

RENK

MARINE















# Intelligent Propulsion and Power Management Systems for Unmanned Naval Ships

Nils Oesterlen, 24.05.2023



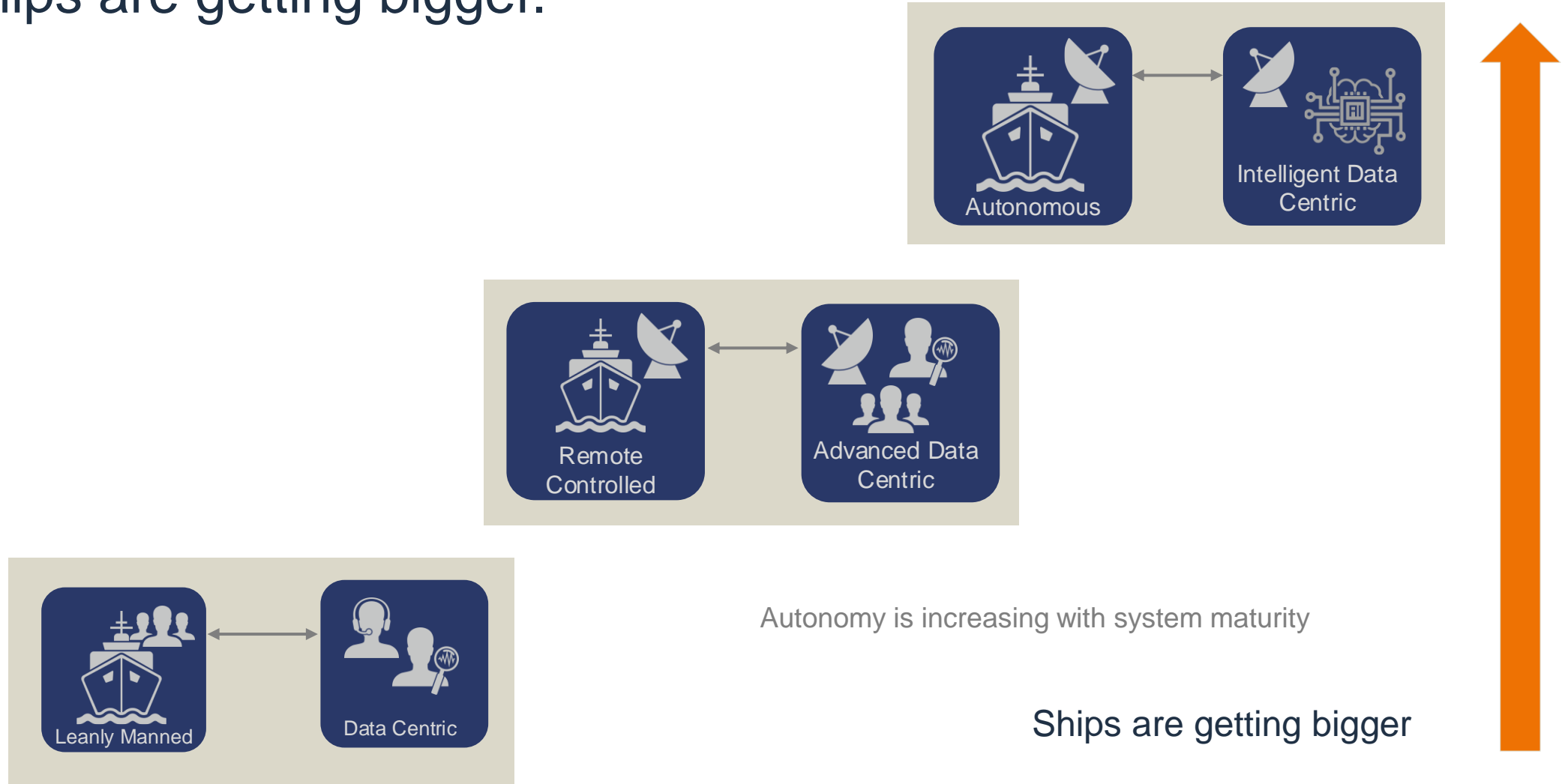
# Technology leader for complex gearboxes for Naval Vessels

