



LEAN PROPULSION



**THE BEST SOLUTION  
FOR ANY FISHING VESSEL**



## STADT LEAN PROPULSION®

Ship owners need *reliable vessels* that are efficient to operate, year after year, in all seasons and weather conditions. Most importantly, the ship must have a *reliable* 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 conventional PWM propulsion systems for many years, we asked the question: “Can a new way of thinking also give us a new generation of ship propulsion systems that are prepared for tomorrow’s environmental challenges” ?

STADT has taken these challenges seriously, when developing the STADT Lean Propulsion®, based on patented, now available for the most powerful applications, more than 50 MW per propeller. A lean propulsion system that is amazingly *reliable*, and also reduces service costs, weight, fuel, emission and waste, while freeing up space. Ready for zero emission solutions.

A sophisticated and silent system performance, documented extremely long lifetime, far ahead of competitors 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.

## STADT - AWARDED TECHNOLOGY LEADER

STADT GROUP was established back in 1985 by Hallvard L. Slettevoll.

In 2015 a modern STADT Maritime Center was opened 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 and *brings 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.



*One of the 150 ship propulsion references*

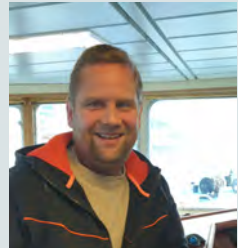
The Lean Drive technology has been awarded several times for its unique characteristics and its reliability is well documented over the last 15 years of operation worldwide.

# REFERENCES - EXPERIENCE

*From MS HARTO - Purse Seiner*

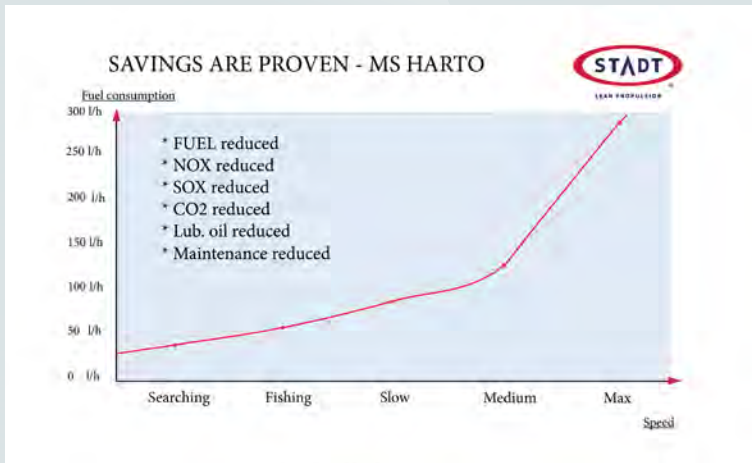
We installed the STADT diesel-electric propulsion in 2008 – now more than 15 years ago. It was a pioneer project, and many thought we were crazy - not using a main diesel engine. Over the 10 years of fisheries in the northern Atlantic, we have seen that the STADT-technology has given us a very robust ship that operates very silent by all means . Extremely low noise when we are searching for the fish, operating with only one genset instead of all the 4 that is in place. It gives a better catch, and we have a very high comfort onboard, in particular when we should go to sleep . The unique noise-free STADT technology does not disturb our sensitive fishing sensors.

It has also been a great advantage for us the redundancy built in to the system, from power generation through switchboard and electric propulsion motor drive arrangements. We have so far never been out of service, and STADT has helped us in an excellent way the very few times something needed to be serviced.



**Tor Hugo Bergtun**  
*MS HARTO ship owner*

# SUSTAINABLE, LEAN AND GREEN



**AT FISH SEARCHING AND MODERATE SPEED - THE FUEL CONSUMPTION  
DROPS FROM 300 L/H DOWN TO 30 L/H.  
A SAVING OF 90 %**

## AWARDED TECHNOLOGY LEADER

*”The STADT Lean Propulsion® system has features that has not been achieved in previous propulsion solutions. Its most impression feature being is its completely silent, stealth operation, which is already been adopted in a series of naval ships and commercial vessels.*

*The systems impressive efficiency comes from its very low power loss. At time contributing to lower emissions and a reduced carbon footprint.”*

*-The RINA awarding committee*



Awarded by The Royal Institute of Naval Architects (RINA) in London



**INNOVATIVE PROPULSION FOR YOUR NEXT SHIP**

# SUSTAINABLE, LEAN AND GREEN

Ensures that the propeller never stops.

