The Digital Twin in action

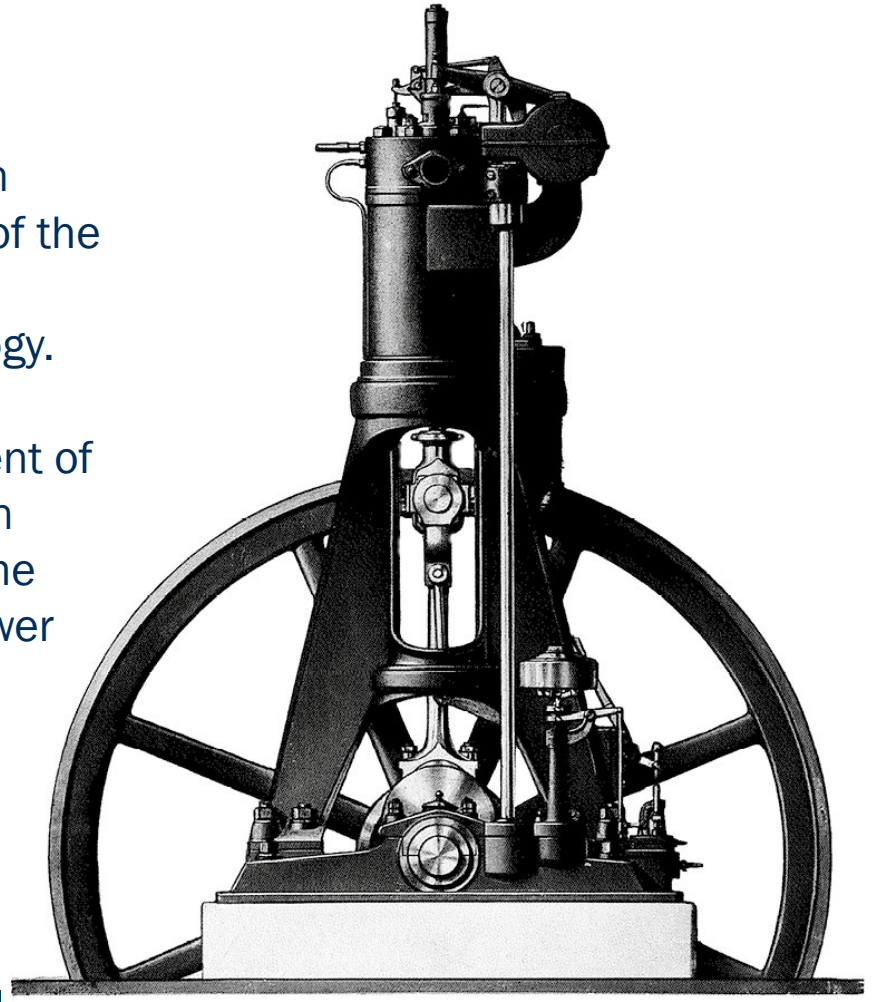
Smart Maintenance Conference, 2019, ETHZ

WIN GD

A long heritage in diesel and gas engine design

WinGD has its headquarter in Winterthur Switzerland, one of the earliest exponents of the Diesel engine technology.

It started with the development of internal combustion engine in 1898 under the **“Sulzer”** name and continues to develop power solutions