- **Market leader in mission-critical drive technologies** for marine and industrial applications
- **Technology leader in specialized gear solutions** for navies (+40 navies worldwide)
- **Production of gear solutions** for commercial marine and mega-yacht applications with propulsive power of up to **84 MW**
- Nr. 1 among suppliers of **slide bearings for electric motors** and **axial bearings** for demanding marine applications

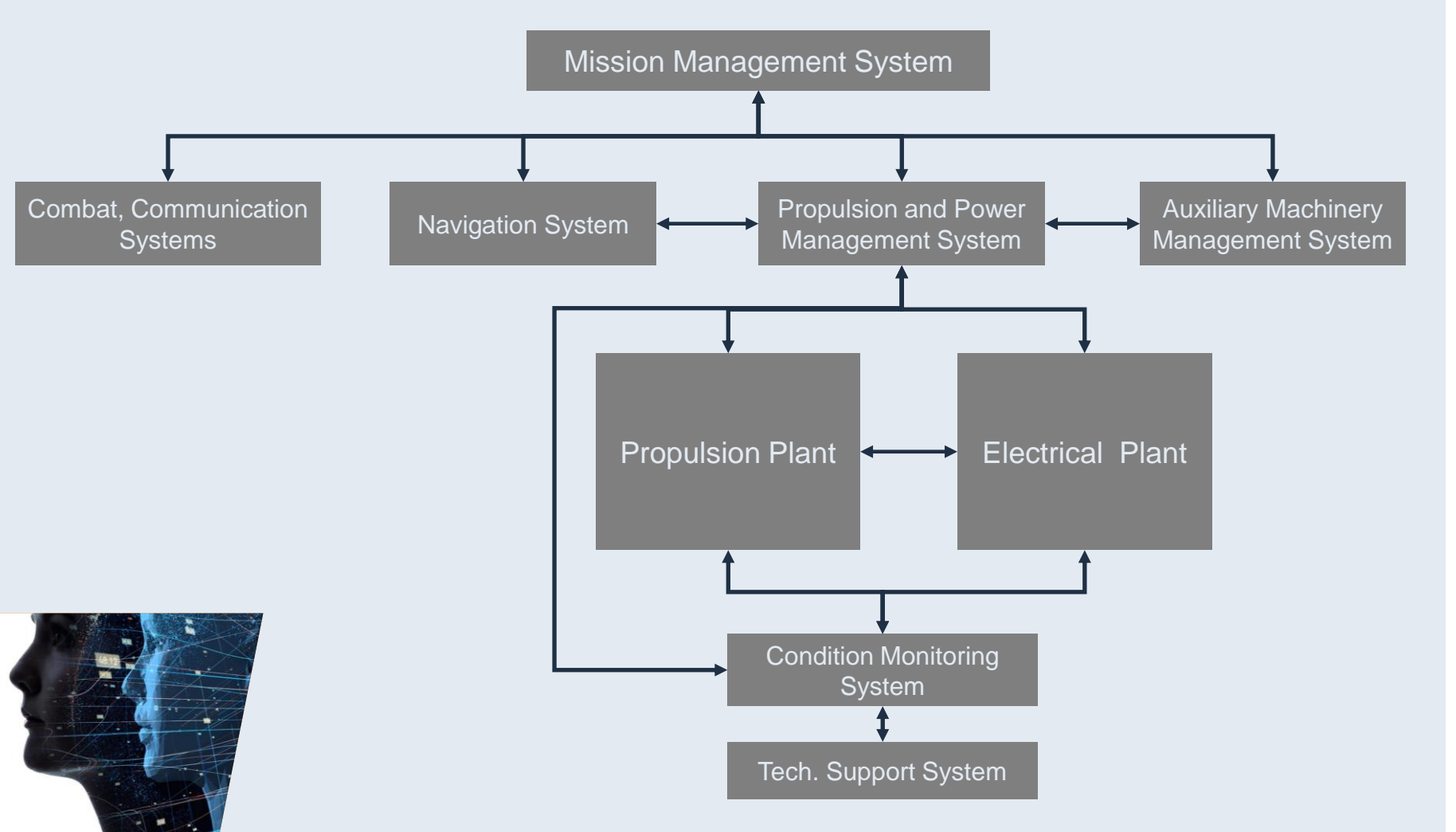
Key products and end markets							
 Marine	 Yachts	 Power generation	 Plastics	 Cement	 Marine (civil)	 Oil & Gas	
 Marine (civil)	 Research vessels	 Oil & Gas	 Mining	 Steel production	 Power generation	 Mining	 Steel production
<b>Marine gearboxes</b>		<b>Turbo gearboxes</b>	<b>Industrial gearboxes</b>		<b>Clutches</b>		



