Use case I Harbor tug

Comparison specifications:

Application	Load profile	Avg. lifespan of the vessel	Engine
Tugboat	Intermittent/ low	25 years	2 x 2,560 kW / 1,800 rpm

Peer group comparison: *mtu* 16V 4000 M65L vs. competitor engine

Time Between Overhaul (TBO) in hours calculated:

mtu 16V 4000 M65L	54,000*
Competitor engine	37,000

TBO in years calculated, based on 2,000 operating hours p.a.:

mtu 16V 4000 M65L	25 years*
Competitor engine	18.5 years

* ***mtu*** engine overhaul is recommended when TBO hours are reached or after **25 years** at the latest, whichever occurs first.

46%

more operating hours than competitor between overhauls

Zero

overhauls during the 25-year operating lifecycle**

** depending on load profile and yearly operating hours

OPTIMIZED TBO REDUCES TIME-CONSUMING OVERHAULS

Lifecycle cost optimization of ***mtu*** Series 4000 M65L marine engines

Executive summary

Engine overhauls mean downtime and loss of revenue. ***mtu*** Series 4000 M65L engines, however, have a much longer TBO than a comparable competitor, as the following use case illustrates. Assuming an average harbor tugboat lifespan of 25 years and 2,000 operating hours per year, this practically eliminates the need for a major overhaul altogether.

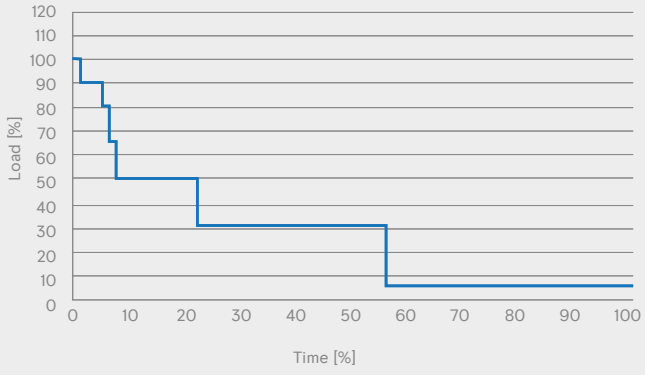
Who: Harbor tug operator

Why? Tugboat readiness and availability with minimal maintenance are essential requirements for harbor operations. Long downtimes for maintenance mean a loss of income and higher costs.

Main benefits:

- Lifecycle maintenance cost optimization
- Reduced tugboat downtime
- More operating hours out of one engine lifecycle before major overhaul

Assumed load profile for the comparison



A Rolls-Royce solution

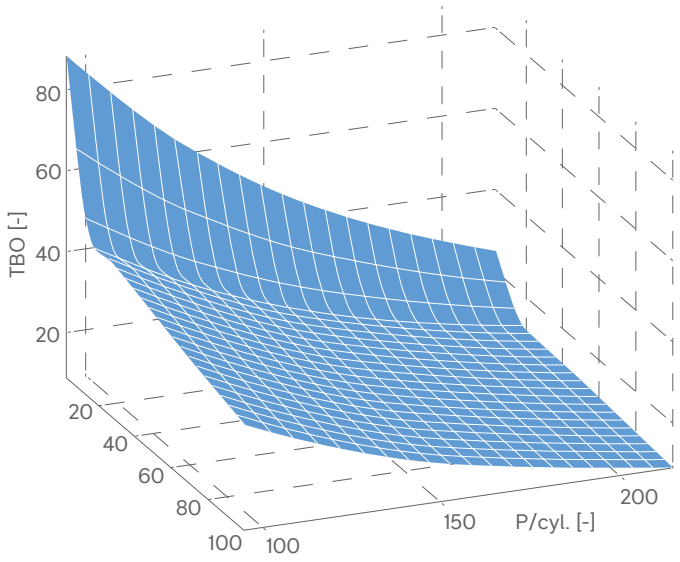
TBO OPTIMIZATION CALCULATION

A real data analysis of overhaul intervals using latest algorithms

We have combined 25 years of experience with the digital analysis of field data from over 50,000 data sets from 18,000 engines and used state-of-the-art calculation methods to optimize the load bands of the ***mtu*** engines.

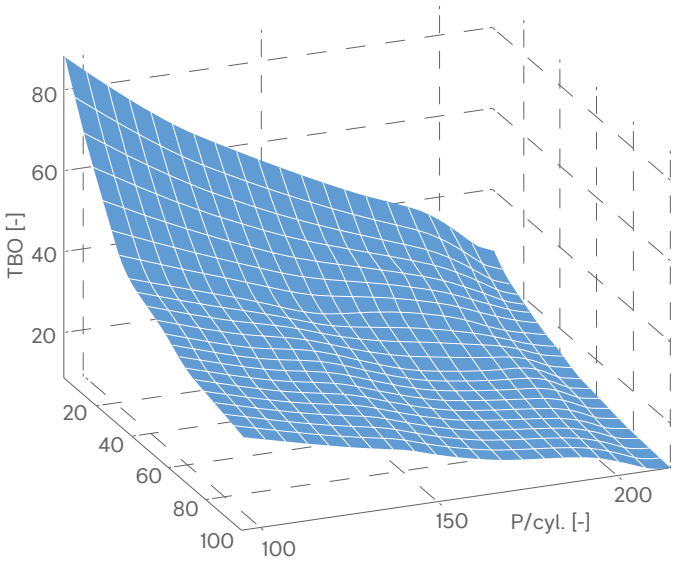
The load factor (LF) represents the average load of an engine, the load indicator (LI) describes the high load share in a load profile.

Load Indicator (LI)



The representative load profiles describe the average load profile per load band that best describes each load band. The real load profiles that can be assigned to this load band can therefore be above or below the representative load profile in the individual values.

Load Factor (LF)



The load band in which most of the engines of an application operate in the field is marked as standard.

Results of the comparison

Competitor engine

Power: 2,560 kW / 1,800 rpm
Operating hours: 2,000 (p.a.)
Average lifespan: 25 years
TBO: 37,000 hours

Requires overhaul after 18.5 years

mtu Series 4000 M65L

Power: 2,560 kW / 1,800 rpm
Operating hours: 2,000 (p.a.)
Average lifespan: 25 years
TBO: 54,000 hours

No overhaul required during lifetime of tugboat

Rolls-Royce Group
www.mtu-solutions.com/marine