2015 — WIN GD Winterthur Gas & Diesel

1997 — WÄRTSILÄ

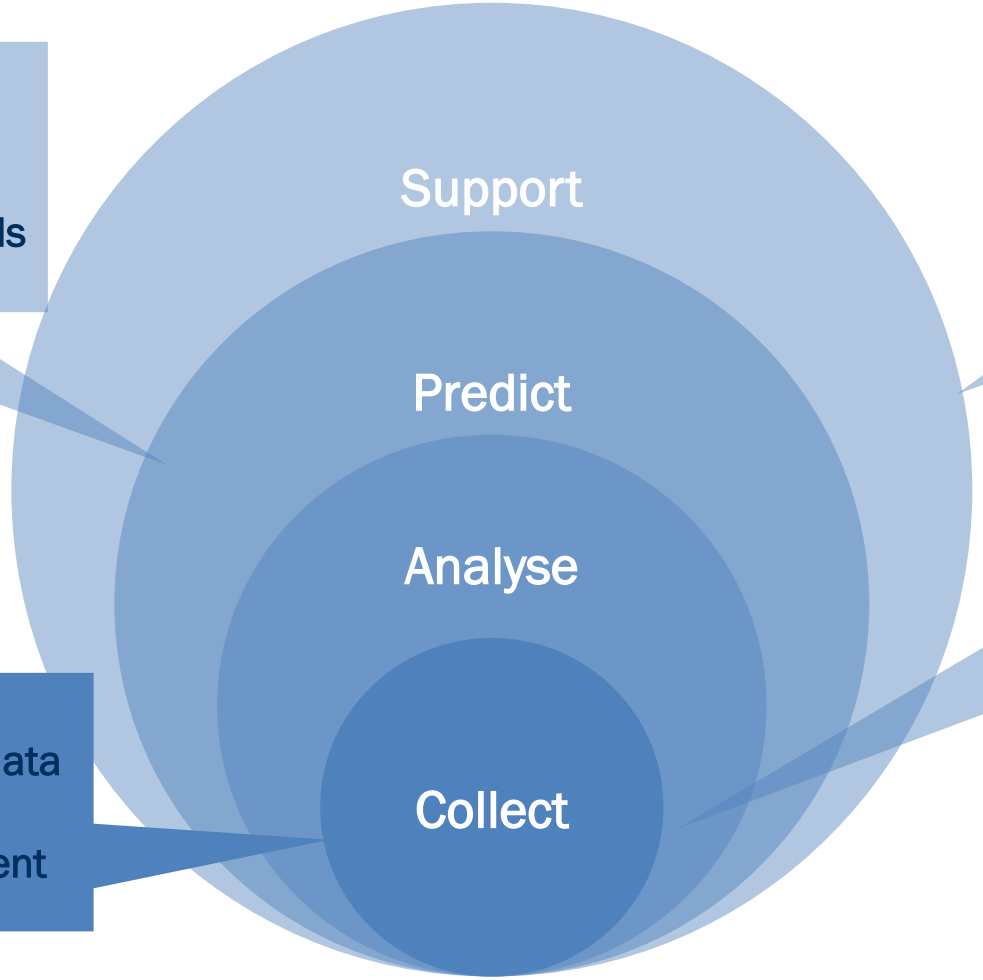
1898 — SULZER

Contents

Digitalization at WinGD

A tool to better support our customers

PREDICT
- Prediction and diagnosis of component malfunction
- Extension of maintenance intervals



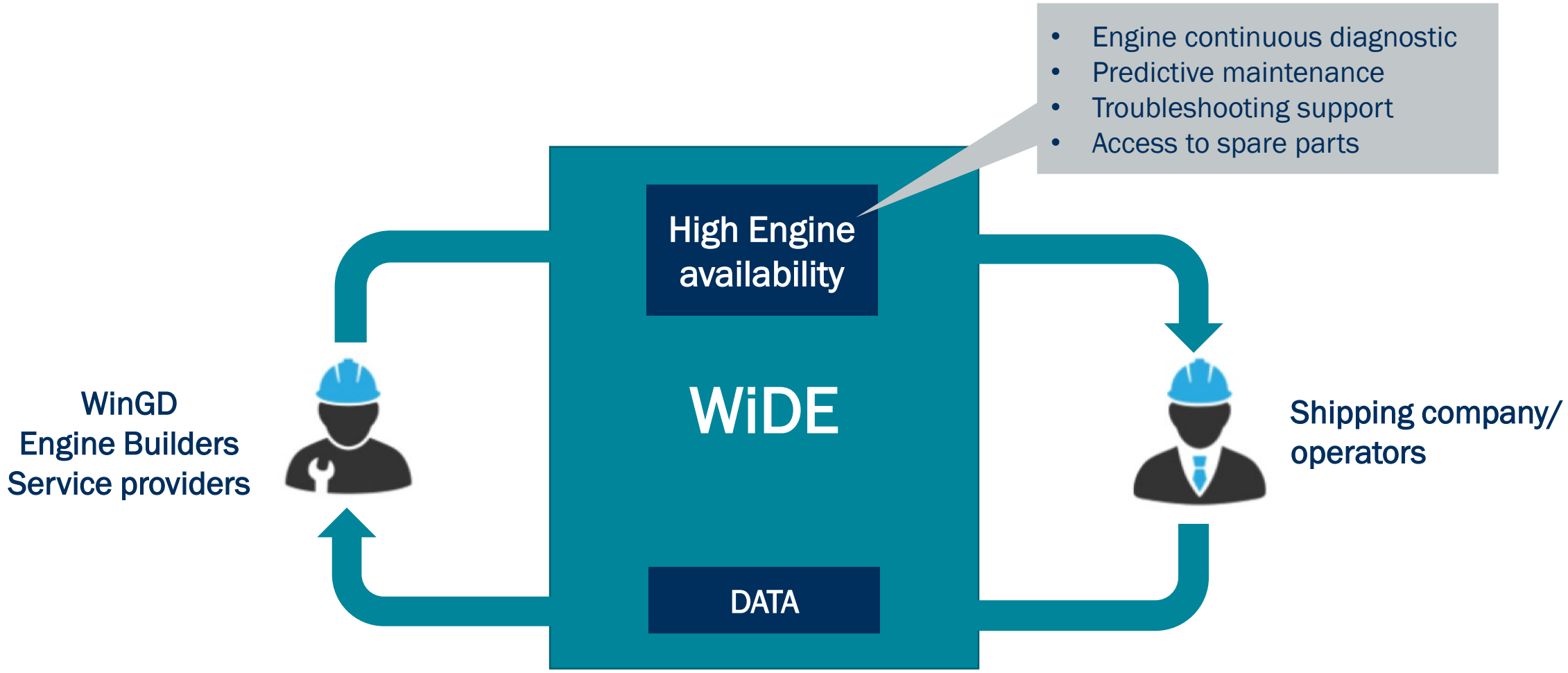
SUPPORT
- Troubleshoot abnormalities
- Steps to fix the malfunction
- Remote support

