

SAIMENA PRESENTATION

DYNAMIC POSITIONING SYSTEMS



- Introduction to Dynamic Positioning
- Dynamic Positioning Systems
 - Dynamic Positioning Control
 - Thruster Control
 - Environmental Sensors
 - Position Reference Sensors
 - Main/Emergency Switchboard
 - Power Generation/Distribution
 - Thrusters
 - Ancillary Equipment
- DP-0 vs DP-1 vs DP-2 vs DP-3
- Redundancy and Single Point of Failure Concept
- Questions and Answers

INTRODUCTION TO DYNAMIC POSITIONING



INTRODUCTION TO DYNAMIC POSITIONING

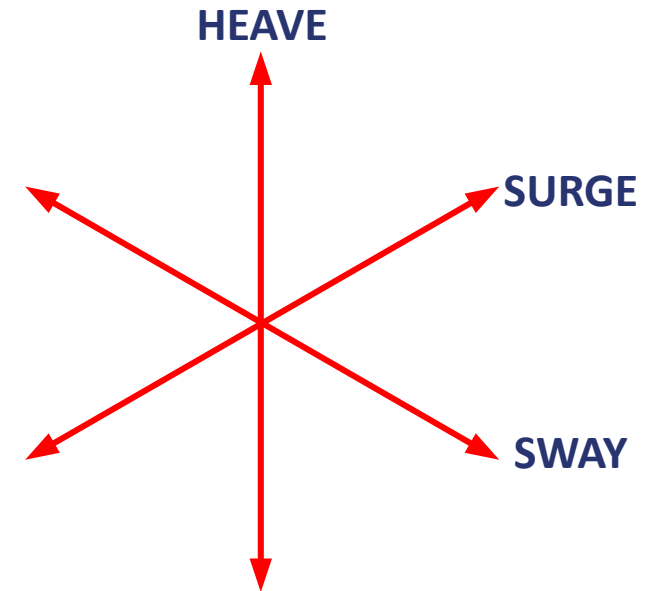
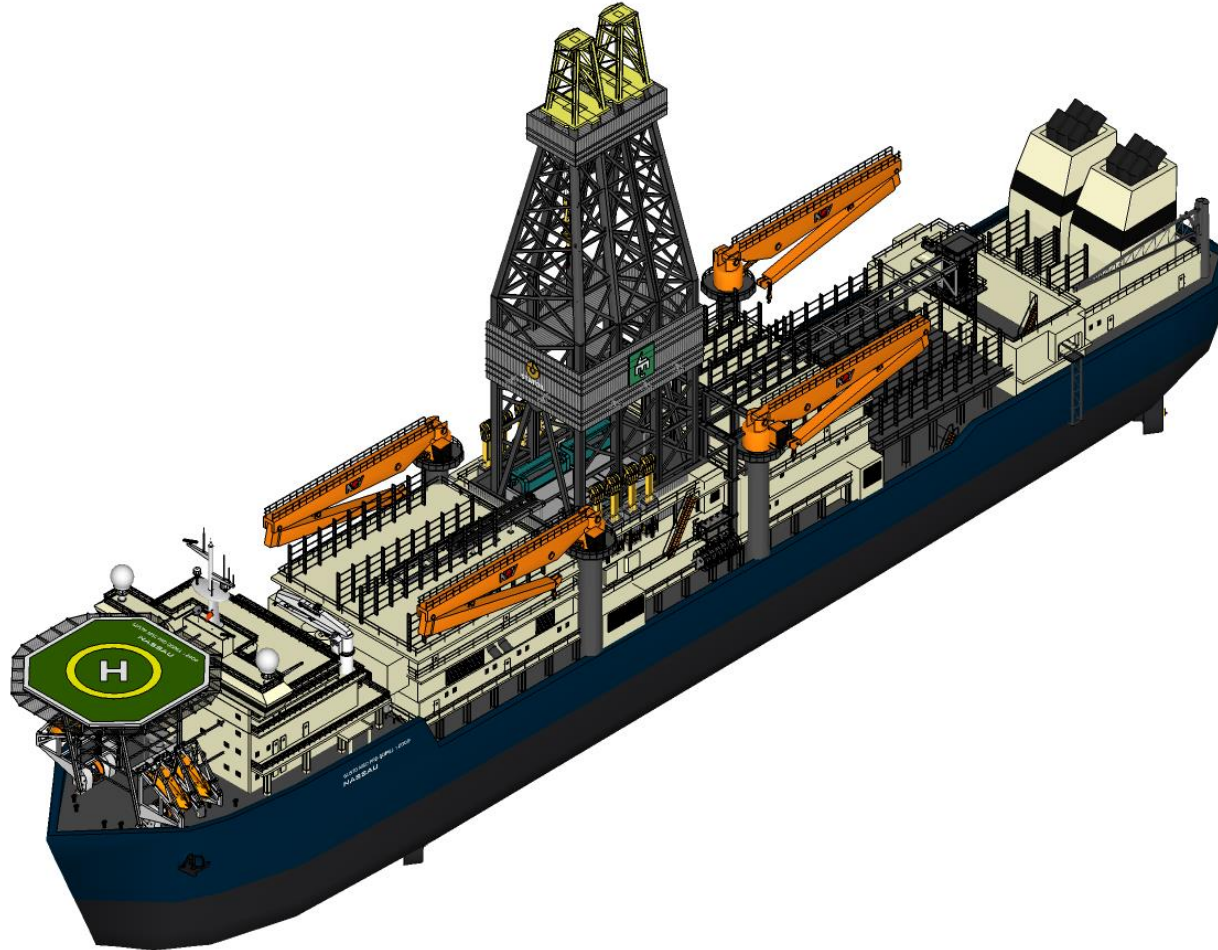
Definition of Dynamic Positioning:

A system which automatically controls a vessel's position and heading exclusively by means of active thrust.

The prime function of a Dynamic Positioning system is to allow a vessel to maintain position and heading. A variety of further sub-functions may be available, such as track-follow or weathervane modes, but the control of position and heading is fundamental.

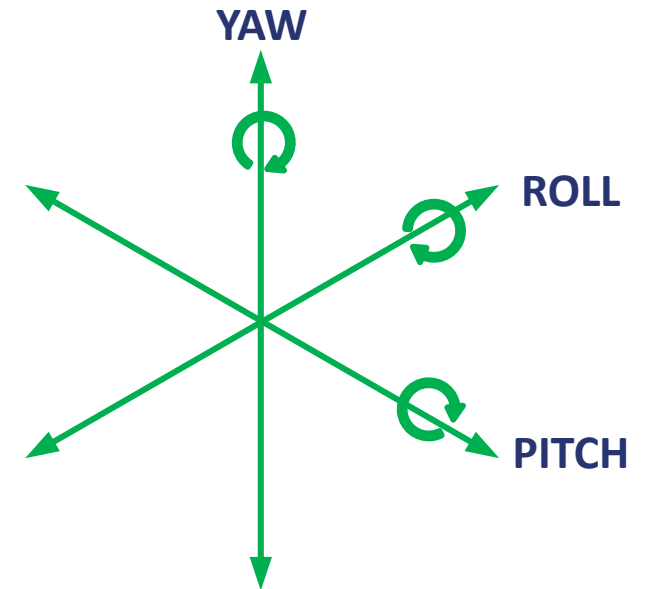
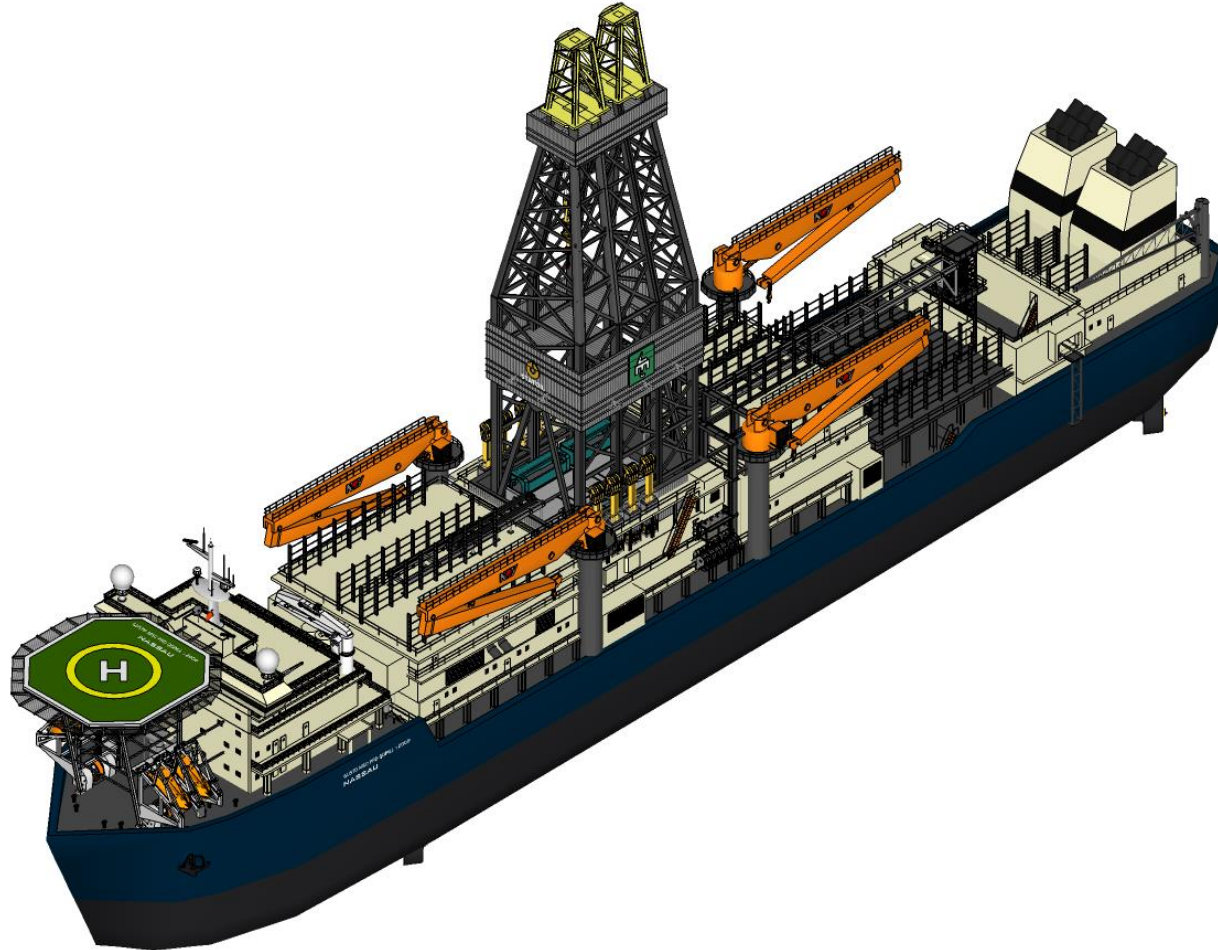
INTRODUCTION TO DYNAMIC POSITIONING

