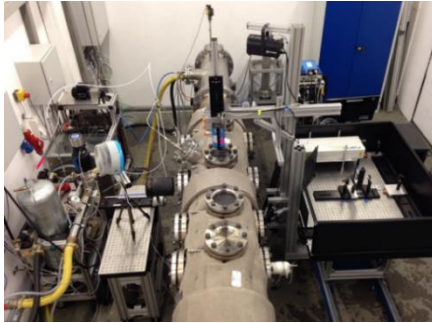
**NDT-testing via CT-scans**







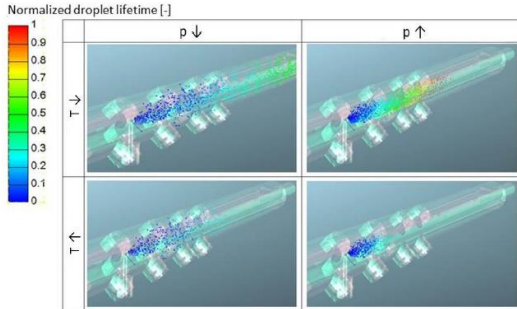
# WPG IV: Near-Zero Emissions Engine



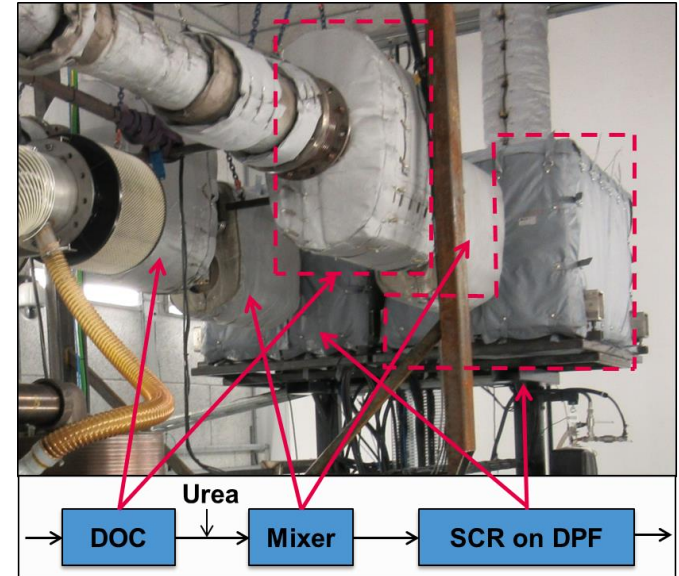
Hot gas test rig for urea decomposition investigations



Mini SCR system for urea mixing/evaporator study



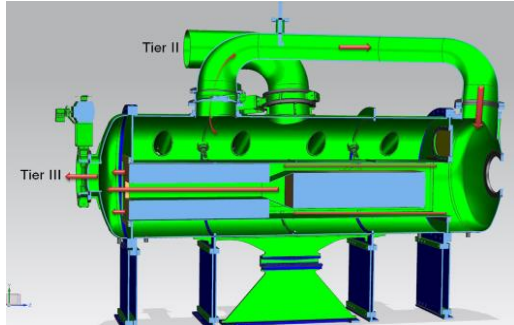
Simulated spray behaviour at different operating conditions



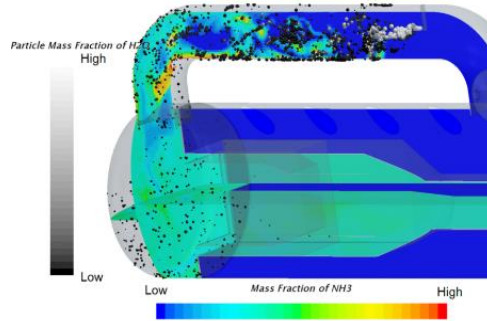
Exhaust aftertreatment (EAT) system, Diesel Oxidation Catalyst (DOC) & SCR coated Diesel Particulate Filter (DPF), installed in full scale.



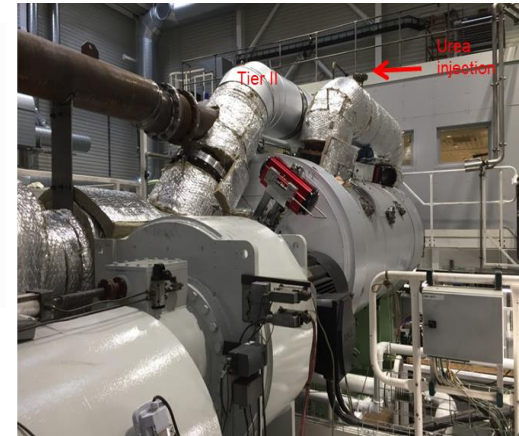
# WPG IV: Near-Zero Emissions Engine



Engine integrated High Pressure SCR system



Exhaust gas flow inside the integrated SCR



Engine Integrated SCR Installation on a 2 stroke 4 cylinder diesel engine.