ANALYSE
- Intelligently diagnose the engine status
- Engine performance and components behaviour

COLLECT
- Display trend of ship and engine data
- Transfer of engine data ashore
- Store data in a secured environment

A common goal: to support our customer

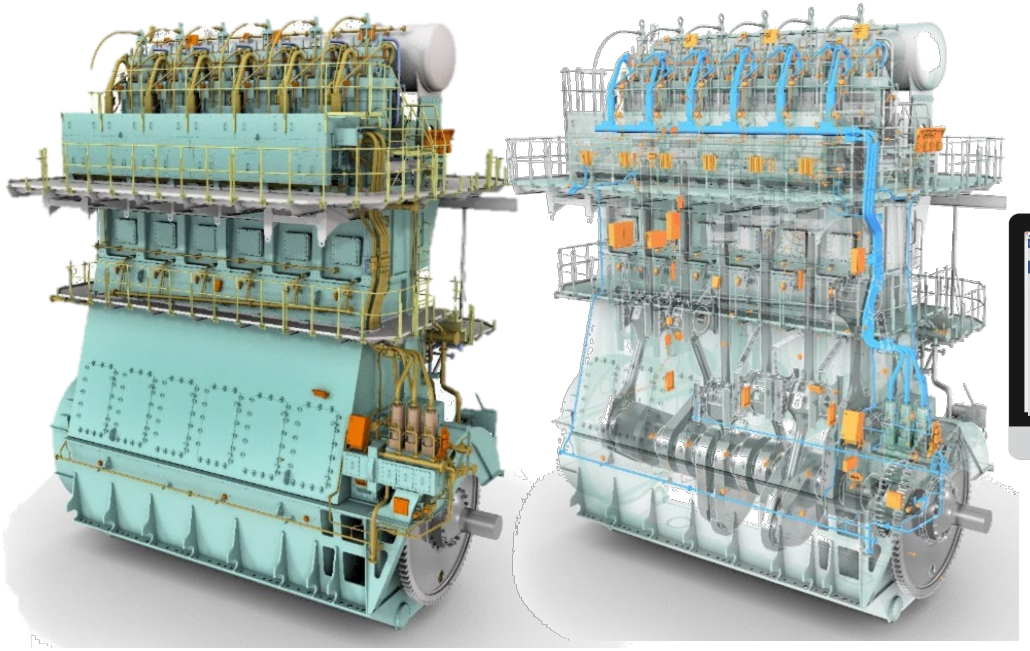
WiDE for a better collaboration between WinGD, engine builders and service provider