The 3 Axis of Movement



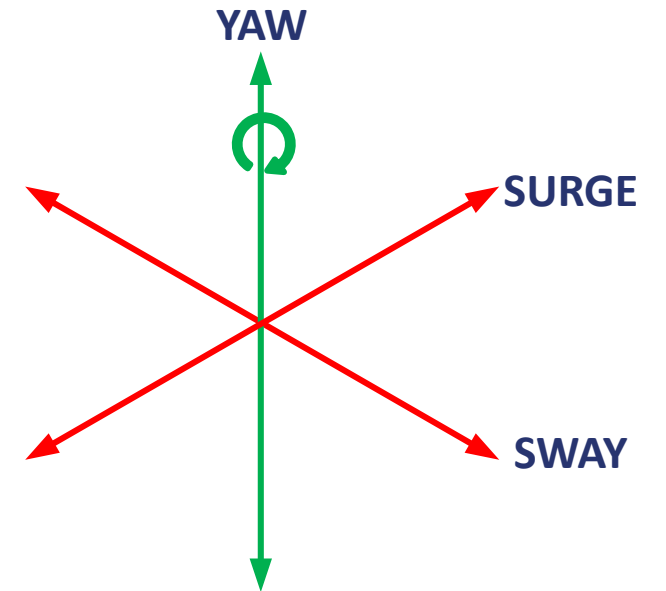
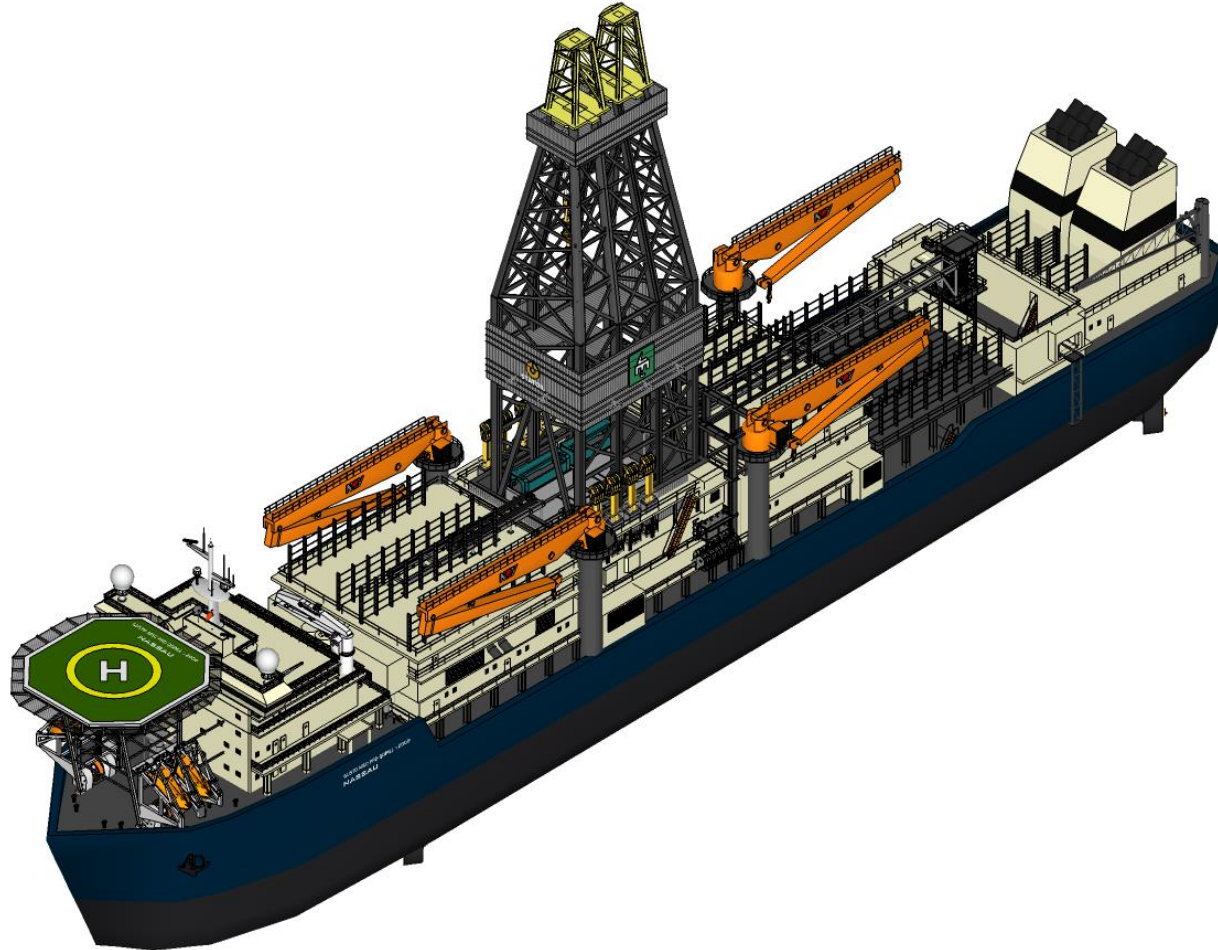
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The 3 Axis of Rotation



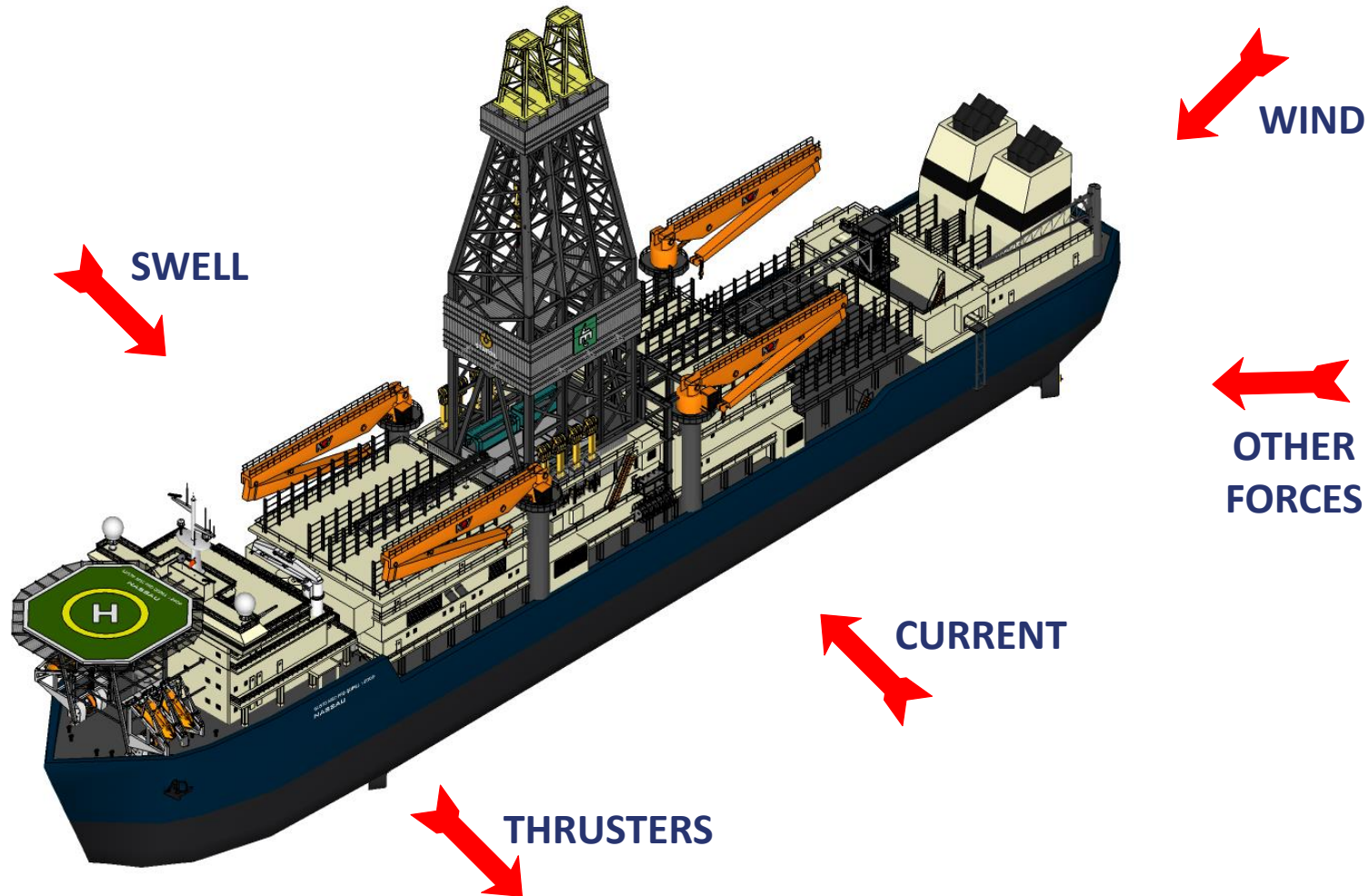
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The 3 Axis that can be Controlled



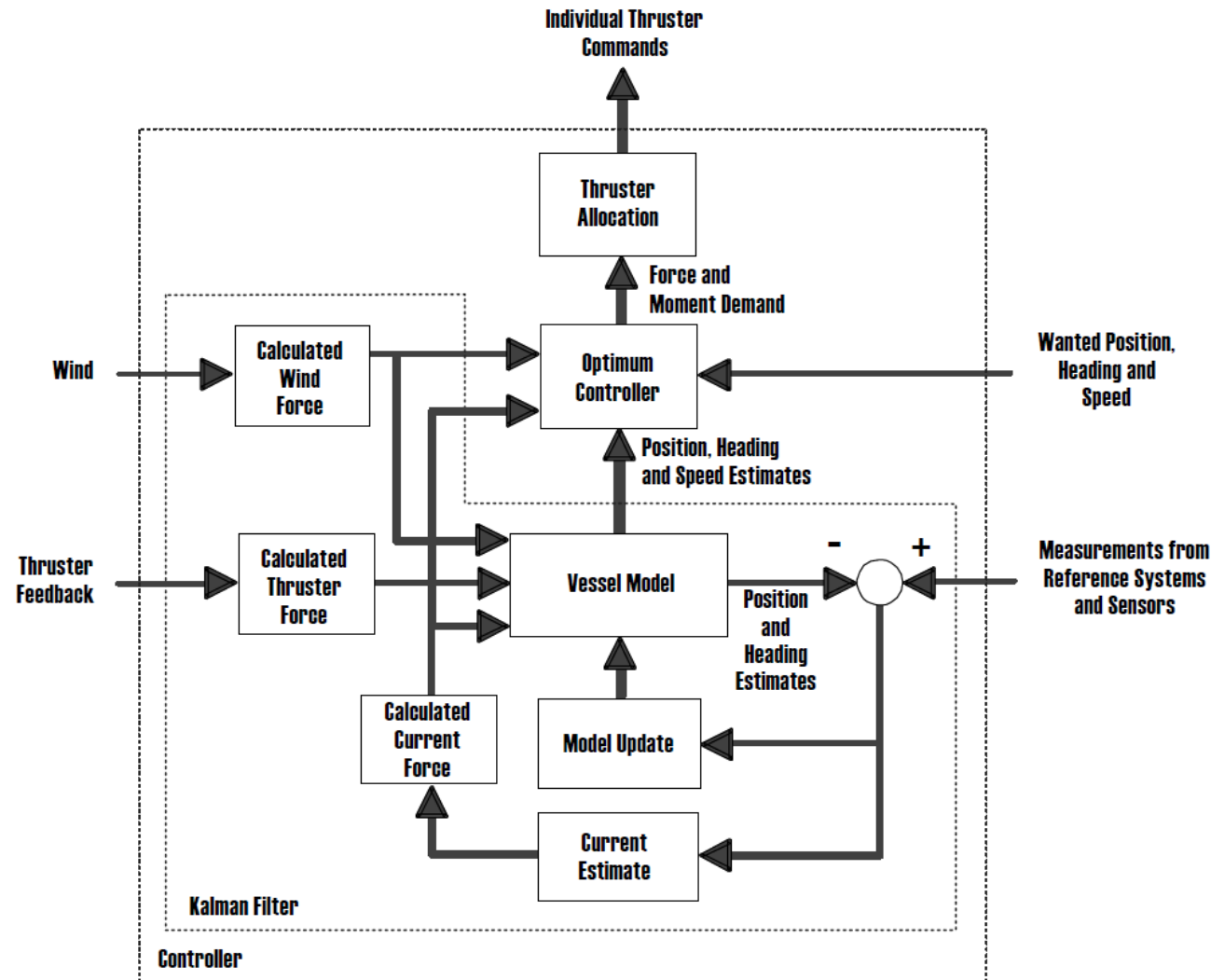
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Forces Acting on the Vessel



