

ACCX300-L axial turbocharger series development update

Greener Shipping Summit

“Building Resilient Companies in Unpredictable Times”

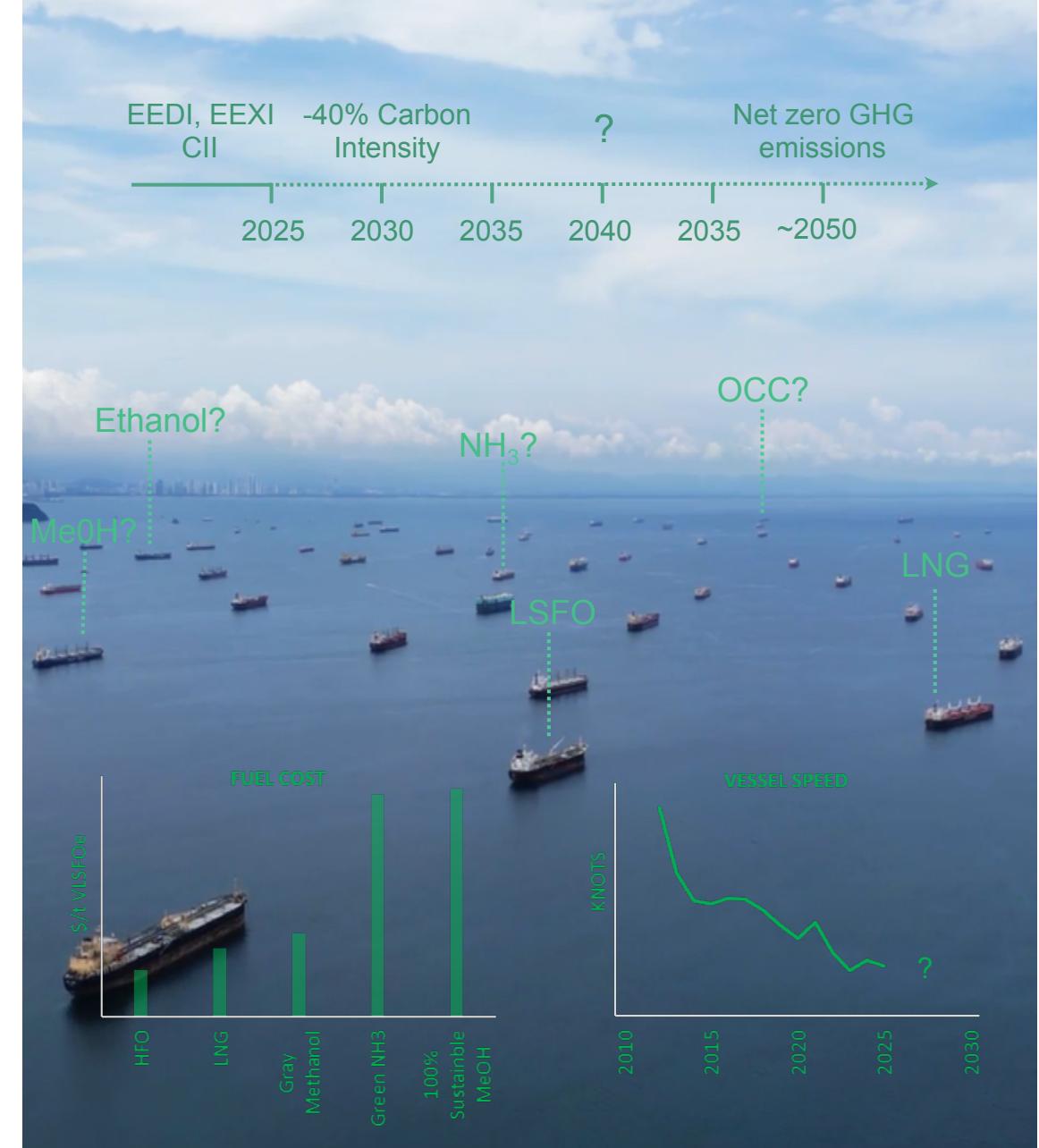
Athens, Greece | November 2025

Context

Many future uncertainties

Increasing need for technical and operational measures that bring more:

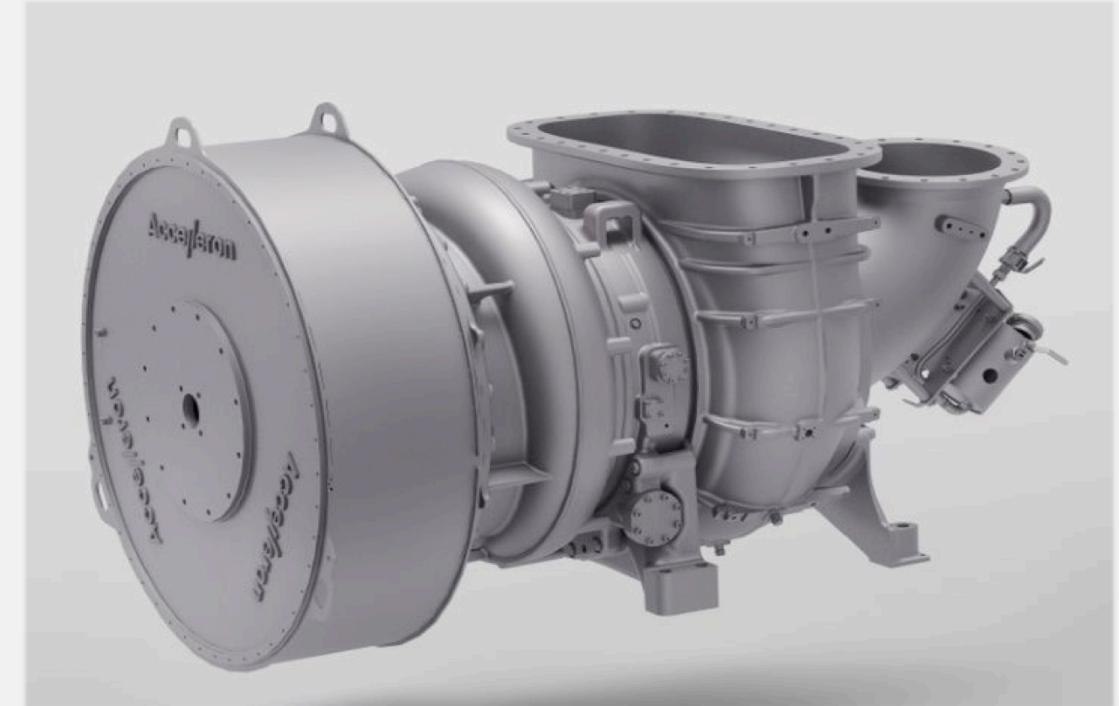
- Flexibility
- Efficiency



ACCX300-L

Next Generation Axial Turbochargers

- High performance
- Enabling innovative service solutions
- More opportunities for tangible fuel savings
- Future fuel ready

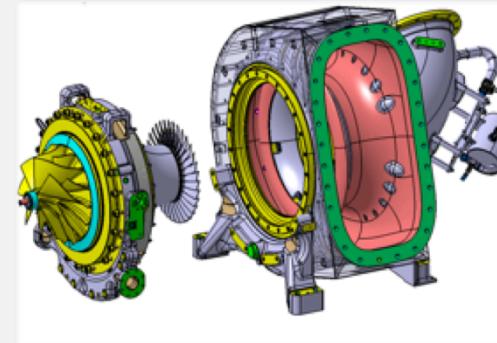


ACCX300-L

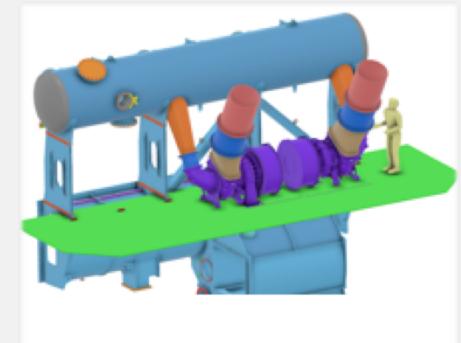
Main Development Objectives

Simplification:

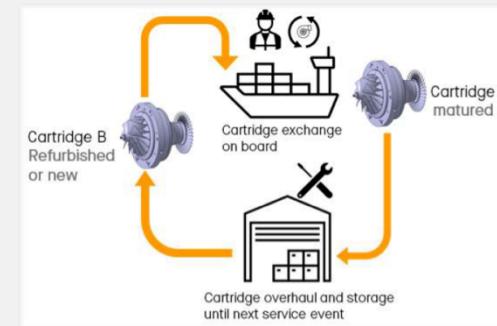
- Maximizing commonality of components, further standardizing interfaces and increasing modularity
- Minimizing variants and complexity
- Starting with two frame sizes ACCX365-L and ACCX370-L



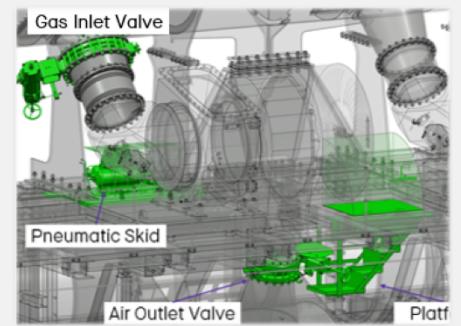
Cartridge Concept



“TWIN” Concept



Cartridge Pooling

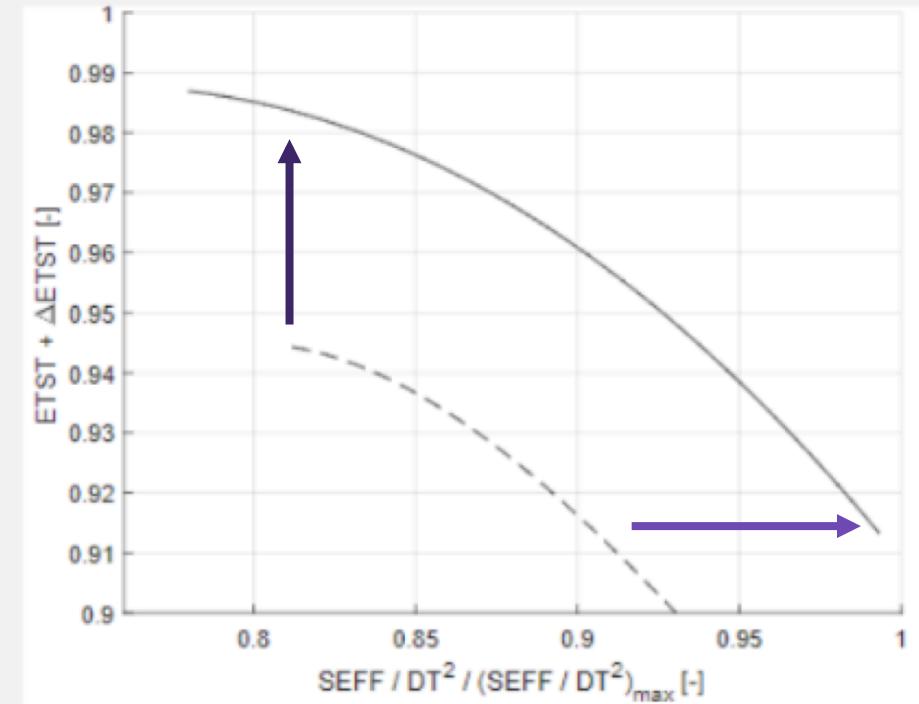


Turbocharger Cut-Out

Design Feature

Advanced Axial Turbine Stage

- Increase in efficiency
- Increased specific volume flow capacity
- 1 turbine stage shared across all compressor stages
- Performance and reliability qualification completed, exceeding expectations



