Introduction to Dynamic Positioning

07 April 2011
Capt. Sanjai Jatar
SVP, Projects and Operations
EMAS AMC Inc.

Together We Deliver
AMC Energy Marine Production

Agenda

- Safety Moment
- What is DP?
- DPO/Engineer Training Requirements
- Typical work for DP vessels
- Regulations and Guidelines
- Questions

EMAS AMC

SAFETY MOMENT

EMAS AMC

BOMBAY HIGH FIELD - 27 July 2005

THE BHN DISASTER

EMAS AMC

THE BHN DISASTER - Basic Facts

- *355 employees rescued, 13 missing; the worst accident in the history of ONGC*
- In terms of property loss, this has been the most serious accident in ONGC history.
- A person on board the ship had broken his finger and needed medical attention, which was available on the offshore platform.

EMAS AMC

Samudra Suraksha – DP 2 MSV - drifting and on fire

Pictures taken from nearby Jackup Rig

BHN structural failure

EMAS AMC

BHN Process Platform – Before and After

Historical Facts – Samudra Suraksha

FEATURE

EDGE OF DISASTER

Not since Independence has a disaster of this magnitude struck Bombay harbour as the devastating fire that ravaged the SCI's oil tanker, MT Lajpat Rai, last fortnight. Although the fire was controlled with great effort before it could spread to any installations in the port, its actual cause is yet to be determined. BOMBAY reports on the heroic fire-fighting operation and also makes some points on the slips that could have been the cause of the inferno.

IT COULD HAVE spelt doomsday for the city. Had the fire that broke out on board *MT Lajpat Rai*, an oil tanker owned by the Shipping Corporation of India (SCI) and berthed at Butcher Island, reached the cargo bay, it could not only have destroyed the 29,000 tonnes of crude it was carrying, but also the atomic reactor in Trombay, the refineries of Bharat Petroleum and Hindustan Petroleum, the whole of Butcher Island itself, a major portion of Bombay's eastern harbour and several oil-loaded tankers. "It would have been a repetition of the 1944 disaster, when a cargo vessel loaded with ammunition and gold caught fire and destroyed the entire dock area. Only Providence helped us," says Captain M.S. Karnik, Deputy Conservator of the Bombay Port Trust (BPT), who played a key role in containing the fire. However, the fire claimed seven lives—five crew members and two Oil and Natural Gas Commission (ONGC) officials.

The fire started in the tanker which was anchored at Berth No 4 at Butcher Island in the early hours of Wednesday, 24 October, following an explosion in the pump room. It flared upwards to the accomodation area, and then spread to the engine room which had 800 tonnes of fuel. However, neither the SCI nor the BPT officials have been able to establish the cause of the

It took over seven fire-fighting tugs, with powerful jets of water, to put out the raging fire on board the Lajpat Rai

fire. Says Vice-Admiral R.K.S. Gandhi, Chairman of the SCI: "At that juncture, it was not important to find out the cause of the fire. The primary task before us was to extinguish it and prevent it from reaching the cargo area. The Director General of Shipping, B.K. Rao, has set up a four-member panel to probe the cause of the fire. Let's wait for their findings."

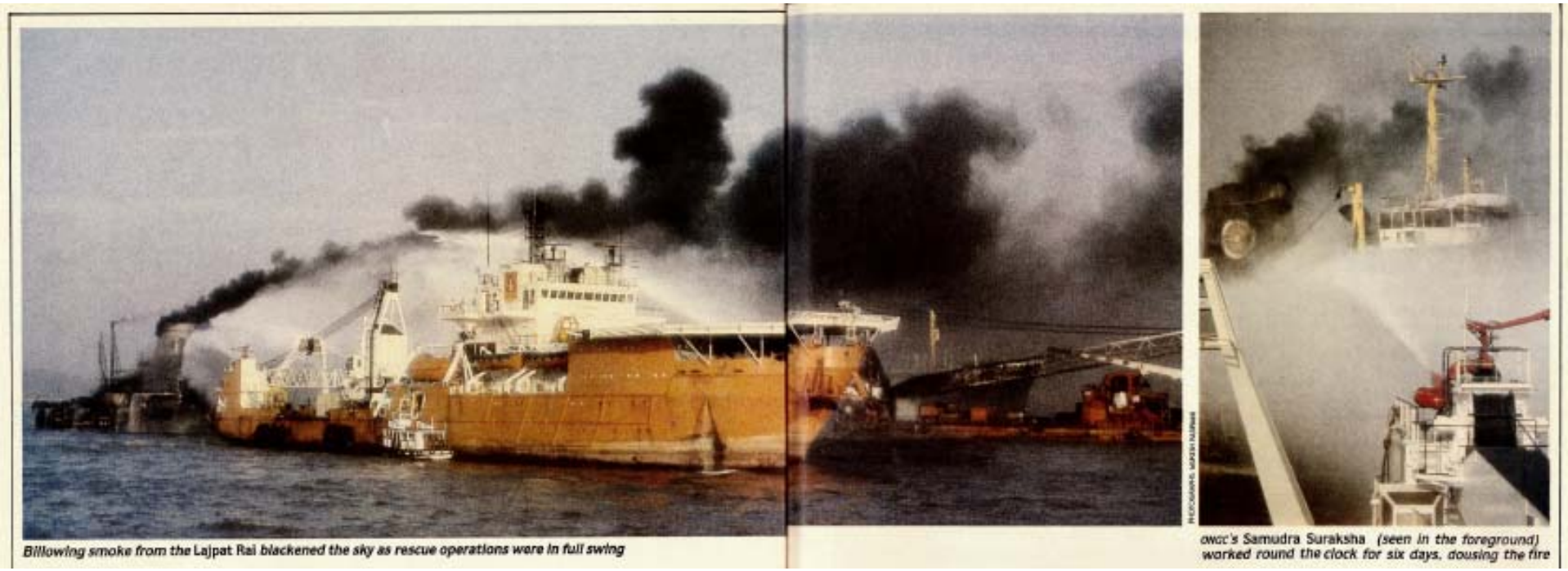
However, according to knowledgeable sources, the fire erupted in the pump room of the tanker while minor repairs were in progress. The 19-year-old Japanese-built tanker, which was loaded with crude from Bombay High for transportation to Wadlar Port, Gujarat, developed a technical snag in its pump room. Immediately, the Orient Workshop was contacted, and it rushed five technicians to carry out repairs on board. "It was during the repair work that, due to some friction, a spark triggered off a small explosion," says a crew member who has been hospitalised in St George's Hospital with 40 per cent burns. "We all rushed out from the pump room. By the time I reached the deck, the explosion had already reached the engine room." He had to swim ashore to safety.

"Crude," explains a BPT official, "contains the inflammable gas, butane. One does not need a flame to ignite a fire in such a dangerous atmosphere—even a small spark is enough to cause an explosion." Interestingly, according to the Major Port Trust Rules, no tanker is allowed to undertake any repair work at the time of crude loading or while it is still at berth. If repairs are necessary, then the tanker authorities are required to inform the Dock Master, who will allow these to be done under his supervision. The *Lajpat Rai* crew, reportedly, did not seek such permission from the Dock Master. SCI officials, however, refuse to comment on this allegation. Rao, too, refuses to either deny or confirm the report, saying, "I do not make statements on assumptions. Let the enquiry commission complete its report."

Soon after the fire, an SOS was sent to SCI and BPT officials, who immediately rushed to the spot. One of the four fire-fighting tugs owned by the BPT, which is always stationed at Butcher Island, came to the rescue. But it was not equipped to contain a raging fire of this magnitude. By 4.30 am, officials from the BPT and SCI reached the island. Karnik immediately decided to move the tanker farther out from the jetty, as the fire was endangering the tankers loading crude at the other three berths. Immediately, the ropes were cut and the tanker was towed nearly three km farther out. "It was a brilliant decision. The jetty at the island was

AMC

Saved Bombay Harbor and Atomic Power Plant

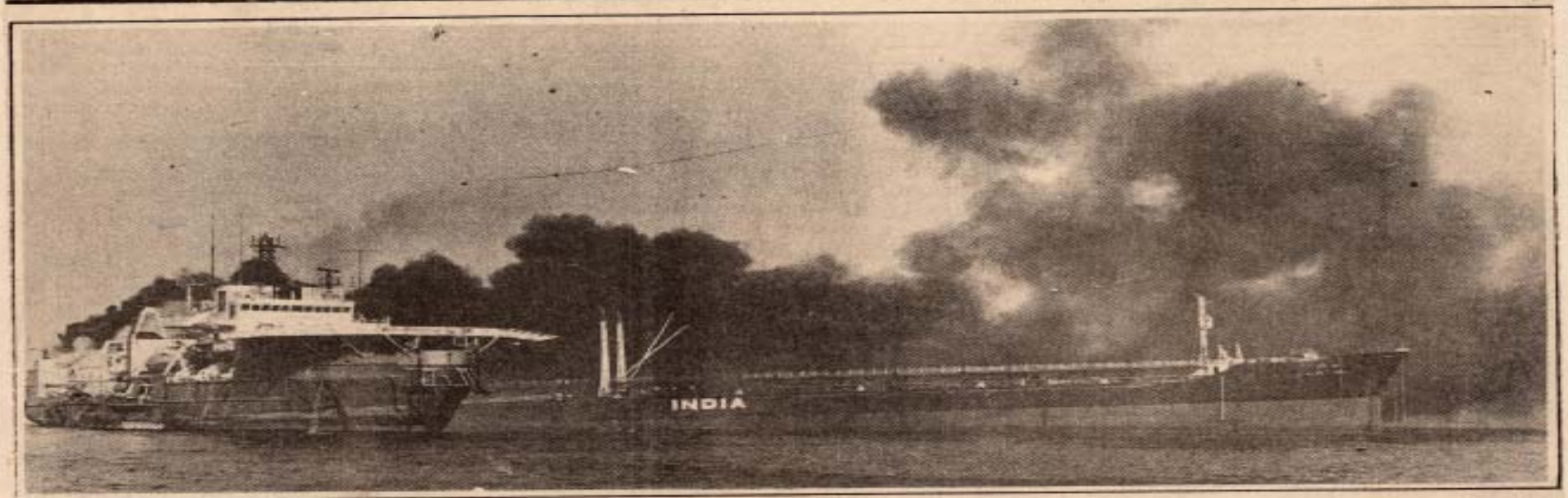


Billowing smoke from the Lajpat Rai *blackened the sky as rescue operations were in full swing*

