AZIPOD PROPULSION

Dr Phil Thompson

Michael Laurie

BMT Marine & Offshore Surveys

Incorporating The Salvage Association

Azipod Propulsion

by

Dr Phil Thompson

&

Michael Laurie

BMT Marine & Offshore Surveys

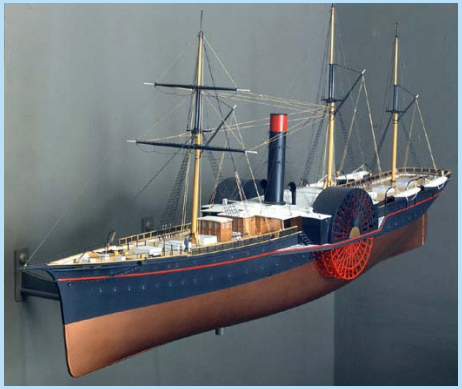
(incorporating The Salvage Association)

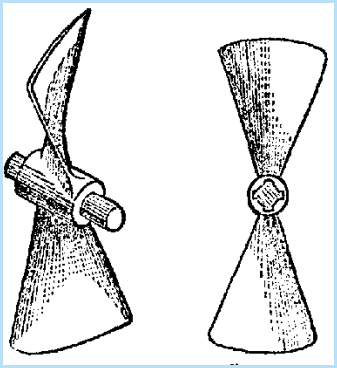
12 September 2007

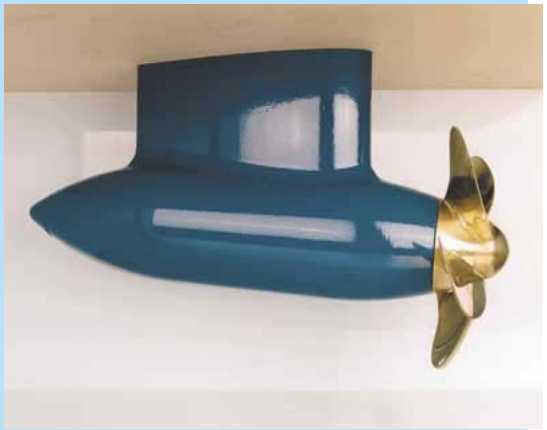
Azipod Propulsion

- Introduction - History & Development
- What is an Azipod
- How does it work
- Manufacturers
- Types of vessels
- Advantages
- Manoeuvrability
- Disadvantages & Problems
- The Future
- Conclusions

