

A Proposal to the Specifications of DPS for a Training Ship

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요 약 : 최근 DPO (Dynamic Positioning Operator) 자격증을 취득하고자 하는 해기사가 급증하고 있다. 그러나 우리나라에는 취득과정에 필수적인 승선실습을 제공할 수 있는 선박이 거의 없기 때문에 취득까지 많은 시간과 노력을 필요로 하게 되며, 때로는 중도에 포기하는 경우도 발생하고 있다. 이러한 어려움을 완화하고 보다 더 많은 해기사가 DP 선박에 진출할 수 있도록 하기 위하여 DPS (Dynamic Positioning System)를 설치한 실습선이 적극 검토되고 있다. 이러한 요구에 발맞추어 이 논문에서는 실습선에 탑재할 DPS의 요건에 대하여 제안한다.

핵심용어 : DPS, DPO, STCW, Training Ship, NI, DP Class

연구의 배경

- ▶ 심해 유전 및 가스전 개발
 - ▶ DPS 선박 및 해양플랜트 증가
 - ▶ DPO 수요 증가
- ▶ DPO 관련 국제규정의 변화
 - ▶ STCW 2010 (Manila Amendment)
 - ▶ The Nautical Institute DPO 관련규정 변화
- ▶ 우리나라의 현황
 - ▶ DPO 교육훈련센터 부재
 - ▶ DPS 탑재 선박이 희소
- ▶ DPS를 탑재한 실습선 도입 필요

Dynamic Positioning System

- ▶ Thruster system means all components and systems necessary to supply the DP-system with thrust force and direction.
 - ▶ thrusters with drive units and necessary auxiliary systems
 - ▶ main propellers and rudders (if under the control of the DP-system)
 - ▶ thruster control electronics
 - ▶ manual thruster controls
 - ▶ associated cabling and cable routing
- ▶ DP-control system means all control components and systems, hardware and software necessary to dynamically position the vessel.
 - ▶ computer system/joystick system
 - ▶ sensor system
 - ▶ display system (operator panels)
 - ▶ position reference system
 - ▶ associated cabling and cable routing

Dynamic Positioning System

- ▶ IMO MSC Circ. 645
 - ▶ 1.3.1. Dynamically positioned vessel (DP-vessel) means a unit or a vessel which automatically maintains its position (fixed location or predetermined track) exclusively by means of thruster force.
 - ▶ 1.3.2. Dynamic positioning system (DP-system) means the complete installation necessary for dynamically positioning a vessel comprising the following sub-systems:
 - ▶ .1. power system,
 - ▶ .2. thruster system, and
 - ▶ .3. DP-control system.
 - ▶ 1.3.3. Position keeping means maintaining a desired position with the normal excursions of the control system and the environmental conditions.

Equipment Classes

- ▶ DP 1, loss of position may occur in the event of a single fault.
- ▶ DP 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 where adequate protection from damage is demonstrated, and reliability is to the satisfaction of the Administration. 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.
- ▶ For equipment class 3, a single failure includes:
 - ▶ Items listed above for class 2, and any normally static component is assumed to fail.
 - ▶ All components in any one watertight compartment, from fire or flooding.
 - ▶ All components in any one fire sub-division, from fire or flooding.

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Equipment Classes

DP Class Notation

IMO equipment class	BV	DNV	ABS	GL	LR	NK	RINA	RS	BS	CCS	NMD	KR
Remote Station	Deck Remote Station	Assurance Rating of Station	Communication Method	Heath Register of Station	Remote Key Facility	Register Station Name	Assurance Rating of Station	Index Register of Station	Class Classification	Redundant Station Arrangement	Register of Station Name	
DYNAPOS SMT	DYNAPOS AJTS	DPS-0	DPS-0		EP (CP)		DYNAPOS SMT				DPS-0	
Class 1	DYNAPOS AMAT DYNAPOS AJT	DPS-1	DPS-1	DP-1	EP (AM)	Class A DP	DYNAPOS AMAT DYNAPOS AJT	DP-1	DP-1		DPS-1	DPS (1)
Class 2	DYNAPOS AMAT B DYNAPOS AJTB	DPS-2	DPS-2	DP-2	EP (AA)	Class B DP	DYNAPOS AMAT B DYNAPOS AJTB	DP-2	DP-2		DPS-2	DPS (2)
Class 3	DYNAPOS AMAT BS DYNAPOS AJTBS	DPS-3	DPS-3	DP-3	EP (AAA)	Class C DP	DYNAPOS AMAT BS DYNAPOS AJTBS	DP-3	DP-3		DPS-3	DPS (3)