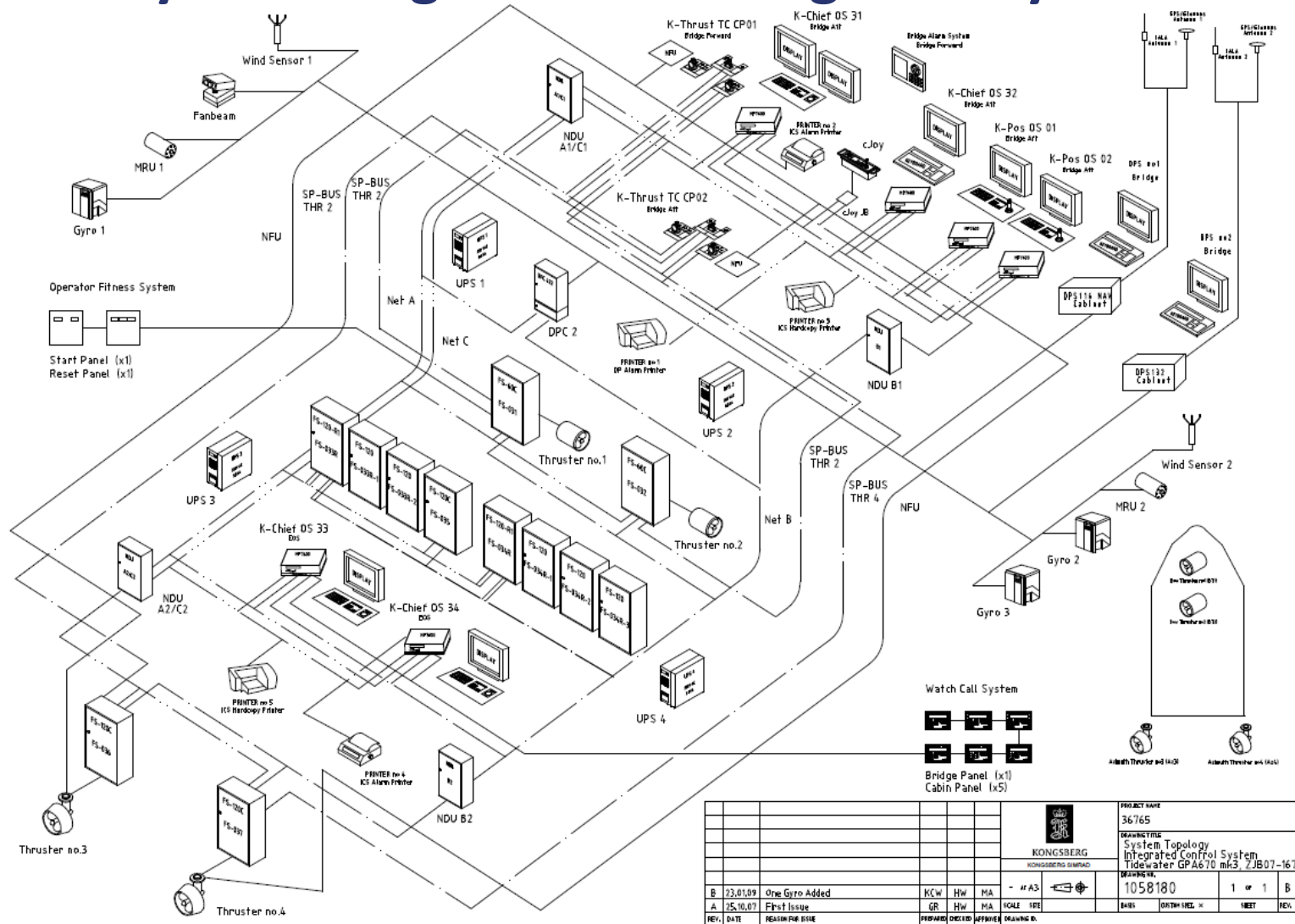
INTRODUCTION TO DYNAMIC POSITIONING

Dynamic Positioning Mathematical Model and the Kalman Filter



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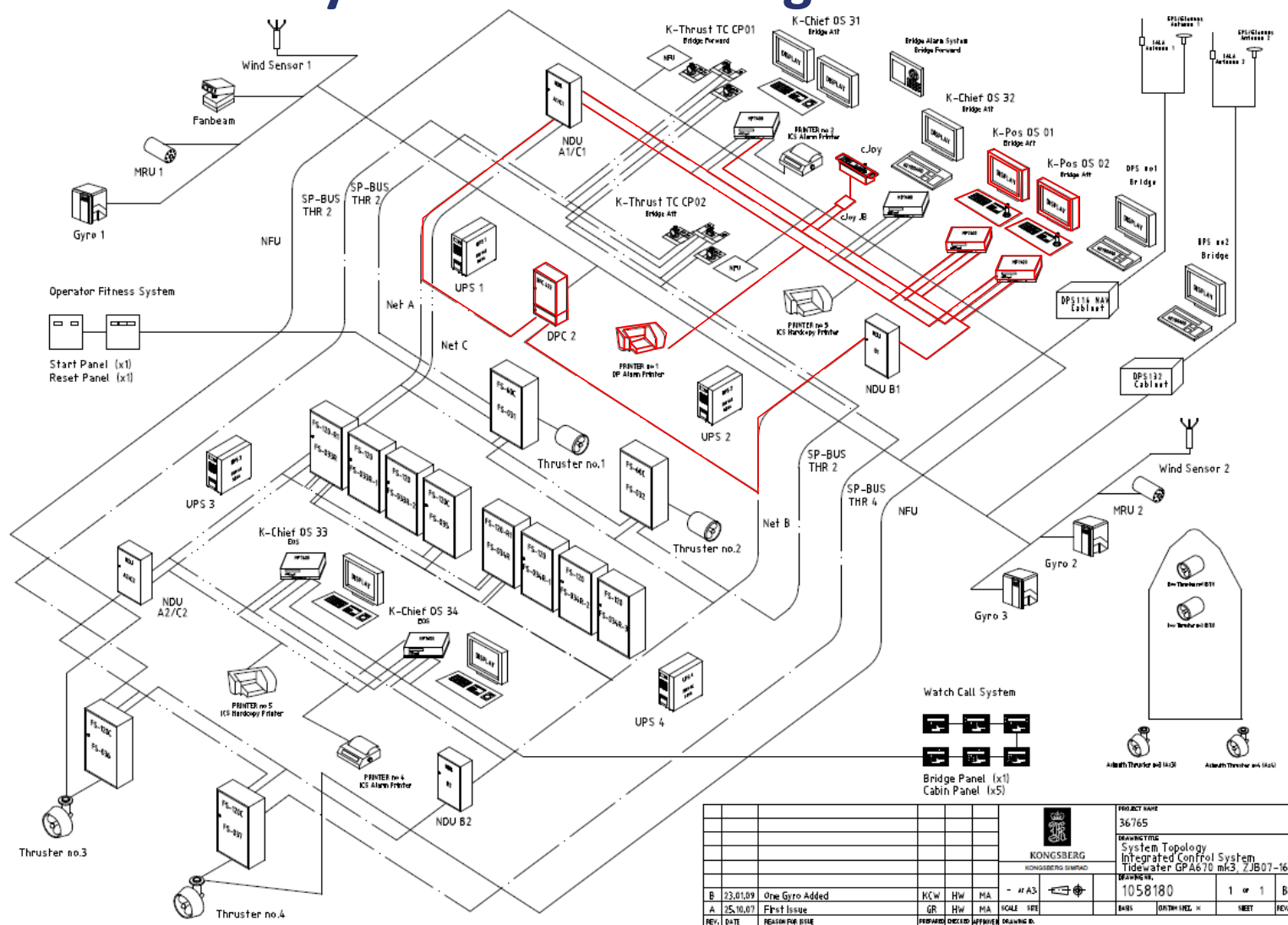
System Diagram of an Integrated System



										PROJECT NAME			
KONGSBERG										DRAWING TITLE			
KONGSBERG SIMULATOR										System Topology			
										Integrated Control System			
										Modeling			
										1058180			
										Basis		1 of 1 B	
B 35.01.09		Org. Goro Added		K/CW		Hw		MA		-- H/A3			
A 35.10.07		First Issue		GR		Hw		MA		SOLE		1058180	
REV. DATE		REASON FOR ISSUE		PREPARED		CHECKED		APPROVED		DRAWING NO.			

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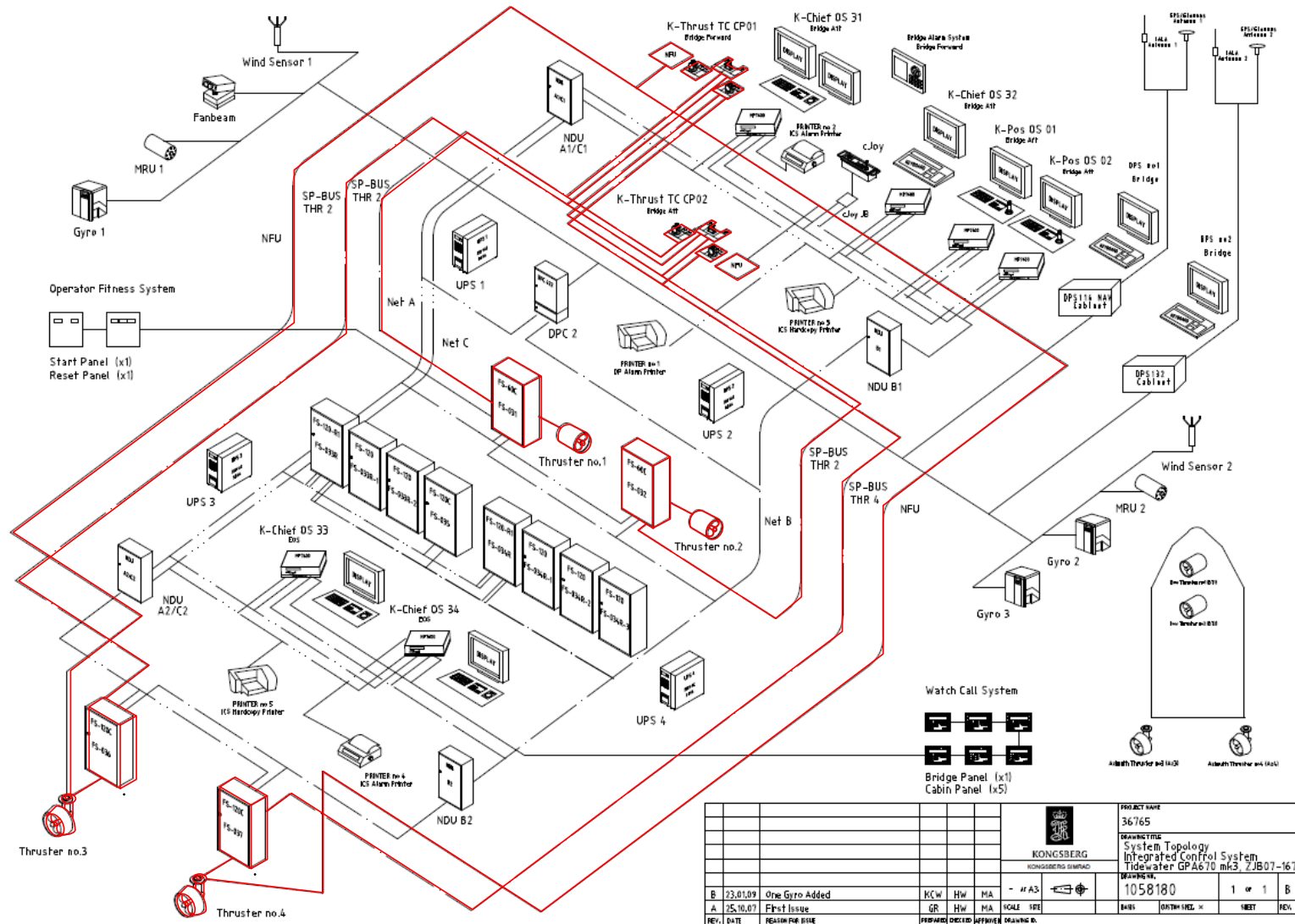
Dynamic Positioning Control



PROJECT NAME				36765			
DRAWING TITLE				System Topology			
KONGSBERG				Integrated Control System			
KONGSBERG SIMRAD				Tidewater GPA670 mk3 ZJB07-167			
REVISION				1058180			
B 23.01.09 One Gyro Added				1 of 1			
A 25.10.07 First Issue				B			
REV.	DATE	REASON FOR ISSUE	PREPARED	DRAWN	CHECKED	DATE	REV.