## STADT LEAN PROPULSION WILL GIVE:

- ⚡ High reliability, long lifetime
- ⚡ Silence by all means, lowest Underwater Radiated Noise (URN) - increased comfort
- ⚡ Reduced NOx, SOx, BC and CO2 emission, zero emissions ready
- ⚡ Reduced OPEX/CAPEX
- ⚡ Scalability (up to 100 MW)



**LEAN DRIVE FOR ANY SIZE OF SHIPS**

## THE MOST IMPORTANT DESIGN CHOISES:

### **CPP** OR FP PROPELLER?

-SEE OUR PRESENTATION

### **AC** OR DC GRID?

-SEE OUR SPECIAL BROCHURE

### **GEARED** OR GEARLESS?

-SEE OUR SPECIAL BROCHURE

### **LEAN PROPULSION**®



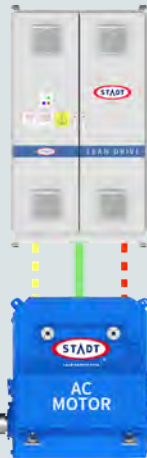
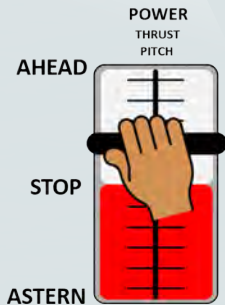
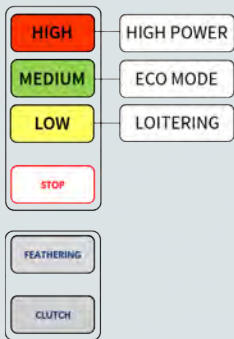
# THE CONTROLLABLE PITCH PROPELLER

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

- ▲ Possibility for full feathering position, which is saving fuel when only running one propeller
- ▲ Each blade may be changed independently if damaged, at sea
- ▲ The perfect propeller also for ice classed ships
- ▲ Possible to combine with flywheel in Ice conditions
- ▲ The CPP are available with 4, 5, 6 or 7 blades, giving lowest URN.
- ▲ Better manoeuvrability (acceleration, breaking, crash stop)
- ▲ Eliminating high power braking resistors – no waste energy
- ▲ Significantly improved efficiency at varying load / weather / speed conditions
- ▲ Future-proof with regard to changes of use of the vessel, slow steaming, extensions, etc.
- ▲ CPP's are the propeller type with widest power range - 1 to 75 MW per unit