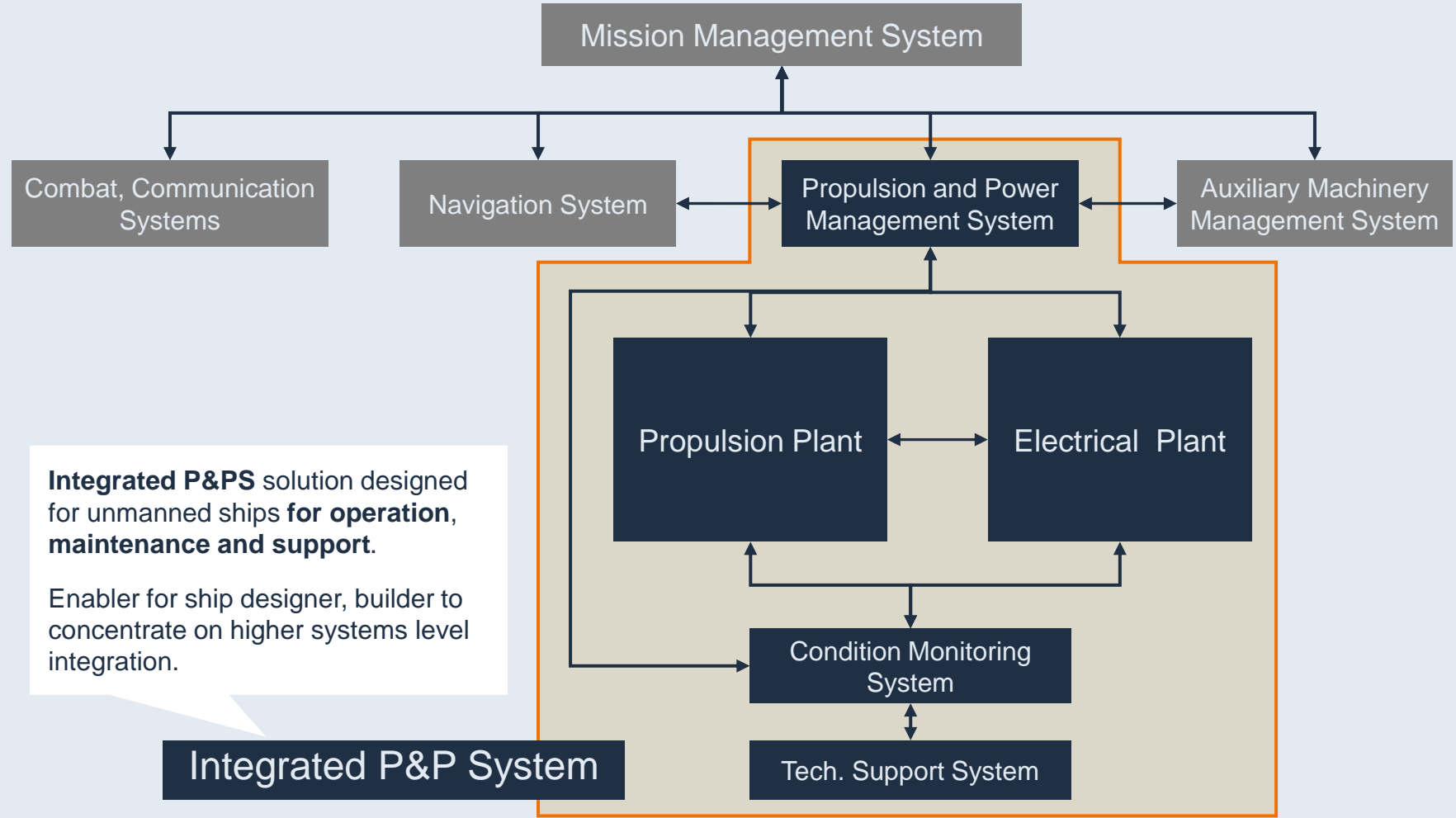
The transition to unmanned ships is ongoing. Autonomy is increasing and ships are getting bigger.