Position Reference Systems

- Position reference systems should be selected with due consideration to operational requirements, both with regard to restrictions caused by the manner of deployment and expected performance in working situation.
- For equipment classes 2 and 3, at least three position reference systems should be installed and simultaneously available to the DP-control system during operation.
- When two or more position reference systems are required, they should not all be of the same type, but based on different principles and suitable for the operating conditions.

DPS 탑재 실습선 도입의 배경과 필요성

- DPO 지망 재학생 및 해기사 급증**
 - DP 선박 증가 – 수요 증가
 - 국가 정책으로서 대대적인 홍보
 - 해양플랜트 관련 교육훈련 (국가주도, 무료)
 - 상선보다 좋은 조건이라는 기대
- 실습선 도입의 의의**
 - DPO 양성
 - DPS 국산화
 - 유사시 실습선의 안전확보 – 주기관 손상시 감항성을 확보 할 수 있는 최소한의 추진력 확보

Position Reference Systems

- Satellite-based systems**
 - GPS, Differential GPS
 - DARPS (Differential, Absolute and Relative Positioning System)
- Acoustics (HPR: Hydroacoustic Position Reference)**
 - USBL, SBL, LBL
 - HiPAP (High Precision Acoustic Positioning)
- Taut Wire**
- Laser-based systems**
 - Fanbeam, CyScan
- Radar-based systems**
 - Artemis, RADIUS, RadaScan

Vessel Sensors

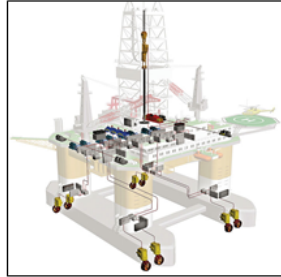
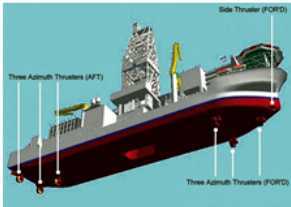
- Vessel sensors should at least measure vessel heading, vessel motions, and wind speed and directions.
- Vessel Heading**
 - Mechanical or optical gyro compasses
 - At least 3 - fully dependent on correct signals from sensors
- Vessel Motion**
 - Motion Reference Units
 - Vertical Reference Units
- Wind Speed and Directions – wind sensor**
- Draft sensors, if needed**

Adequate PRSs for a Training Ship

- DGPS**
 - Basic position reference system
 - Two DGPSs are preferable for redundancy
- HPR**
 - Used for most of offshore plant related works
 - Transducers shall be hull-mounted
- Laser based system – CyScan**
 - Relatively simple and high precision system
 - Can be used when alongside

Thruster System

- ▶ All Azimuth Thrusters or Azipods
- ▶ For Large Drill ships or Drilling Rigs



Thruster System

- ▶ Main Engines (1 engines with 1 FPP)
- ▶ Bow thrusters X 2 (tunnel thrusters)
- ▶ Stern thrusters X 2 (azimuth thrusters or azipods, retractable)

Thruster System

- ▶ Azimuth Thrusters or Azipods for stern (afterward) and Tunnel Thrusters for bow (forward)



결론

- ▶ DPS 탑재 실습선 도입의 의의
 - ▶ 효율적이고 전략적인 DPO 양성
 - ▶ DPS 장비 국산화에 일조
 - ▶ 선박의 안전성 및 감항능력 대폭 향상
- ▶ 실습선 탑재 DPS 구성요소
 - ▶ Vessel Sensors:
 - ▶ 3 Gyro compasses + 2 MRUs (VRUs) + 2 Wind sensors
 - ▶ Position Reference Systems:
 - ▶ 2 DGPs + HPR + CyScan
 - ▶ Thrusters
 - ▶ 1 main propulsion engine with FPP + 2 bow thrusters (tunnel) + 2 stern thrusters (retractable azimuth thrusters or azipods)

Thruster System

- ▶ Main Engines (2 engines with 2 CPP), 2 bow thrusters and 1 stern thruster (optional)
- ▶ OSV