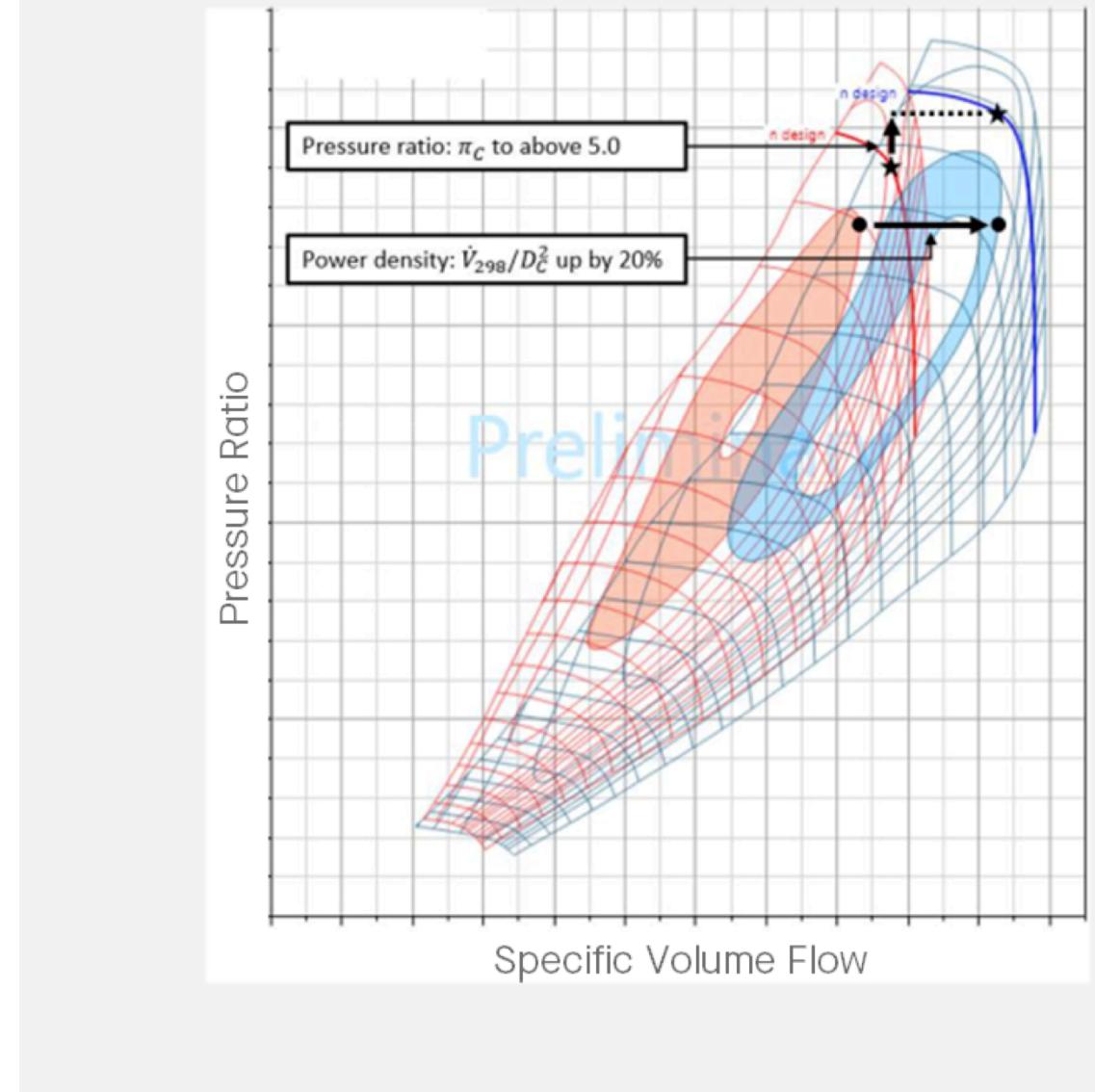
Peak efficiency + ~4%

Specific volume flow + ~11%

Design Feature

Compressor Stages

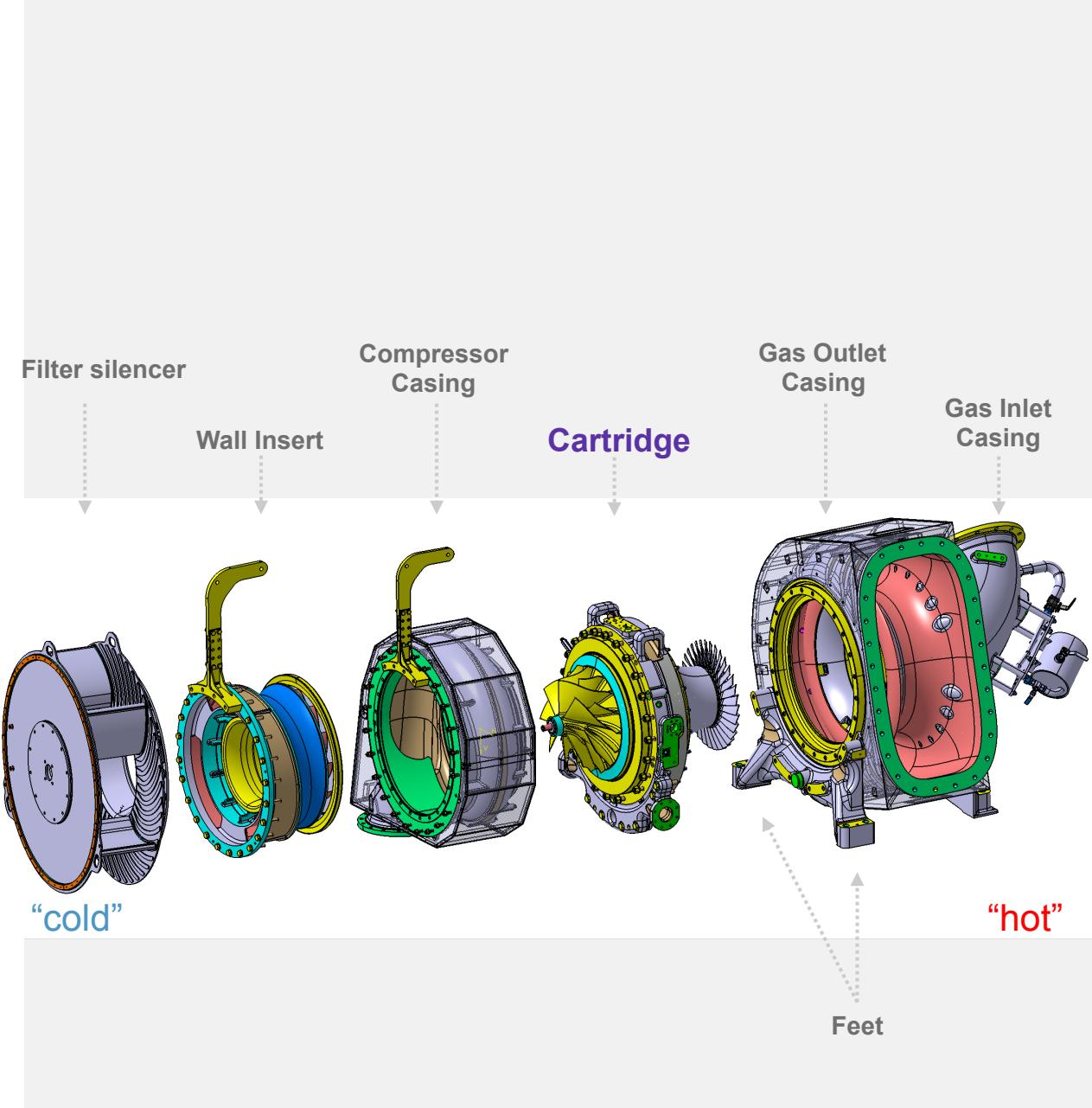
- Increase specific volume flow capacity
- Increase pressure ratio
- All compressor stages fit into one casing
- All stages share same shaft connection



Design Feature

Cartridge Concept

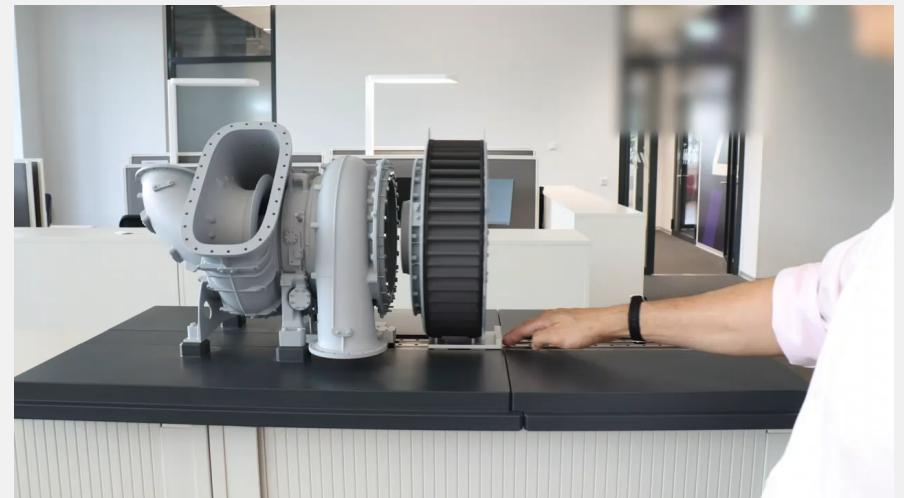
- Cartridge unit containing all rotating components
- Further dismantling to isolate the rotor, as done during a major service event is not needed
- Extraction of the cartridge is possible from the “cold” side, without touching “hot” gas inlet/outlet casings as well as both feet



Design Feature

“Fast” Exchangeable Cartridge

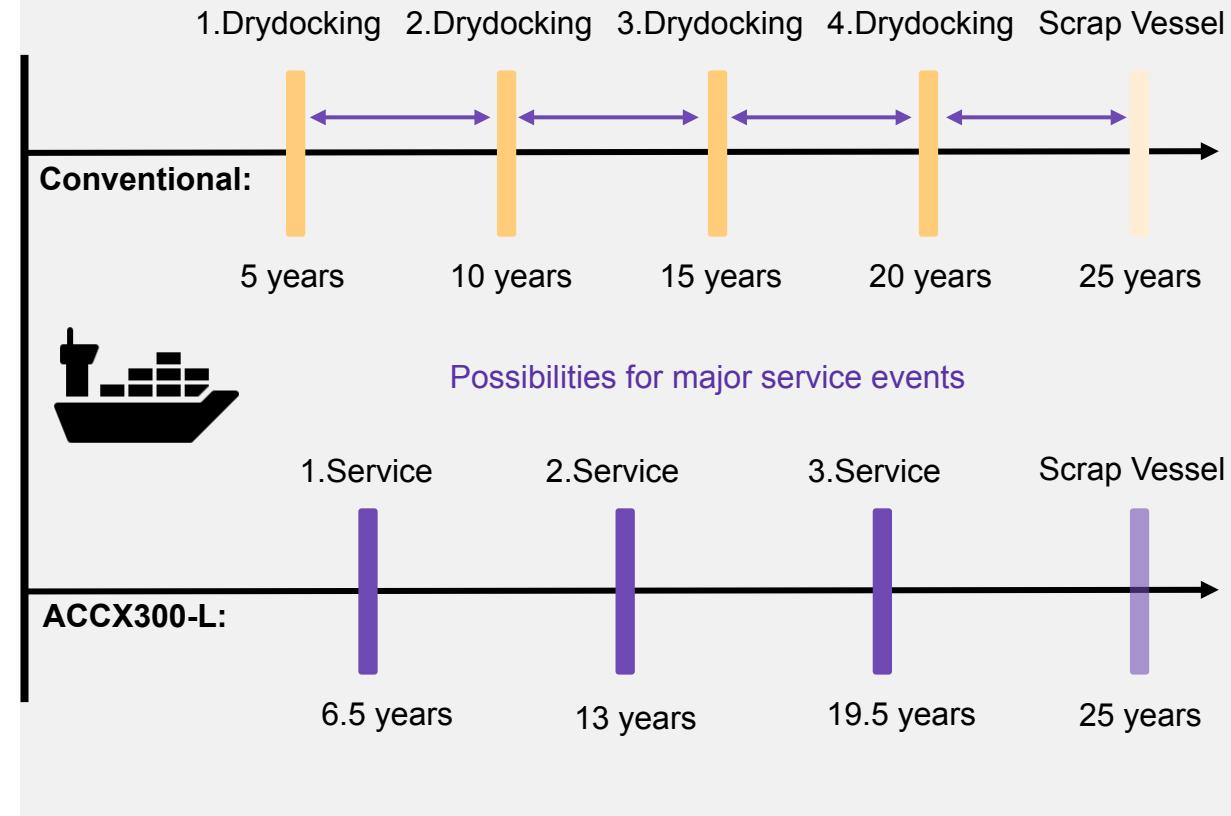
- All casing connections are axially accessible within the box volume of the turbocharger after dismantling the air outlet
- The cartridge including packaging for transportation are designed to fit on a standard shipping pallet
- Design incorporates learnings from service engineers’ field experience
- Cartridge extraction and installation by the vessel crew is possible