# The Unmanned Naval Ship will be a 'System of Systems'



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**Integrated P&PS** solution designed for unmanned ships for **operation, maintenance and support**.

Enabler for ship designer, builder to concentrate on higher systems level integration.

# Large unmanned vessel design criteria require a sophisticated P&PS

## Naval Unmanned Vessels: Concept of Operations (CONOPS)

Speed, range: long periods of patrolling, charge based on need

Compact power dense design,

Others: low Underwater Radiated Noise (URN)

Very high reliability

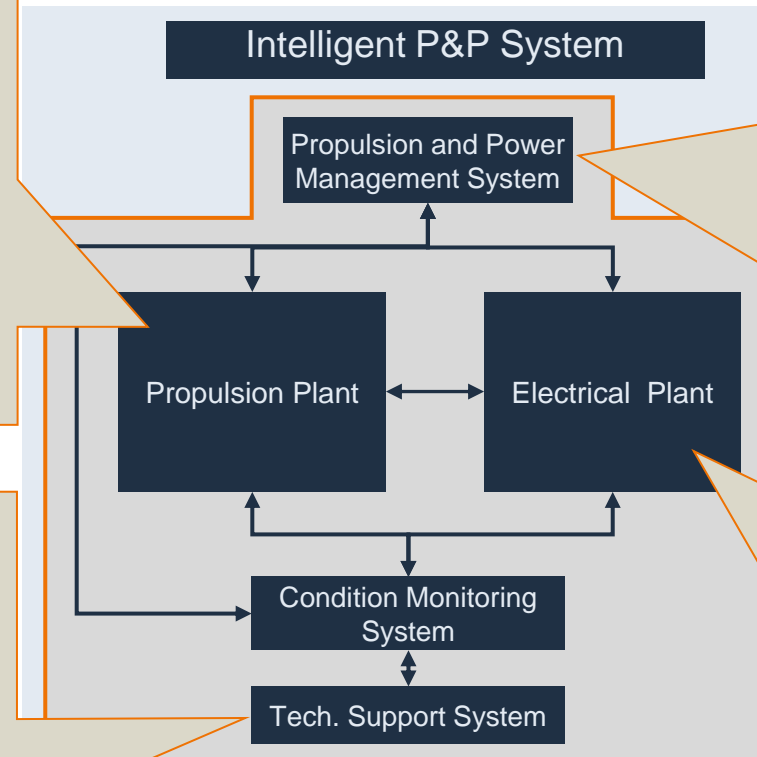
No physical human intervention for maintenance in the designed mission length



**Demands a highly sophisticated P&PS**

- Combination of prime movers to achieve power density, high reliability, low maintenance
- Current research: **Hybrid Plant Arrangements best suited**
- Compact CODELAD, CODELAG
- High flexibility, transmission system design