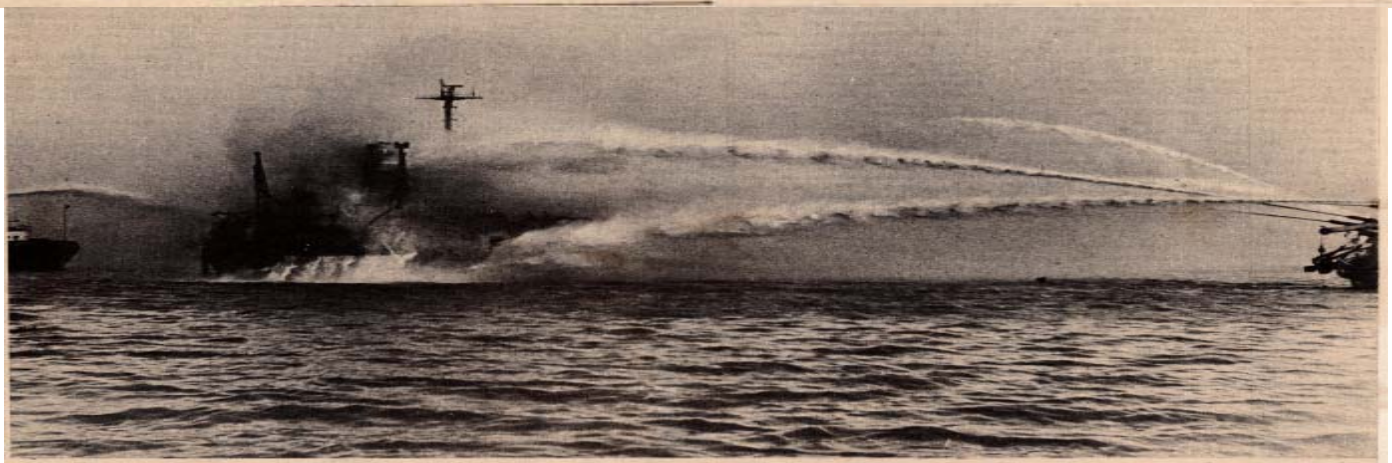
owac's Samudra Suraksha *(seen in the foreground) worked round the clock for six days, dousing the fire*

4 x 1850 m^3/hr water jets

Bombay: Saturday, October 27, 1984 80 Paise 24 Pages Late City Edition



Thick columns of smoke emanating from the engine room of the burning tanker MT Lajpat Rai which caught fire off the Butcher Island near Bombay Harbour on Wednesday. ONGC's multipurpose support vessel "Samudra Suraksha" struggles to put out the fire on Friday afternoon.



THE BATTLE CONTINUES — The blaze aboard oil tanker Lajpat Rai continues to rage 84 hours after it started even as the fire is fought with powerful water cannon from the Samudra - Suraksha, right and another offshore supply vessel brought in on Saturday, left. (Pic. by Hoshi Jal)

Blaze still raging

EMAS AMC

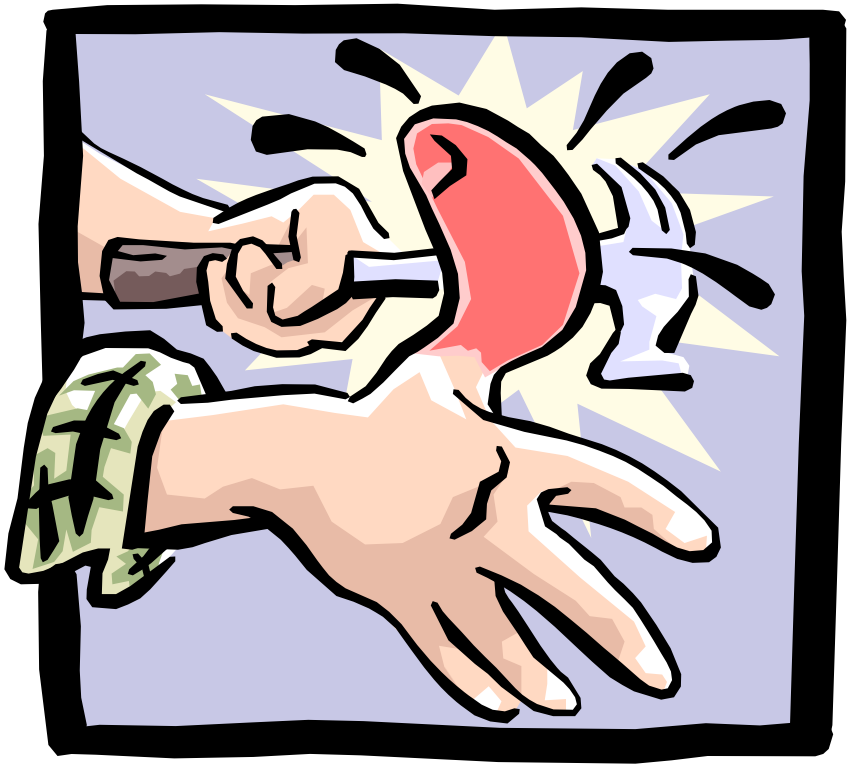
So……..What did this incident cost?

The offshore Bombay High North platform was insured for **$195 million** under ONGC's offshore package insurance policy.

The platform was totally lost in less than two hours along with a Pawan Hans helicopter positioned on it

EMAS AMC

Root Cause ??



All this is the result of someone injuring their finger, which set off this chain of events

EMAS AMC

What is DP?

EMAS
AMC

What is DP?

IMCA Definition

Dynamic Positioning (DP) is a means to automatically control vessel movement, keeping it in a desired location and heading or on a specific track, solely through the use of thrusters.

It is a technique used extensively in the many branches of the offshore oil and gas industry, including diving, ROV operations, survey and marine construction, all over the world.