# DYNAMIC POWER - AT YOUR FINGERTIPS



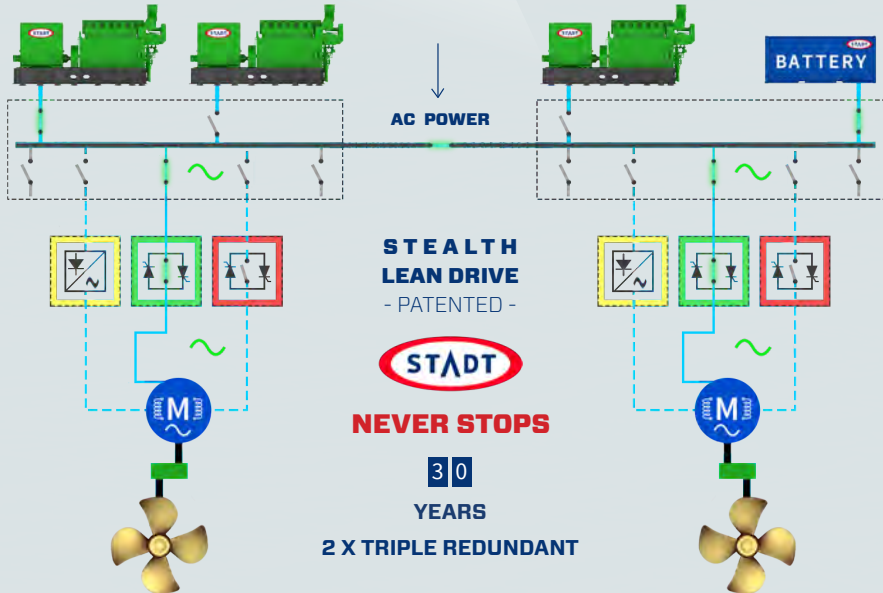
0-100 rpm  
0-15000 kW



Geared transmissions save a lot of weight and space

**STEALTH LEAN PROPULSION®**

# STADT LEAN PROPULSION® = REDUNDANCY





## BEST IN CLASS ELECTRIC PROPULSION

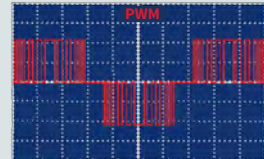
- ^ **RELIABLE** & low maintenance cost
- ^ **STEALTH SILENT** - no interference / acoustic noise
- ^ **HIGH EFFICIENCY** - less than 0.1 % power loss
- ^ **LOW WEIGHT** - more space for cargo

**INNOVATIVE PROPULSION FOR YOUR NEXT SHIP**

# PWM OR LEAN DRIVE - THE DIFFERENCE

^ **PWM (Pulse Width Modulated AC)** is an artificial chopped waveform

- ^ Created by AC to DC to AC conversion via the transistor inverter
- ^ Power-loss both in drive and transformers
- ^ Represent a variety of disturbance issues and will create :
- ^ Common mode noise, EMI, THD, URN and audible noise
- ^ Stress on EI-motor bearings and windings
- ^ Hidden failures, also on other equipment on the same grid – **high failure rate**

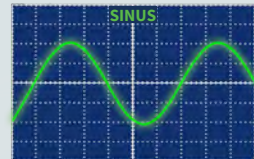


→ **PWM is a complex technology - power loss & heat - challenging installation**

---

^ **STADT LEAN PROPULSION®** is based on Perfect Sinusoidal Waveform

- ^ No disturbance due to **Dynamic Ultra Low Frequency Switching Technology**
- ^ Low audible Underwater Radiated Noise (URN)
- ^ Minimum loss - no heat generation – no need for water-cooling
- ^ Represents the **perfect source for our AC induction motors**
- ^ **Lowest** failure rate



→ **Sinus is simplicity - efficiency - increased reliability - eased installation**

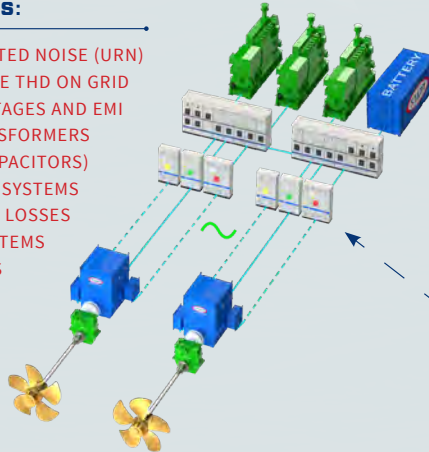
...so why disturb perfection ?

# LEAN - WHEN LESS GIVES MORE

## STADT ELIMINATES:

- UNDERWATER RADIATED NOISE (URN)
- POWER DISTURBANCE THD ON GRID
- COMMON MODE VOLTAGES AND EMI
- THE BIG DRIVE TRANSFORMERS
- EXPLOSION RISK (CAPACITORS)
- BREAKING CHOPPER SYSTEMS
- 6 % WASTED ENERGY LOSSES
- WATER COOLING SYSTEMS
- 80.000 COMPONENTS
- SCREENED CABLES
- COMPLEXITY

= **LESS DOWNTIME**



## STADT GIVES YOU MORE:

- + REDUNDANCY IN DRIVE SYSTEM
- + POWER TO PROPELLER
- + SAFETY AND RELIABILITY
- + SPACE AND LOWER WEIGHT
- + STEALTH PERFORMANCE
- + HMS AND COMFORT (SILENCE)