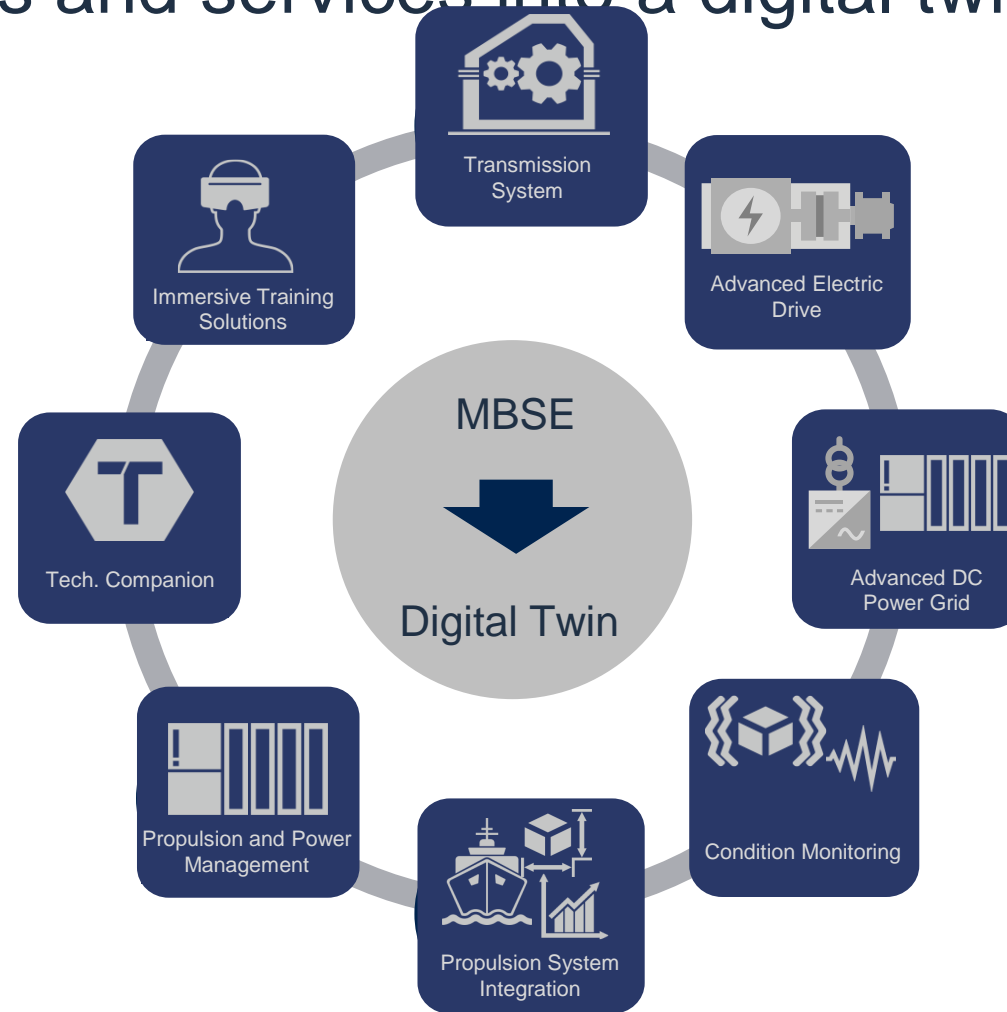
- **Model based integrated training systems** for training of remote, local, emergency assistance crew
- **VR-AR based assistance** for human repair, maintenance actions when needed



- Intelligent P&P management system designed for complete operational decision loop: **Monitoring, Analysis, Decision and Action**
- Complete integration with condition monitoring
- Special measures for increased reliability of transmission system
- Increased redundancy measures for support systems

- **DC grid architecture** for high load density (compact, high efficiency with variable speed gensets)
- Bi-directional energy flow between Propulsion and Electrical plants (PTI / PTO functions for high flexibility)
- Seamless integration with propulsion plant functions