DYNAMIC POSITIONING SYSTEMS

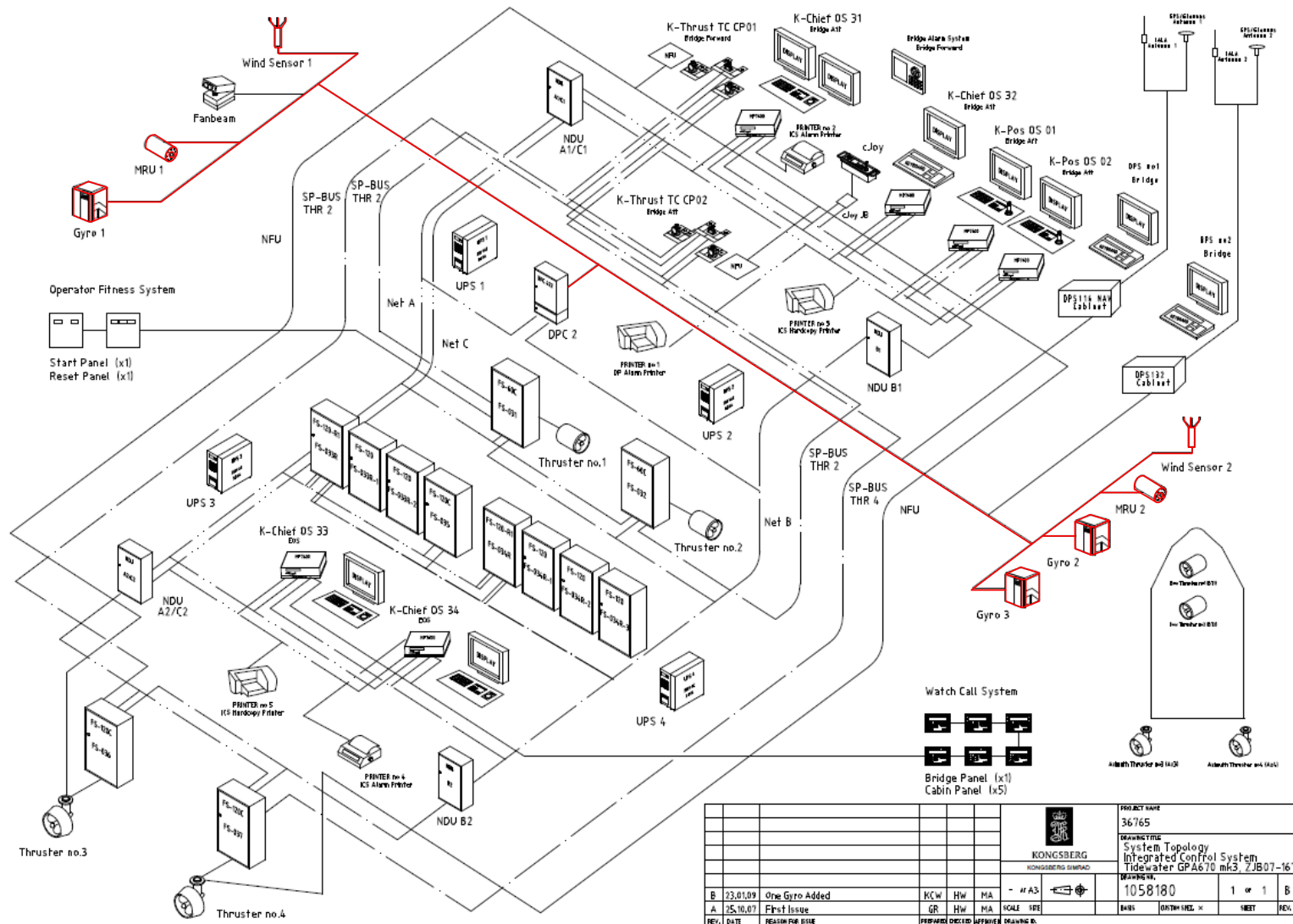
Thruster Control and Thrusters



PROJECT NAME				36765			
DRAWING TITLE				System Topology			
KONGSBERG				Integrated Control System			
KONGSBERG SYSTEM				Tidewater GPA670 mk3 ZJB07-167			
REVISION				1058180			
REV. DATE				1 of 1			
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DRAWING NO.							

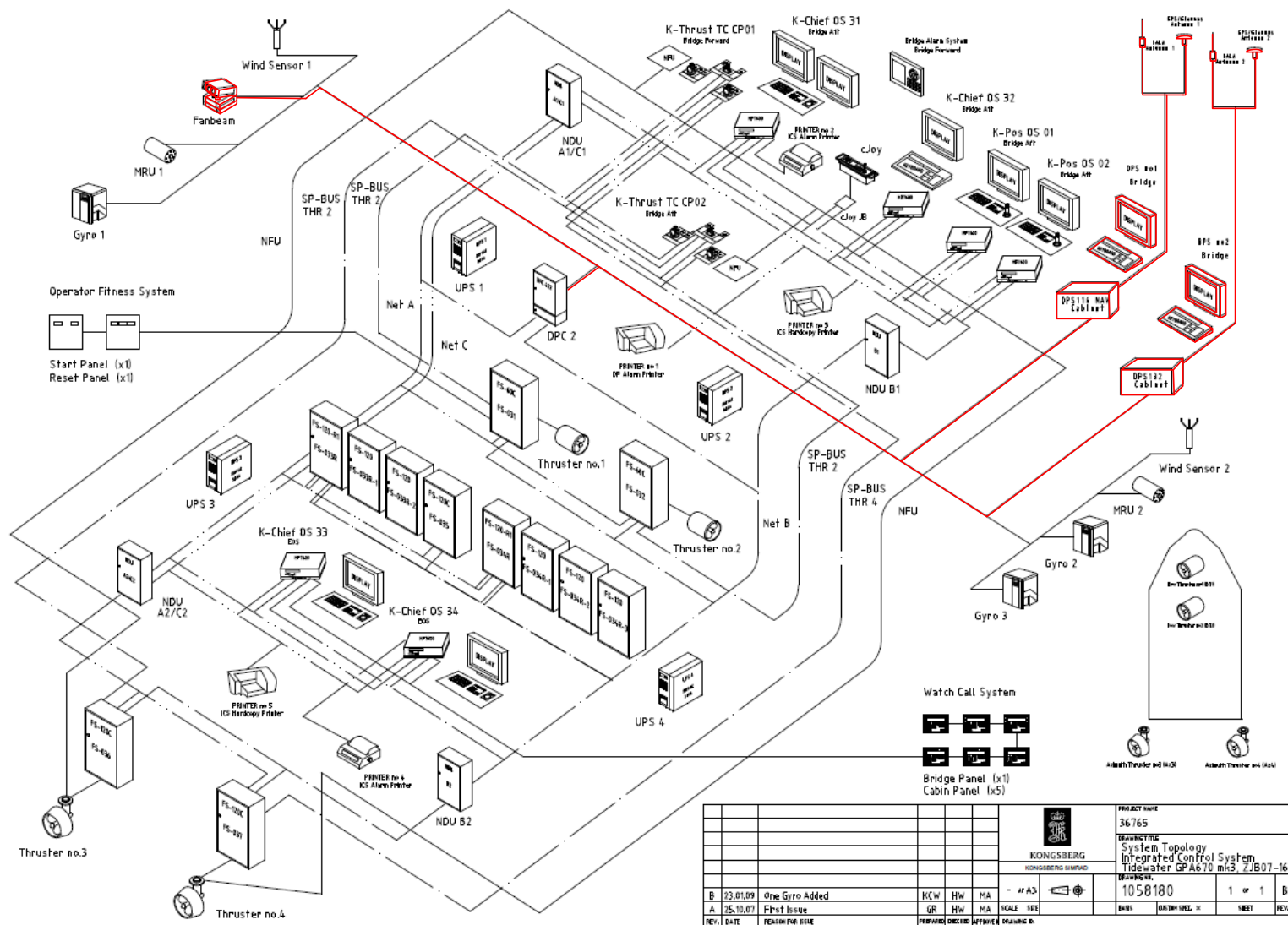
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Environmental Sensors

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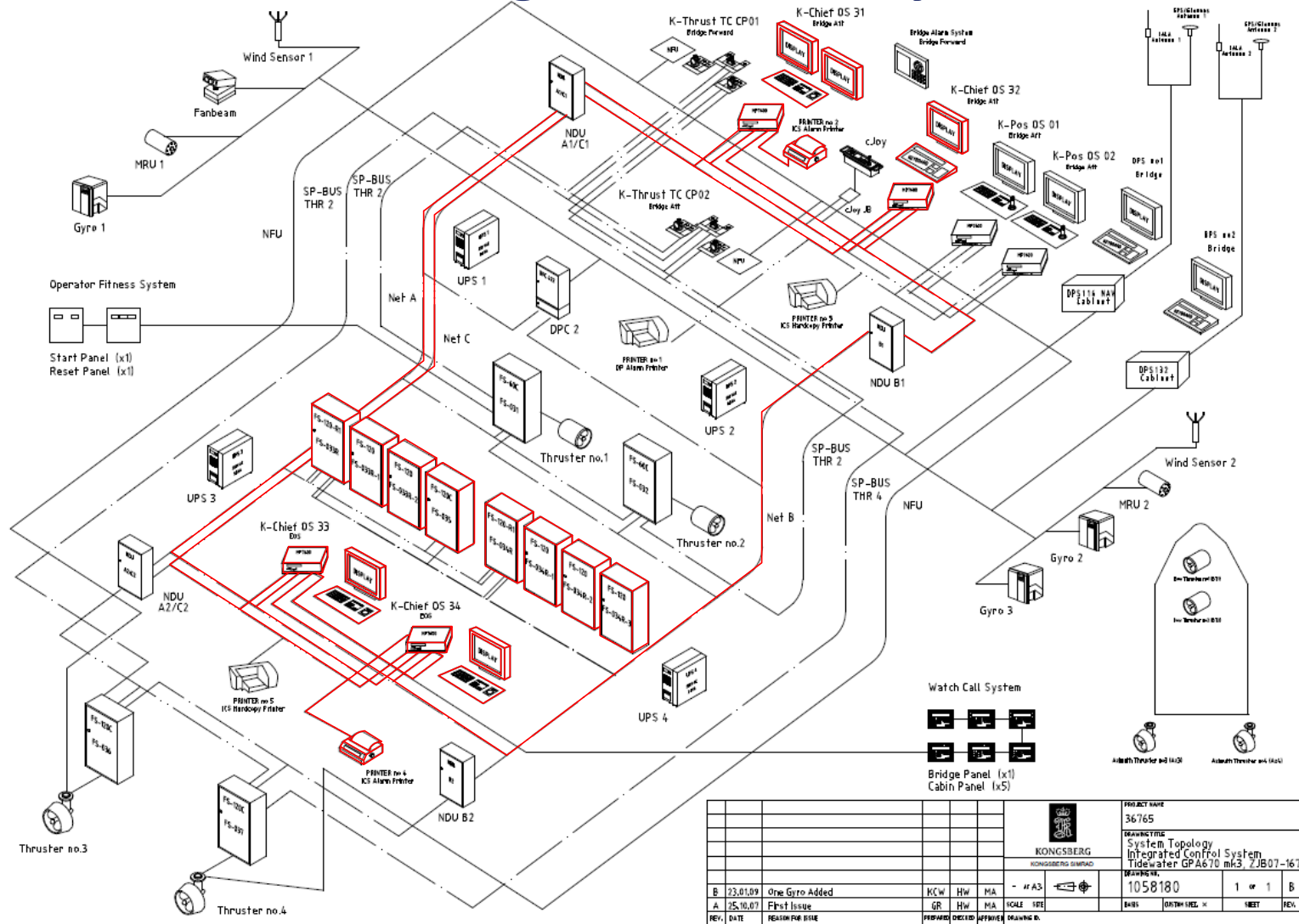
Position Reference Sensors



PROJECT NAME				36765			
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DRAWING NO.				1058180			
REVISION				1 of 1			
DATE				25.10.07			
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PREPARED				CHECKED			
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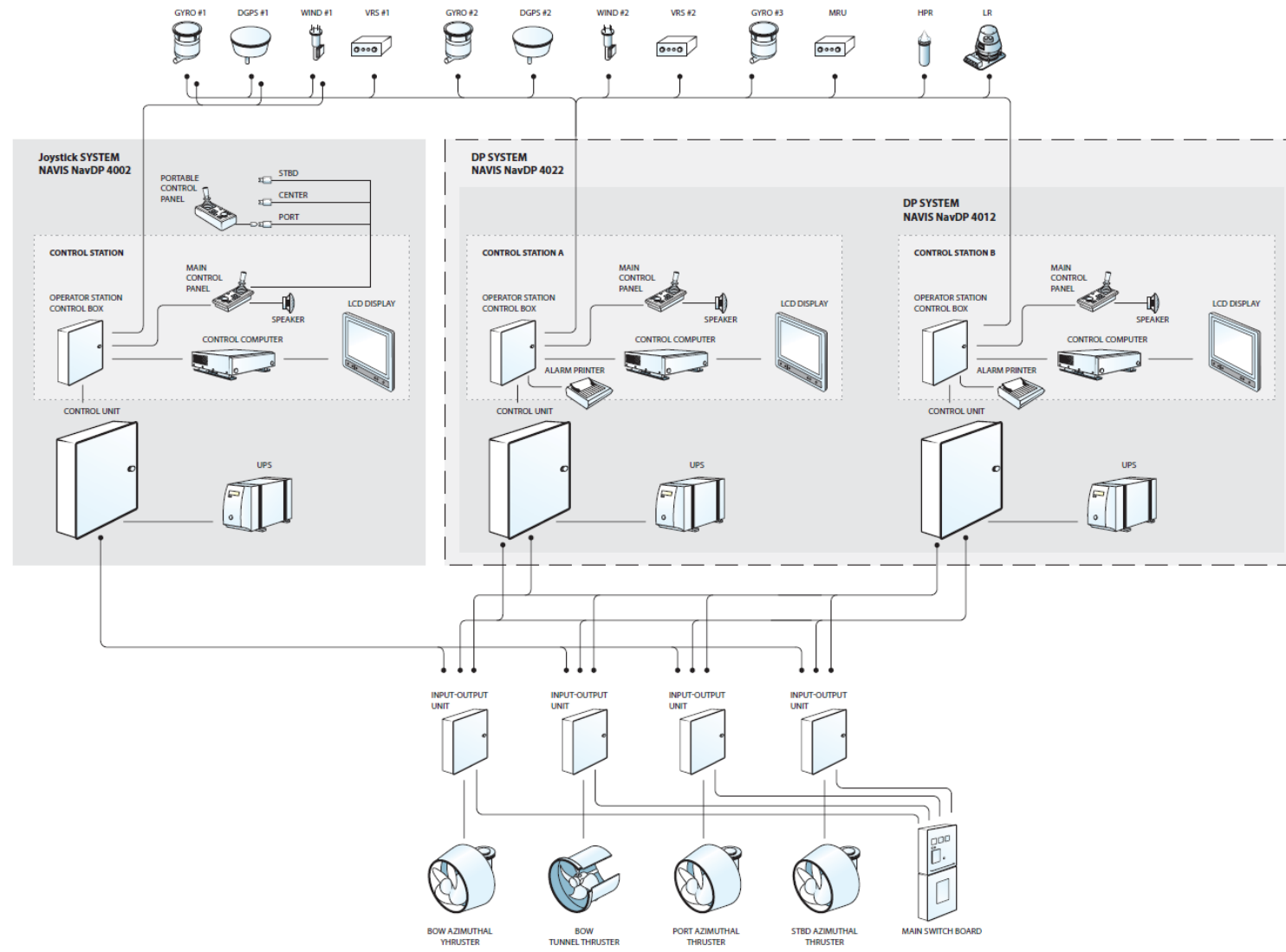
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Monitoring and Control System