WinGD engines go on line

A closer customer relationship

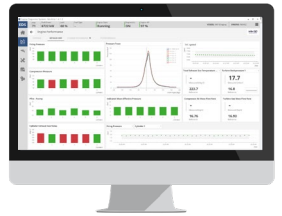
On board



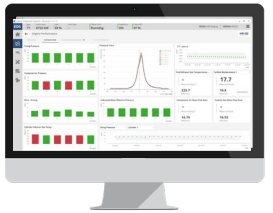
Customer

Onshore/online

WinGD server



Customer

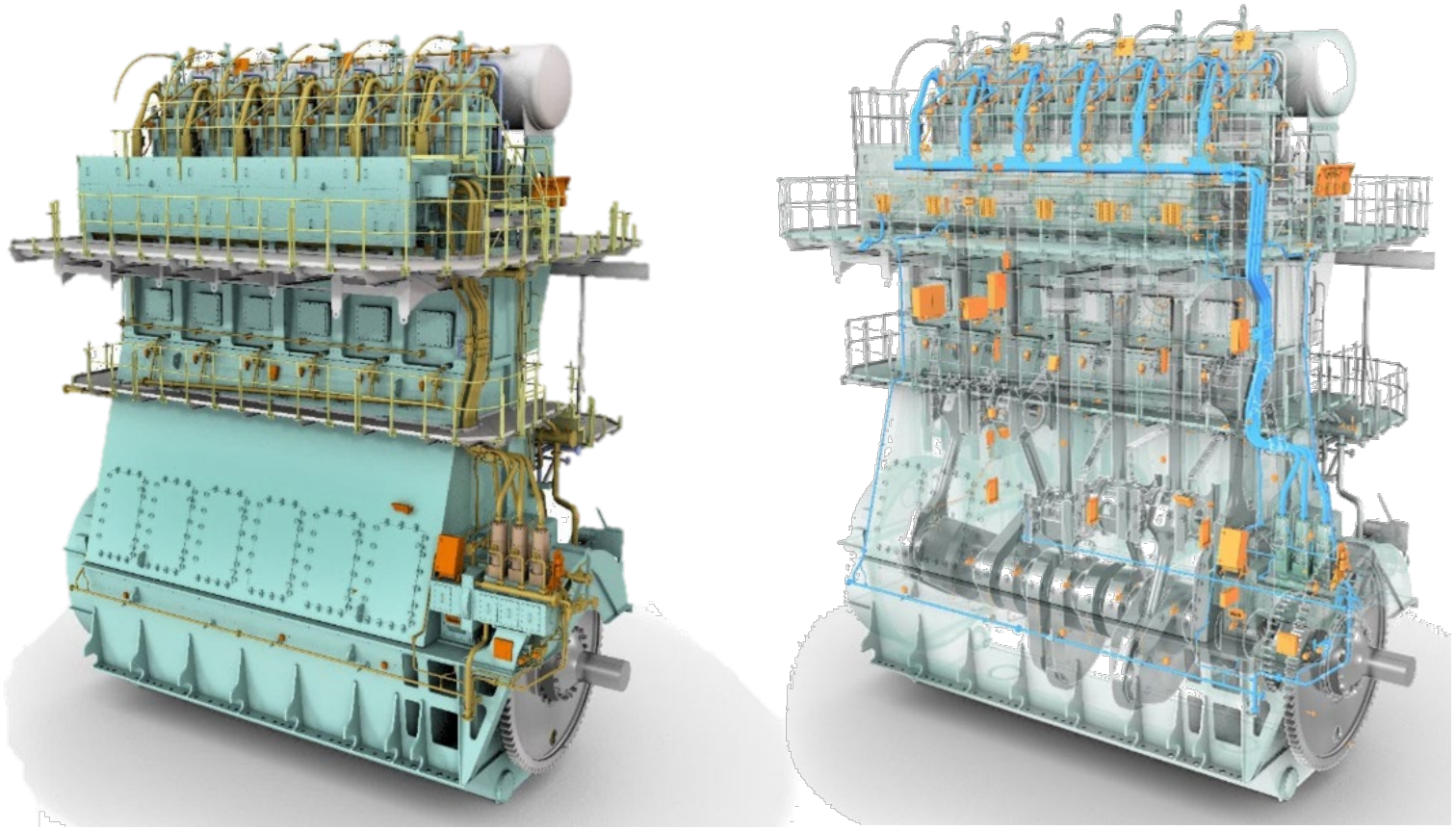


WIN GD
Winterthur Gas & Diesel

Data collection → Data Analysis ↔ Data Storage → Remote support

The Engine Diagnostic System

The WinGD's main Engine Digital Twin



Advanced engine simulation and data analysis for:

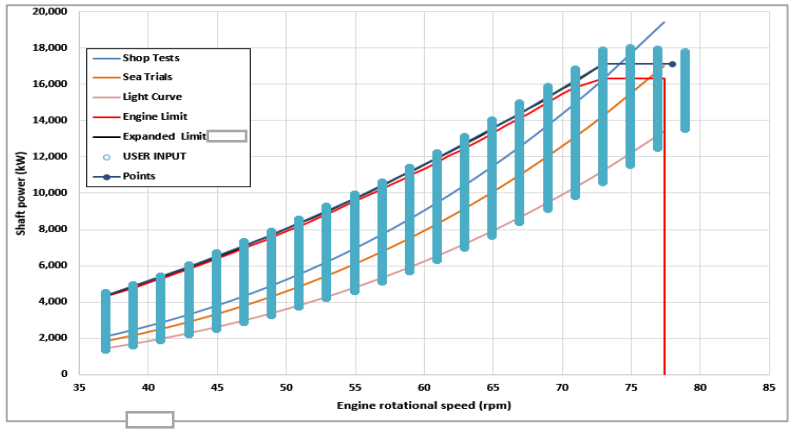
1. Engine Performance
2. Engine components

- Condition Based Maintenance
- Engine Health management
- Energy efficiency
- Safe operations
- Fleet management
- Remote support