Concepts & Benefits

Enabling innovative service solutions

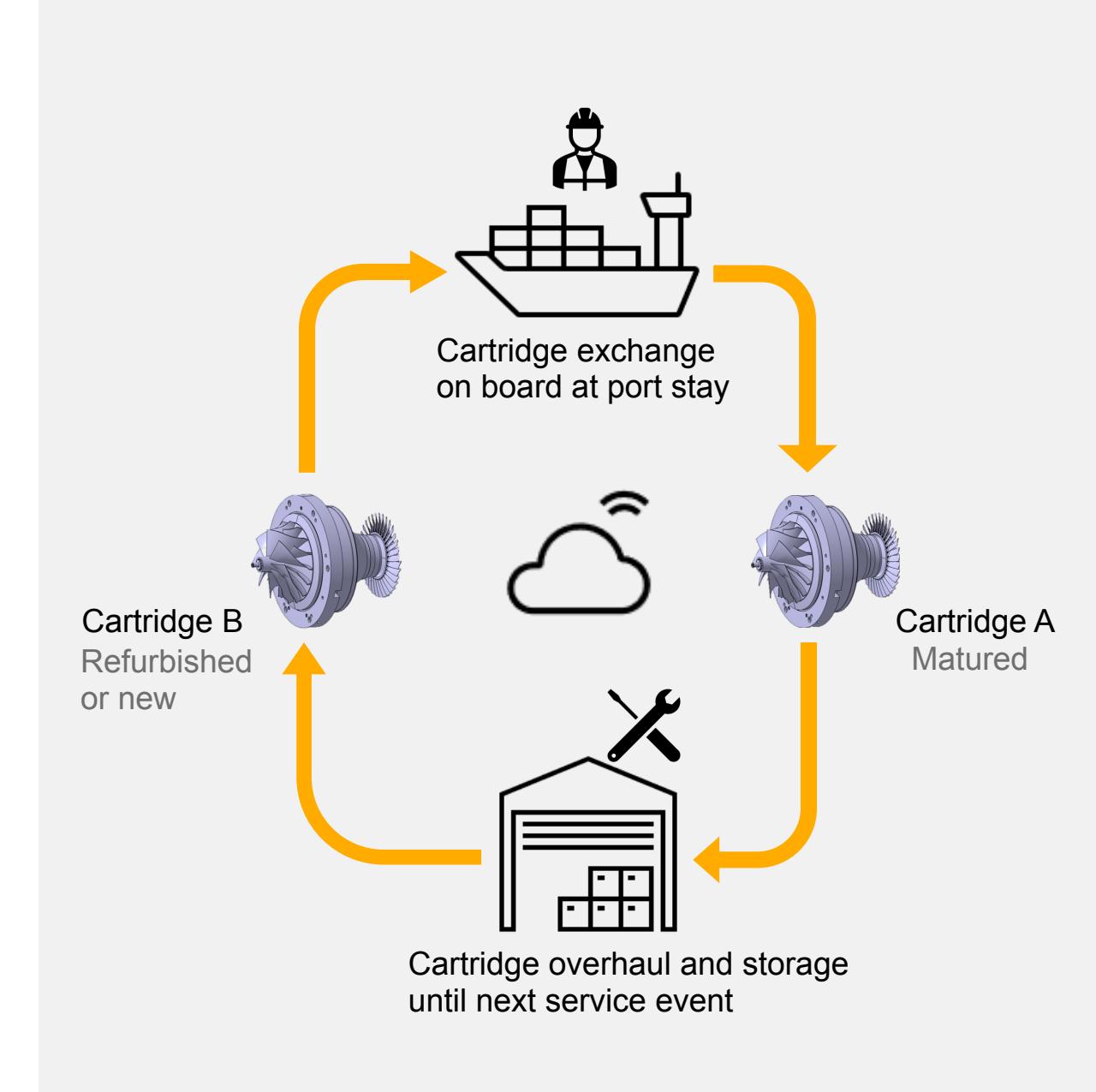
- “Fast” exchange of the cartridge gives flexibility to ship operators, with more opportunities for major service events at port stay*
- Less dependence on dry-docking schedule, full utilization of service intervals, leading to more optimal usage of components
- Potential for less service events over lifetime of a vessel



Cartridge Pooling

Innovative service solution example

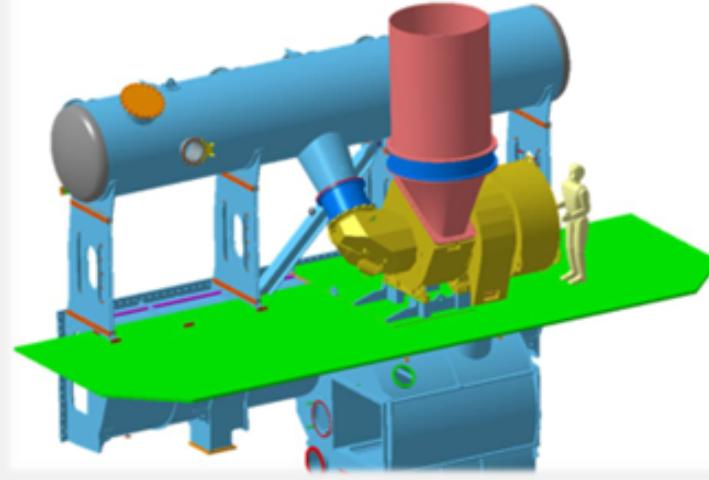
- Gain access to a pool of cartridges new and refurbished managed by Accelleron's global service network
- Health of exchange cartridges are known via Turbo Insights™ and inspections in the workshop
- Flexibility, optimal usage of parts, optimal turbocharger performance and highest availability



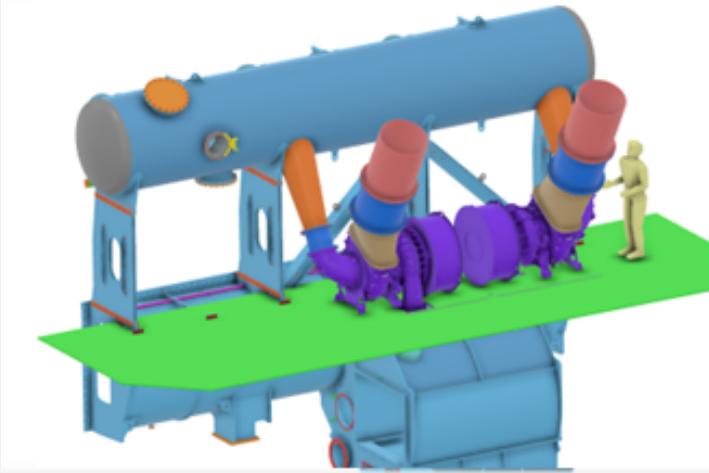
Concepts & Benefits

“TWIN” Concept

- “TWIN”, unconventional pairings of X365-L and/or X370-L
- Coverage of larger frame sizes of current A100/200-L portfolio with smaller and lighter turbochargers
- Made possible from a significant increase in specific volume capacity and high-performance components