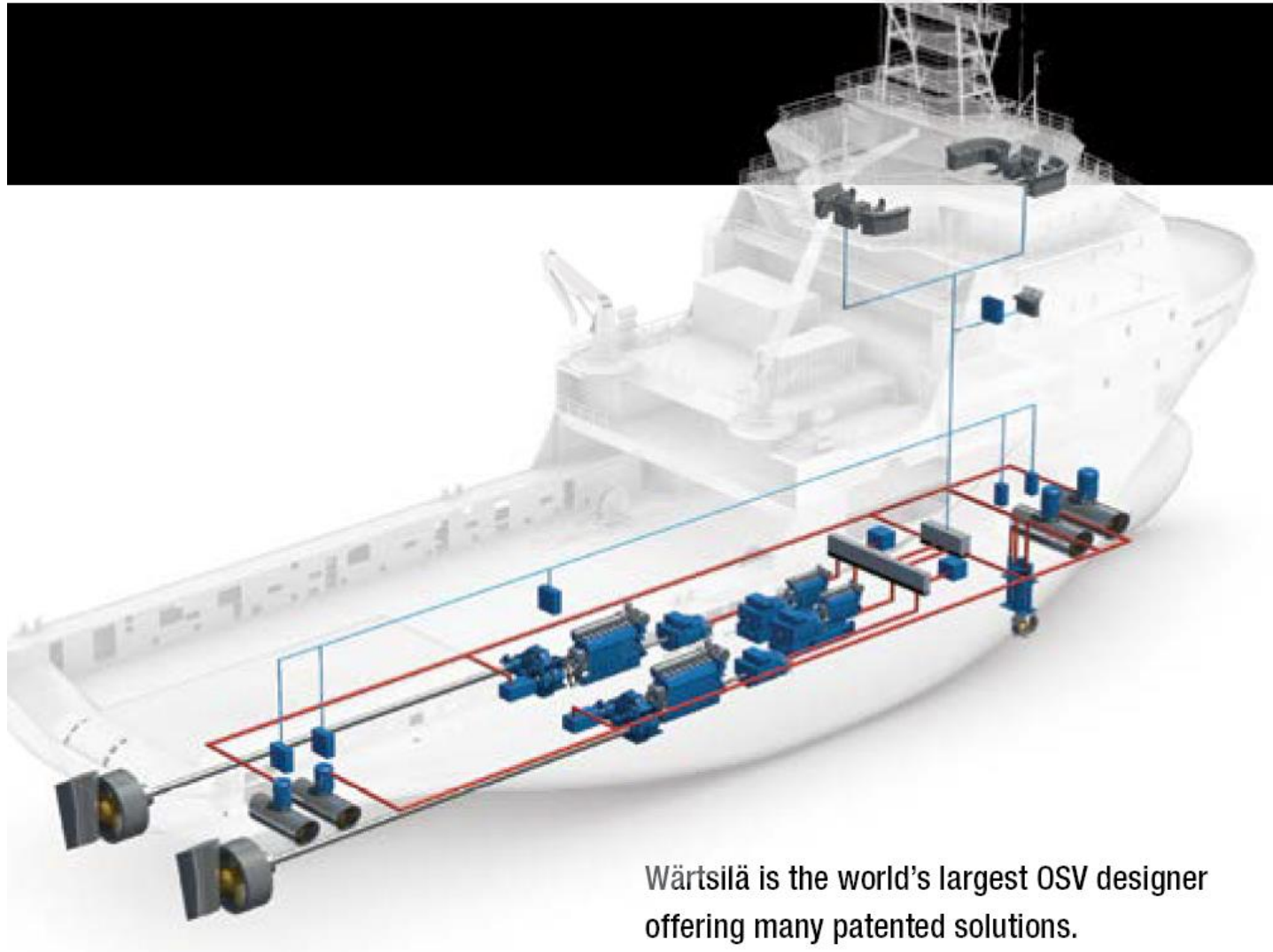
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Dynamic Positioning Control



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Thruster Control



Wärtsilä is the world's largest OSV designer offering many patented solutions.

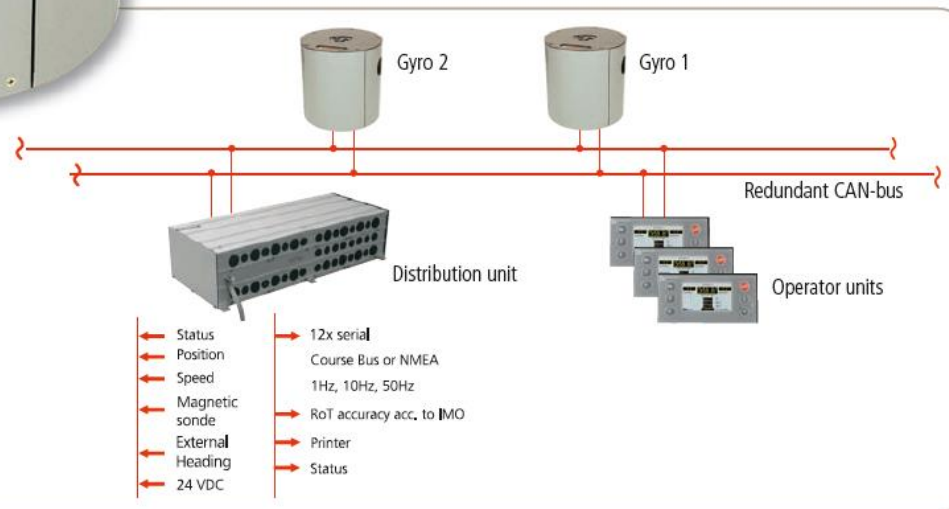
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Environmental Sensors – Gyro

Standard 22 Gyro Compass

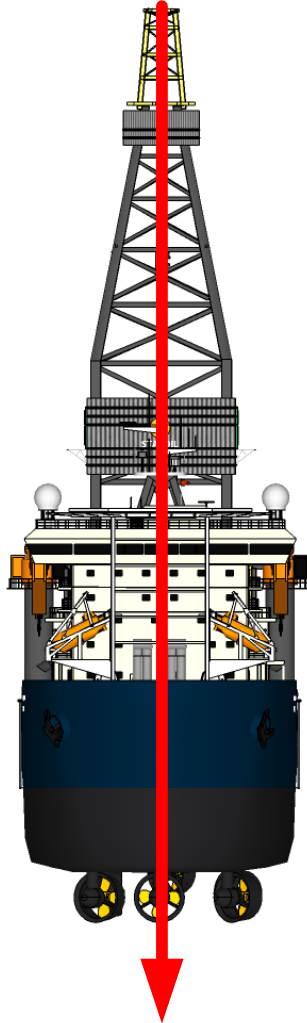


Steering repeater compass



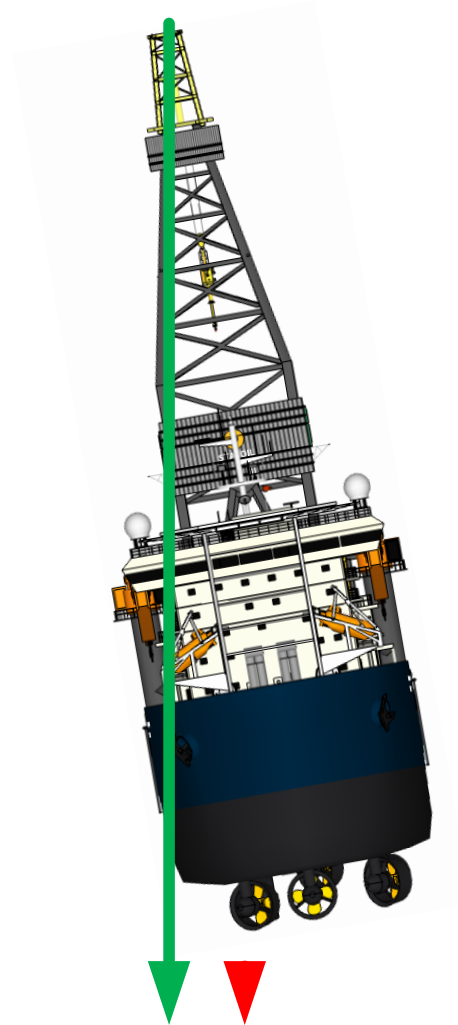
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Environmental Sensors – Motion Reference Sensor



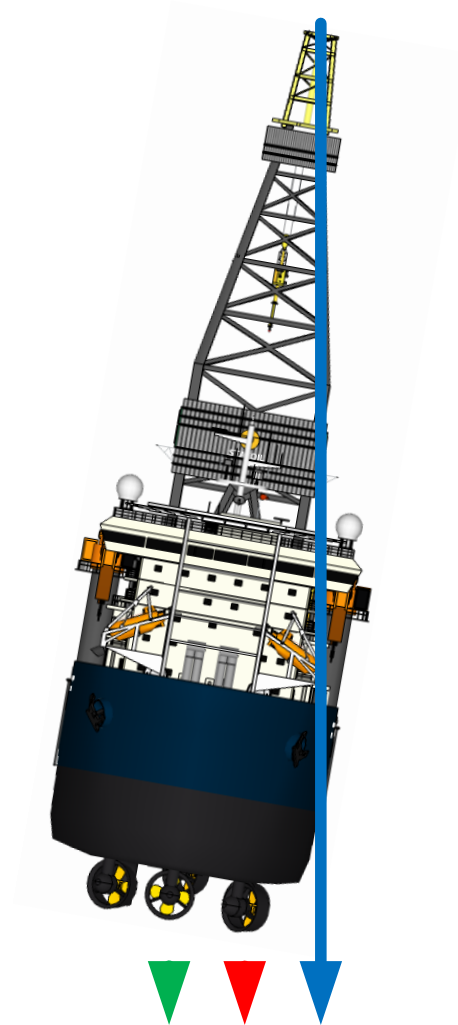
DYNAMIC POSITIONING SYSTEMS

Environmental Sensors – Motion Reference Sensor



DYNAMIC POSITIONING SYSTEMS

Environmental Sensors – Motion Reference Sensor



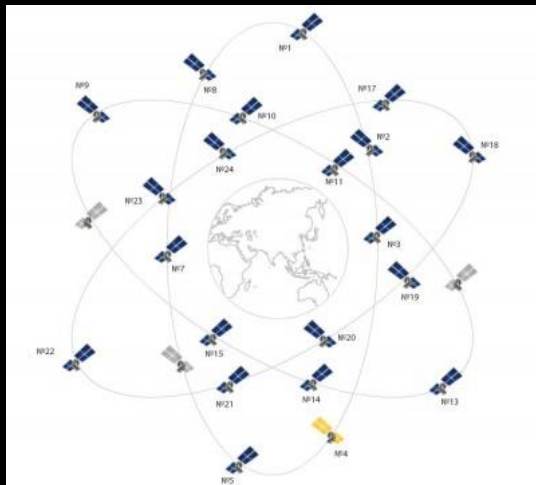
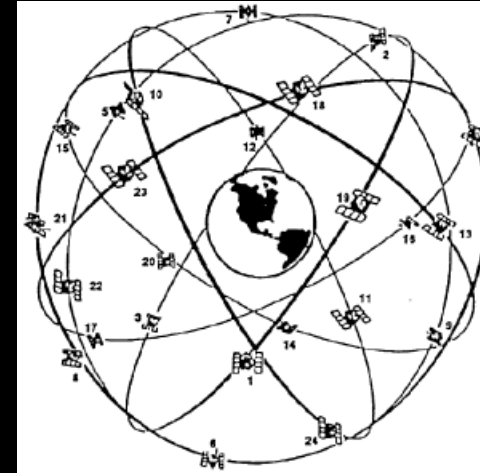
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Environmental Sensors – Anemometer



