



LEAN PROPULSION

SILENCE IS GOLDEN

LEAN AND GREEN



**SIMPLY THE BEST SOLUTION**  
FOR YOUR YACHT

LET US GO ELECTRIC

## STADT LEAN PROPULSION®

Yacht owners need reliable vessels that are efficient to operate, year after year, in all seasons and weather conditions. Most importantly, the yacht must have a reliable and quiet propulsion system with propellers and power systems that never fail. One that enables them to operate safely anywhere on the planet. As a vendor of electric propulsion systems for many years, we asked the question: “Can a new way of thinking also give us a new generation of propulsion systems that are prepared for tomorrow’s environmental challenges” ?

STADT has taken these challenges seriously, when developing the STADT Lean Propulsion®, based on a completely different architecture – a truly revolutionary design, also for the most powerful crafts. An electric propulsion system that is amazingly reliable, and also reduces service costs, weight, fuel, emission and waste, while freeing up space by its compact design.

A sophisticated and silent system with STEALTH performance, extremely long lifetime, and excellent manoeuvrability.

The new drive technology has been awarded several times for its unique characteristics, and many ships are now sailing with the Lean Drive technology all over the world.



**Hallvard Slettevoll**  
Director, CEO

## BE PREPARED FOR THE CARBON-NEUTRAL FUTURE

**No** electromagnetic interference, EMI, due to sine wave operation

**No** acoustic switching noises

**No** harmonic voltage distortion, THD, on the ship

**No** transformers for the propulsion are needed

**No** electric losses in the drives at normal operation

**High** redundancy in all levels of the drive systems

**Major** reduction of space and weight for the drives

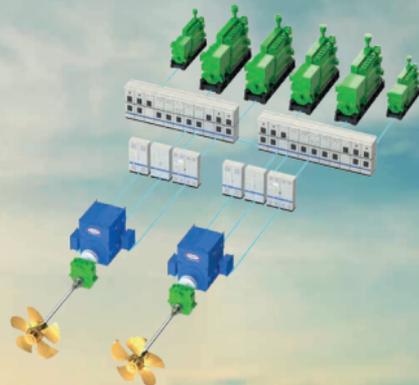
**Minimal** need for cooling of drives and its systems

**No need** for screened power cables and cable segregation

**Rugged** and very well proven technologies

**MTBF and lifetime** improved dramatically compared to competitors

**Simplified** technology , 80 % reduction in number of components



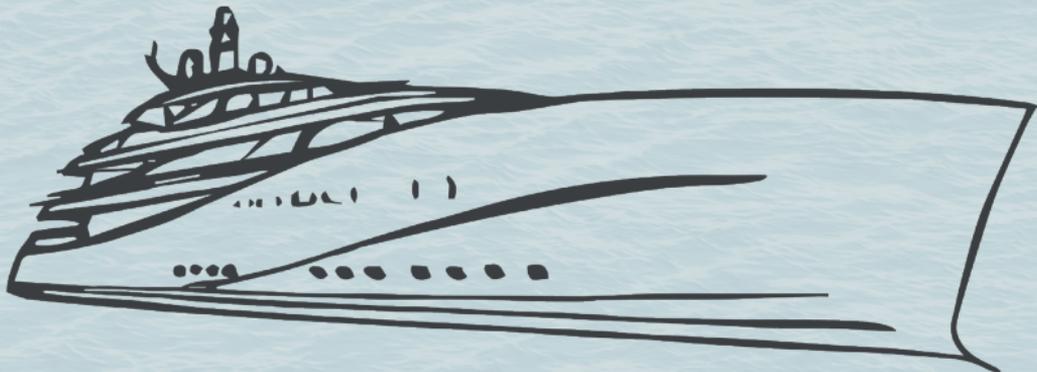
**COMPLETE SILENCE**  
**HIGHER COMFORT**

## SUSTAINABLE, LEAN AND GREEN

Superior technology with Stealth performance. Ensures that the propeller never stops.

### STADT LEAN PROPULSION WILL GIVE:

- Silence by all means - increased comfort
- Reduced NOx, SOx, BC and CO2 emission
- Reduced cost and high redundancy
- Scalability (power from 100 kW to 50 MW)
- Fit any size of yacht



LEAN DRIVE FOR ANY YACHT

## EXPERIENCING THE **STADT LEAN PROPULSION®**

*From Echo Yachts, Perth, Australia*

Echo Yachts are Australia's largest customised superyacht manufacturer.