A275-L

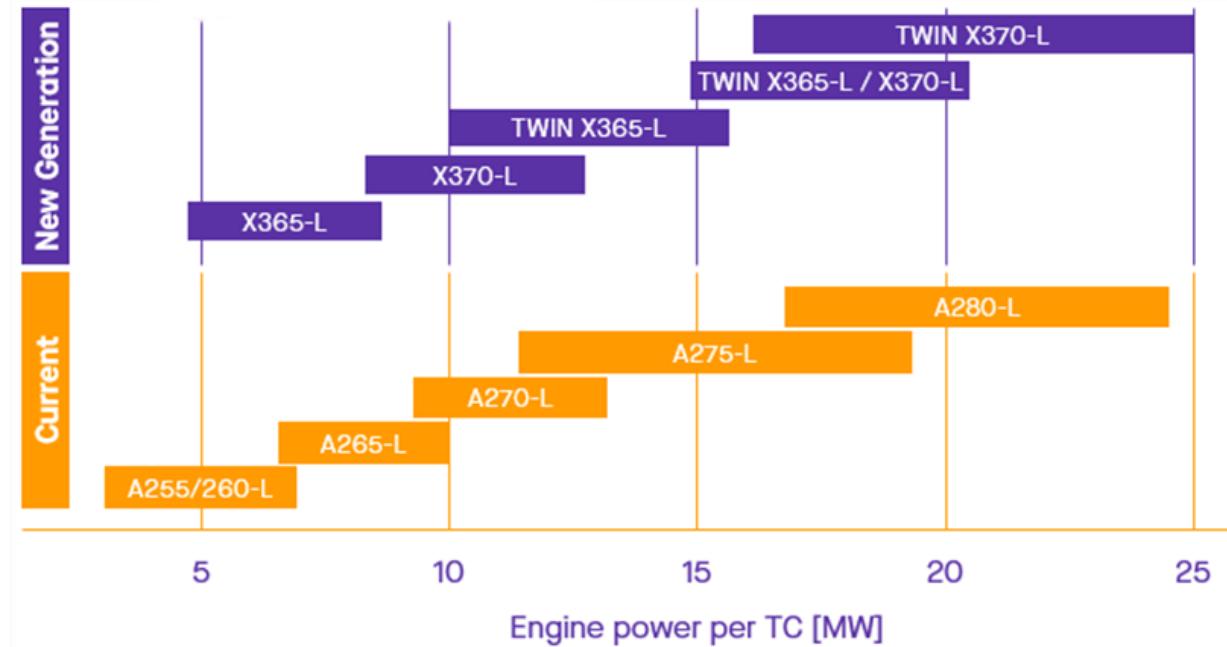


TWIN X365-L

Concepts & Benefits

Exchangeable cartridge for higher engine power with “TWIN”

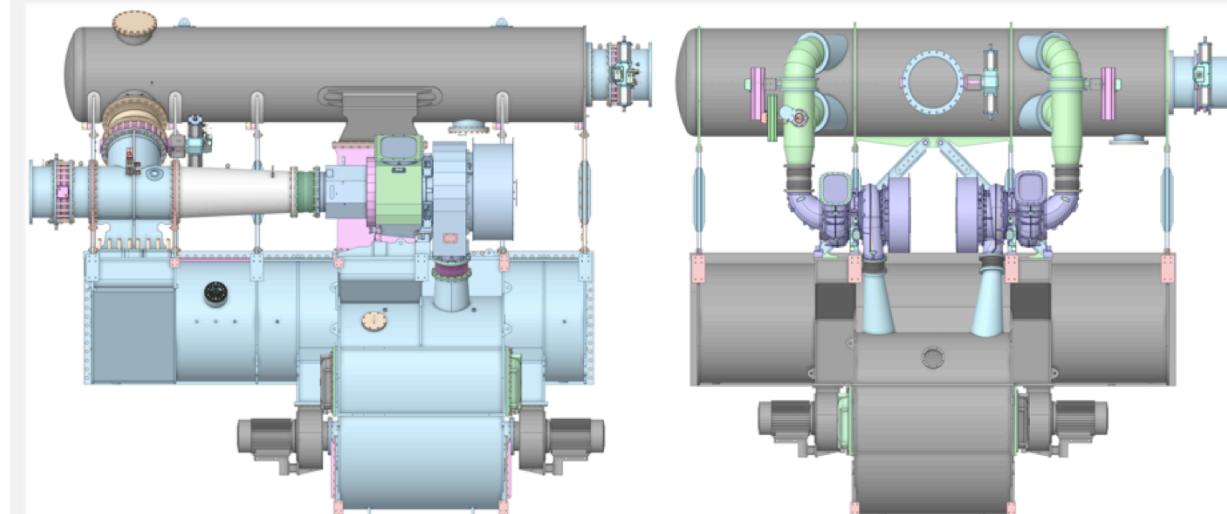
- Higher engine power coverage of A200-L portfolio with only two frame sizes
- Benefits of an exchangeable cartridge can then be extended across this engine power range
- Two frame sizes, maximizes opportunities for cartridge exchange and minimizes complexity for cartridge pooling



Concepts & Benefits

Further benefits supported by “TWIN”

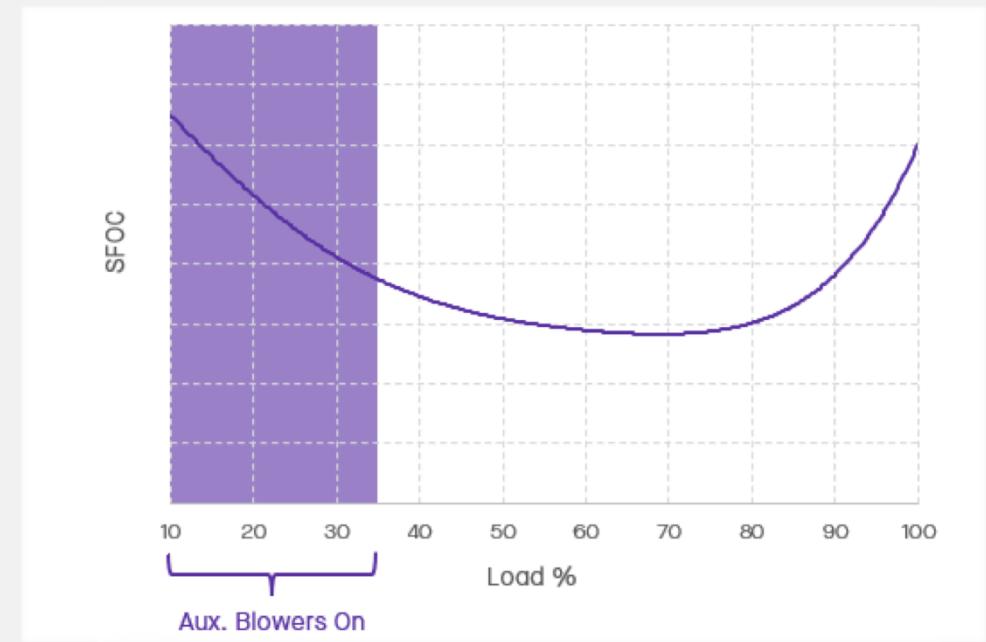
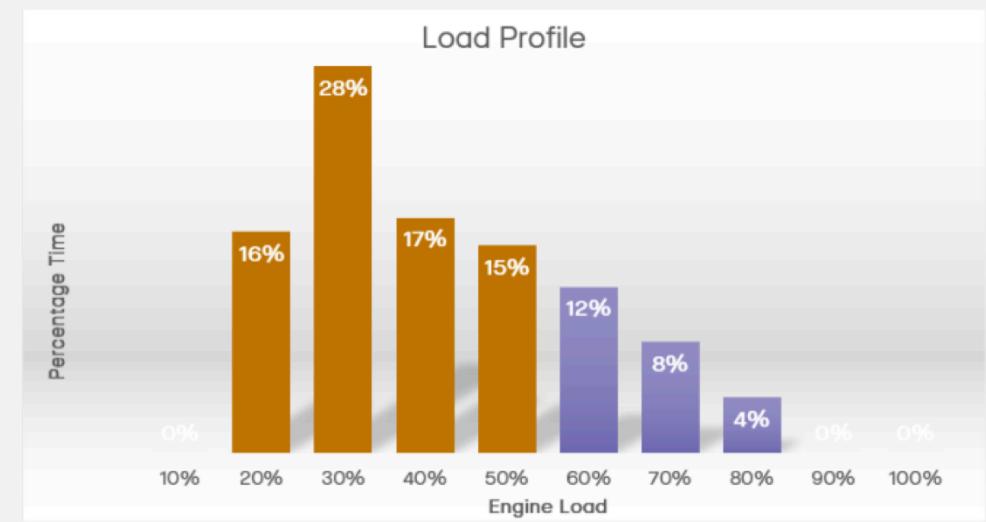
- Potential for optimized on-engine arrangement with smaller and lighter turbochargers
- Improved accessibility at the top platform, improved flow distribution at cooler inlet and less overall weight of welded structures
- More opportunities for turbocharger cut-out