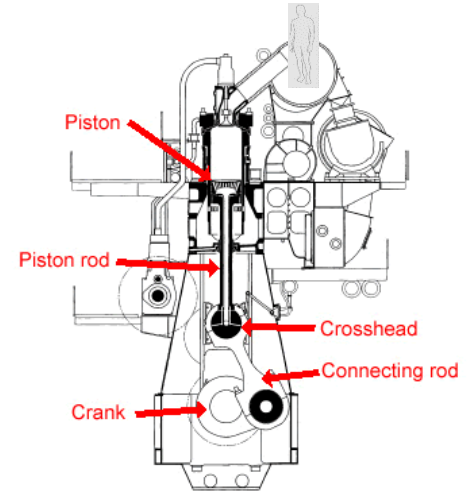
# WPG IV: Near-Zero Emissions Engine



Installation of field test catalyst device in exhaust manifold

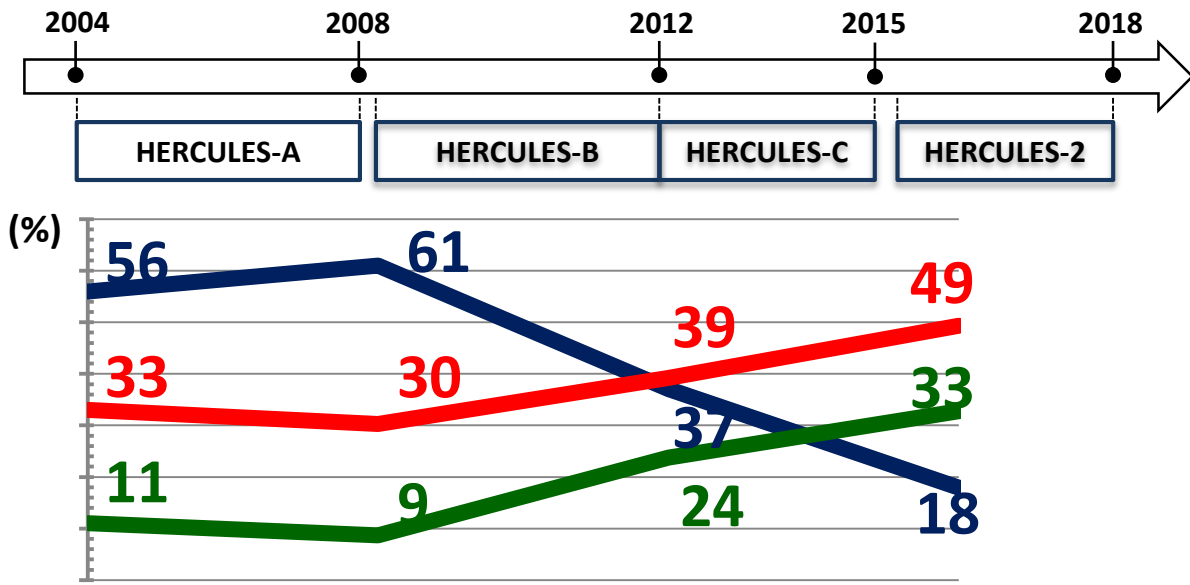


Inspection of field test catalyst device in exhaust manifold





Percentage allocation of budget into 3 main areas of R&D in the 4 HERCULES Projects (189 subprojects)