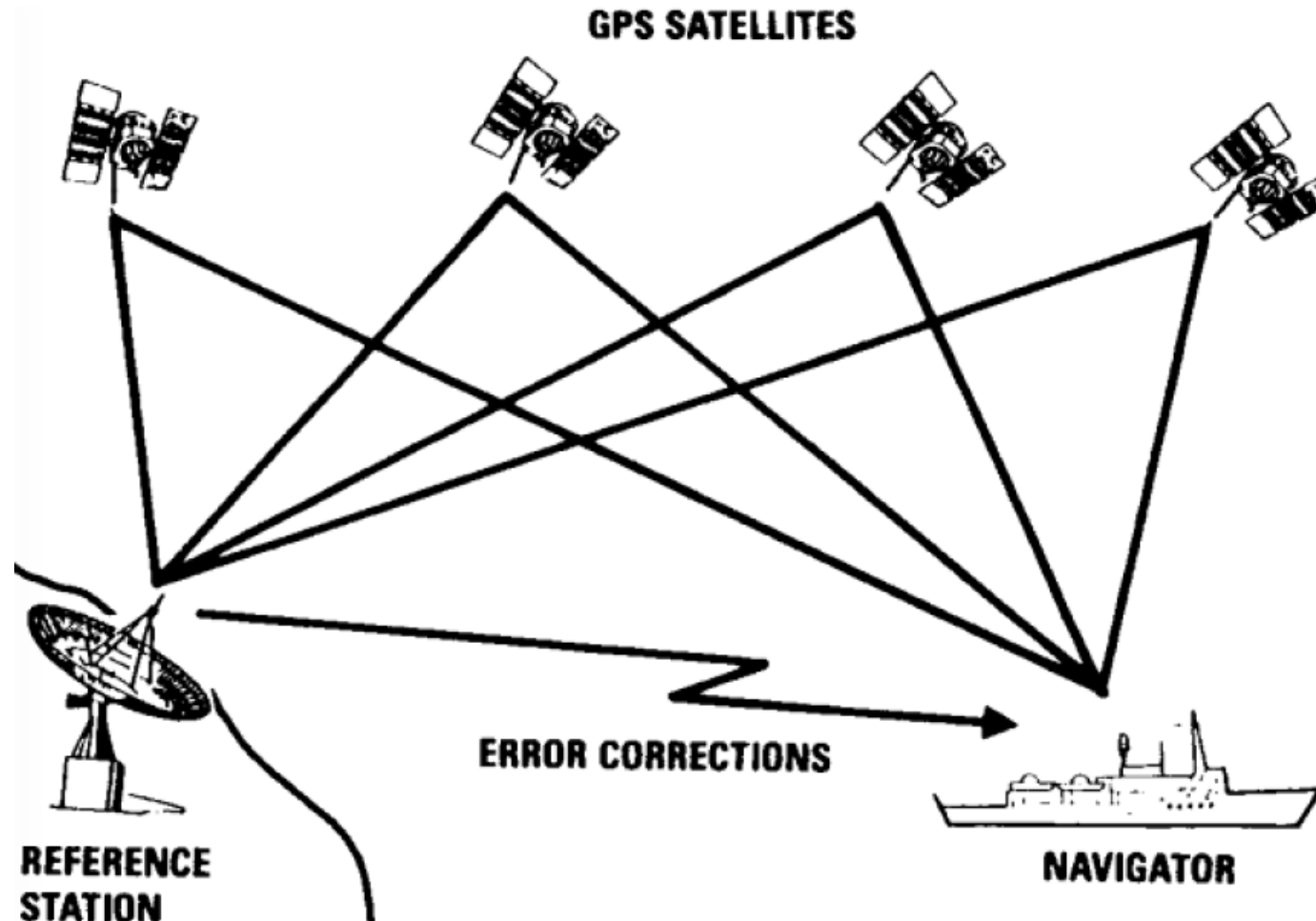
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Position Reference Sensors – DGNSS



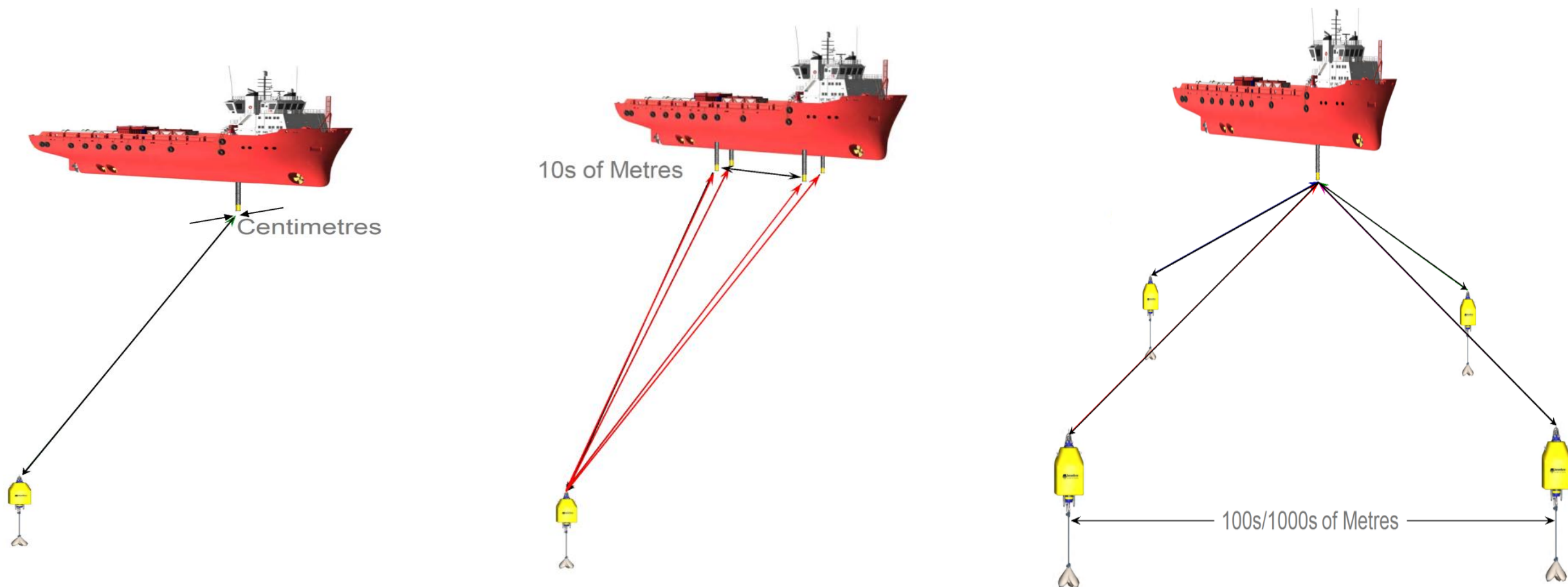
DYNAMIC POSITIONING SYSTEMS

Position Reference Sensors – DGNSS



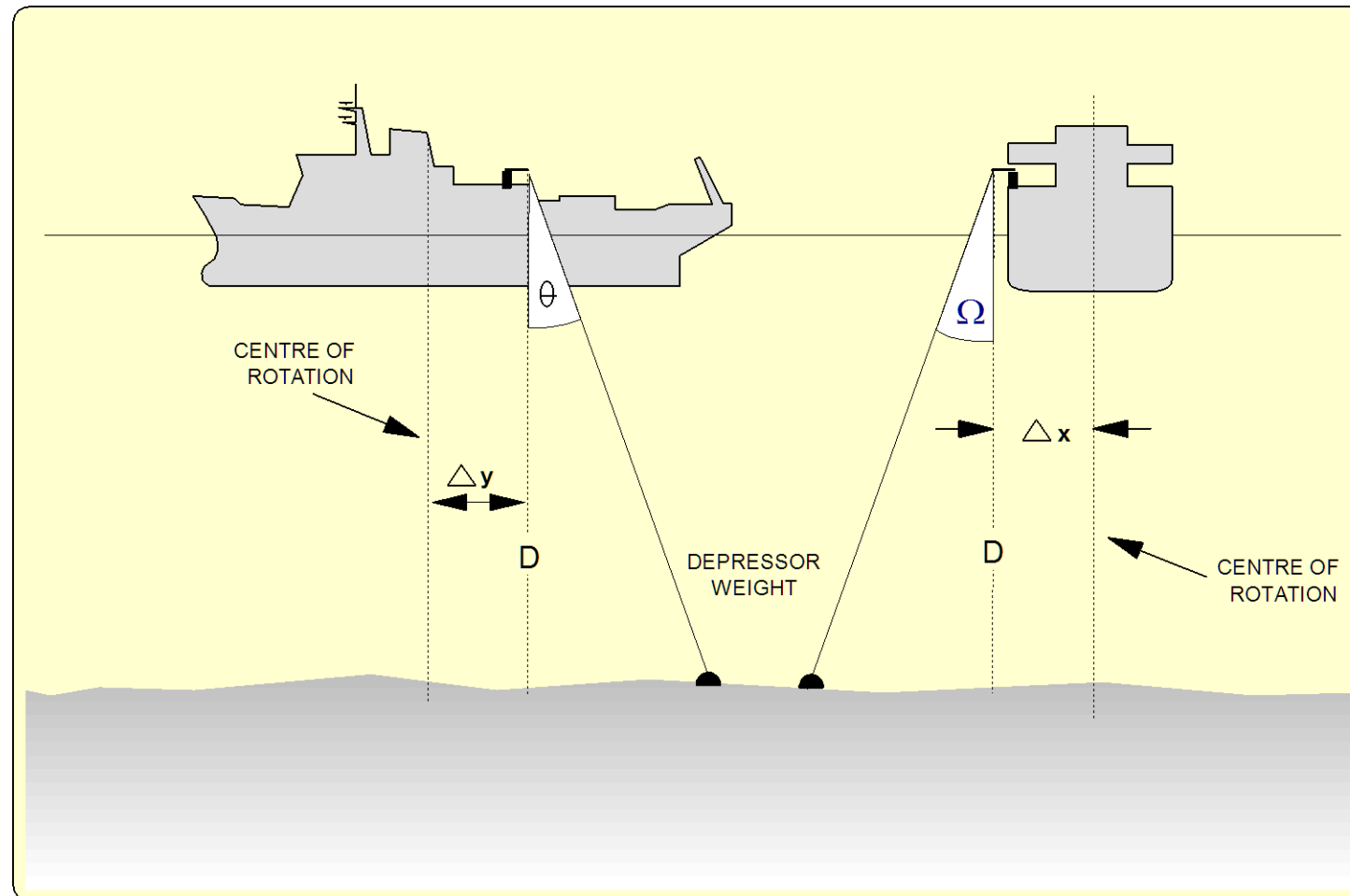
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Position Reference Sensors – Hydroacoustic



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Position Reference Sensors – Taughtwire



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Position Reference Sensors – Laser Radar

The CyScan System

The CyScan system has three main components:

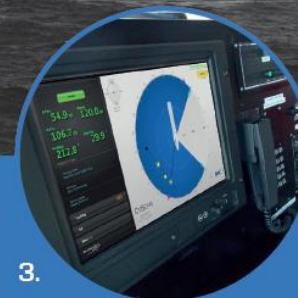
1. **CyScan Targets**
(one or more) that are mounted on the fixed platform or mobile object
2. **CyScan Sensor**
that is installed on a vessel equipped with a DP system
3. **CyScan Dashboard**
software is used by the DP operator to control the CyScan Sensor. It runs on a marine processor installed on the vessel's bridge



1.



2.



3.