"When we took the challenge to build the first ever diesel-electric superyacht in Australia, there were many design challenges to be solved. Such as low weight, small footprint, low noise, high efficiency, long endurance and reliability. We have found the STADT Lean Propulsion® extremely suitable for this yacht", says Mark Stothard, CEO at Echo Yachts.

The White Rabbit Golf is the largest trimaran and largest aluminium superyacht in the world at 84 meter long and 20 meter wide. Designed by Sam Sorgiovanni and One2Three Naval Architects. The STADT Lean Propulsion® is 4200 kW diesel-electric.



**Mark Stothard**

*Managing director, Echo Yachts*

## WHY WE USE CPP - CONTROLLABLE PITCH PROPELLER

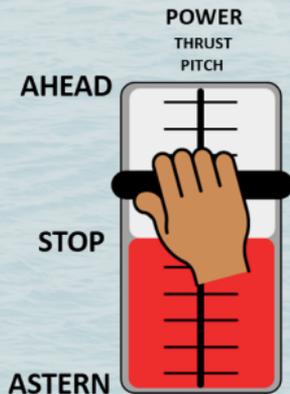
### THE PATENTED STADT LEAN DRIVE COMBINES PITCH AND RPM-CONTROL

- Significantly improved overall efficiency at varying load and/or varying speed conditions
- Better manoeuvrability (response acceleration, crash stop)
- Better performance at reversing and in DP, full power control at your fingertips
- Better operational conditions for gear, shaft, and bearings, especially at low speed
- Forgiving for design errors
- Each blade may be changed independently if damaged, at sea
- Future-proof with regard to changes of use of the vessel, slow steaming, extensions, etc.
- Possibility for full feathering position, which is saving fuel when only running one propeller