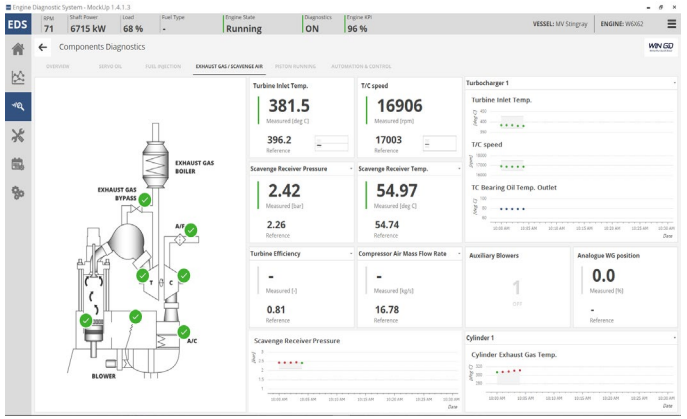
Engine data analysis process

A combination of advanced analyses to closely simulate the engine reality

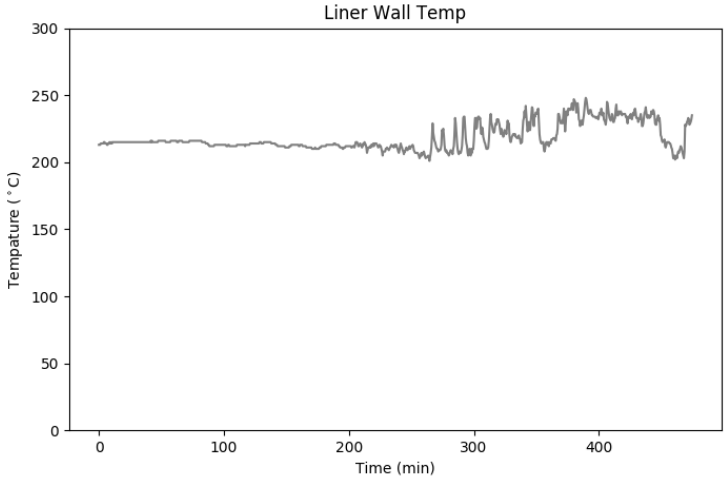
1. Thermodynamic analysis



2. Engine subsystem diagnostics



3. Machine learning



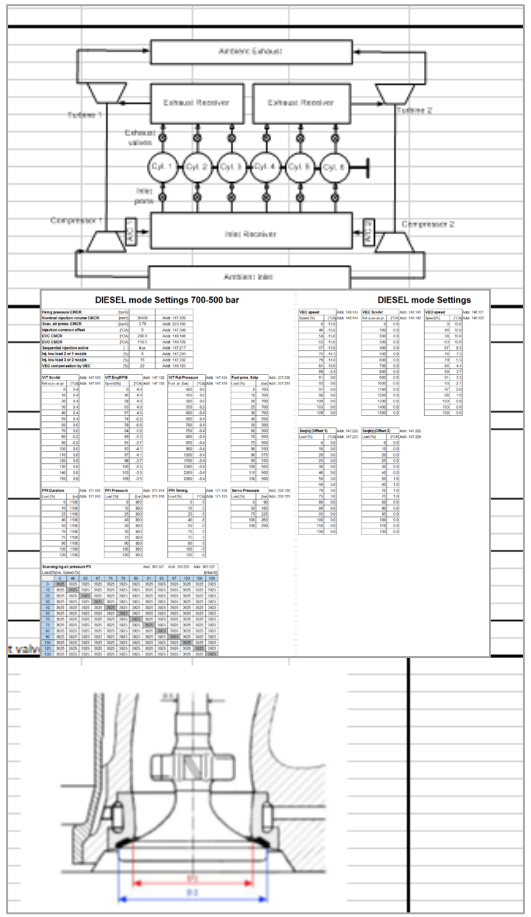
Thermodynamic analysis

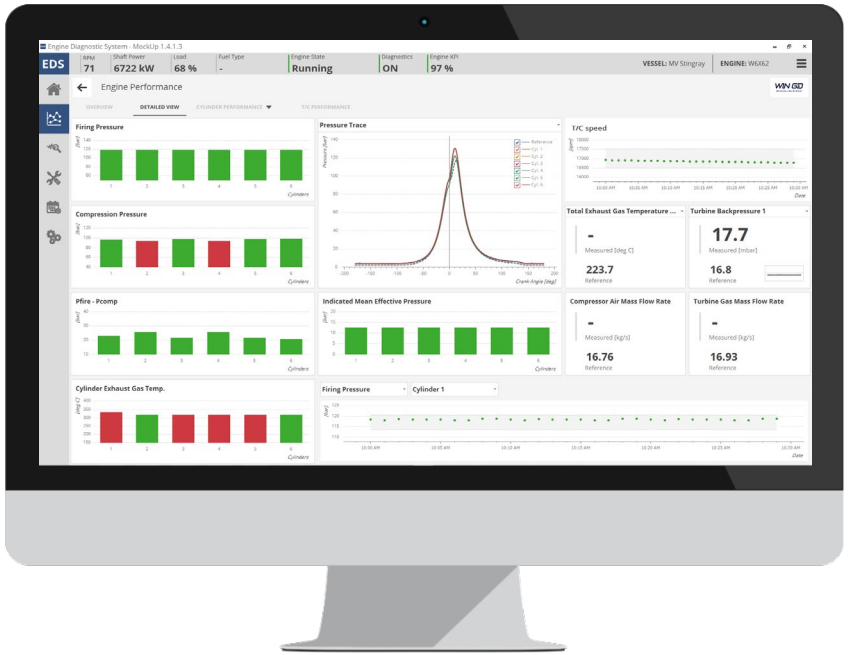
A sophisticated model customized for each engine

A thermodynamic model is created for each engine, using the specific:

- Geometry
- Settings
- Controls Data
- Shop tests data

This is the thermodynamic “Digital Twin”