Source: IMCA

EMAS AMC

Principles of DP

$$F_x = K_x^P (x_0 - \hat{x}_{LF}) - K_x^V \hat{\dot{x}}_{LF}$$

$$F_y = K_y^P (y_0 - \hat{y}_{LF}) - K_y^V \hat{\dot{y}}_{LF}$$

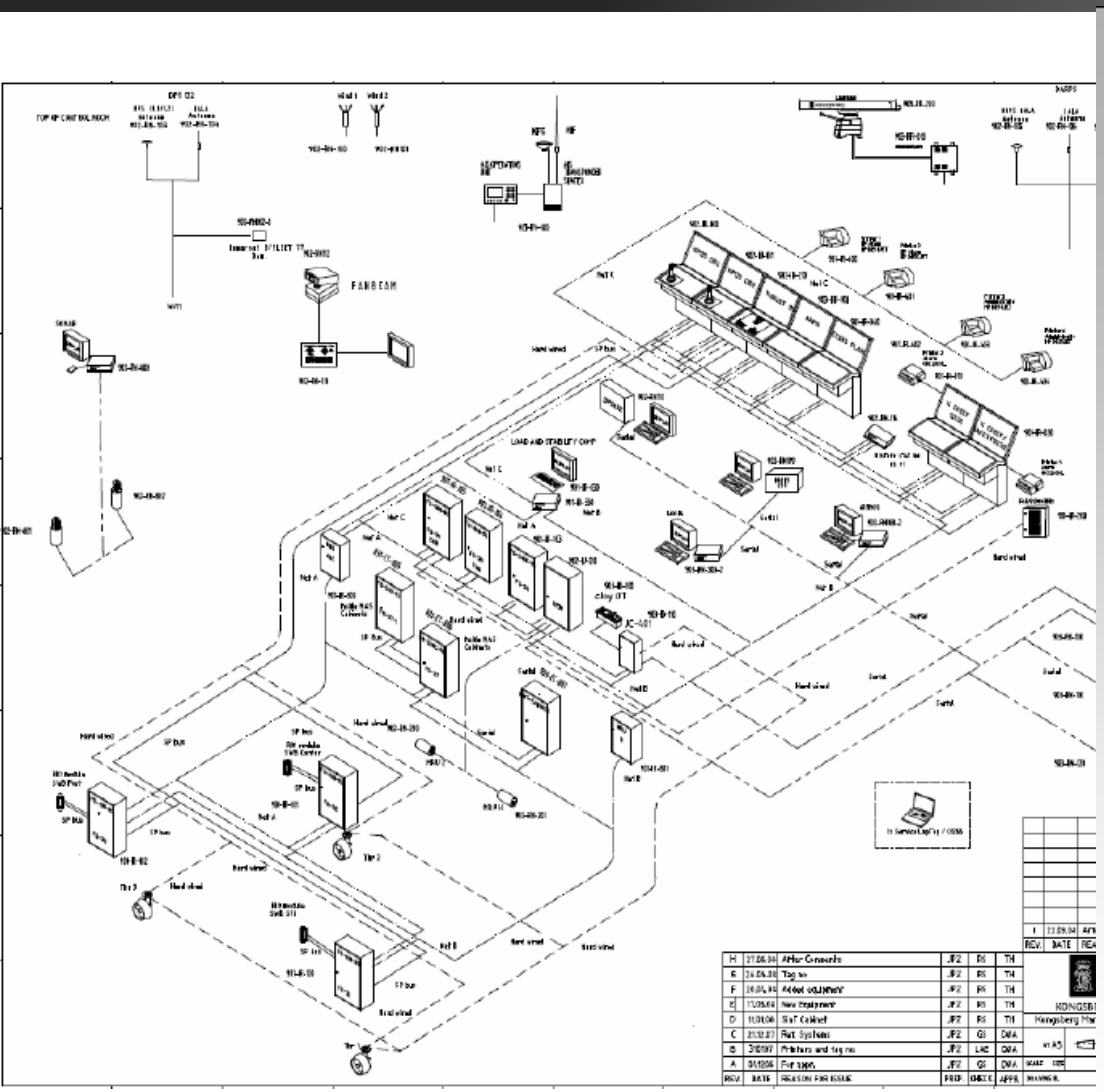
where

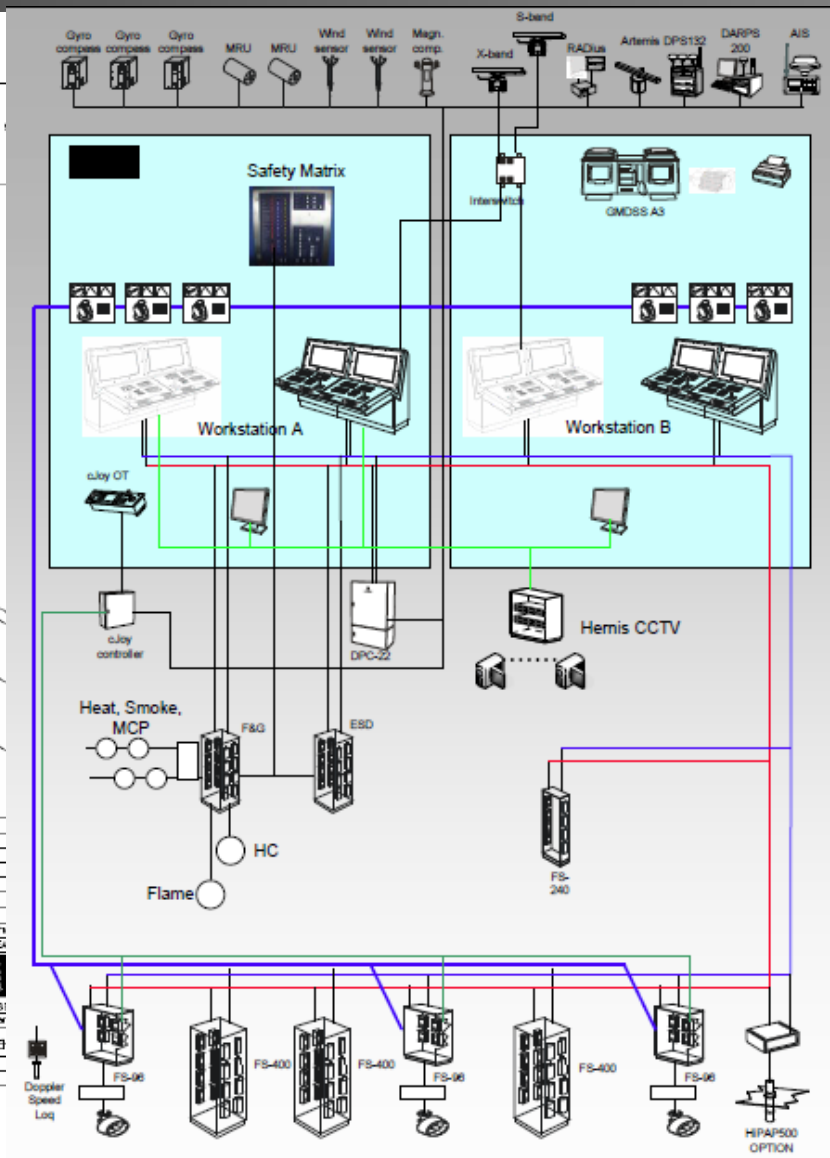
F_x, F_y	= longitudinal and transverse forces from thruster
x_0, y_0	= wanted (target) position
$\hat{x}_{LF}, \hat{y}_{LF}$	= estimated slowly varying position of HiLoad
$\hat{\dot{x}}_{LF}, \hat{\dot{y}}_{LF}$	= estimated slowly varying velocity of HiLoad
K_x^P, K_y^P	= position feedback gains
K_x^V, K_y^V	= velocity feedback gains

Source: www.km.Kongsberg.com

EMAS AMC

Typical DP system configuration





DPO/Engineer Training Requirements

IMCA M117

EMAS AMC

What is needed to be a DPO

- Education & Qualifications
  - Typically watch keeping deck officers
  - Other personnel can aspire to be DPO's
  - Senior DPO's are always watch keeping officers

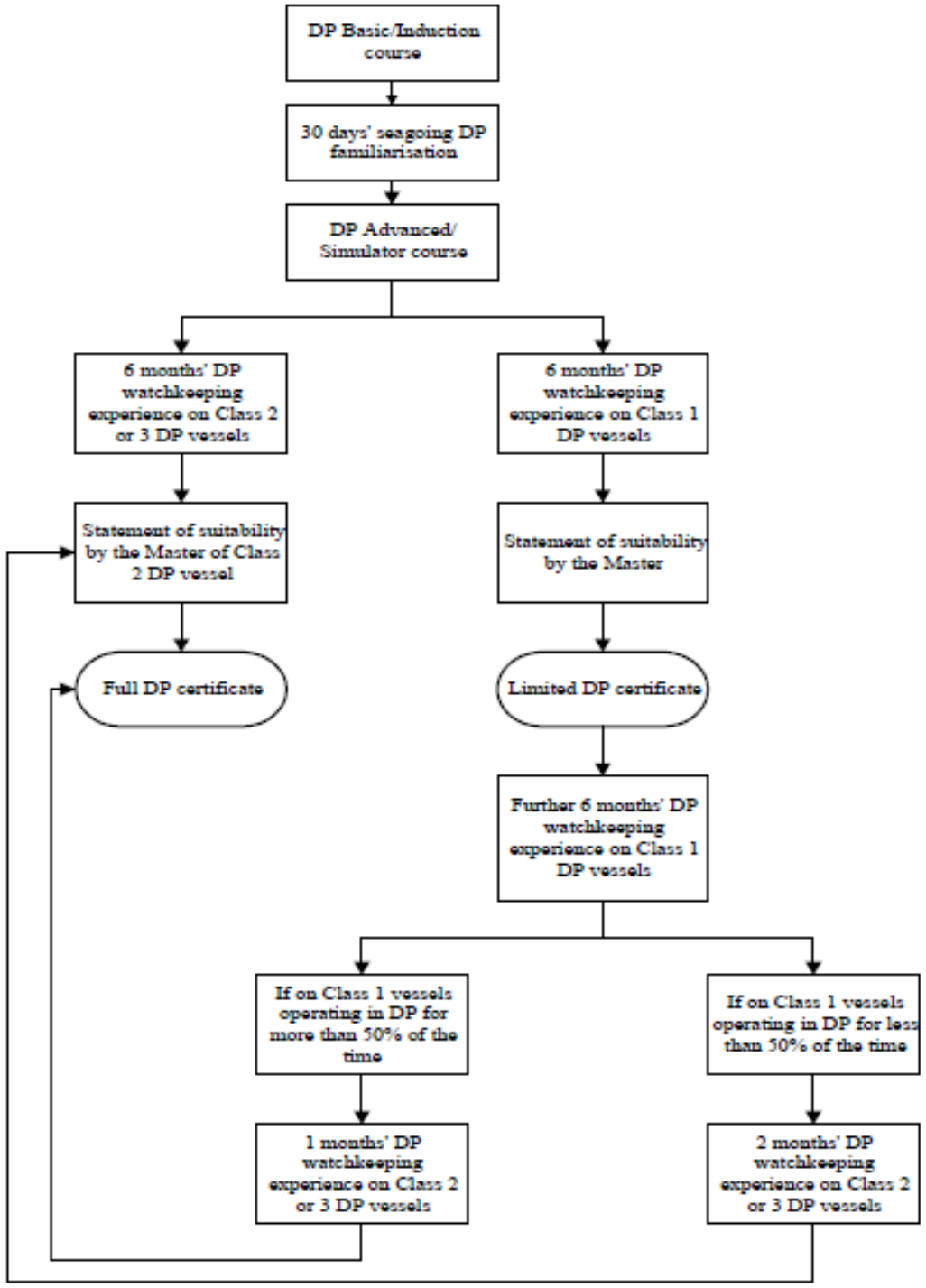
- DP Training
  - **Phase 1** – Basic induction course
  - **Phase 2** – Documented training on DP vessel for minimum 30 days
  - **Phase 3** – Attendance at approved DP simulator course or on v/l
  - **Phase 4** – Complete above and receive DP certificate after minimum 6 months supervised DP watch keeping