# POWER, - AT YOUR FINGERTIPS

<b>HIGH</b>	FULL POWER
<b>MEDIUM</b>	ECO CRUISING
<b>LOW</b>	SUN-SET MODE
<b>STOP</b>	
<b>FEATHERING</b>	
<b>CLUTCH</b>	

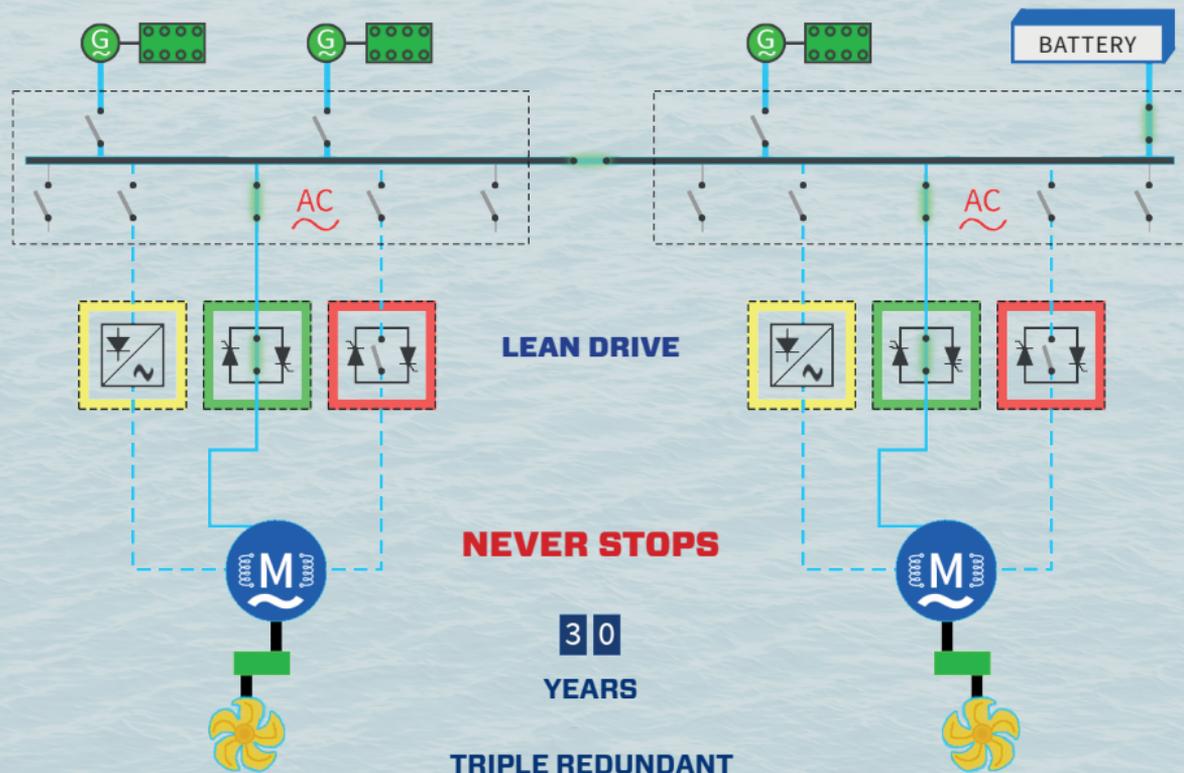


0-100 rpm  
0-5000 kW



LEAN PROPULSION®

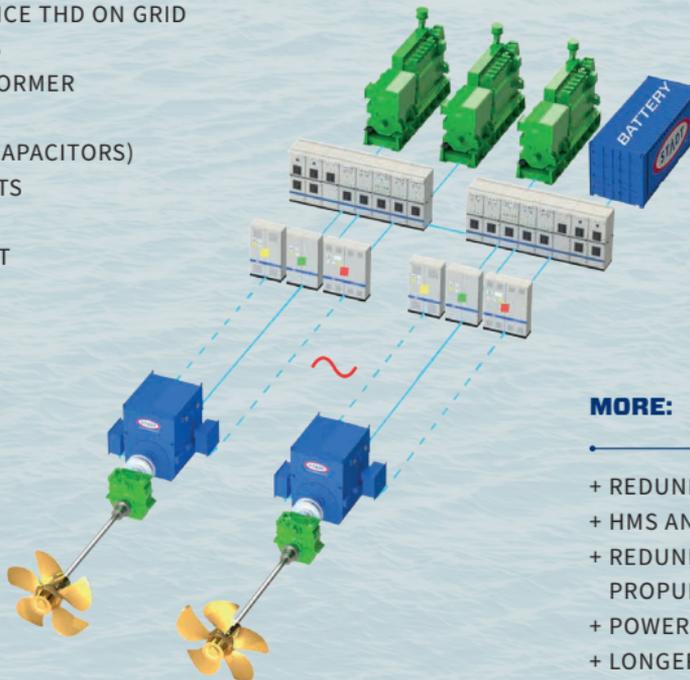
# STADT LEAN PROPULSION®



# DISCOVER THE POWER OF SIMPLICITY

## ELIMINATED:

- POWER DISTURBANCE THD ON GRID
- HARMONIC FILTERS
- 12 P - 24 P TRANSFORMER
- NOISE (PWM→EMI)
- EXPLOSION RISK (CAPACITORS)
- 80.000 COMPONENTS
- COOLING SYSTEMS
- 5-6 % WASTED HEAT
- COMPLEXITY



## MORE:

- + REDUNDANCY IN DRIVE
- + HMS AND COMFORT (SILENCE)
- + REDUNDANCY, ALSO IN AC PROPULSION MOTORS
- + POWER TO PROPELLER
- + LONGER ENDURANCE