= **BETTER PERFORMANCE**

## HOW COME ?

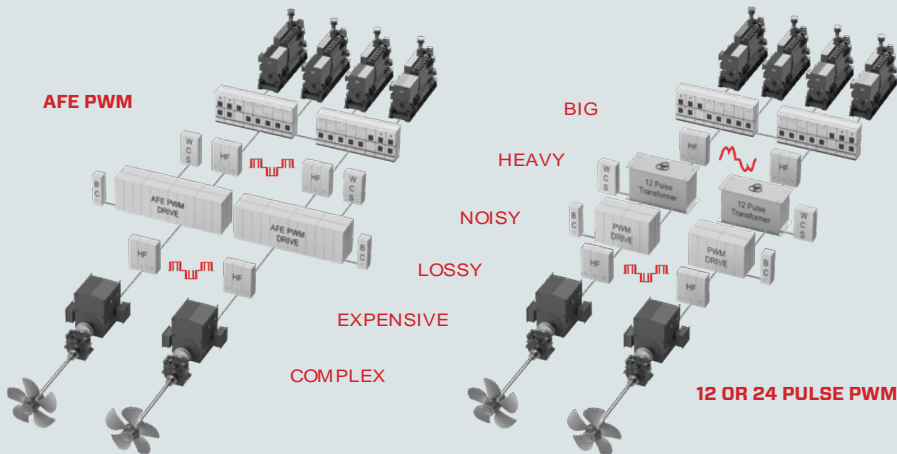
PATENTED, DYNAMIC -  
ULTRA LOW FREQUENCY  
SWITCHING TECHNOLOGY.

WHY DISTURB PERFECTION?

STADT LEAN PROPULSION®

# PWM WILL NEVER BE STEALTH OR NOISE-FREE

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



PWM = PULSE WIDTH MODULATION 

# EVALUATION OF TODAY'S DIFFERENT DRIVE SOLUTIONS

Lean Issues To Consider	STADT Stealth 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 in Drive	0,1 %	6 %	6 - 7 %
Cooling Type	Air is sufficient	Water	Water
Power Transformers Needed	No	Yes	Sometimes • - - ,
Regenerates Power to Grid	Yes	No	Yes
Weight & Size of Drive System	100 %	500 % - 600 %	450 % - 700 %
All Voltage Class (220V-15kV)	Yes	No	No
Underwater Radiated Noise (URN)	Lowest	High	High
Harmonic Distortion (THD)	No	High	High
Common Mode Voltages and EMI	No	High	High
Acoustic Switching Noise and URN	No	Yes	Yes
Screened Power Cables needed	No	Yes	Yes
Redundant Power Units	Standard	Special	Special
Designed Economic Lifetime	40 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
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
Financial Risk (Service cost, Off-hire)	Very Low	High	High

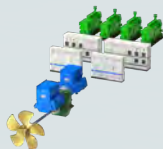
# STADT LEAN PROPULSION® ARRANGEMENTS - IEP

## SOME BASIC ARRANGEMENTS FOR FULL ELECTRIC PROPULSION



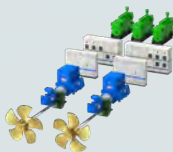
### Single screw PTI, CP

- ▲ 3 generators
- ▲ 2 electric motors, big and smaller
- ▲ 2 main switchboards



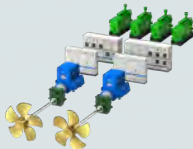
### Single screw Twin, CP

- ▲ 4 generators
- ▲ 2 electric motors
- ▲ 2 main switchboards



### Twin screw PTI, CP

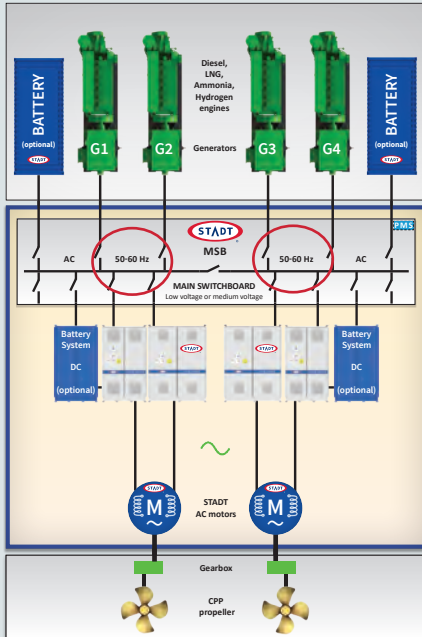
- ▲ 3 generators
- ▲ 4 electric motors, big and smaller
- ▲ 2 main switchboards



### Twin screw, CP

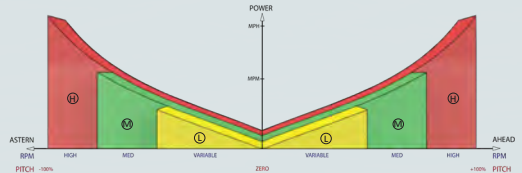
- ▲ 4 generators
- ▲ 2 electric motors
- ▲ 2 main switchboards

# STADT - YOUR SYSTEM INTEGRATOR



LET US DESIGN YOUR NEW  
SUSTAINABLE PROPULSION  
SOLUTION

STADT AC VARIGRID IS AN OPTION



# THE STADT SCOPE

Delivered to meet any typical ship classification standard.