Source: IMCA

- Logbooks
  - Issued by Nautical Institute
  - Record of DP hours on vessels while operating on DP
  - Verified by Master on signing off a vessel
  - Certificates are issued by NI

EMAS AMC

DPO Flowchart



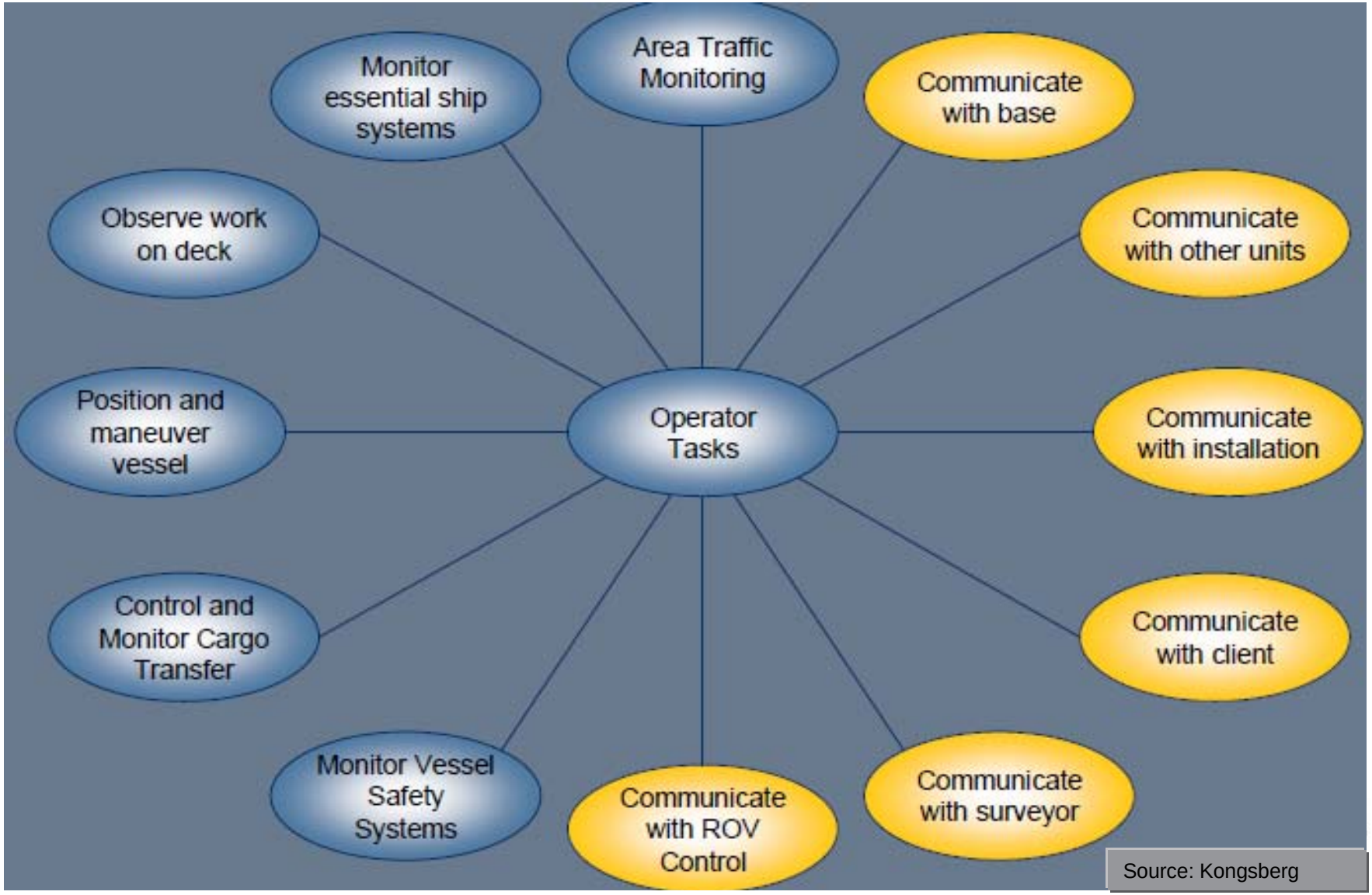
EMAS AMC

Competency Recommendations
Bridge watchkeepers on DP OSV's

Category A **Master or navigating officer**	♦ STCW 95 navigating officer certificate appropriate to class of vessel. ♦ NI DP certificate. ♦ Fully competent in operating the OSV in manual control when in close proximity to an offshore installation. ♦ Adequate experience on the vessel type – recommend 14 days. ♦ Adequate experience of the DP control system type and equipment classification – recommend 14 days. ♦ Knowledge of the vessel's FMEA, together with a detailed understanding of the implications of all identified failure modes. ♦ Detailed knowledge of the vessel's DP operations manual and adequate knowledge of the contents of the vendor manuals. ♦ Knowledge of relevant IMCA guidelines including DP incident reporting. ♦ Consideration should also be given to providing manufacturers' courses for masters and officers in this category, in particular for the DP control system and position reference systems.
Category B **Navigating officer or other person**[1]	♦ STCW 95 navigating officer certificate appropriate for class of vessel or other appropriate certification, as required by the DP OSV owner. ♦ Received on board training of the vessel's DP system, using the NI DPO logbook to record training received. ♦ Competent in taking control of the vessel in manual control and moving away from the installation.

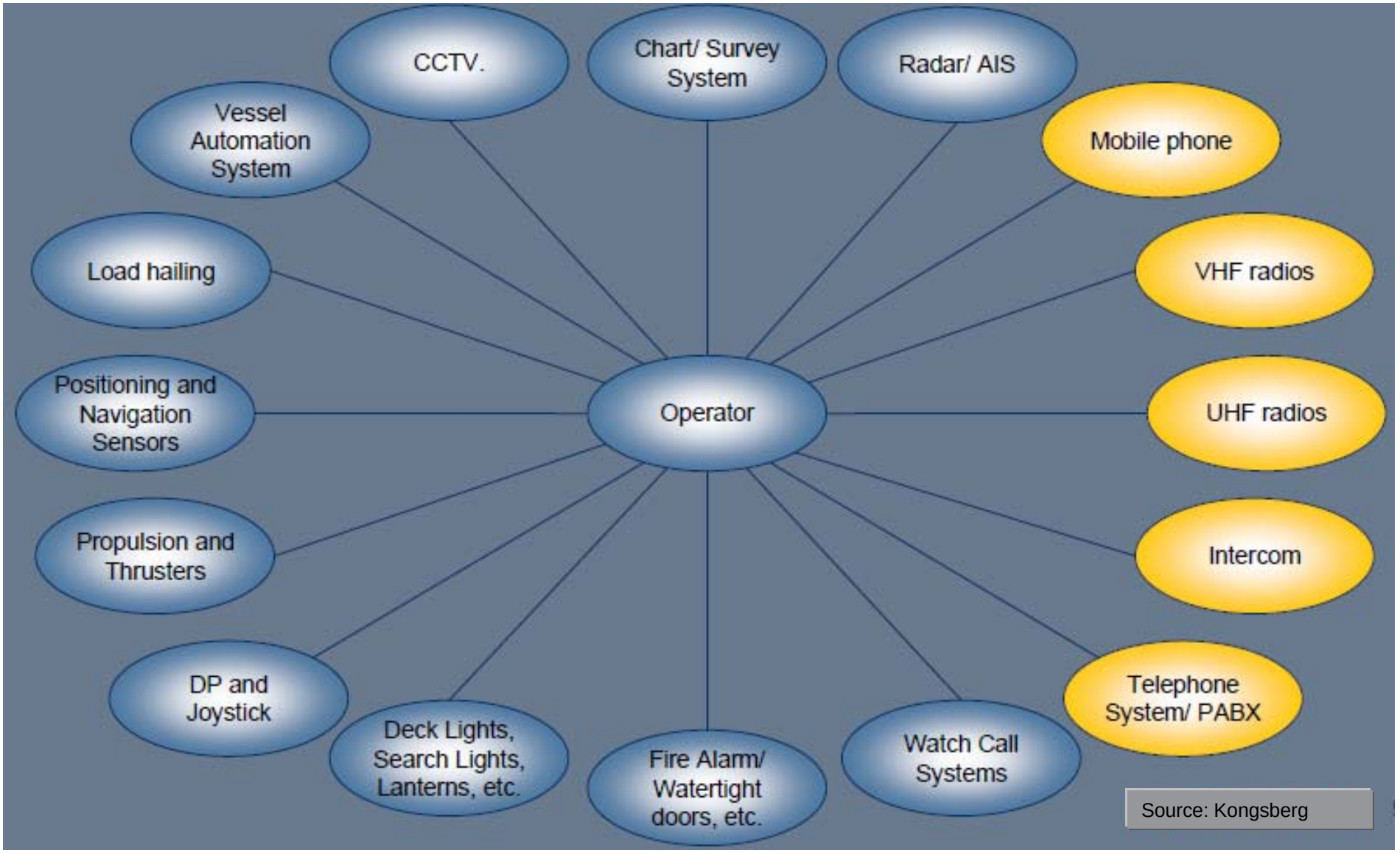
EMAS AMC

DPO tasks under DP operations



Source: Kongsberg

Equipment used or monitored under normal operations



Engineers qualifications for DP

Chief Engineer

The Chief Engineer should have appropriate experience and sufficient competence to take charge of a watch in the ER or ECR during DP operations and understand the DP operational requirements of the vessel, the consequences of failures and the optimisation of the redundancy available in equipment such as:

- power generation;
- power distribution;
- thruster units electrical power and sensors;
- thruster units and associated systems;
- network;
- power management/logic;
- power and UPS systems;
- DP control system interfaces;
- DP control system hardware;
- DP control system software;
- computer functions, tests and fault finding.

The Chief Engineer should understand the need for and implement good communications between the bridge and engine control room and have a comprehensive knowledge of the vessel's operations manuals including the FMEA as currently updated.

The chief engineer should be:

- at assessor level in the setup and use of all DP related systems operated by the technical department;
- able to plan, execute and lead blackout recovery drills.

The Chief Engineer should hold a formal, appropriate, current qualification to an approved STCW convention standard and have attended the manufacturer's/supplier's training course on any integrated DP/power management control system onboard.

Electrician/Electronics qualifications

EMS should be experienced and sufficiently competent to maintain the DP control system and associated systems and carry out routine checks and maintenance. They should also have a comprehensive knowledge of the vessel's operations manuals and FMEA as currently updated with respect to the following equipment:

- power and UPS systems;
- thruster units electrical power and sensors;
- DP control system interfaces;
- power and UPS systems;
- DP control system hardware;
- DP control system software;
- computer functions, tests and fault finding.

They should be able to carry out tests and effect maintenance, repairs and replacements to systems and components with reference to the manufacturer's approved operation and maintenance procedures. They should understand when such work is safe and sensible to carry out, have appropriate understanding of the vessel's current FMEA and implement good communication with bridge and engine control locations.

All EMS should hold a DP control system maintenance course certificate. If they are also electricians, they should satisfy requirements set out under chapter 6.10.

EMAS AMC

Other requirements

- Medical Fitness
  - Generally UKOOA medical certificate – valid for 2 yrs
  - Locally a certificate of fitness from approved Dr.
- Helicopter Underwater Egress Training (H.U.E.T)
- Basic Offshore Survival (more common to see BOSIET certification approved by OPITO)
- STCW for certified watch keeping officers

- And.. A positive attitude to deal with multinational colleagues and remote locations for operations worldwide

Source: IMCA

EMAS AMC

Vessel Classification and applicable regulations

EMAS AMC

IMO DP Vessel Classification

Description	IMO	Corresponding class notations		
	DP Class	ABS	LRS	DNV
Manual position control and automatic heading control under specified maximum environmental conditions.	-	DPS-0	DP (CM)	DNV-T
Automatic and manual position and heading control under specified maximum environmental conditions.	Class 1	DPS-1	DP (AM)	DNV-AUT DNV-AUTS
Automatic and manual position and heading control under specified maximum environmental conditions, during and following any single fault excluding loss of a compartment. (Two independent computer systems).	Class 2	DPS-2	DP (AA)	DNV-AUTR
Automatic and manual position and heading control under specified maximum environmental conditions, during and following any single fault including loss of a compartment due to fire or flood. (At least two independent computer systems with a separate back-up system separated by A60 class division).	Class 3	DPS-3	DP (AAA)	DNV-AUTRO

EMAS AMC

Regulations and Guidelines - DP OSV's

Region	Title	Issuing Body	Type
North West Europe Area	Guidelines for the Safe Management of Offshore Supply and Anchor Handling Operations (NWEA)	UK Chamber of Shipping Danish Ship Owners' Association Netherlands Oil and Gas Exploration and Production Association Norwegian Oil Industry Association (OLF) Norwegian Shipowners' Association United Kingdom Oil & Gas	Industry Body Standards
Norway	NORSOK 1997, Marine Operations, J-003 *Section 5.2*	OLF & TBL	Industry Body Standards
Norway	OLF/NSA 061 'Guidelines for safe operation of offshore service vessels'	OLF/NSA	Industry Body Standards
United Kingdom	Guidelines for Ship/ Installation Collision Avoidance	UKOOA	Industry Body Guidance
United States	Use of DP by OSVs for Oil and Hazmat Transfers	USCG	Regulatory Authority Guidance

EMAS AMC

References

- DNV Recommended Practice DNV-RP-E307
  - Dynamic Positioning Systems – Operation Guidance
- IMCA
  - M -103 Guidelines for Design and Operation of DP Vessels
  - M – 117 Training and Experience of DP Personnel
  - M – 149 Common Marine Inspection Document (CMID)
  - M – 182 International Guidelines for Safe Operations of DP OSV's
  - M - 203 Guidance on Simultaneous Operations (SIMPOS)
  - M – 166 Guidance on Failure Modes & Effects Analyses (FMEA's)
- IDPOA (www.dpoperators.org)

EMAS AMC

Types of Vessels fitted with DP and work performed

EMAS AMC

Vessel Layouts

EMAS AMC

to edit this text

EMAS
AMC

DP Operator Workspace

EMAS AMC

Typical DP Vessels

EMAS AMC

EMAS AMC

Heavy-lift vessels / crane ships
Pipelay vessels

Sources: cdiver.net, hmc.heerema.com

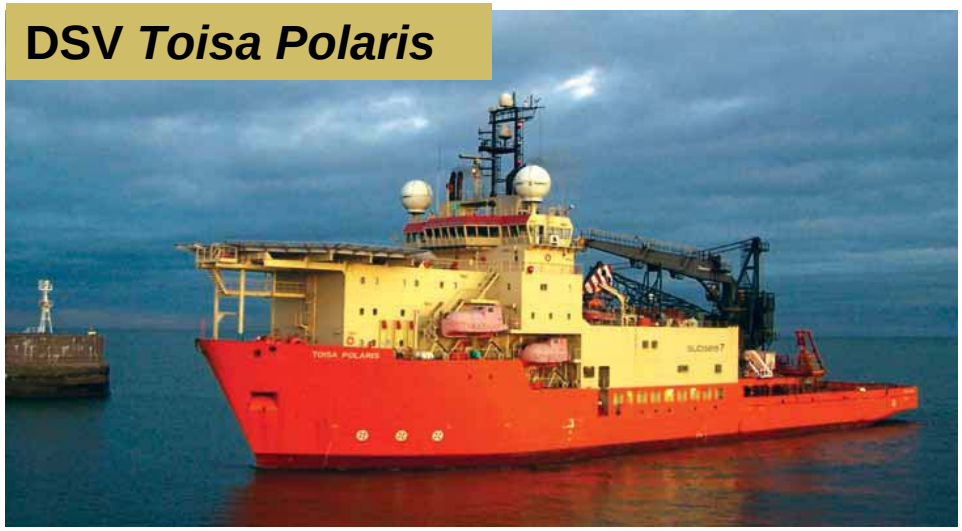
EMAS AMC

Dive Support vessels (DSV)
ROV vessels, AHTS vessels

ROV Support Vessel *Seisranger*

AHTS Vessel *Maersk Attender*

DSV *Toisa Polaris*



Soruces: www.subsea7.com, www.maersksupplyservice.com

EMAS AMC

Drill Ships

EMAS AMC

DP Shuttle Tanker and HiLoad System

Source: HiLoad

EMAS AMC

Equipment on MSV's

EMAS AMC

EMAS AMC | Offshore Construction

Strong Construction Assets Portfolio

Boa Deep C

Deepwater construction

Boa Sub C

Deepwater construction/flex lay

Enterprise 3

Conventional/ heavy lift/ pipe-lay/ accommodation.