**STADT LEAN PROPULSION®**

**= BETTER PERFORMANCE**

## EVALUATION OF TODAY'S DIFFERENT DRIVE SOLUTIONS

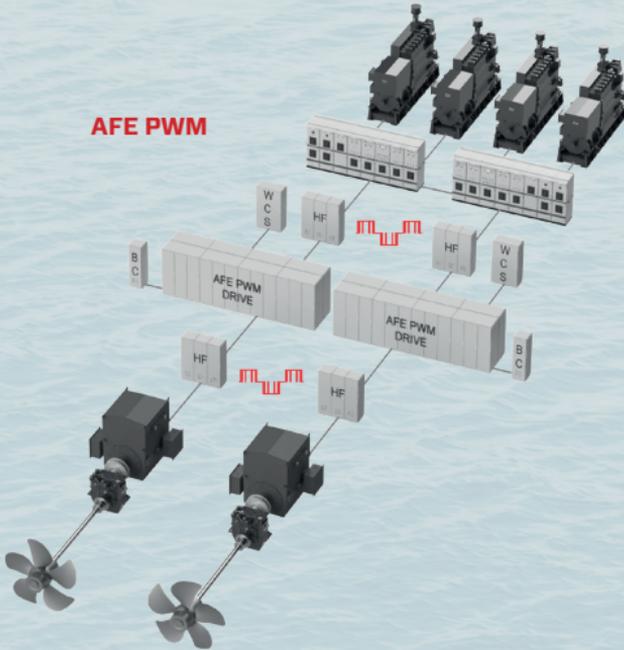
Lean Issues To Consider	STADT Lean Drive	12 Pulse or 24 Pulse	AFE (Active Front End)
Technology in AC drive	Sine Wave	PWM	PWM
No. of electric energy transformations	0	4	4 or 5
Power Train Losses	No, (negligible)	6 %	6 - 7 %
Cooling Type	Air is sufficient	Water	Water
Power Transformers Needed	No	Yes	Sometimes
Redundant Power Units	Standard	Special	Special
Harmonic Distortion (THD)	No	High	High
Electromagnetic Interference	No	High	High
Acoustic Switching Noise	No	Yes	Yes
Screened Power Cables needed	No	Yes	Yes
Depending on Harmonic Filters	No	Yes	Yes
Designed Economic Lifetime	30 Years	6 Years	6 Years
Maintenance Requirement	Very Low	Frequent	Frequent
Onboard Crew Skills	Ordinary	Special	Special
MTBF (mean time between failures)	7 Years	1 Year	1 Year
MTTR (mean time to repair)	1 Hour	1 Week	1 Week
Spares Globally Available	Yes	No	No
Weight of Drive System	100 %	1100 % - 1400 %	600 % - 1600 %
Size of Drive System	100 %	500 % - 600 %	450 % - 700 %
All Voltage Class (220V-15kV)	Yes	No	No
Power Scalable	Yes	No	No
Regenerates Power to Grid	Yes	No	Yes
No. of Power Components in Line	1	80 000	150 000
Capacitors In Main Power Circuit	No	Yes	Yes
Explosion Risk in Drive	No	Yes	Yes
Propeller Pitch Configuration	CP	CP or FP	CP or FP
Financial Risk (Service cost, Off-hire)	Very Low	High	High

# PWM WILL NEVER BE NOISE-FREE

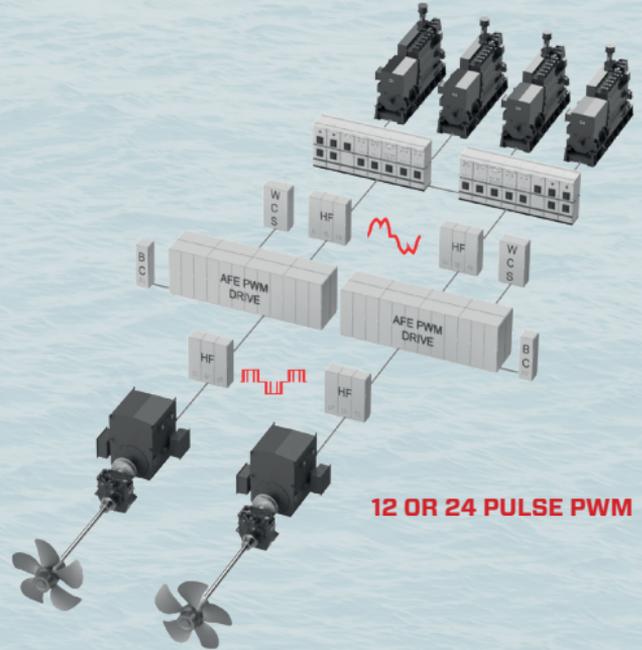
Complex PWM Drives (for comparison), competitor's technology



**AFE PWM**



**12 OR 24 PULSE PWM**



**PWM = PULSE WIDTH MODULATION**

## SELECTED REFERENCES



### White Rabbit

Trimaran yacht 83x20m  
Echo Yard Australia

**WORLD'S LARGEST TRIMARAN YACHT**



### Econuri

Incheon Port Authority  
Samsung Heavy Industries

**PASSENGER**



**Trollfjord**  
Midnatsol  
Hurtigruten  
Fosen Yard

**CRUISE**



**Polarlys**  
Hurtigruten  
Ulstein Yard

**PASSENGER**

## SELECTED REFERENCES



**OFFSHORE**

**SK Arctic, SK Atomik, SK Kinetik,  
SK Technik, SC Winter, SC Bongkot,  
SK Dynamik, Warami**  
AHTSV NCA80E, Nam Cheong