Engine subsystem diagnostics

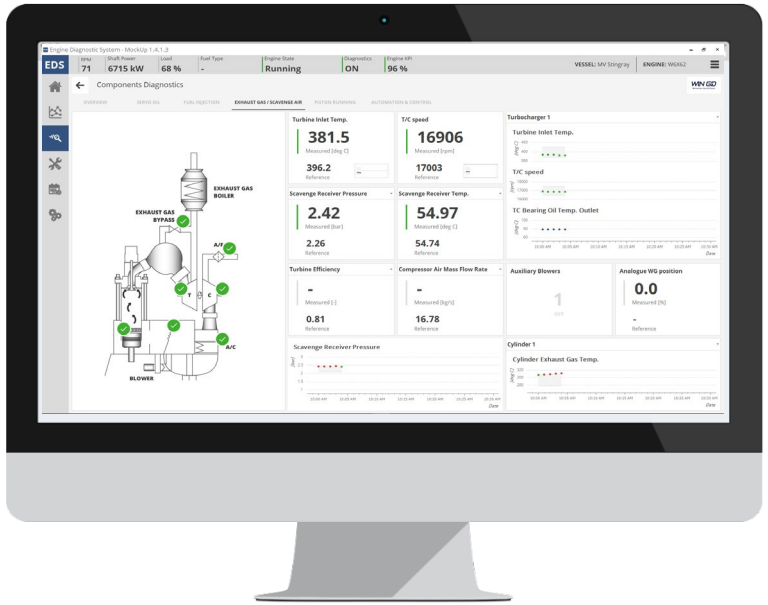
Algorithms based on WinGD core know-how

WinGD core know-how

- Failure modes
- Root cause analysis
- Cause – Effects on the components
- Reference Value
- Trace of the fault-influenced parameters
- Tolerance and threesholds
- Rule sets

The following engine **components** are monitored and analyzed:

- Fuel injection system
- Gas admission system (for dual fuel engines)
- Servo oil system
- Piston running
- Scavenge air system & Exhaust gas system
- Engine control & automation system

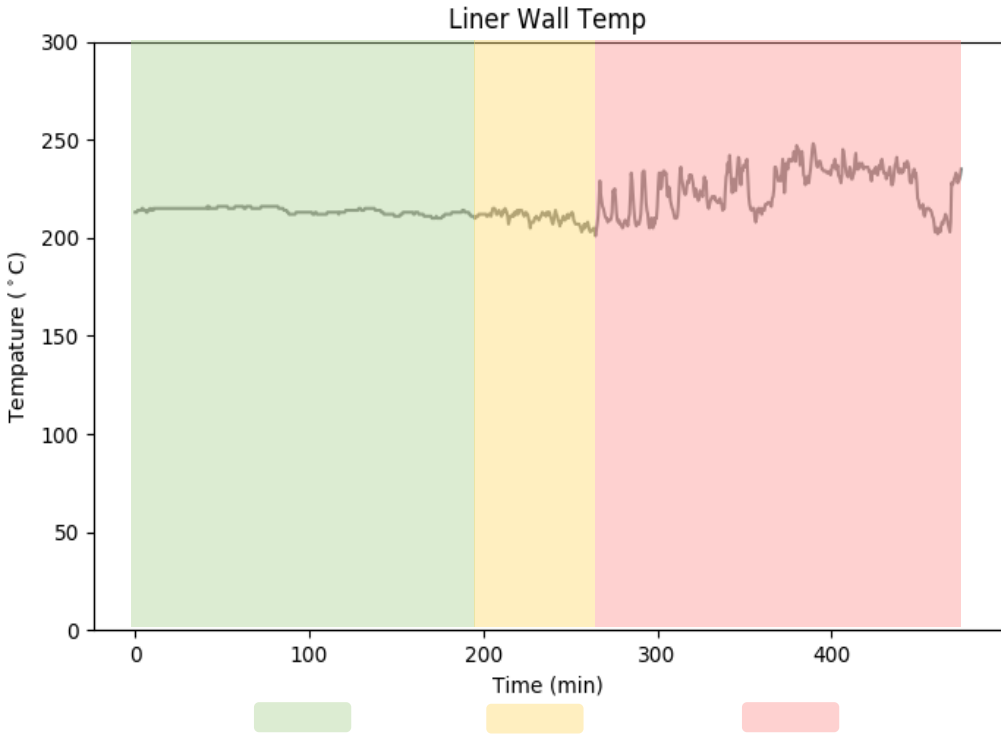


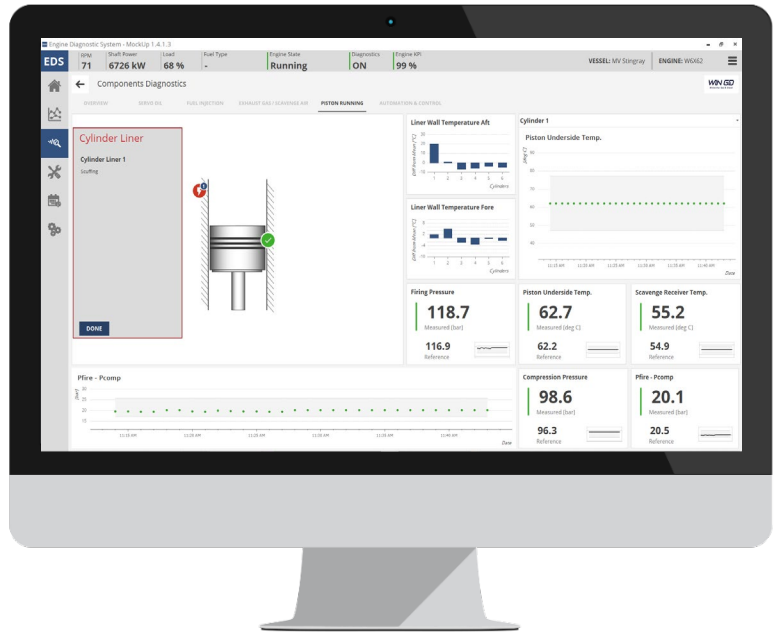
Machine learning for the engine diagnostic