DYNAMIC POSITIONING SYSTEMS

Position Reference Sensors – Microwave Radar

The RadaScan System

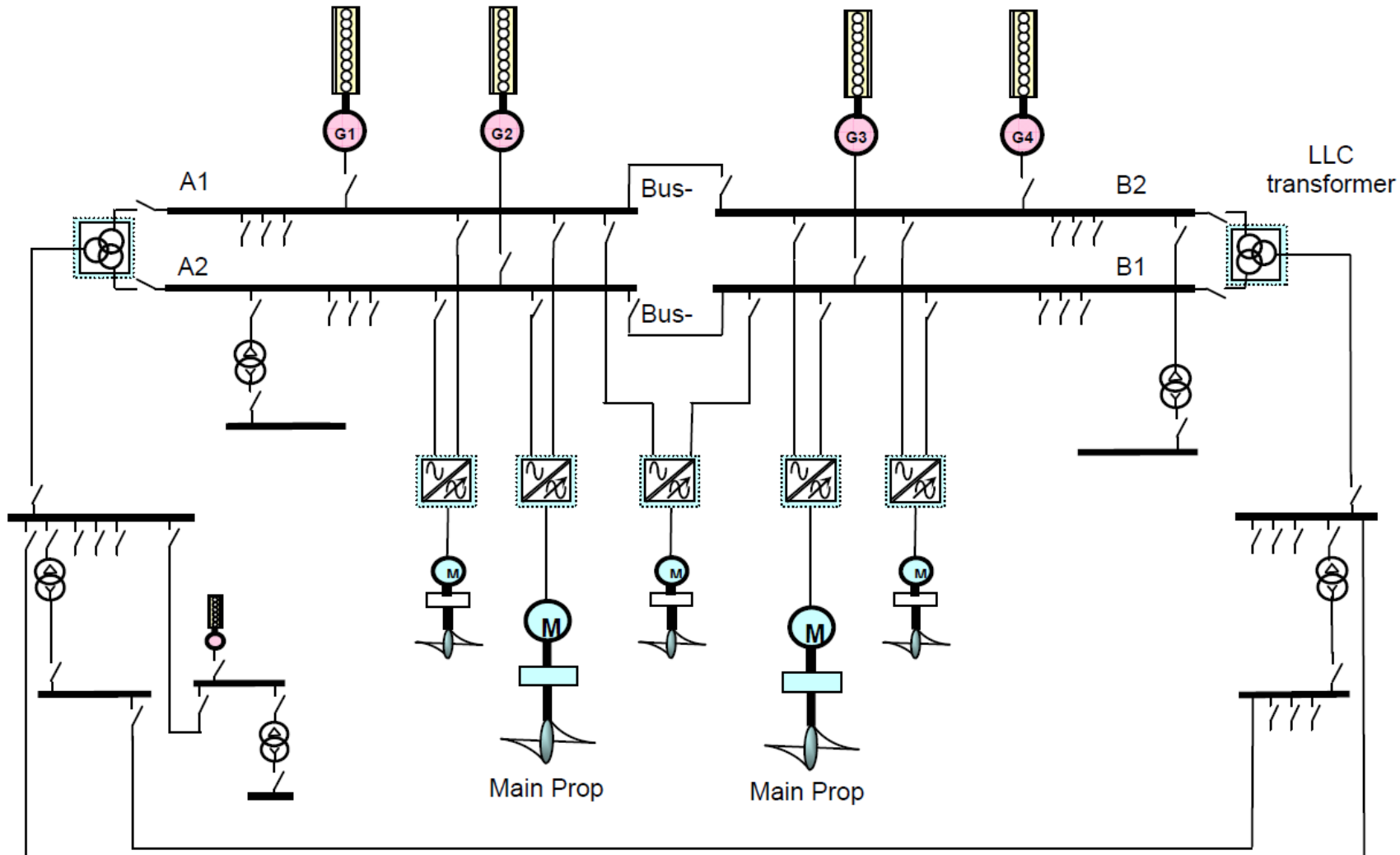
The RadaScan system has three main components:

1. **RadaScan Responders**
One or more uniquely coded responders allow for safe and reliable tracking are mounted on the fixed platform or mobile structure
2. **RadaScan Sensor**
that is installed on a vessel equipped with a DP system
3. **RadaScan Dashboard**
software is used by the DP operator to control the RadaScan Sensor. It runs on a marine computer installed on the vessel's bridge



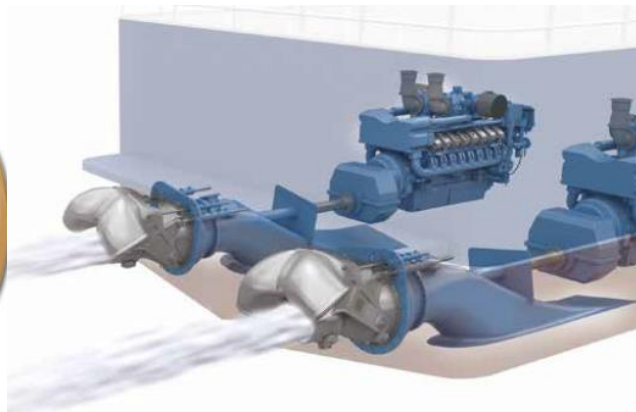
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Main Switchboard and Power Generation



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Thrusters



Forward propulsion



Zero speed



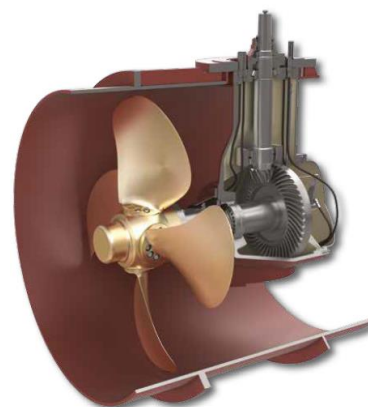
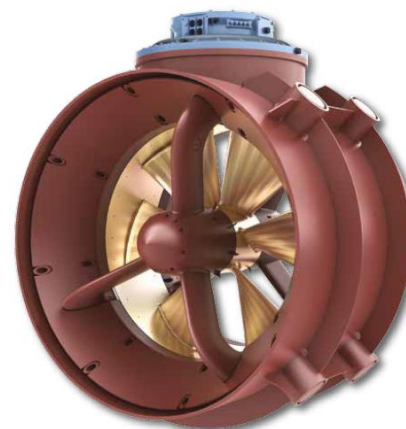
Reversing



Steering port



Steering starboard



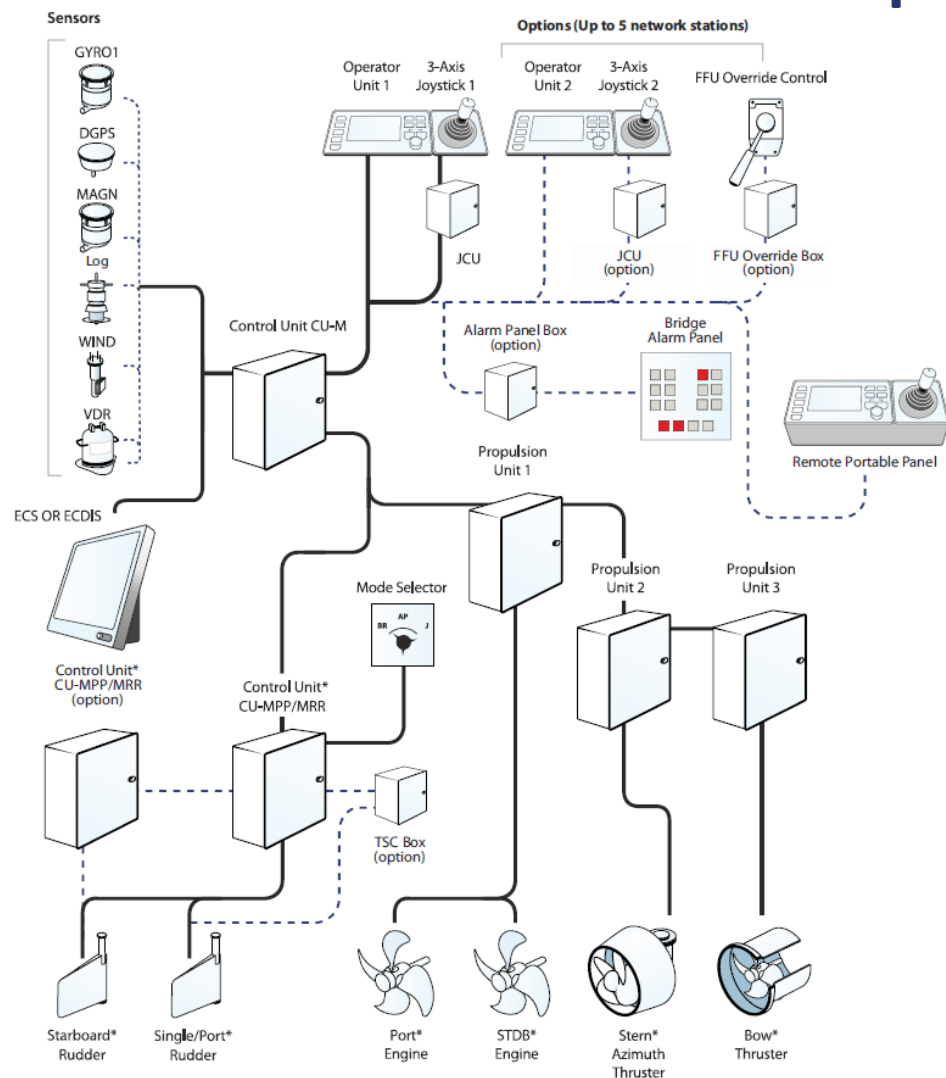
DYNAMIC POSITIONING SYSTEMS

Ancillary Equipment

- Fuel Oil System
- Lube Oil System
- Seawater Cooling System
- Freshwater Cooling System
- Compressed Air System

DYNAMIC POSITIONING SYSTEMS

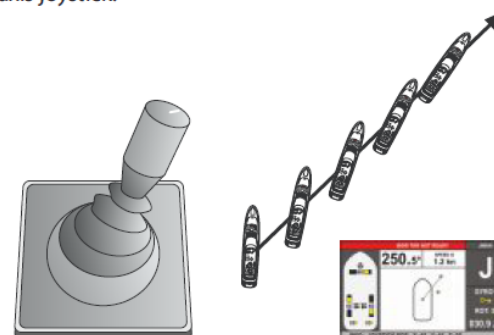
IMO Equipment Class – DP-0



* Note: Depends on ship configuration

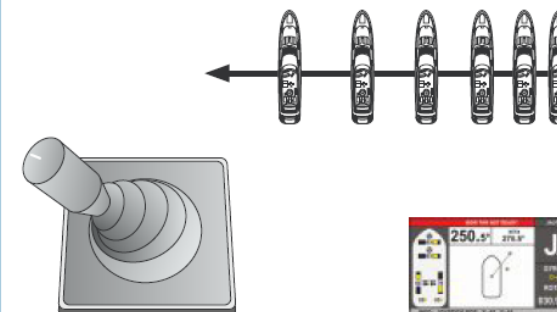
Joystick Manual

The low-speed 'Joystick Manual' control mode provides you with the variety of ways to control your yacht motion. The yacht's heading and position are set by the 3-axis joystick.



Joystick Auto-Heading

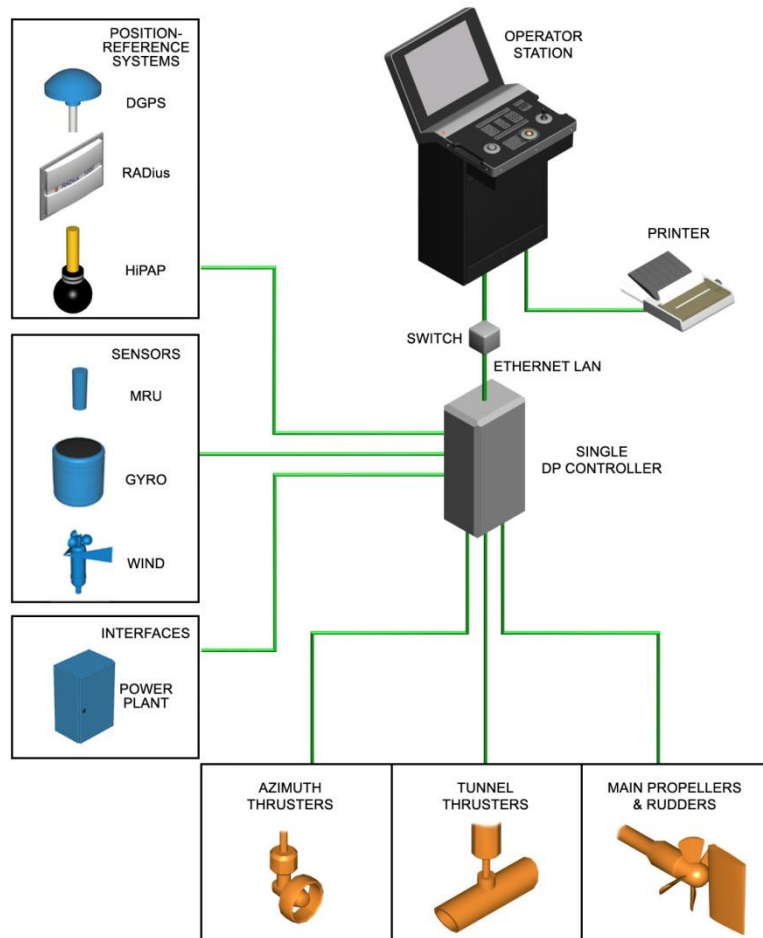
By switching to the 'Joystick Auto-Heading' mode you can control the yacht's position in the fore-and-aft and traverse directions while the heading will be fixed (the 3rd axis of the joystick is ignored).