Introduction – History & Development



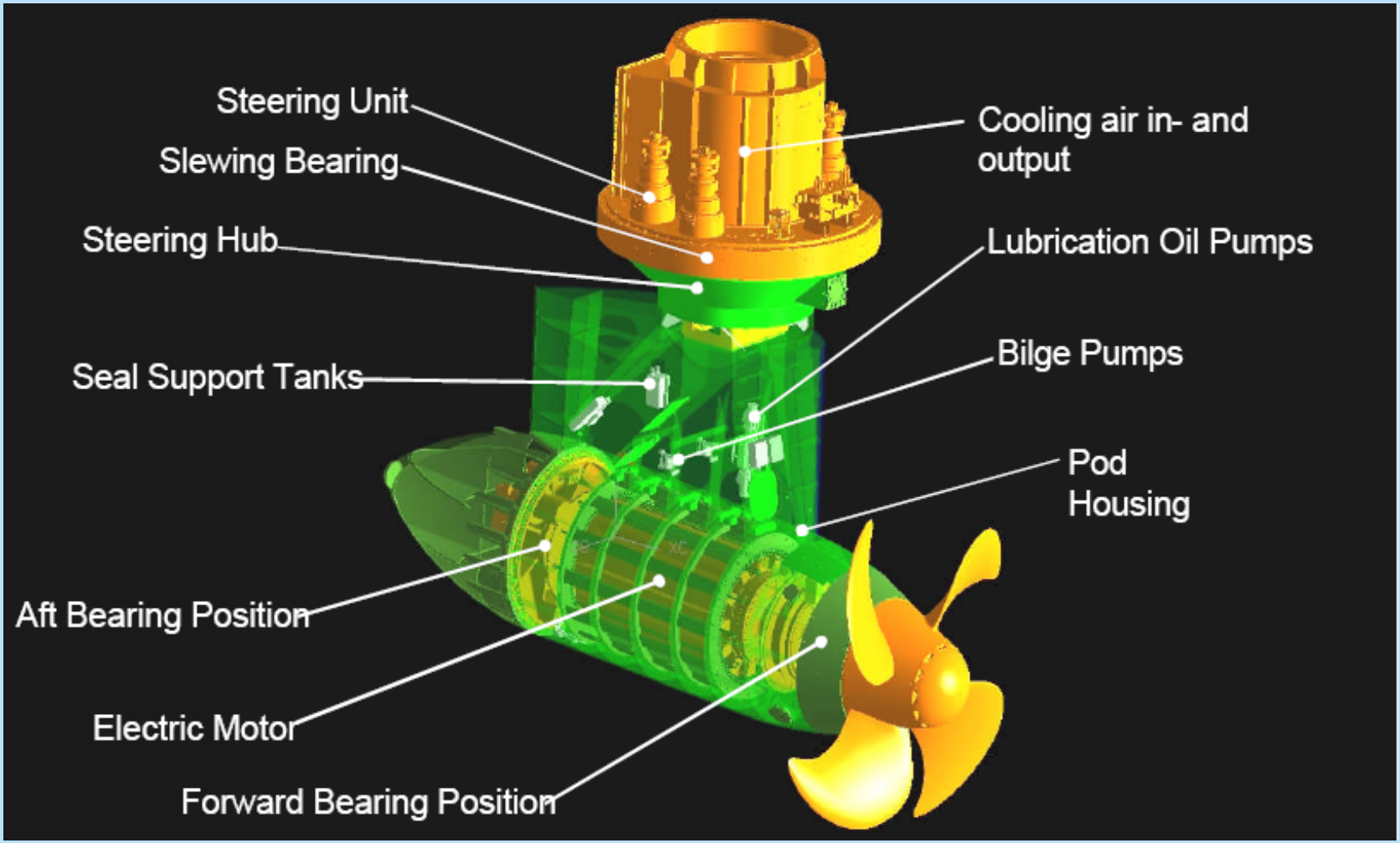




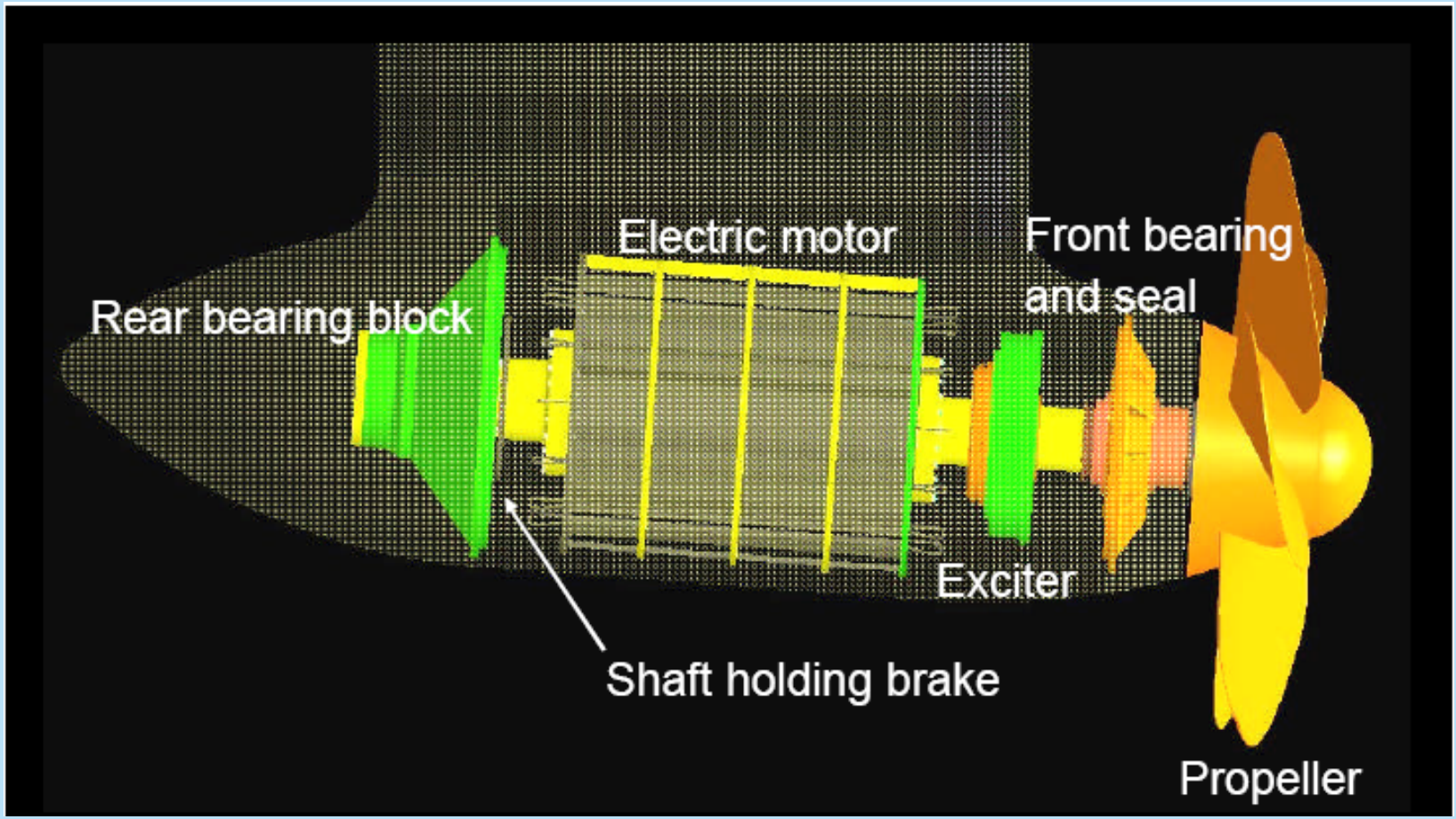
What is an azipod?

- "Azipod" is a registered trademark for ABB's electrical propulsion systems
- azipod has become the generic name for all manufacturers systems
- An Azipod or podded propulsor to give it its technical name is a propulsion or manoeuvring device that is external to the ship's hull and houses a propeller powering capability. This definition differentiates them from azimuthing thrusters which have their powering machinery within the hull and usually drive the propeller through a system of shafts and gearing.