Turbocharger Cut-Out

Tangible fuel savings

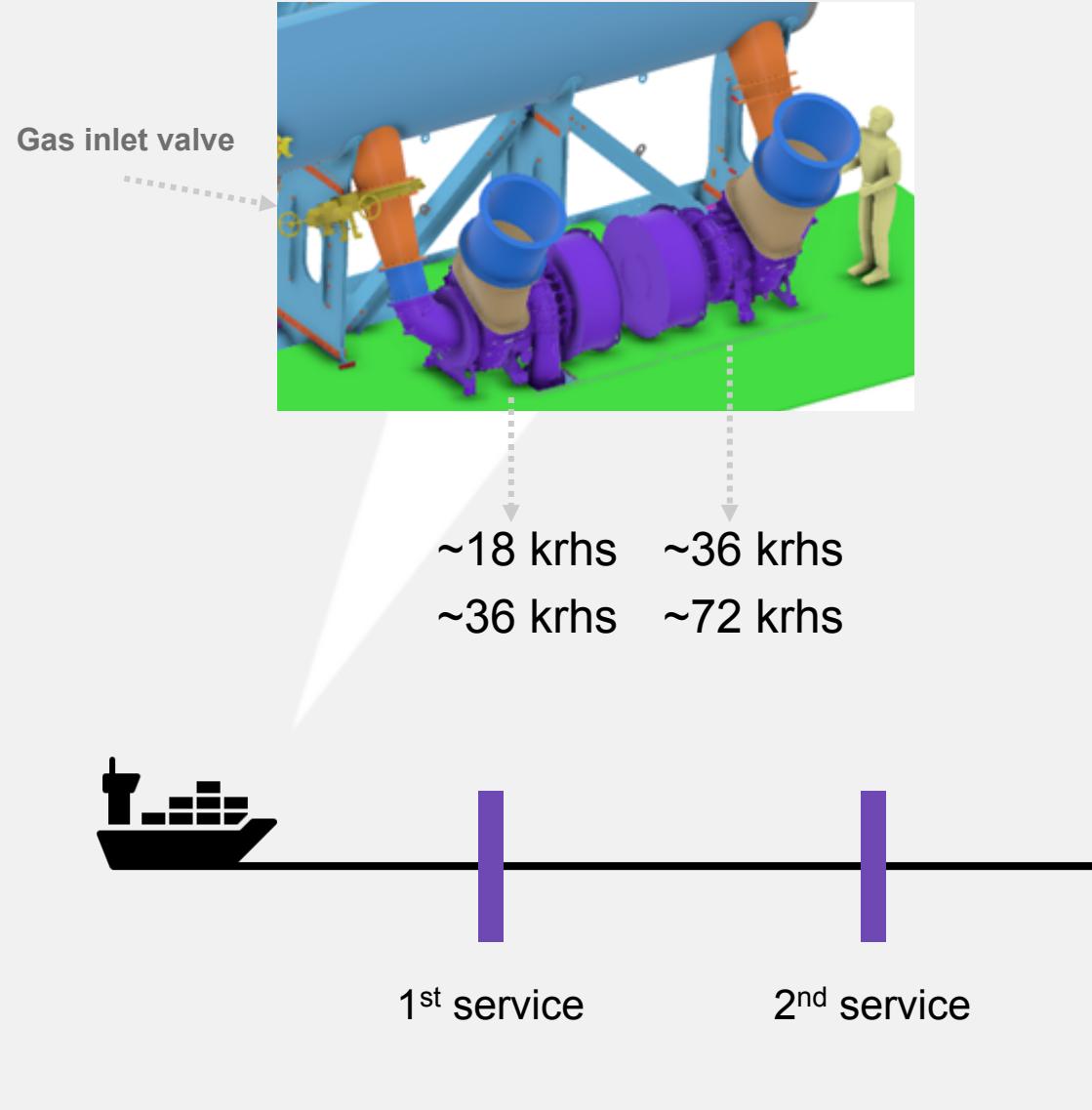
- Higher scavenging air pressure at engine part load, leading to higher engine efficiency, lower specific fuel consumption* and lower costs
- Possibility to switch off electrically powered auxiliary blowers and reduce energy consumption



Turbocharger Cut-Out

Further enabled by ACCX300-L

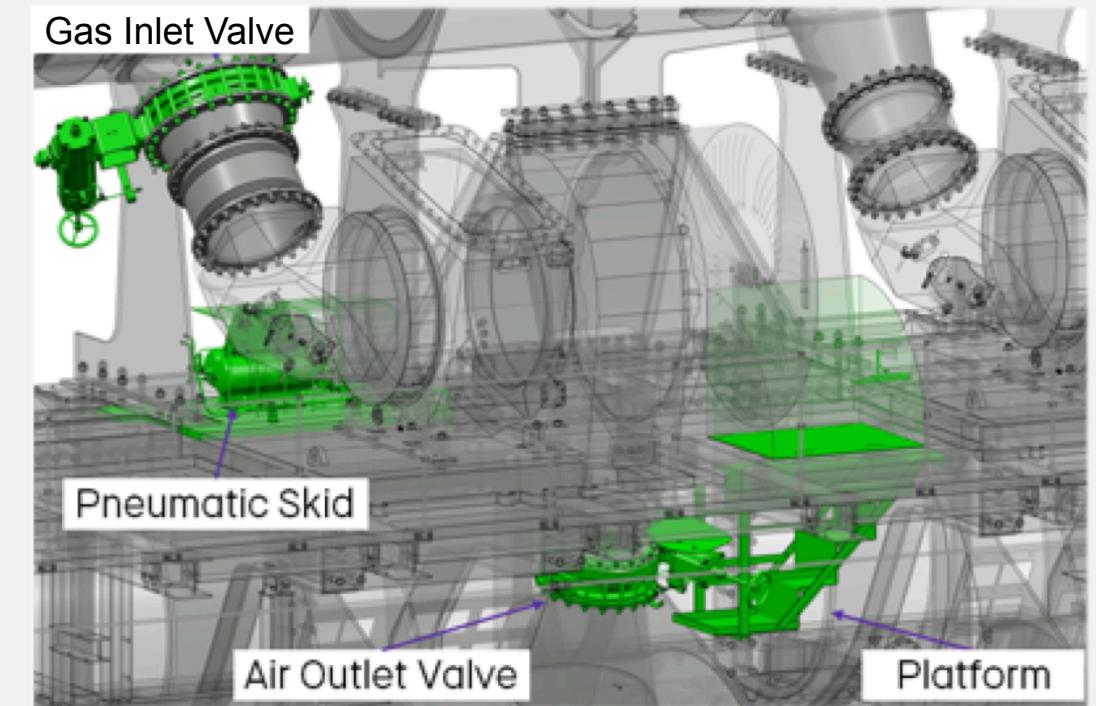
- Utilize cartridge exchange to address mismatching maintenance schedules of each turbocharger
- ACCX300-L turbochargers are designed and qualified for the cut-out operation.