**SAAB AB - Sweden  
and NATO contract**



ILLUSTRATION ONLY

**NAVY**



**SUPPORT VESSEL**

**THOR Magni, Modi,  
Frigg, Freyja**  
SSV operated by PGS

**Sanco Star  
Sanco Spirit**  
SRV operated by PGS

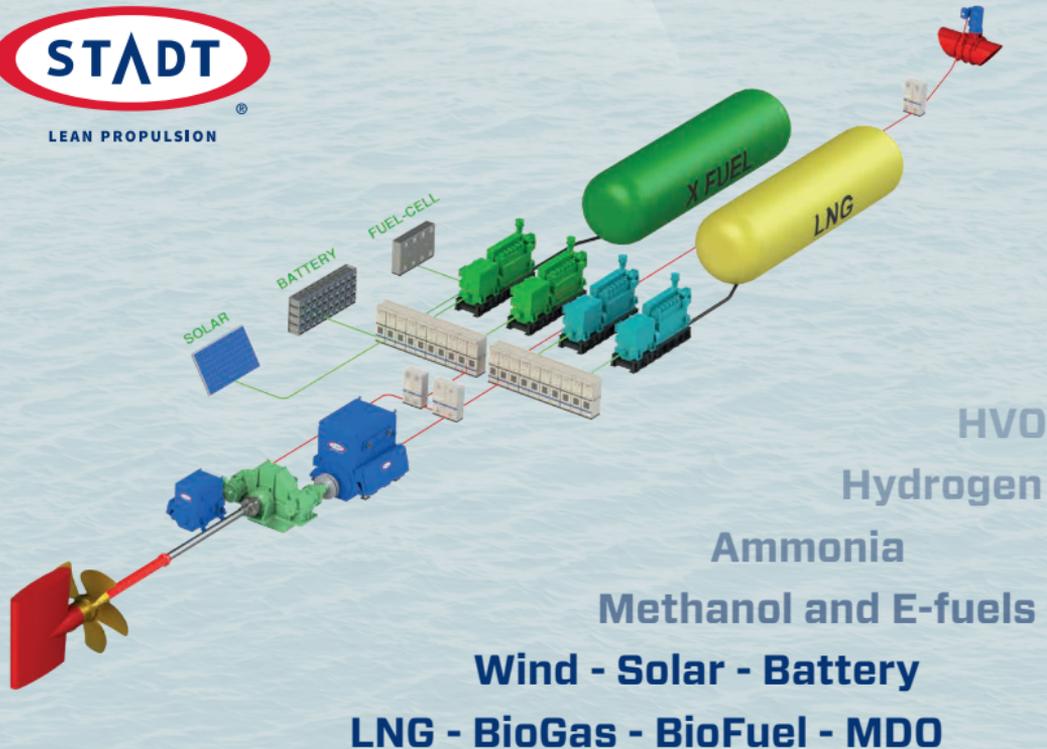


**RESEARCH**

# STADT HYBRID



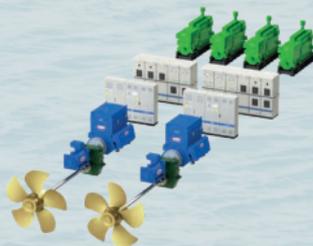
ANY COMBINATION POSSIBLE



**Carbon-Robust Solutions:**

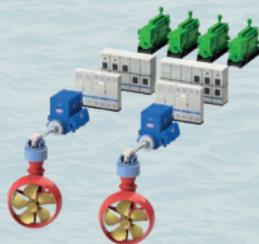
# STADT LEAN PROPULSION® ARRANGEMENTS

## SOME BASIC ARRANGEMENTS FOR FULL ELECTRIC PROPULSION



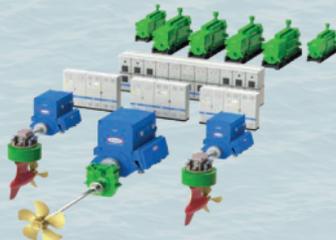
### Twin screw PTI, CP

- 4 generators
- 2 electric motors + 2 small as option
- 2 main switchboards
- Battery option