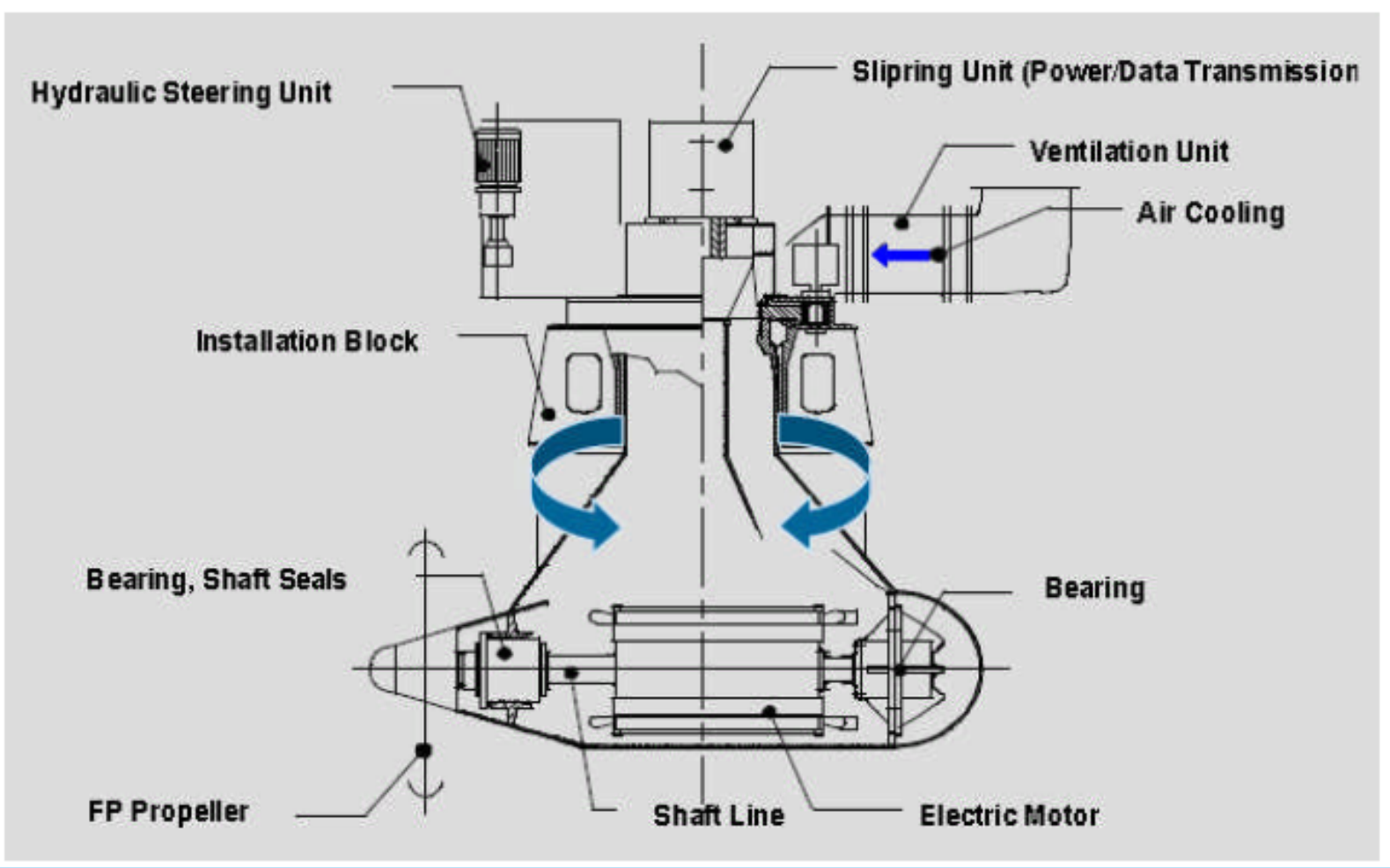
TYPICAL AZIMUTHING PROPULSOR POD



POD INTERNALS

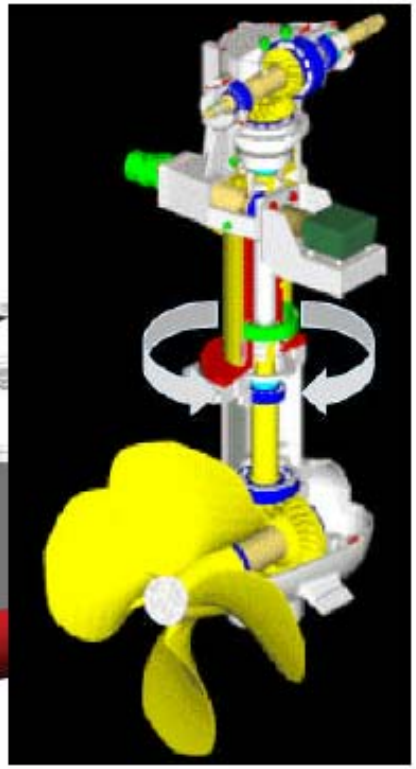


ARRANGEMENT – POD HOUSING

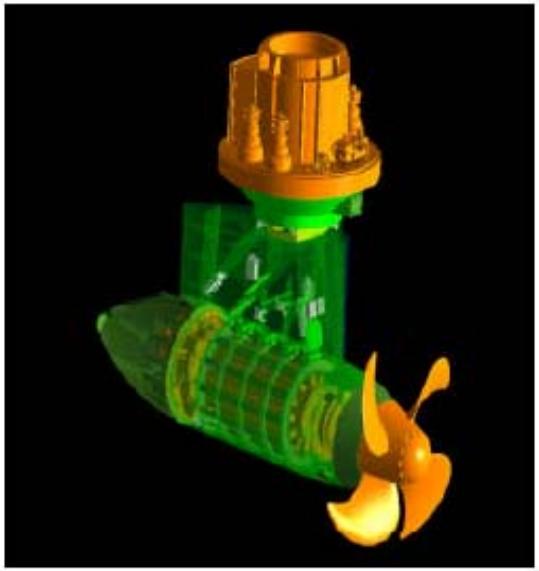


Electrical Propulsion

Shaft Line

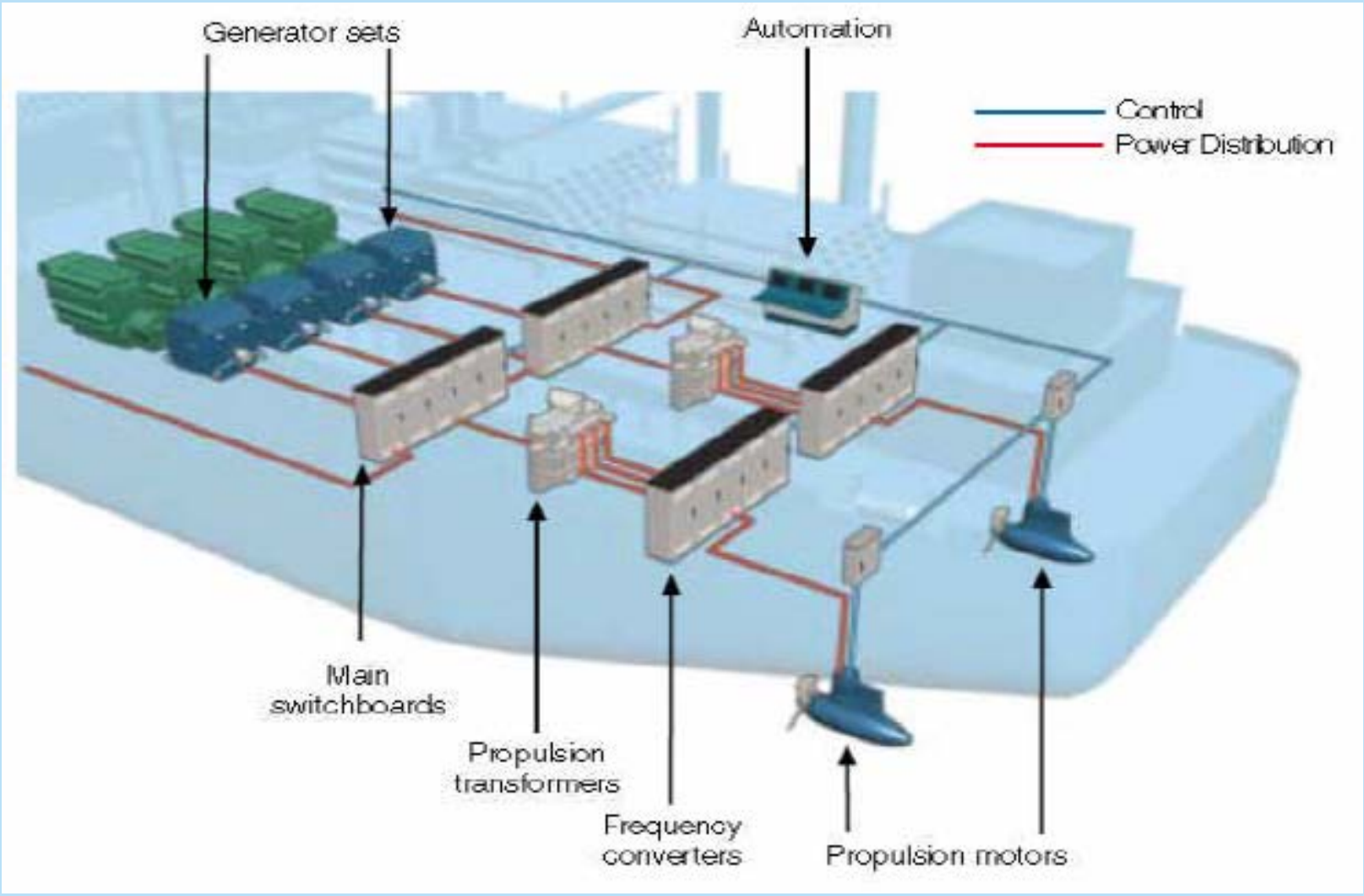