Lewek Champion

DP2/rigid pipelay/ heavy lift/ accommodation

Lewek Ambassador

Multi-purpose offshore support with IMR capabilities

AMC Connector

Deepwater construction/ heavy lift/flex lay

Lewek Toucan

Diving/construction support with deepwater installation and construction capabilities

Lewek Falcon

MFSV/deepwater multi -function construction with deepwater installation and construction capabilities

Lewek Crusader

Heavy lifting/flex lay/ accommodation

Lewek Constellation

Ice-class subsea multi-lay vessel with heavy lift

EMAS AMC

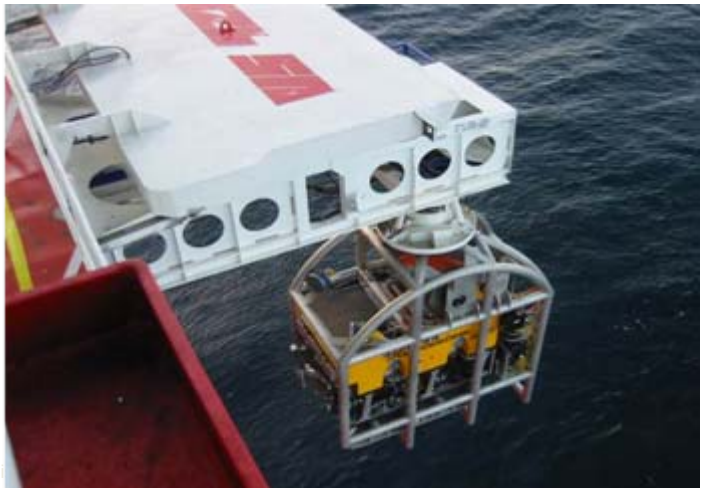
Common Tasks of MSV’s

EMAS AMC

SURF Equipment installation

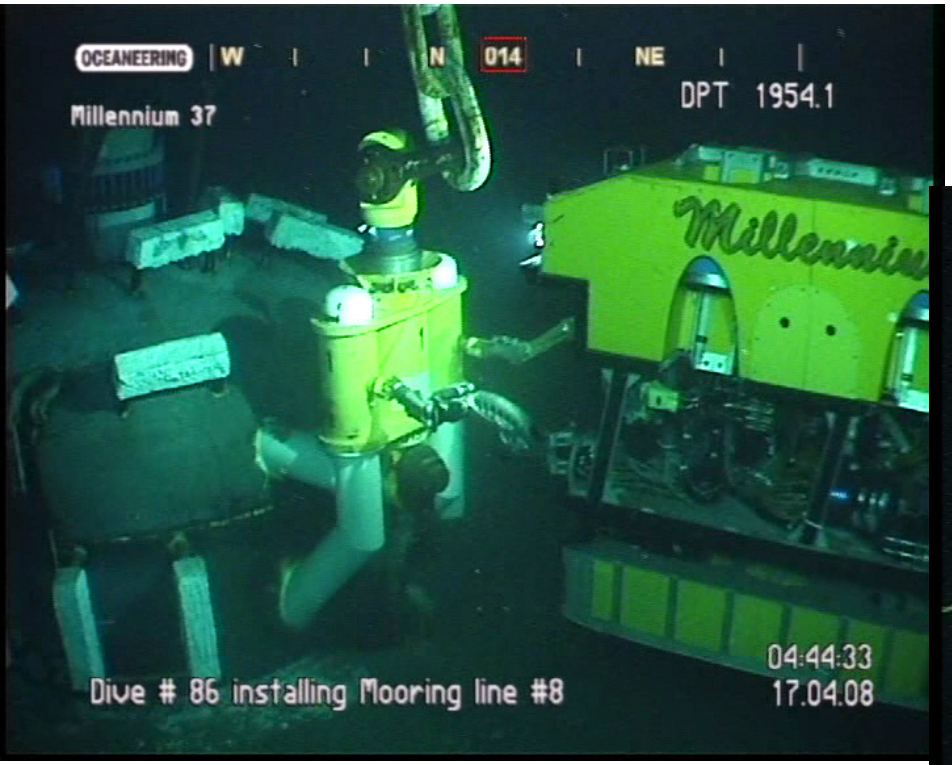
EMAS AMC

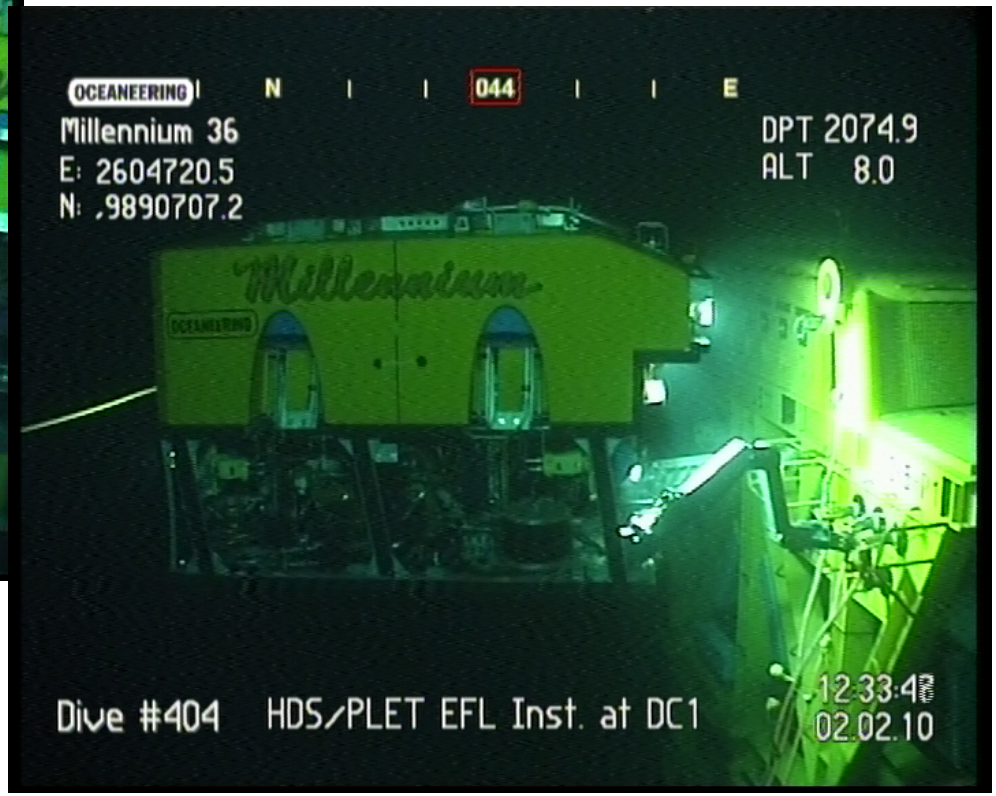
ROV Launch & Recovery



EMAS AMC

ROV Operations



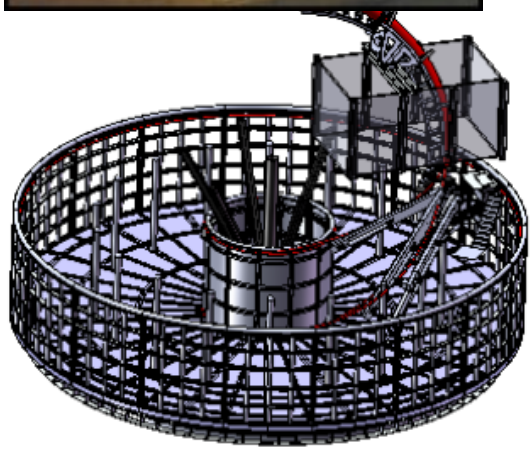


EMAS AMC

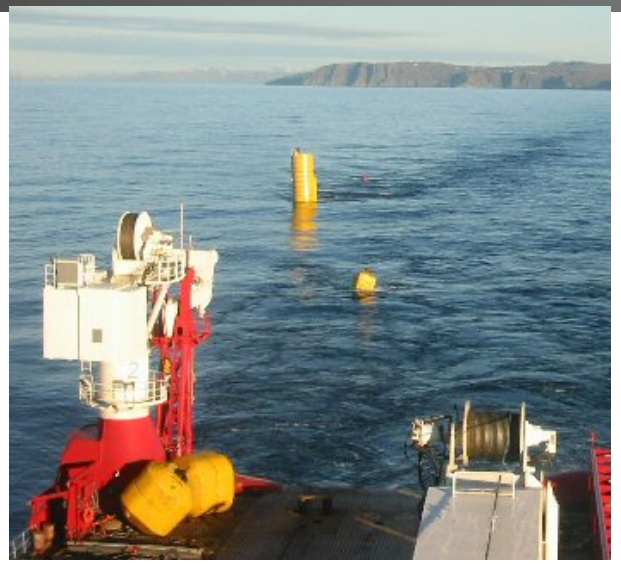
Umbilical/Flexible Installation

EMAS AMC

Lay Systems for Rigid and Flexible Lines



Installation and Towing

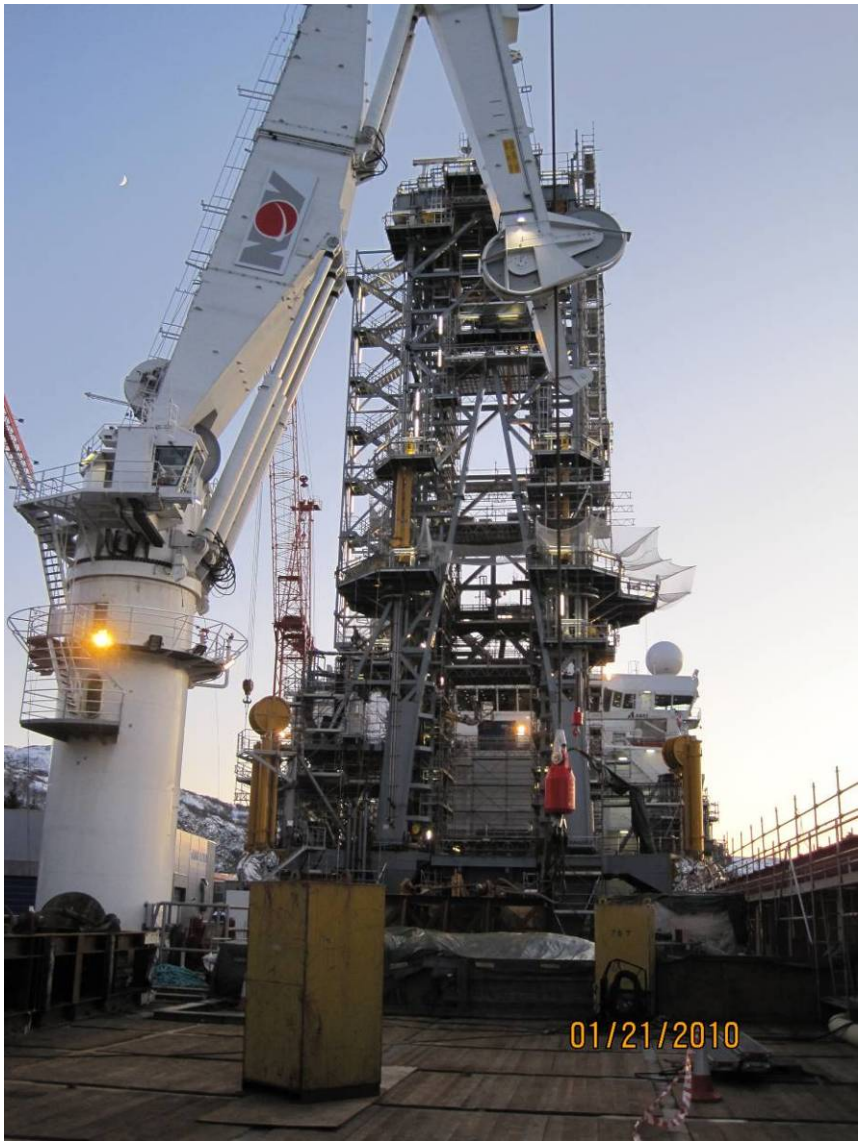


EMAS AMC

Fire Fighting