Flexible TC Cut-Out

FiTS2 for upgrades

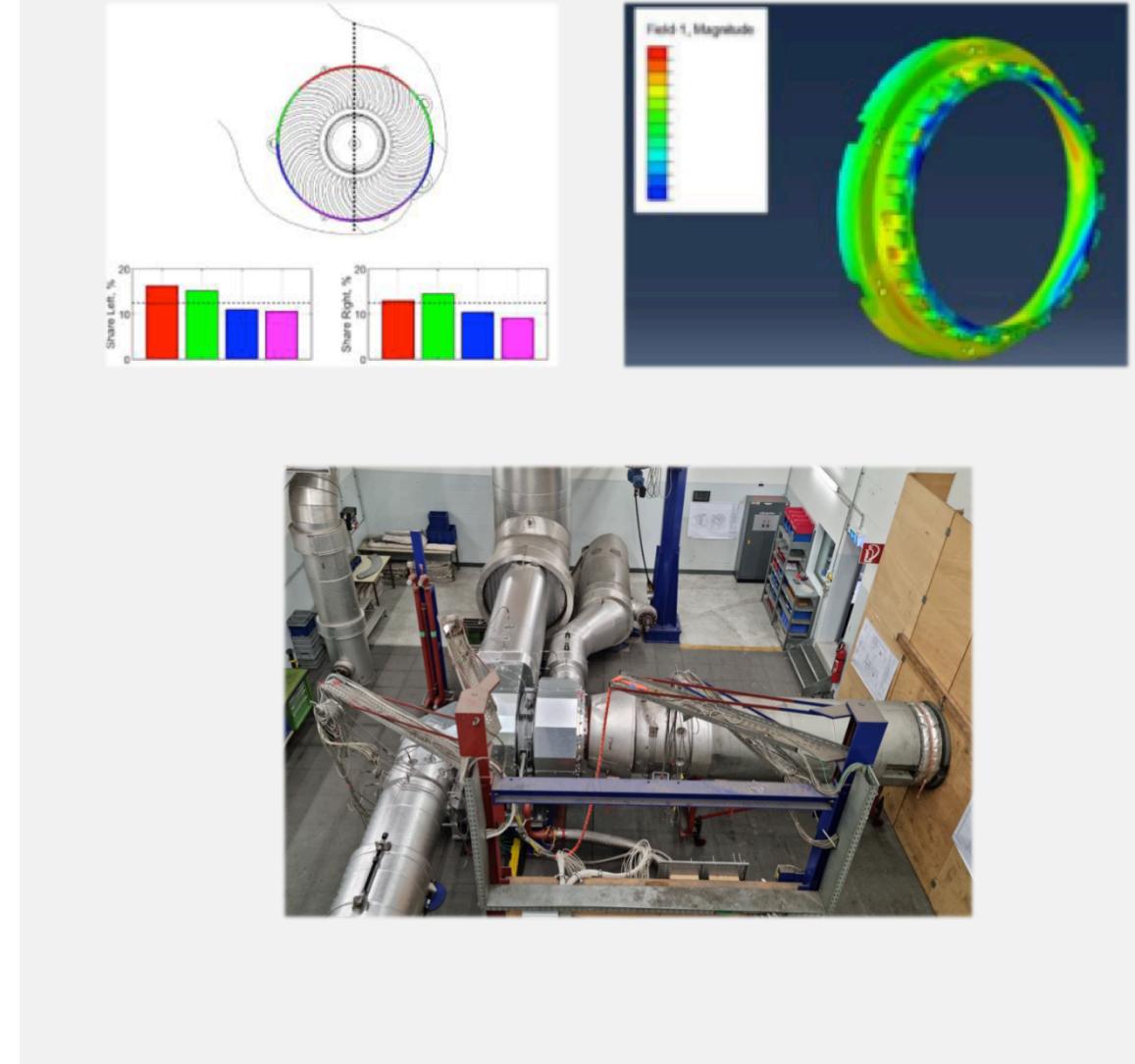
- Fully automated cut-out and cut-in operation
- In-house developed control unit
- Maintains the flexibility to go to full engine output immediately
- Additional features ensure fail safe and reliable valve operation



Development Status

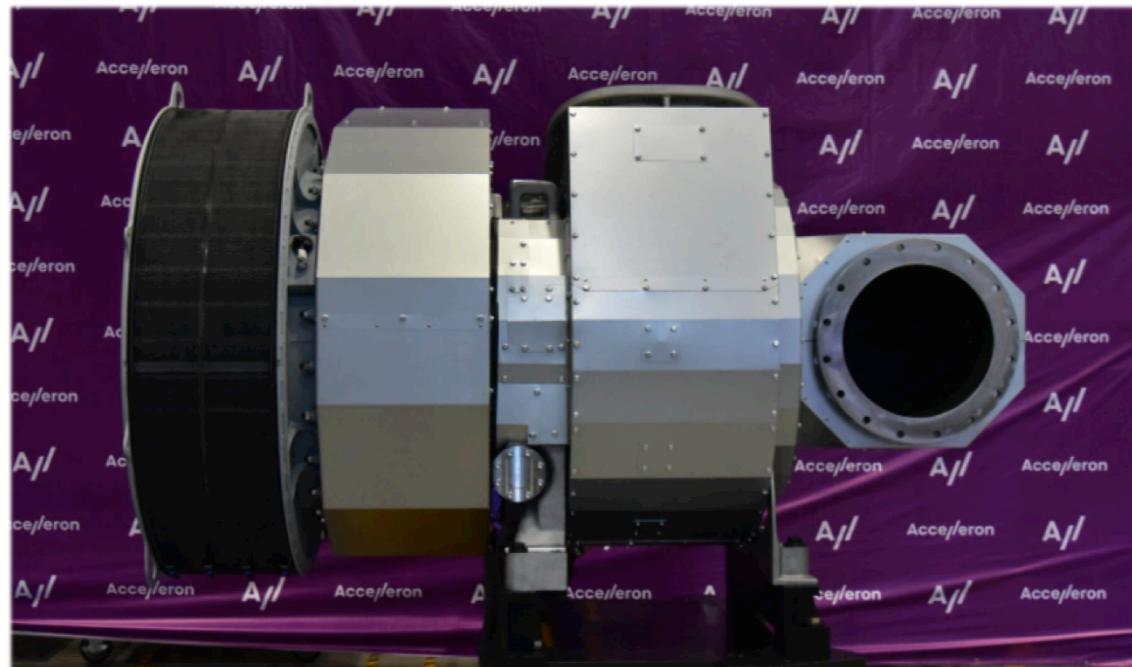
Design and Qualification Phase

- The Qualification Process of Accelleron covers operational reliability, product safety and conformity
- The process comprises more than 20 qualification tests which must be completed by hardware tests, numerical or analytical assessment

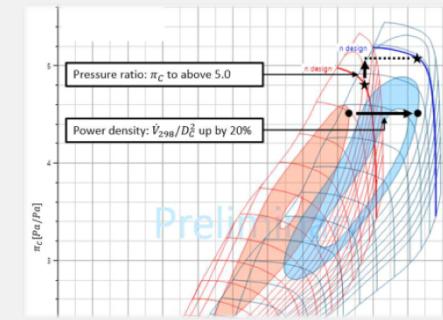


ACCX300-L

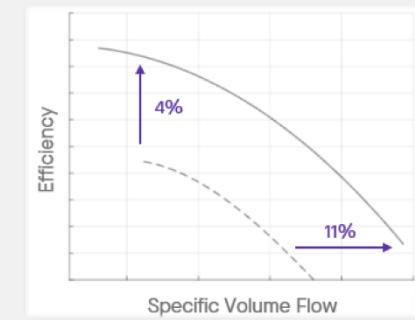
Next Generation Axial Turbochargers



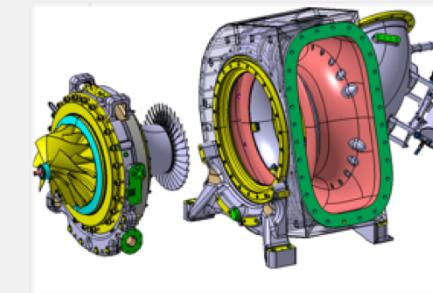
FleXibility Built-In



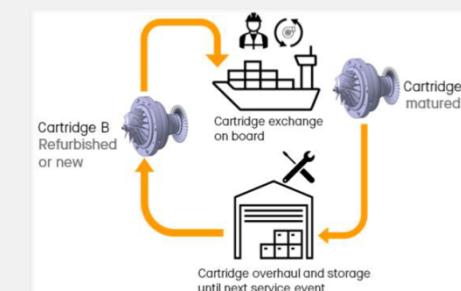
High performance



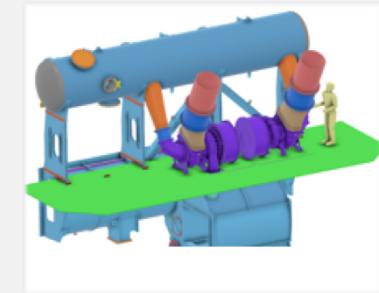
High power density



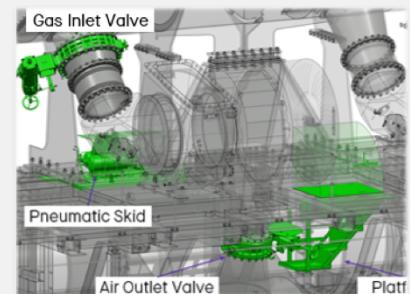
Exchangeable Cartridge
Major Service at Port Stay