Azimuth



Pods

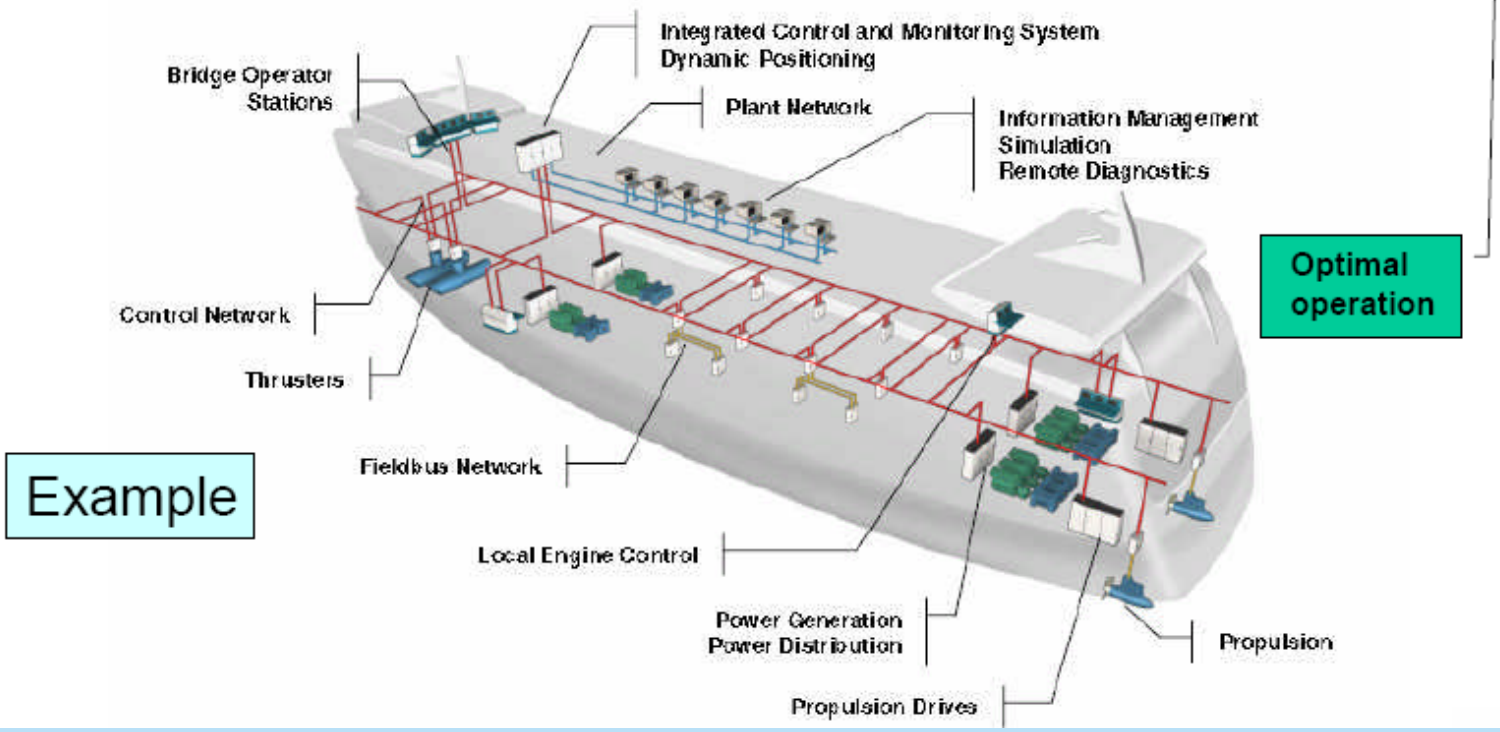
PROPULSION SYSTEM DESIGN



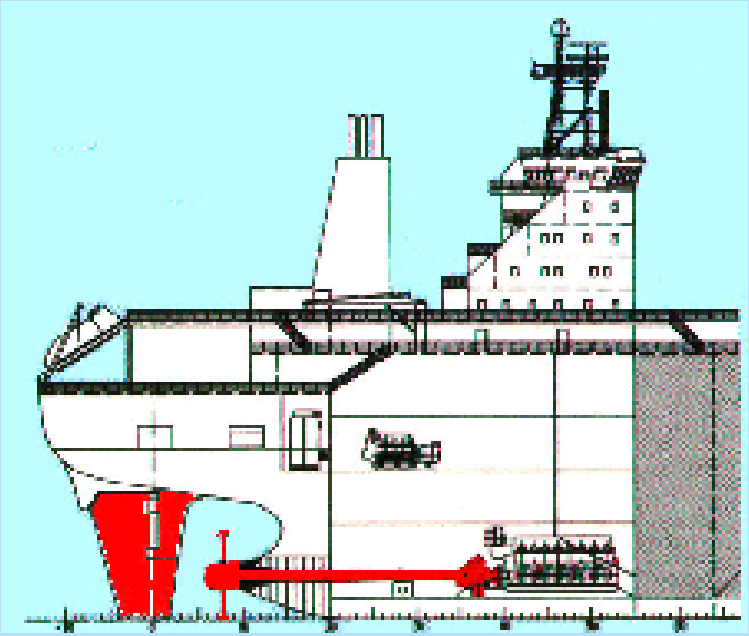
INTEGRATED ELECTRICAL POD PROPULSION

AES (All Elec. Ship) / IEP (Integrated Elec. Propulsion)

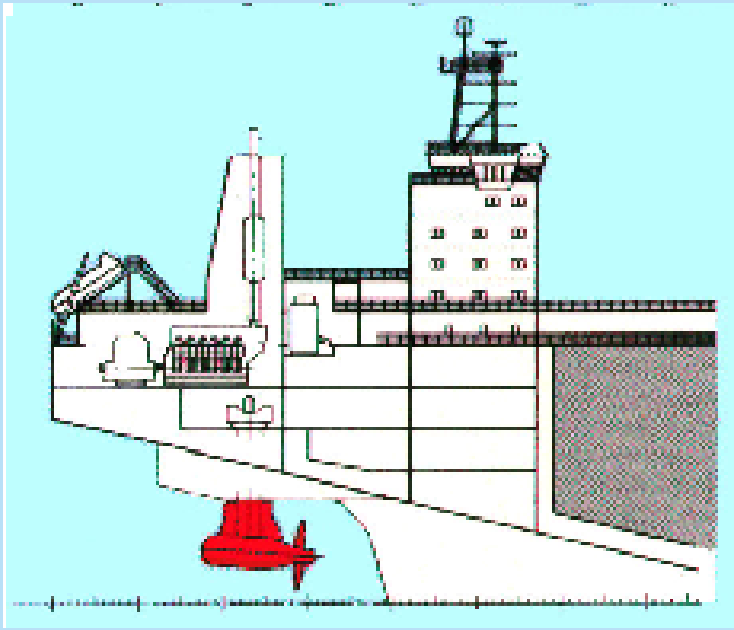
System consists of a centralized power plant (supplying propulsion and domestic services requirements) and a variable speed drive system connected to propeller. A comprehensive Power Management System (PMS) ensures that each prime mover operates at its optimal load.