% of individual project budget

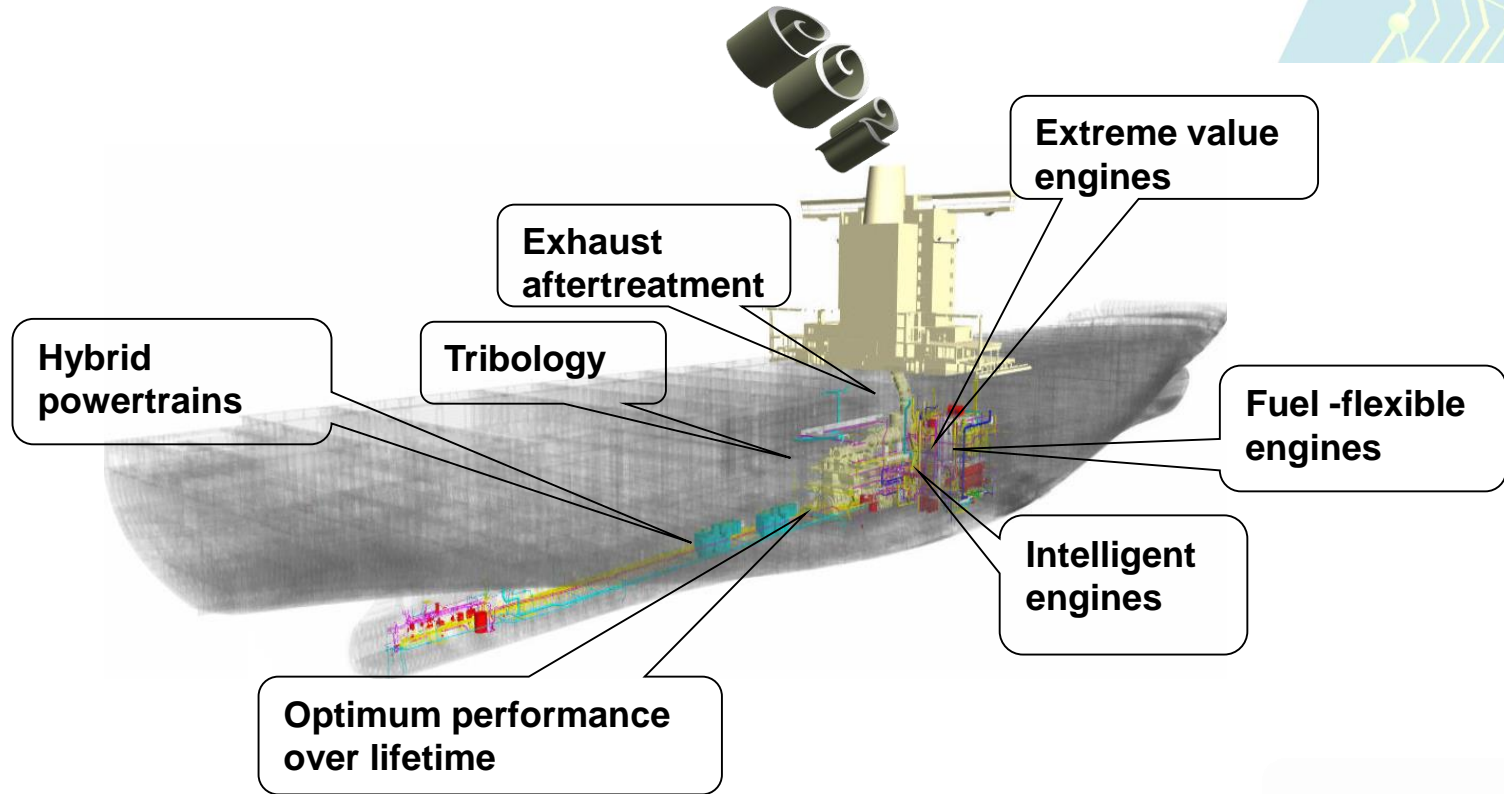
- Efficiency
- Emissions
- Reliability & Lifetime

Total 102 M€

- 43%
- 38%
- 19%

<i>TECHNOLOGY AREA</i> <i>TECH ITEMS</i>	COMBUSTION	TURBO CHARGING	EMISSIONS ATU	MATERIALS FRICTION	MONITOR CONTROL OPTIMIZATION
<b>Multi-Turbo/ VVT</b>		✓			✓
<b>PTI/PTO</b>		✓			✓
<b>Increased Pmax. Cyl.</b>	✓	✓		✓	✓
<b>Cylinder auto-tuning</b>					✓
<b>Water-in-Fuel</b>	✓		✓		
<b>SCR</b>			✓		✓
<b>Tribology</b>				✓	
<b>WHR- Hot Engine</b>				✓	✓
<b>EGR</b>			✓		✓
<b>Cylinder cut-out</b>					✓
<b>Dual Fuel /Multi Fuel</b>	✓				✓

# Near future in ship propulsion engines



# Final Comments



- The longevity of alliances is often used as proxy of their performance.
- The HERCULES alliance of 14 years has been demonstrably successful.
- Many results of R&D already matured into products.

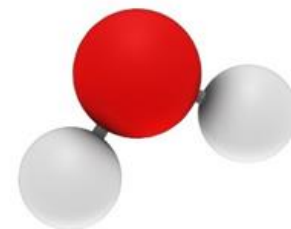
An aerial photograph of a turbulent ocean surface, showing white foam from breaking waves and deep blue-green water. The word "HERCULES" is superimposed in the center in a large, bold, orange, sans-serif font.

# HERCULES

**HERCULES Program 1.5min. video**



# HERCULES Program Partners



SIXTH FRAMEWORK PROGRAMME



SEVENTH FRAMEWORK PROGRAMME





## Contact

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