DYNAMIC POSITIONING SYSTEMS

IMO Equipment Class – DP-1

For equipment class DP-1, loss of position may occur in the event of a single fault.



- Single stand-alone
- One computer - DPC-1
- Simple network
- Independent Joystick System
- IMO Equipment class 1

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IMO Equipment Class – DP-2

For equipment class 2, a loss of position is not to occur in the event of a single fault in any active component or system.

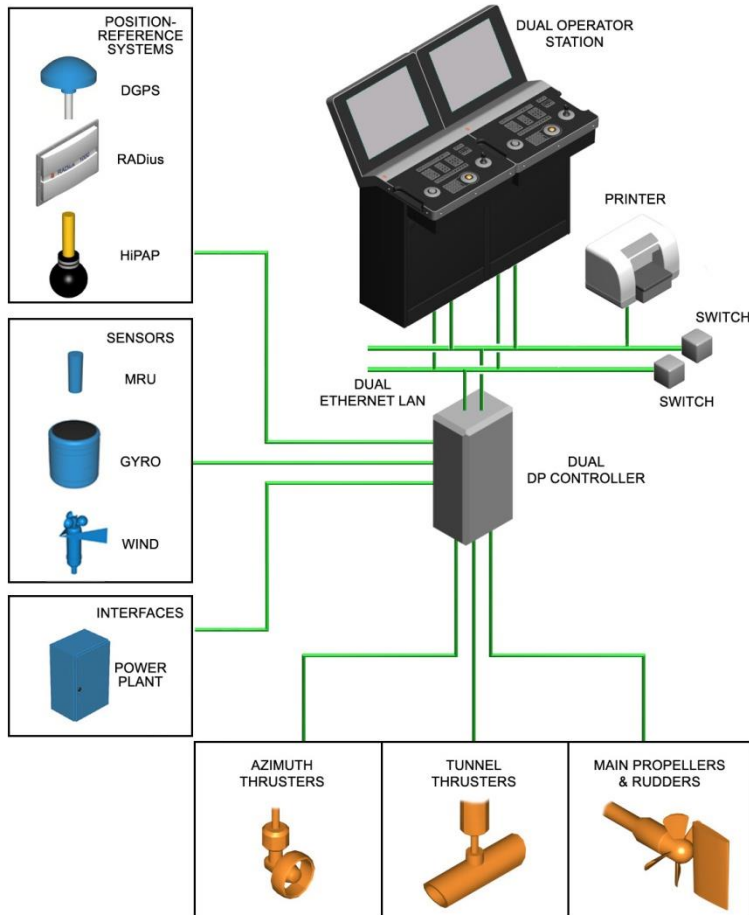
Normally static components will not be considered to fail.

Single failure criteria include:

- **Any active component or system (generators, thrusters, switchboards, remote controlled valves, etc.).**
- **Any normally static component (cables, pipes, manual valves, etc.) which is not properly documented with respect to protection and reliability.**

DYNAMIC POSITIONING SYSTEMS

IMO Equipment Class – DP-2



- Stand-alone system
- Dual-redundant system
- Two separate computers - DPC-2
- Dual network
- Independent Joystick System
- IMO Equipment class 2

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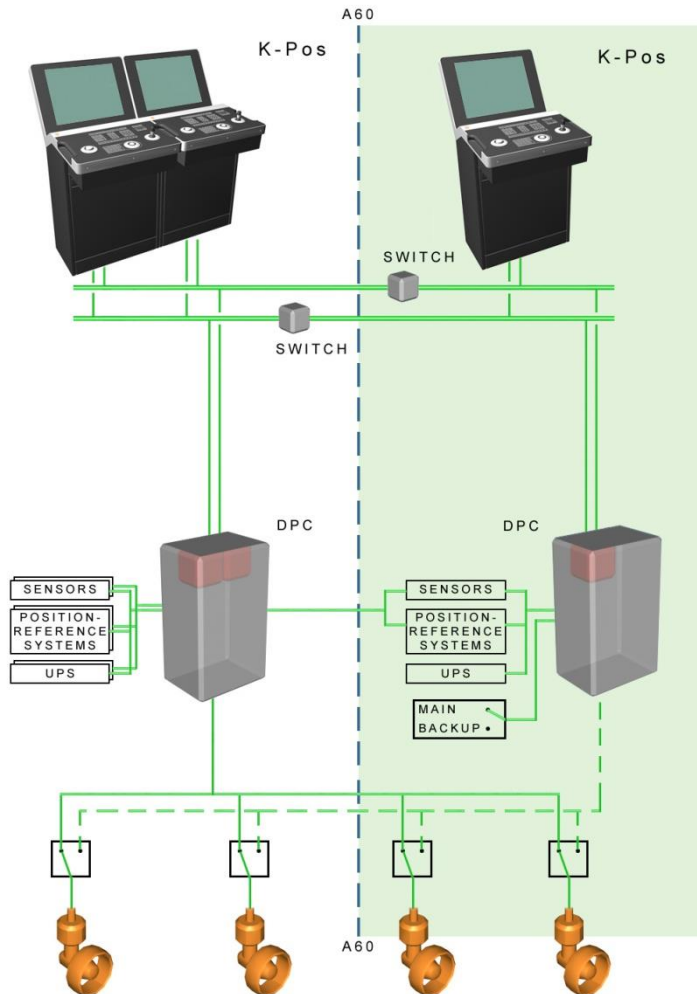
IMO Equipment Class – DP-3

For equipment class 3, a single failure includes

- Items listed previous for class 2, and any normally static component is assumed to fail**
- All components in any watertight and fire protected compartment, exposed from fire or flooding**

DYNAMIC POSITIONING SYSTEMS

IMO Equipment Class – DP-3

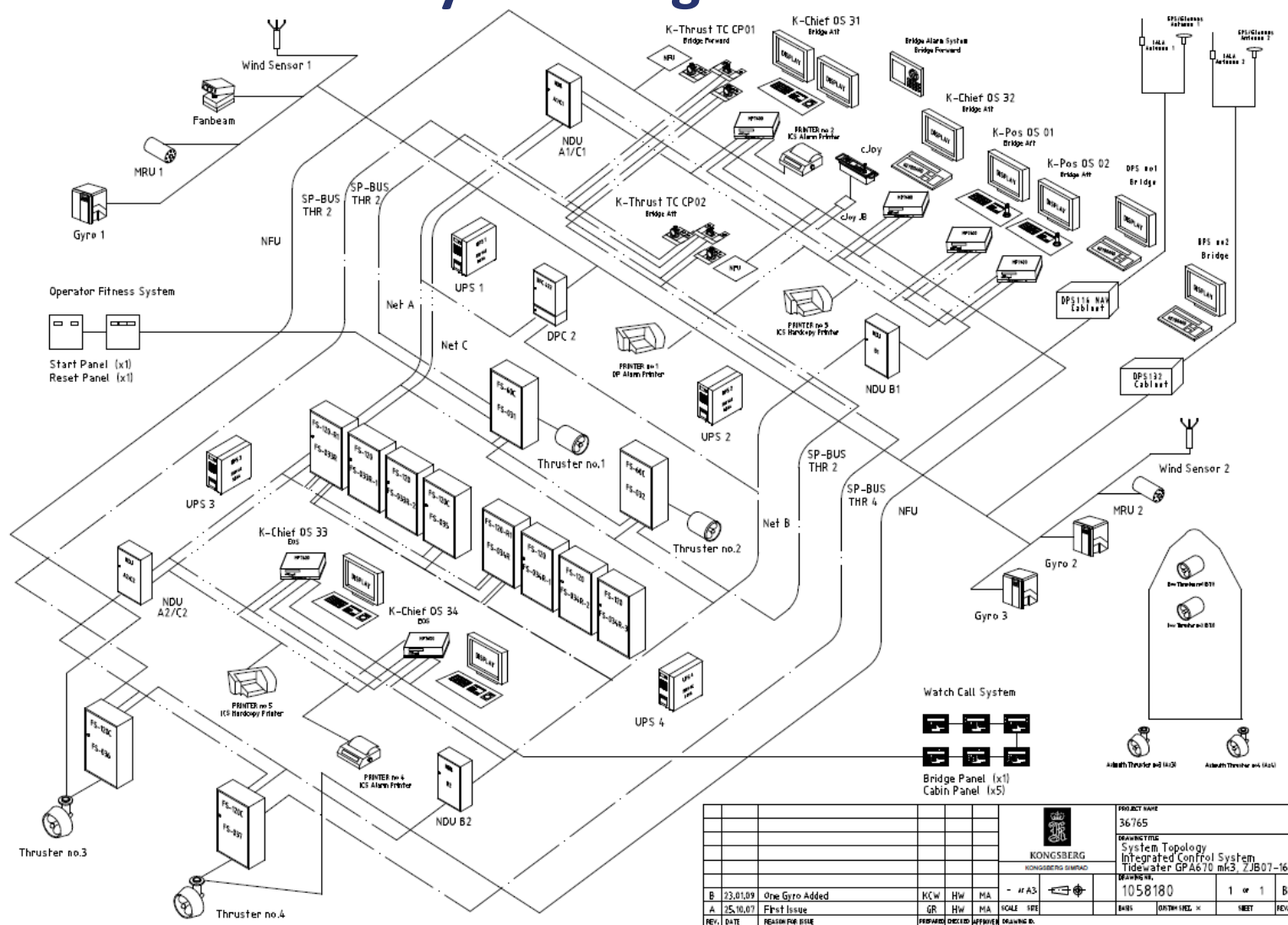


- DP-2 system as the main system
- DP-1 system as backup system
- Separate input from sensors and position reference systems
- Separate outputs to thrusters
- Separated with A60 division (fire and flooding)
- Manual switchover

Subsystem or Component			Minimum Requirement for each Class			
			CLASS 1	CLASS 2	CLASS 3	
Power System	Generator and prime movers		Non-redundant	Redundant	Redundant, in separate compartments	
	Main switchboard		1	2 with bus ties	2 with normally open bus ties in separate compartments, A60	
	Bus tie breaker		0	1	2	
	Distribution system		Non-redundant	Redundant	Redundant, through separate compartments	
	Power Management		No	If a power management is installed, adequate redundancy or reliability to the satisfaction of the administration should be demonstrated.	If a power management is installed, adequate redundancy or reliability to the satisfaction of the administration should be demonstrated.	
Thrusters	Arrangement of thruster		Non-redundant	Redundant	Separate compartments redundant, A60	
Control	Auto control; no. of computer systems		1	2	2 + 1 back-up	
	Manual control; joystick with auto heading		Yes	Yes	Yes	
	Single levers for each thruster		Yes	Yes	Yes	
Sensors	Pos. ref. Systems		1	3	3 whereof 1 in alternate control station directly connected to Back-up system.	
	External Sensor	Wind	1	2	3	Whereof 1 in alternate control station
		VRS	1	2	3	
		Gyro compass	1	3	3	
		Other necessary sensors				
UPS	Should be provided for each DP-computer system		1	2	2+1 separate compartment	
Alternative control station for backup unit.			No	No	Yes	

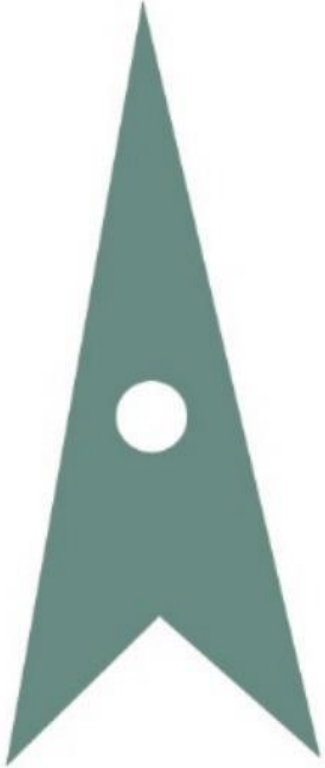
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Redundancy and Single Point of Failure



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DYNAMIC



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