DESIGN FLEXIBILITY

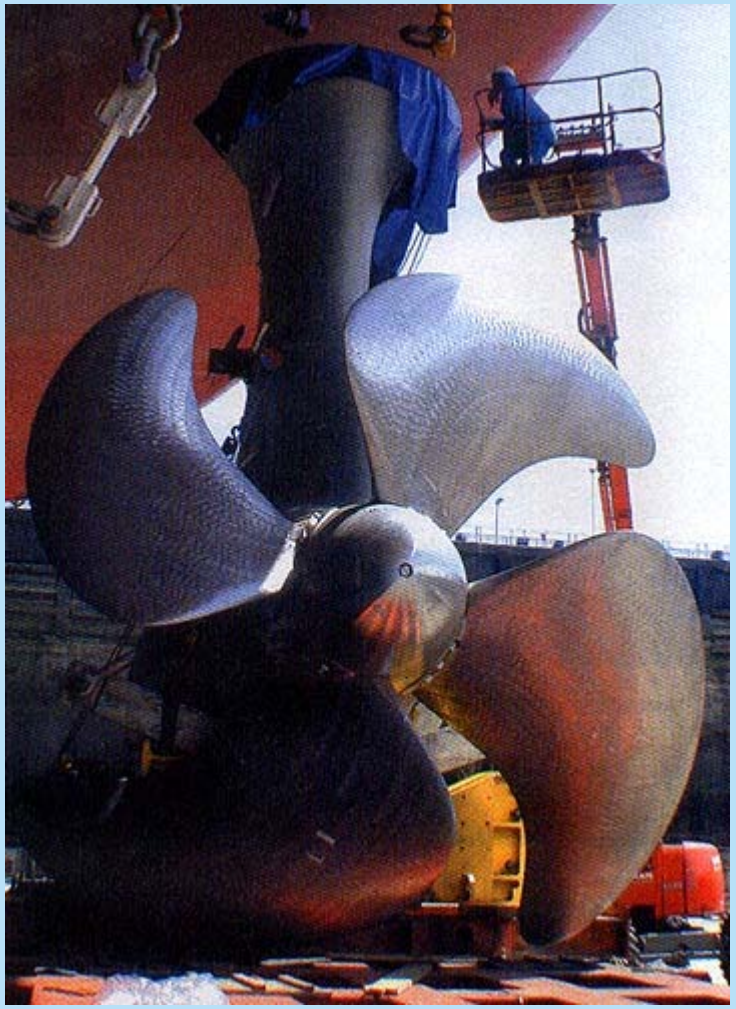


Conventional propulsion



Azimuthing podded propulsion

QUEEN MARY AZIMUTHING POD



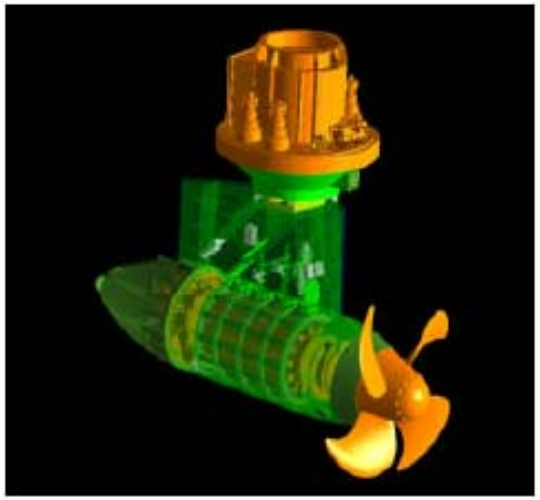
QUEEN MARY II – FITTING OF PODS

Different Makes of Pods

Azipod - ABB

SSP

SAM/JC-L - DOLPHIN



Compact Azipod - ABB

Mermaid - RR

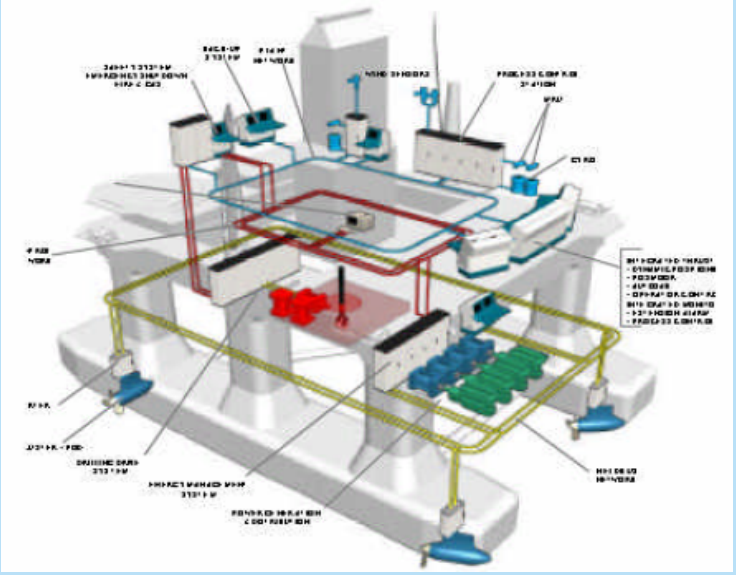
Applications for Cruise Ships

Increasing market – strong advantages

- Noise and vibration – comfort requirements
- Reliability and availability – Passenger safety
- Improved manoeuvrability gives greater safety & allows greater range of ports
- Increased propulsion efficiency – increase in speed
- Large non propulsion electric load (large cruiseliner ~ 10-15 MW)
- Use of DP mode for safety, reduces anchor damage to reefs
- Emission concerns, fines for smoke emissions, especially in coastal & recreational areas
- Frees up internal space for revenue generation

OIL RIGS, TANKERS, PRODUCTION VESSELS

- High demand of station-keeping & DP operation
- High electrical loads for production and drilling
- Typical installed electric power 25 to 55 MW
- All weather operational requirements



ICE BREAKERS

- Significant and rapid load variation – almost shock loading
- High dynamic performance required – tripping undesirable
- High torque at low speed
- Electric propulsion in new buildings since 1980
- Typical propulsion power 5 – 55 MW depending on ice-breaking capability
- High manoeuvrability and use of wash

FURTHER APPLICATIONS

Various other vessel types:

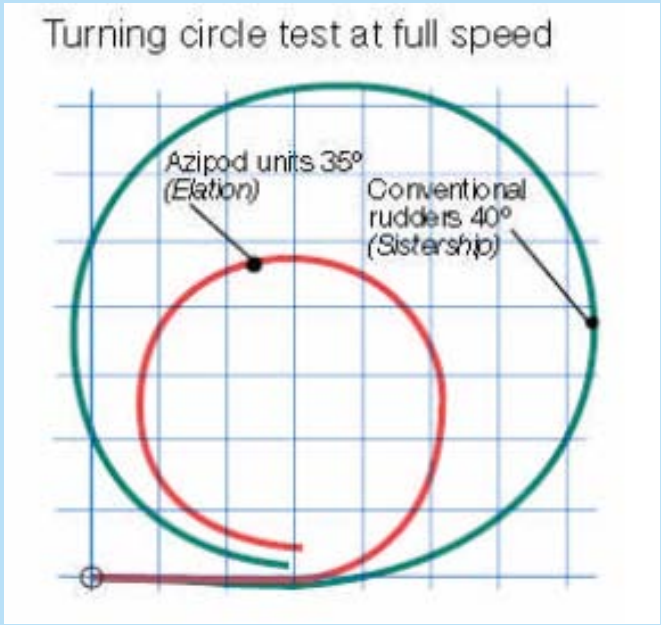
- **Freight & Passenger Ferries**
- **Tankers**
- **Research Vessels**
- **Yachts particularly megayachts over 130ft**
- **Pleasure Craft**
- **Warships**
- **Offshore supply vessels**
- **Dredgers**