Data analytics combining expertise with operational data

Analysis steps

- Use historical data & expert's knowledge to train the Machine Learning algorithm
- Apply the trained algorithm to predict future events

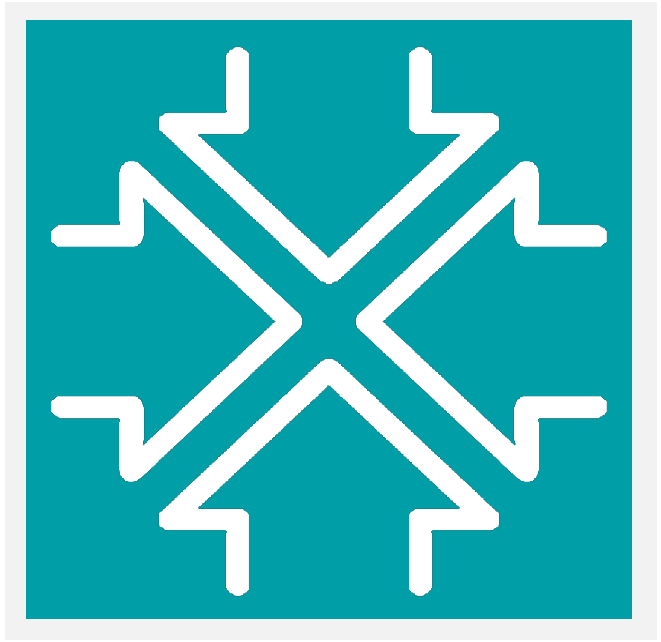




Consolidation & Orchestration

Consolidate the analyses and make them actionable

- Consolidation of findings of the Analysis part from various methods of analysis
- Orchestration of actions to follow:
  - Troubleshooting
  - Maintenance tasks/events
  - Spare parts



The valuable outcome of the analyses

Troubleshooting, maintenance and spare parts

TROUBLESHOOTING

- Provides a list of possible causes for detected faults & core relevant parameters
- Presents a set of corrective actions for each possible cause based on:
  - Operation manual
  - Maintenance manual

MAINTENANCE

- Condition-based maintenance based on asset usage & status
- This allows operator to extend or advance overhauling/maintenance event

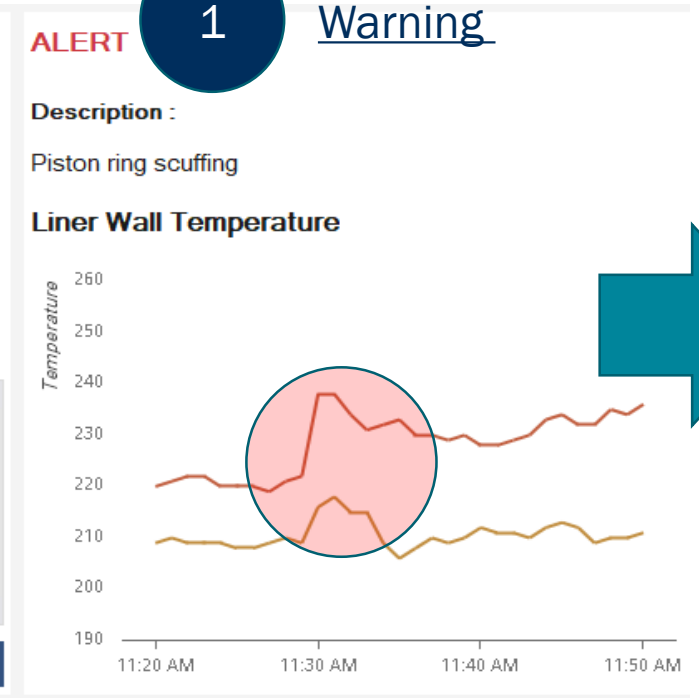
SPARE PARTS

- Automatic creation of relevant spare part list for each maintenance task identified
- Spare parts drawings
- Digital spare part code book

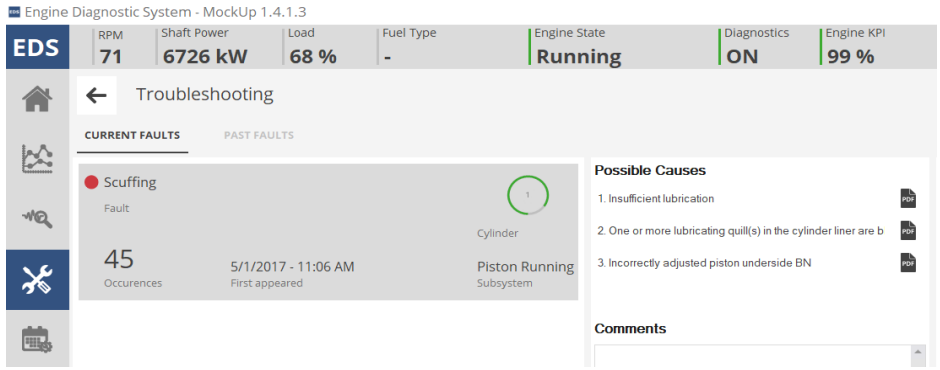
A tool for a stronger customer relationship