EMAS AMC

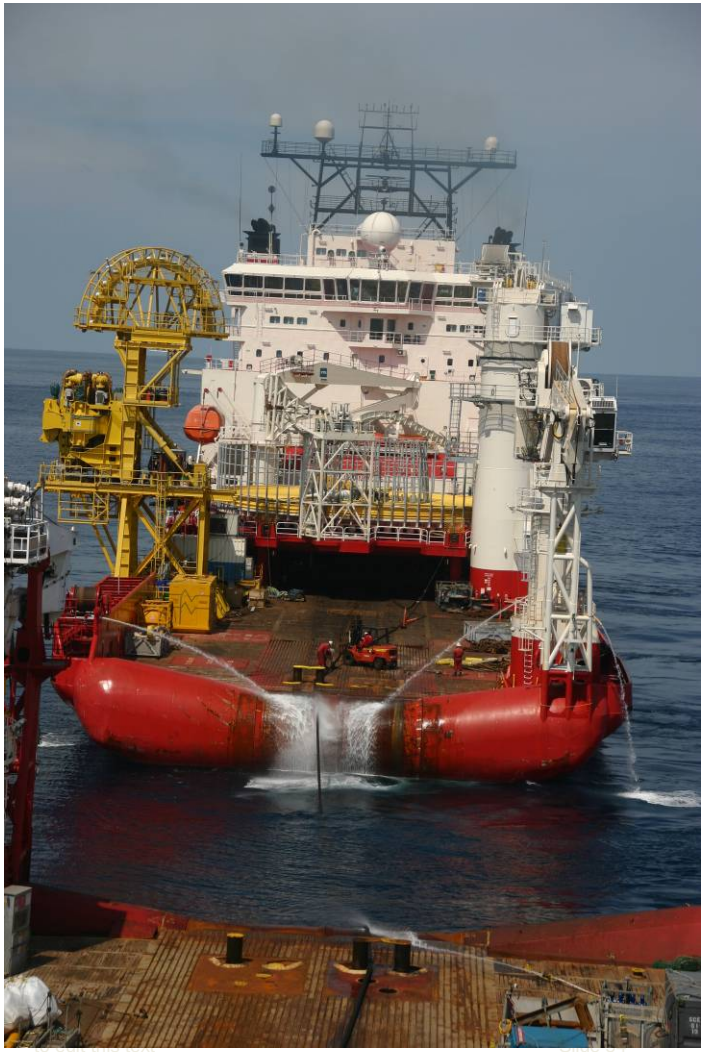
Well Intervention



to edit this text

EMAS AMC

Mooring System Installation

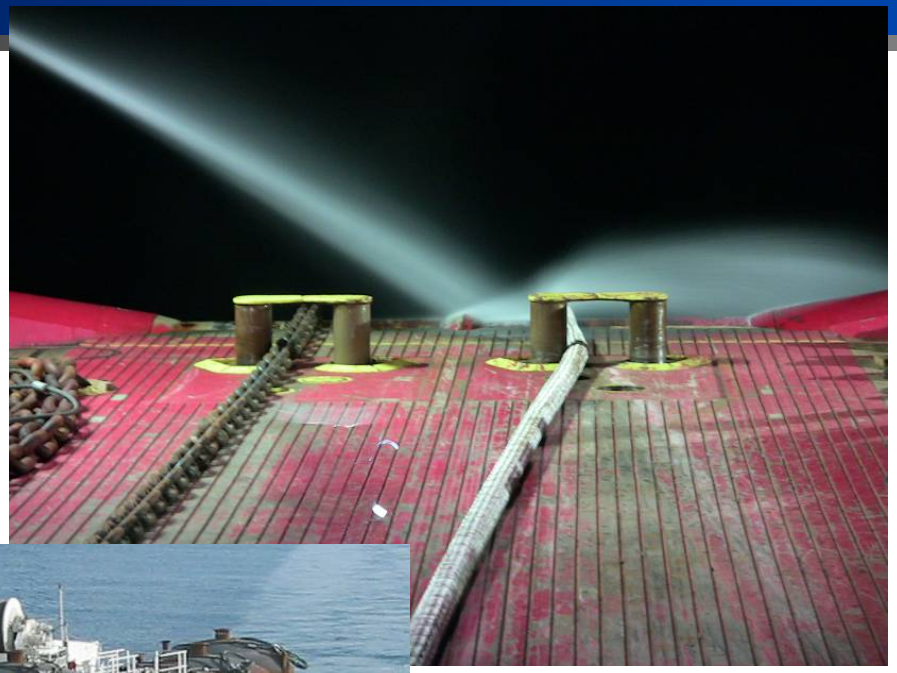


EMAS AMC

Mooring and Riser Hook Up

Drag Anchor Installation

Suction Anchor Installation



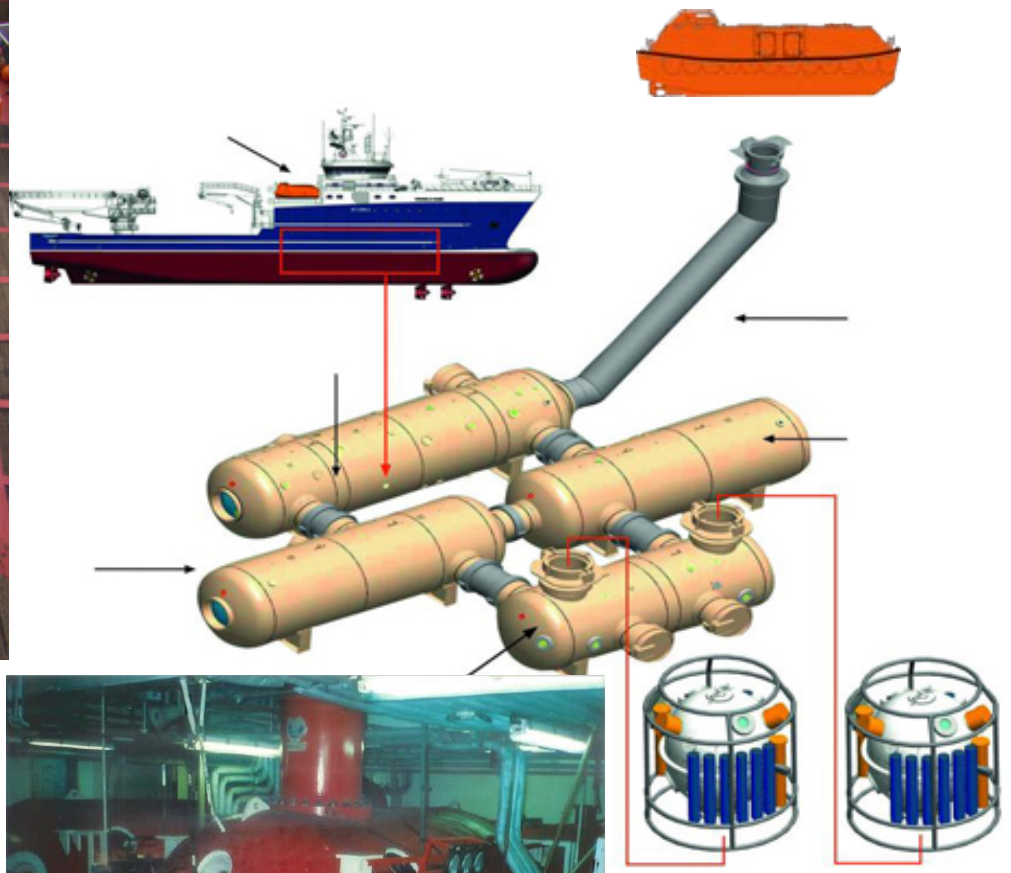
to edit this text

EMAS AMC

Driven Pile Anchor Installation

EMAS AMC

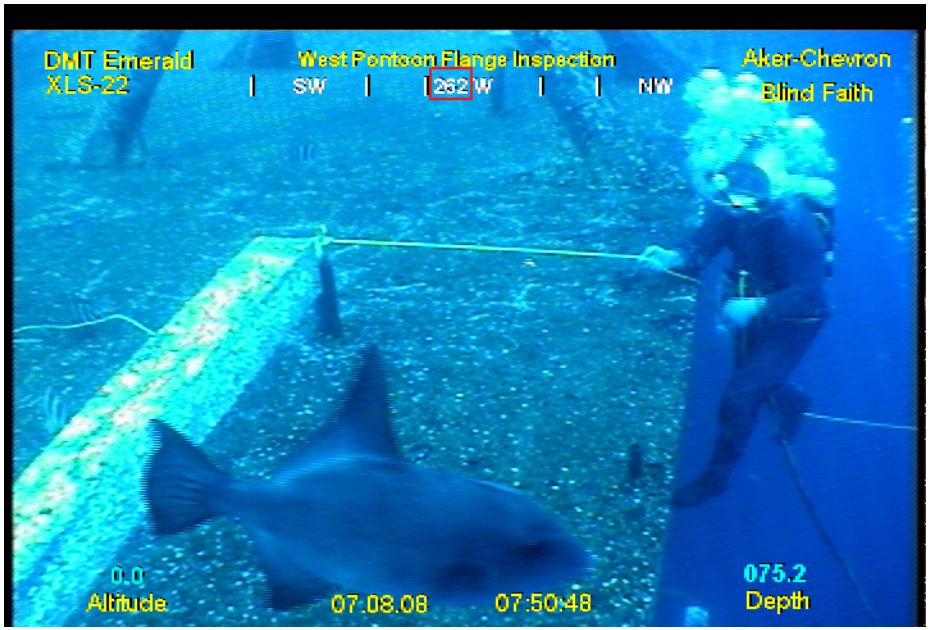
Dive Support



EMAS AMC

Saturation Diving

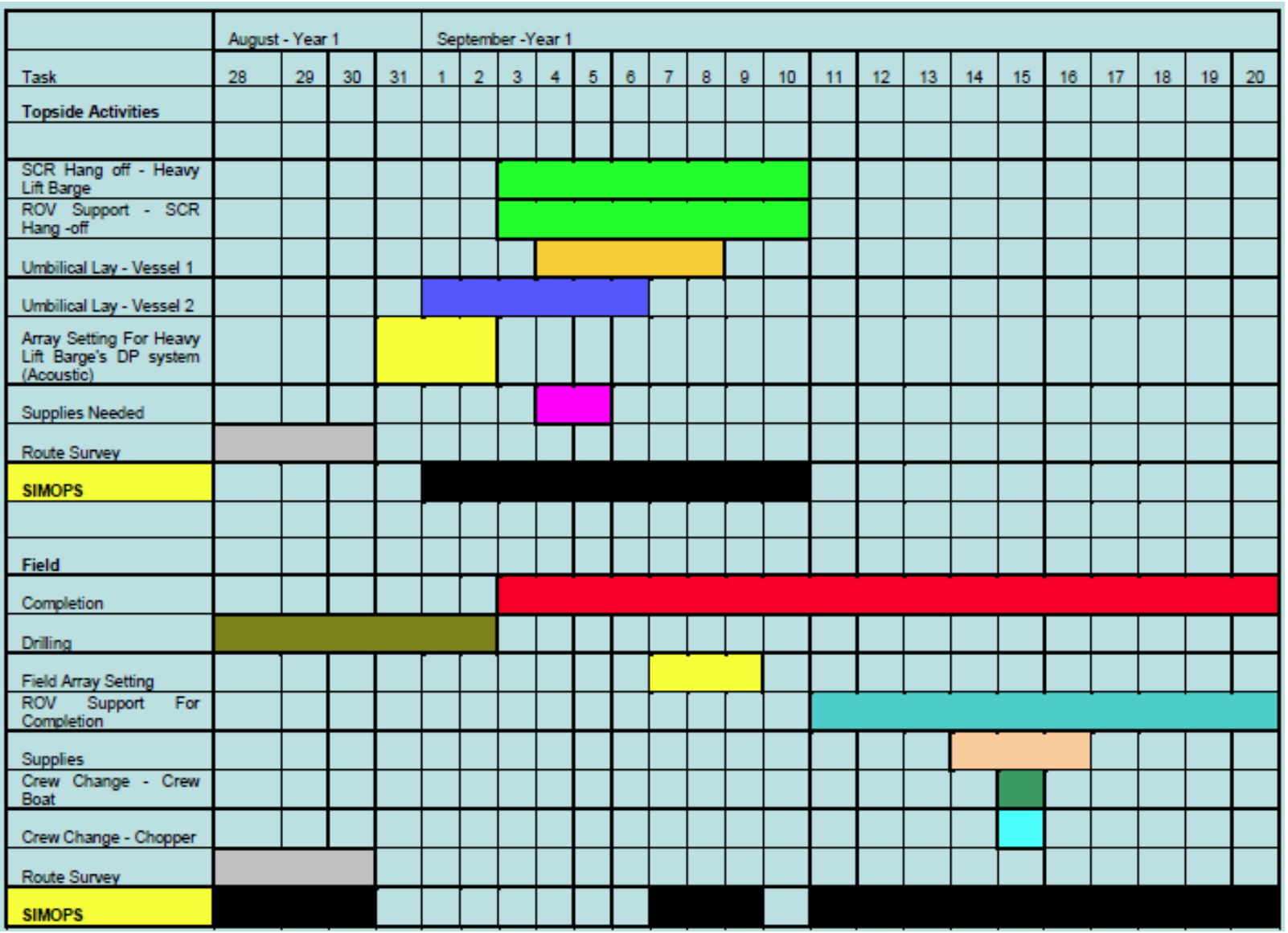
Dive support operations



SIMOPS

EMAS
AMC

SIMOPS Identification and Planning



EMAS AMC

Lead to …. Safe & Smooth Operations

DP Training

EMAS
AMC

EMAS Training Academy & Simulation Centre

- Modern facilities
- Dedicated rooms for different types of simulations
- Class room facilities

Training concept developed in collaboration with Maersk and further enhanced

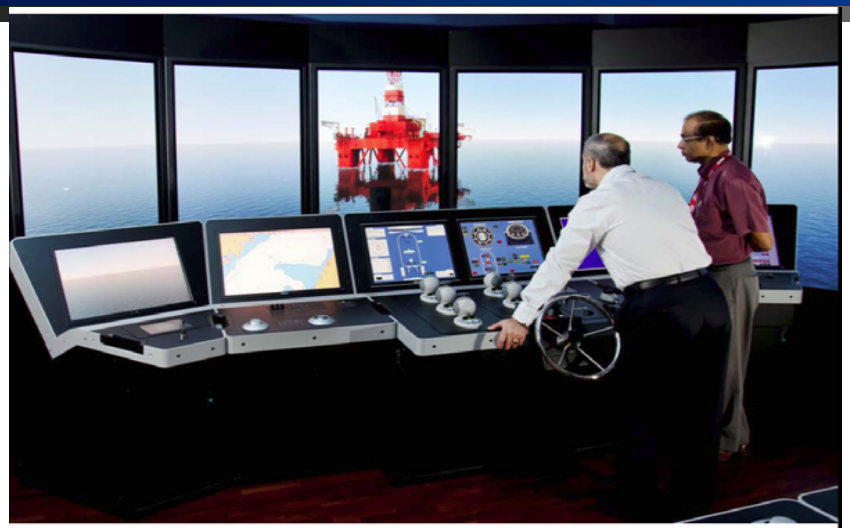
EMAS AMC

EMAS training Academy & Simulation Centre

- Anchor Handling training with DP- Winch – Weather – Incident simulations

EMAS training Academy & Simulation Centre

- Basic Ship Handling, Voyage Management and Engine Room simulations



EMAS AMC

Thank You!

Disclaimer: This material includes forward-looking statements prepared by Ezra Holdings Limited ("Company"). The opinions, forecasts, projections or other statements other than statements of historical fact, including, without limitation, estimates of proved reserves of oil and gas, reserves potential and plans and objectives of management of the Company for financing, are forward-looking statements. Although the Company believes that the expectations reflected in such forward-looking statements are reasonable, it can give no assurance that such expectations will prove to have been correct. All forward looking-statements contained in this presentation are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Each forward looking statement speaks only as of the date of this presentation. Neither the Company nor any of its subsidiaries and associates undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this presentation.

EMAS AMC