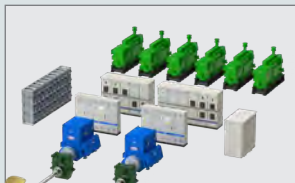
STADT Lean Drives. Scalable in power to more than 50 MW per propeller.



STADT AC motors, asynchronous technology, a broad range.



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



STADT power generators, battery systems, shore-to-ship power solutions, distribution transformers, The Cube™ certified options, 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

## REFERENCES



**Hovden Viking**  
Purse Seiner  
Thrusters Drive System



**Slettholmen**  
Purse Seiner  
Thrusters Drive System



**Solværskjær**  
Purse Seiner  
Thrusters Drive System



**Sildaskjær**  
Purse Seiner  
Thrusters Drive System



**Bernt Oskar**  
Purse Seiner  
Thrusters Drive System

**See [www.STADT.no](http://www.STADT.no)  
for more references**

# REFERENCES



## **Seihav**

WELL-BOAT

Diesel-electric Propulsion

Thrusters Drive System



## **Benjaco**

Purse Seiner

Diesel-electric Propulsion

Thrusters Drive System



## **Voldnes**

Purse Seiner

Diesel-electric Propulsion

Thrusters Drive System



## **Harto**

Purse Seiner

Diesel-electric Propulsion

Thrusters Drive System



## **Hepsøhav**

Purse Seiner

Thrusters Drive System



## **Sjøglans**

Purse Seiner

Thrusters Drive System

# STADT GLOBAL NETWORK

## STADT SERVICE POINTS:

---

STADT NORWAY, GJERDSVIKA  
STADT ITALY, ROME  
STADT SINGAPORE, SINGAPORE  
STADT JAPAN, TOKYO  
STADT GERMANY, HAMBURG  
STADT SPAIN, VIGO  
STADT POLAND, GDYNIA  
STADT TURKEY, TUZLA  
STADT DANMARK, ESBJERG  
STADT BALTIC, KLAIPEDA  
STADT UK, ABERDEEN  
STADT MEDITERRANES, LIMASSOL  
STADT NORTH AMERICA, MIAMI  
STADT SOUTH AMERICA, RIO DE JANEIRO  
STADT KOREA, BUSAN  
STADT JAPAN, TOKYO  
STADT TAIWAN, KAOHSIUNG  
STADT INDIA, MUMBAI  
STADT AUSTRALIA, PERTH



## STADT OFFICES:

---

STADT NORWAY, GJERDSVIKA  
STADT ITALY, ROME  
STADT SINGAPORE, SINGAPORE  
STADT JAPAN, TOKYO

# STADT GROUP HISTORY

## 40 YEARS IN AC DRIVES



MORE THAN 150 SHIPS AND RIGS ARE POWERED BY STADT DRIVES

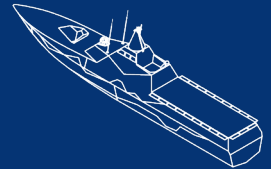
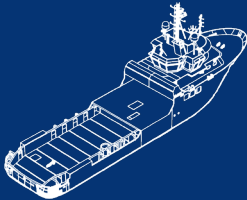
## LEAN BRINGS YOU

---

- + SAFETY & RELIABILITY
- + VERY LONG LIFETIME
- + SUSTAINABILITY

- + STEALTH & HSE
- + MORE CARGO CAPACITY
- + LONGER ENDURANCE

- + LESS EMISSION AND FUEL
- + COST EFFICIENCY
- + LOWEST URN



STADT AS IS PART OF THE STADT GROUP AS

STADT AS

Moljevegen 50 | N-6083 Gjerdsvika | Norway  
Tel.: +47 700 25 800 | [www.stadt.no](http://www.stadt.no)



Made in Norway