### Twin screw (Azimuth), CP

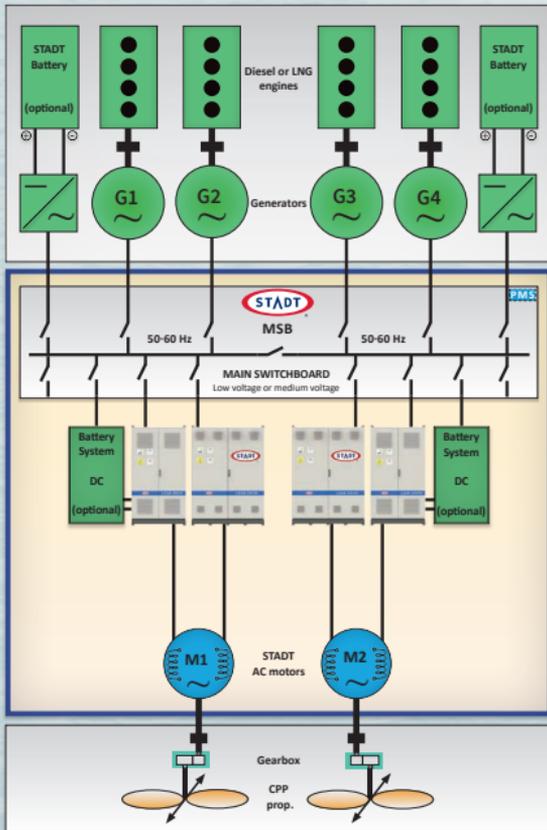
- 4 generators
- 2 electric motors
- 2 main switchboards
- Battery option



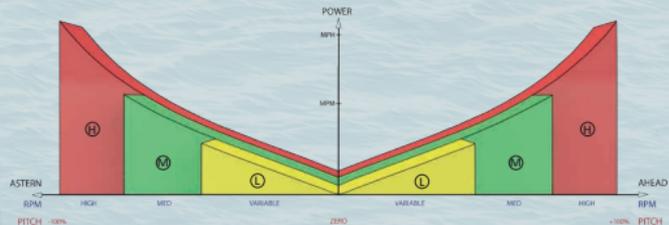
### Triple screw (2 Azipulls), CP

- 6 generators
- 3 electric motors
- 1 main switchboard with Bus-Tie
- Battery option

# STADT - YOUR SYSTEM INTEGRATOR

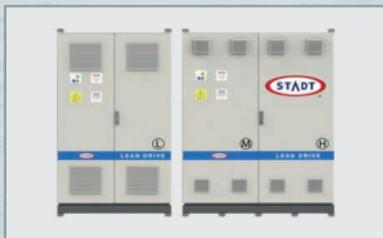


LET US DESIGN YOUR NEW  
SUSTAINABLE PROPULSION  
SOLUTION



## THE STADT SCOPE

Delivered to meet any typical ship classification standard.



STADT Lean Drives. Scalable in power to more than 50 MW per propeller.



STADT AC motors, a broad range.



STADT main switchboards, MCC, low voltage and medium voltage.



STADT power generators, battery systems, shore-to-ship power solutions, distribution transformers, etc.



Power Management System (PMS), IAS, remote access from shore, Dynamic Positioning (DP).

### SERVICES and EPC:

- Engineering of propulsion solutions
- Manufacturing and installation
- Commissioning
- Global Services

## STADT - AWARDED TECHNOLOGY LEADER

**The STADT Group was founded by Hallvard L. Slettevoll in 1985. We are located in the new and modern STADT Maritime Center in Gjerdsвика harbour.**

For many years STADT has been a leading company in AC drive innovations. Long experience from development of motor drives has resulted in the patented STADT Lean Drive technology. This has huge advantages compared to traditional PWM-technology, since it is free from electric disturbances. The STADT Lean Drive is also a very efficient



power drive system, bringing reliability up to a new standard.

The first STADT electric propulsion delivery went to the Norwegian coastguard K/V Tromsø in 1996, representing a technological breakthrough.



The Lean Drive was patented in 2008, and launched to the first ship applications the same year. The new drive technology has been awarded several times for its unique characteristics, and many ships are now sailing with the Lean Propulsion® technology all over the world.

# STADT HISTORY



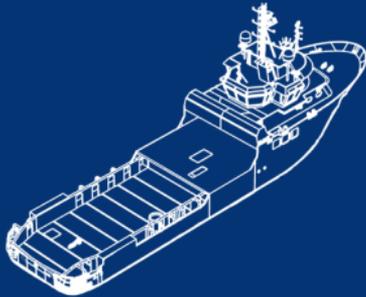
**35 YEARS IN AC DRIVE DEVELOPEMENT**

# LEAN BRINGS YOU

+ SAFETY & RELIABILITY  
+ VERY LONG LIFETIME

+ STEALTH & SILENCE  
+ MORE CARGO CAPACITY  
+ LONGER ENDURANCE

+ LESS EMISSION AND FUEL  
+ COST EFFICIENCY



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