# Model Based System Engineering (MBSE) enables the integration of several products and services into a digital twin

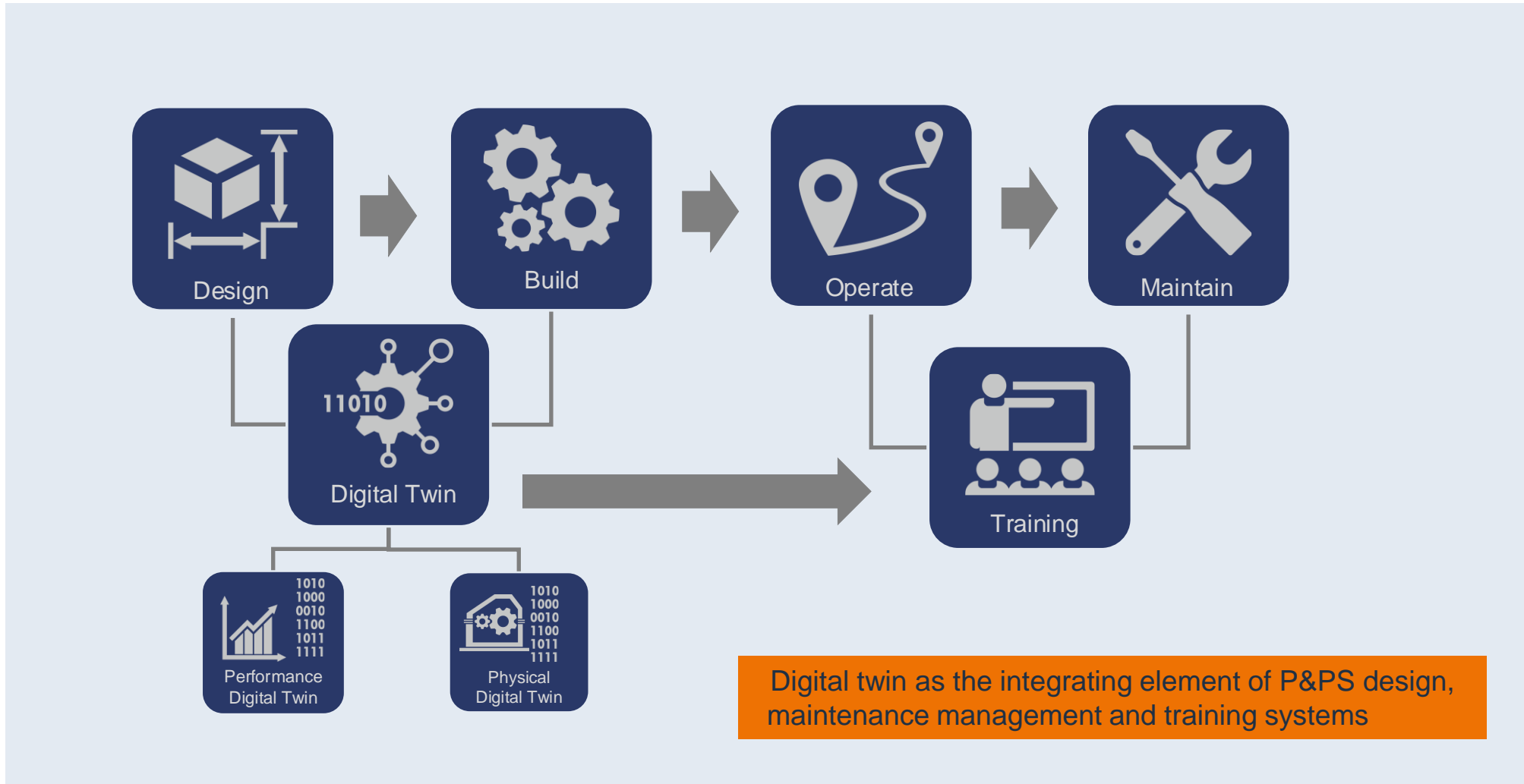


Model Based Product Integration  
for development of the  
**RENK Intelligent P&P System**

Connect product family through an  
evolving Digital Twin, based on  
MBSE approach