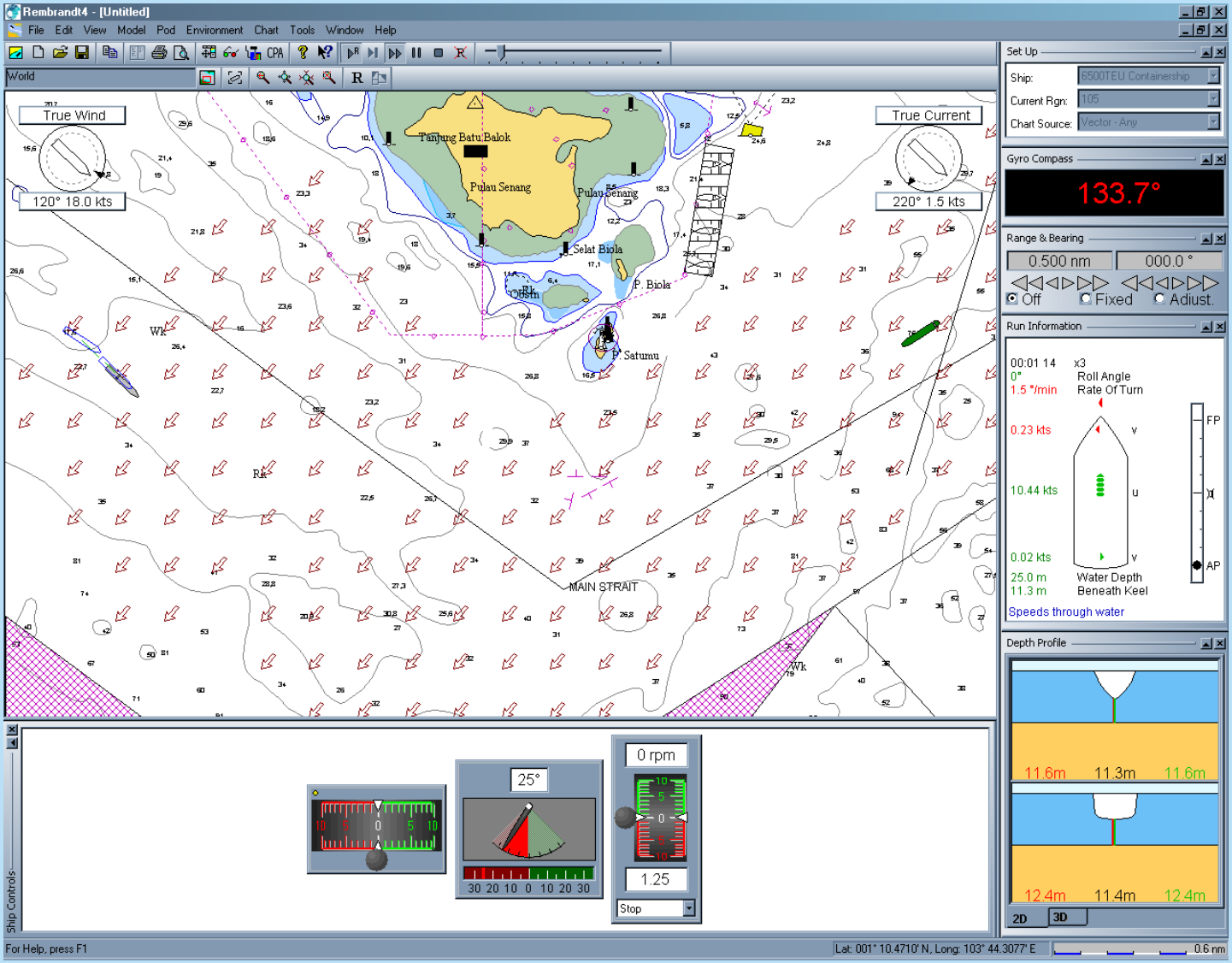
Manoeuvrability

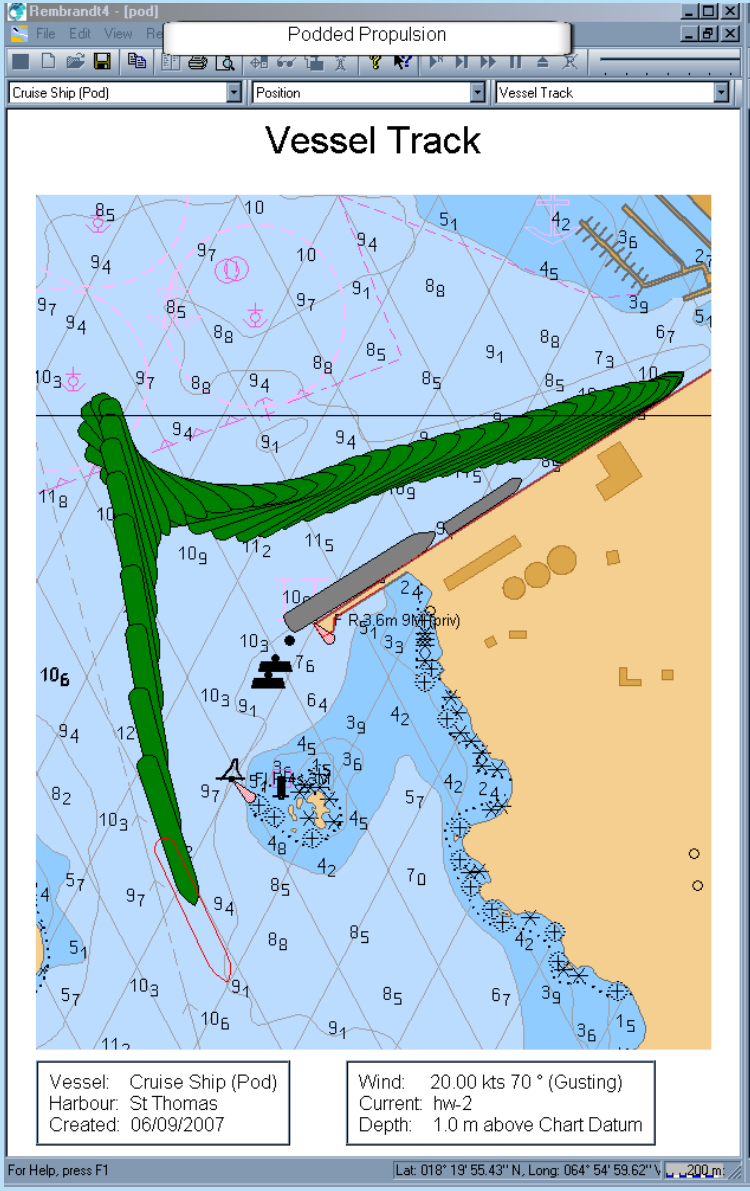
One of the big advantages of using azipod propulsion is the significantly improved manoeuvring ability of the vessel.