We speak with customer the language of data

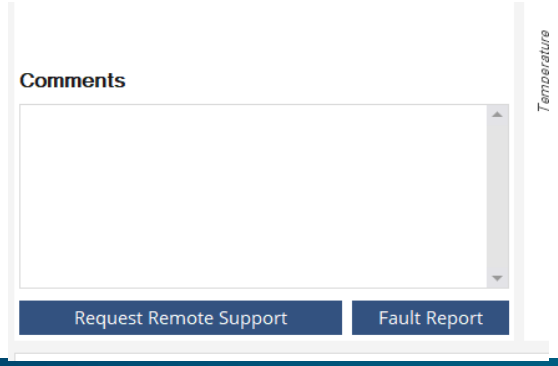
1 Warning



2a Troubleshooting



2b Request for remote support



3 Solution

- Actions
- Operating manual
- Maintenance plan
- Spare parts identifications

Value for the ship operators

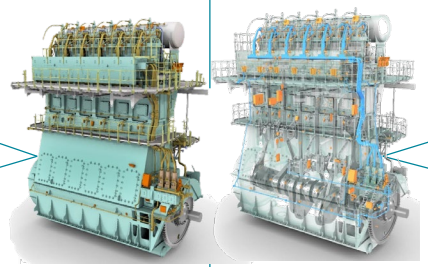
Engine failure prediction

Predictive maintenance and real time component diagnostic

Full access to all engine data

Saving fuel cost

Real time engine performance monitoring with a digital twin



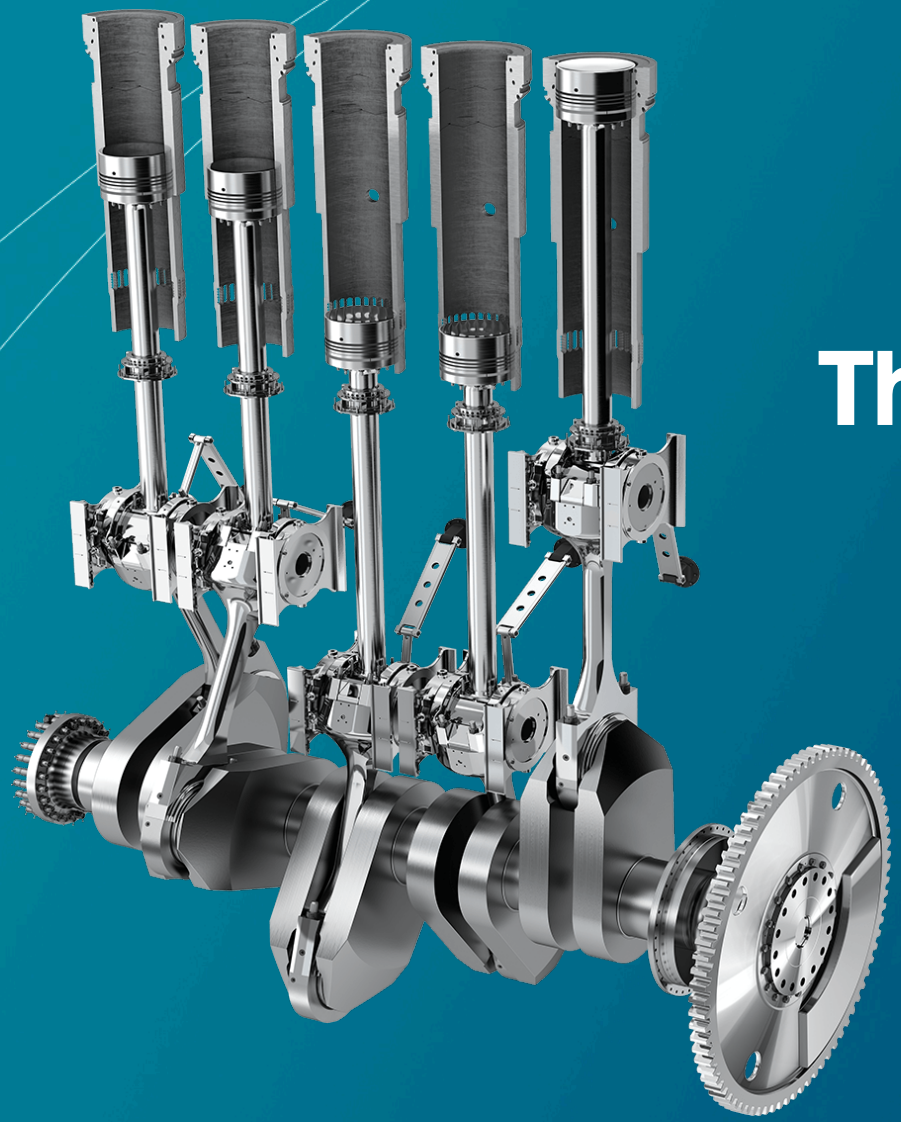
Advanced Troubleshooting

Digital expert and remote support on board and on shore

Easy access to spare part, documents and updates

Dynamic maintenance plan

Based on the engine conditions



Thanks!