Turbo Insights™
Cartridge Pooling



“TWIN”
Enabler for Larger Engines



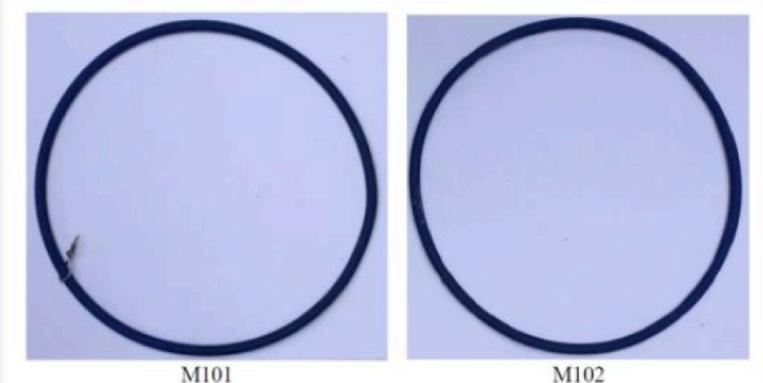
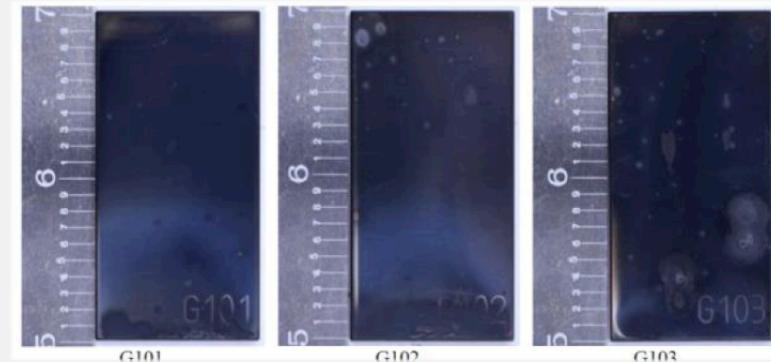
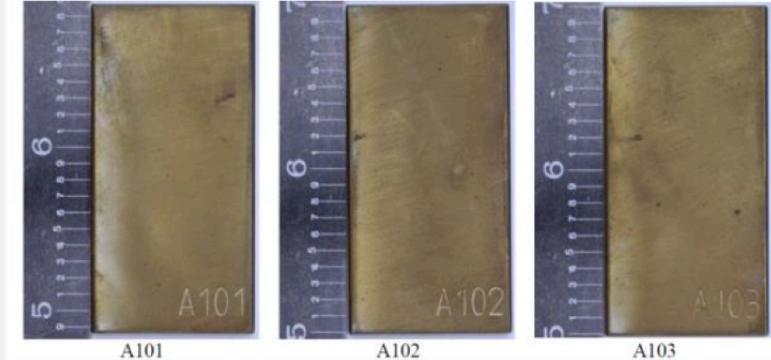
Turbocharger Cut-Out
FiTS2

Acceptor

NH₃ Lab. Investigation

Corrosion performance of turbocharger materials

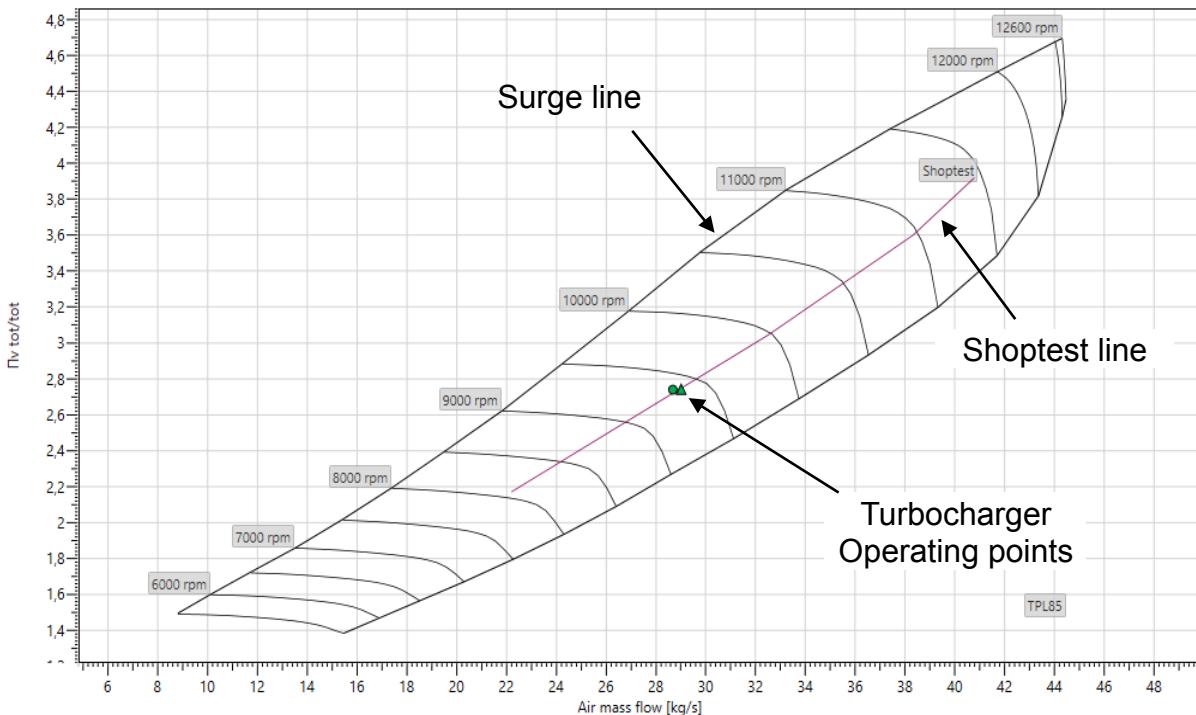
- For metals, the observed corrosion rate is very low
- Rubber materials are not directly exposed to the gas flows, but only to gas entering via the clearances between the casing parts
- The use of ammonia as a fuel under currently anticipated operating conditions poses a low risk for Accelleron turbocharger materials



Turbo Insights

Remote 24/7 access to current turbocharger performance vs the optimum*

Turbocharger Compressor Map



LOREKA Customer Portal

A screenshot of the LOREKA Customer Portal interface. The top navigation bar includes 'Access' (highlighted in blue), 'Customer portal', 'Company name', a gear icon, 'steve.advanced@ch.abb.com', and a user icon. The main dashboard shows a 'Shipping Company' summary with a score of 9/10 for Engine health, 1.0% Optimization potential, $\approx 2.0 \text{ t/d}$ Fuel saving potential, and $\approx 5.9 \text{ t/d}$ CO₂ reduction potential. Below this is a 'PERFORMANCE EVALUATION' section with a table for 'Fleets' and 'Installations'. The 'Fleets' table lists six ships: BULKER STAR, BULKER MOON, BULKER SUN, TANKER HIMALAYA, TANKER ALPS, and TANKER ANDES, each with its optimization potential, engine health score, fuel saving potential, CO₂ reduction potential, and a 'Turbo Insights' button. The 'Installations' table is currently empty. A search bar is located at the top right of the evaluation section.

* Optimum as observed at the engine shoptest (FAT) / Turbocharger performance derived from pre-defined signals at engine control unit