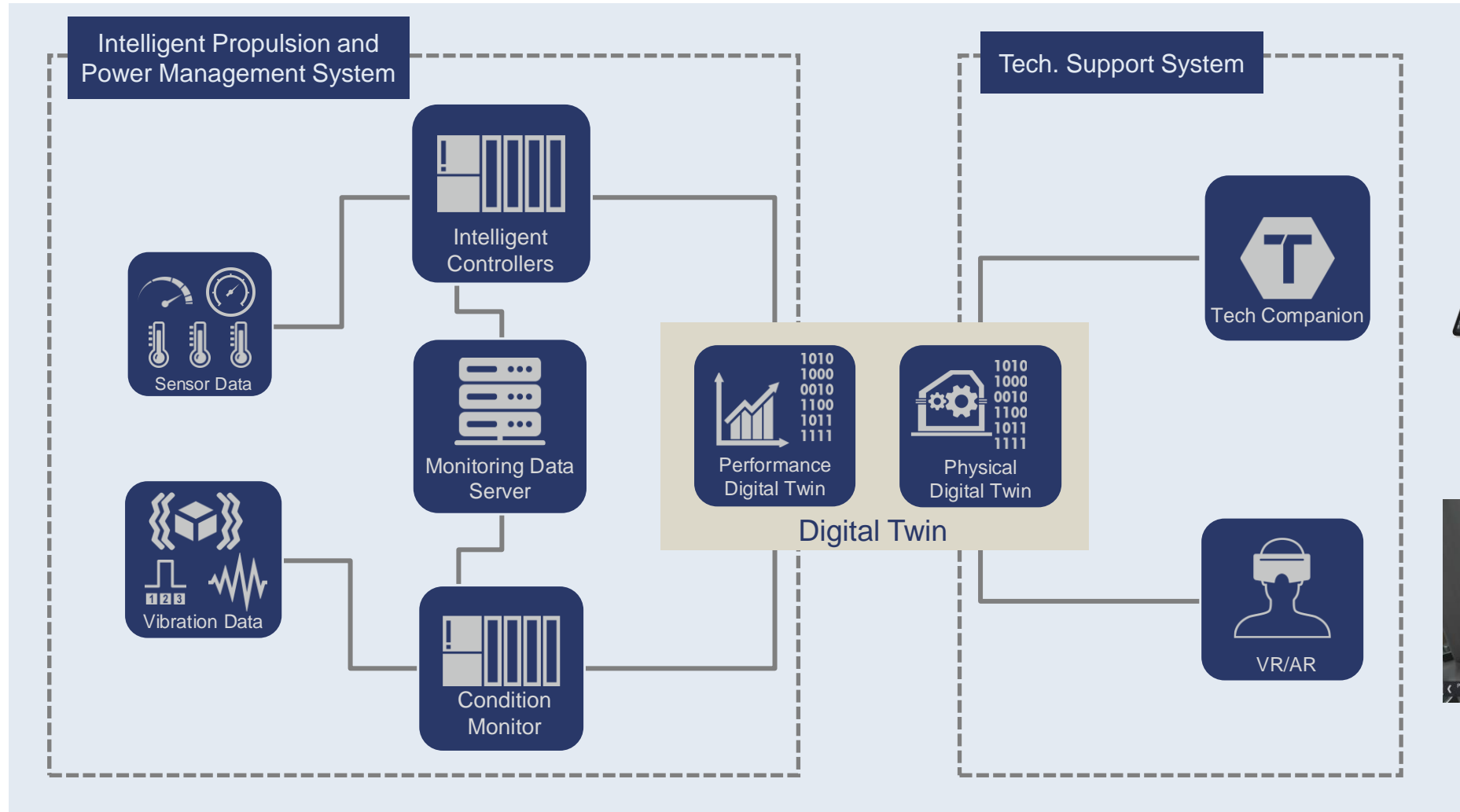
**“One model to connect all”**

# Linking design, build, operation, maintenance and support

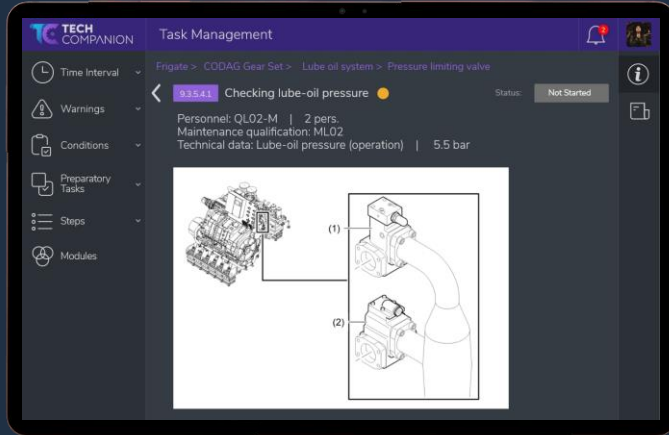




# Relationship: P&P Management System with Tech. Support System



# The Modules



## Digital Work Cards

Convert manufacturer's technical manuals into interactive customized operational and maintenance tasks lists (work cards) that provide procedural information on the task and collect data on the maintenance completed, streamlining service reporting and supporting compliance.



## 3D Training / remote support

Integrated 3D training lessons which the technician is able to access to support their maintenance task. Enables technicians to visualize the procedural steps for a task.

## LARGE UNMANNED VESSEL - CONCLUSION

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1

Future large unmanned naval vessel will require a sophisticated and fully integrated P&PS

2

Digital Twin enables the deep integration of several systems

3

Extensive domain knowledge is needed to design and integrate a P&Ps



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Thank you for your  
interest!