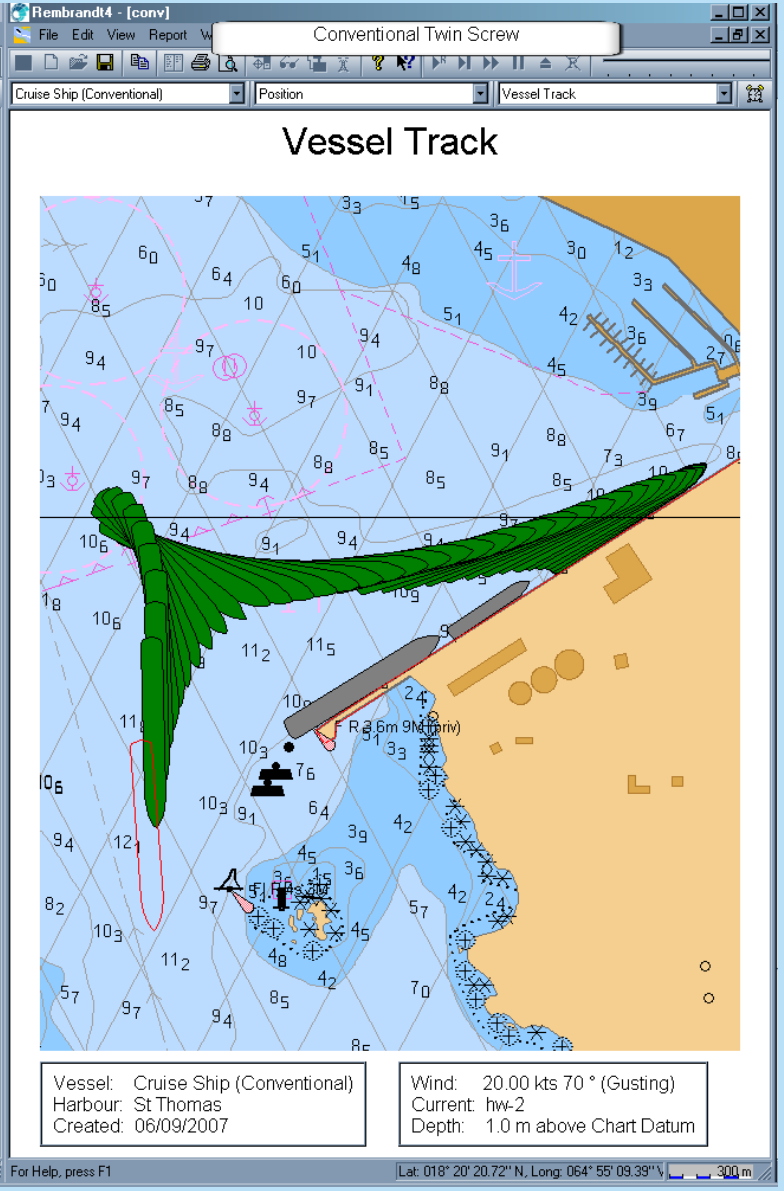
The ship is able to turn in its own length and move sideways. This ability reduces or eliminates the requirement for tug assistance and gives shorter berthing & unberthing times

- **Dynamic Positioning mode allows "hovering" in a fixed position**
- **Tighter turning circle (approximately 30% less)**
- **Emergency crash stops**




Rembrandt4 - [Untitled]
File Edit View Model Pod Environment Chart Tools Window Help
World
True Wind
120° 18.0 kts
True Current
220° 1.5 kts
Tanjung Batu Balok
Pulau Senang
Pulau Senang
Selat Biola
P. Biola
P. Satumu
MAIN STRAIT
Set Up
Ship:
6500TEU Containership
Current Rgn:
105
Chart Source:
Vector - Any
Gyro Compass
133.7°
Range & Bearing
0.500 nm
000.0 °
Off
Fixed
Adjust.
Run Information
00:01 14
x3
0°
Roll Angle
1.5 °/min
Rate Of Turn
0.23 kts
10.44 kts
0.02 kts
25.0 m
Water Depth
11.3 m
Beneath Keel
Speeds through water
FP
AP
Depth Profile
11.6m
11.3m
11.6m
12.4m
11.4m
12.4m
2D
3D
Ship Controls
25°
0 rpm
1.25
Stop
For Help, press F1
Lat: 001° 10.4710' N, Long: 103° 44.3077' E
0.6 nm


Rembrandt4 - [pod]
Podded Propulsion
Cruise Ship (Pod)
Position
Vessel Track
Vessel Track
Vessel: Cruise Ship (Pod)
Harbour: St Thomas
Created: 06/09/2007
Wind: 20.00 kts 70 ° (Gusting)
Current: hw-2
Depth: 1.0 m above Chart Datum
For Help, press F1


Rembrandt4 - [conv]
Conventional Twin Screw
Cruise Ship (Conventional)
Position
Vessel Track
Vessel Track
Vessel: Cruise Ship (Conventional)
Harbour: St Thomas
Created: 06/09/2007
Wind: 20.00 kts 70 ° (Gusting)
Current: hw-2
Depth: 1.0 m above Chart Datum
For Help, press F1

Disadvantages of azipods

- High initial capital cost
- Substantial cost of repairs
- Vessel crew training for new equipment
- Technology still needs to be made reliable and more predictable
- New ports may include new problems.

Problems and Failures

- Bearing failures on some types of units
- Contacts & groundings resulting in major damage, particularly to propellers
- Maintaining watertight seals underwater
- Electrical motor windings failures

Slewing ring for a 7.5MW azipod

Propeller repairs

Temporary replacement for damage pod

Electrical rotor under inspection & repair

The Future?

- Continued development of Azipods and other similar systems
- More power, greater efficiency, improving reliability, better hydrodynamics, etc
- ABB's CRP Azipod concept utilises a conventional shafted propeller with an azipod immediately aft of it
- Combines different power sources so if one fails then the other still provides propulsion
- Expected to be more economical for large vessels e.g new generation large Container ships

Conclusions

- Generally successful propulsion and manoeuvring system
- Particularly popular with cruise ship operators
- Expect increasing use of azipods on numbers and types of future vessels
- Susceptible to contact damage due to external position
- Susceptible to some bearing, electrical and seal problems
- Continuing development should reduce early problems
- Expensive to repair – specialist repairs by manufacturers
- Any failures very expensive in cancelled cruises
- Units currently relatively new. Query increasing problems with time
- Question - Have Hull & Machinery underwriters been subsidising the continuing development of azipods over the last 10 years?

Azipod Propulsion

Thank you for listening

Any Questions?