Dynamic positioning (DP)

Operation planning and watchkeeping

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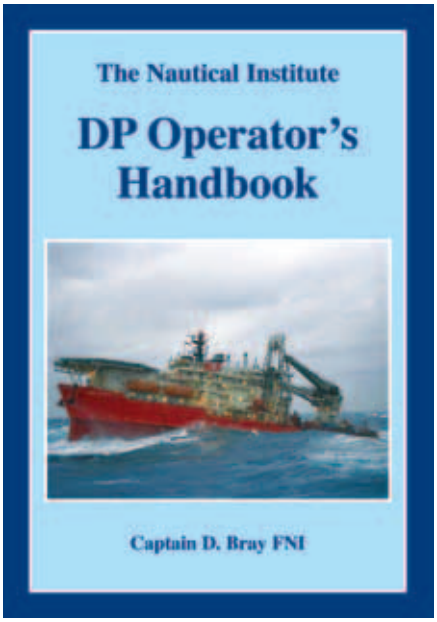
This feature is an extract from the newly published *DP Operator's Handbook*. It aims to provide a summary of good operational practices, which have been assimilated over many years by the author who ran the simulator training unit at Lowestoft College. The *Handbook* will be particularly valuable to operators appointed to a new role. It is a refresher and it will also provide a useful reference when faced with unexpected operational problems. The book is available from The Nautical Institute price £20.00 Members £14.00: see brochure enclosed

The success of any DP-related operation is totally dependent upon the quality of the planning. The plans must be discussed with the client, who must be in agreement with every aspect of the plan. The planning must include the intended sequence of events, with effective contingency plans covering every aspect of the operation. Every stage of the operation should allow at least one escape route possible with the vessel in a degraded status. Planning must cover the worksite approach and set-up, together with any subsequent manoeuvres, and the eventual exit from the worksite.



Preparation of operational plans

Frequently, the vessel is simply providing a working platform from which the client can conduct his operation. The vessel may be relatively static on location, or may be engaged in simple or complex manoeuvres. The actual planning may be done on paper charts or worksite diagrams of the area provided by the client, or may be done using computerised navigation screen facilities. Whatever medium is in use, it is essential to check that the data is up-to-date and comprehensive.

When preparing operational plans, the bridge and DPO team must keep in mind a variety of factors, all of which may affect the viability of the plans. Some of these factors are detailed:

- Environmental conditions expected in the area. Weather conditions expected. Are any phases of the operation weather-limited? Quality of weather forecast data available. Currents and tidal stream. Will the vessel be current-limited? Will any aspect of the operation be current-limited? Is the vessel able to react to changes in weather or current status? Are there any water depth and draft constraints?
- What fixed and mobile hazards may be expected in and around the worksite? Are there any restrictions to manoeuvre or placement of sea-floor hardware imposed by the field operator? Are there any factors which might restrict vessel manoeuvrability or escape routes? Will the vessel be heading-constrained during the operation?
- Does the vessel have any limitations in respect of power availability or thrust provision? Will there be any external or other forces which might degrade the vessel's positioning ability?
- What equipment class is required for the operation? What is the probability of the vessel becoming unable to comply with the equipment class? Are there any problem areas in the vessels redundancy?
- Is there an adequate provision of position-reference? Are there any factors which might result in position-reference systems to become unavailable? Are there any additional position-reference systems on hand to cover unexpected failures?

The planning will include the provision of work permits, and compliance with the requirements of the client's safety case. Before any operation commences, the client will require the completion of vessel DP trials. The machinery configuration will also be decided upon in view of the agreed equipment class, and manning agreed. Availability of additional generators or power units must be clarified together with the notice periods of available units.

Contingency planning and escape routes

A basic principle of DP operations is that the DPO never takes a vessel into a situation from which she cannot be extricated under degraded status. 'Degraded status' means subsequent to worst case switchboard failure, often the loss of half the power and thrust capability. More practically, a DPO should never take a vessel into a location until he has planned his exit.

Contingency planning means answering questions beginning with the words 'what if….?'. During the approach stage of any operation, the contingency plan will simply be the least-power escape route to a drift-clear location. The DPO must always be aware of the areas within the worksite that are 'drift-on' or 'blow-on' zones in relation to any fixed hazard (platform structure). These are particularly hazardous areas and their location is continually changing as wind and current conditions change.

Once on the working position and set-up on DP, the DPO should re-affirm his escape route. If the vessel is close alongside a platform, the most obvious escape route may not be the best. Moving the vessel ahead or astern is always preferable to a sideways manoeuvre. Moving sideways always uses more power and thrust for lower velocity and

acceleration. It may be that the escape is being made under limited power availability conditions. Under these conditions the DPO should always anticipate a total blackout, thus the vessel must be placed into a 'drift-clear' situation as quickly as possible.

The escape route must be maintained clear at all times. If a supply boat parks across the escape route, the situation must be re-assessed. The DPO must have a good view of the escape route direction. If the DP system is located on the aft-bridge of the vessel, facing aft (as is the case in many offshore support vessels) the escape route should ideally be an astern movement. In any situation, the escape route should not be directly against the environment. If that was the case, and the vessel suffered full blackout during an escape manoeuvre, she would just blow straight back into the danger area!

The initial DP set-up

It is assumed that the vessel is proceeding out to an oilfield location in order to commence work close by fixed platform installations. These notes are a general guide to procedure, not intended to be a detailed set of instructions for any particular operation. The first steps generally consist of the transfer of vessel control from conventional navigation to DP control, usually outside of the field 500 m exclusion zone. Prior to this point, contact will have been made with the installation and ETA and other relevant information exchanged. Work permit and notice of readiness will be dealt with.

With the vessel outside the 500 m zone, control functions will be transferred to the DP system. This may entail a change of control location (eg main bridge to aft bridge); a checklist will ensure that all systems are correctly set up and enabled at the new location. It is essential that the propeller and thrusters' controls are tested and proved functioning at the new location. The DP system may need to be re-booted or re-loaded prior to operation. The MCR (machinery control room) will be informed of the status of the operation. All communication systems must be checked and tested at the DP location. Position-reference systems must be confirmed available, including any back-up references allowed for in the planning. Frequently, the first position-reference to be used will be DGPS, so this will be checked and confirmed operational. When all is ready and checks complete, control may be transferred to the DP system. This usually involves turning a 'transfer switch' on the thruster panel, selecting control input to DP instead of from the manual thruster controls. On the DP system thrusters can be enabled, and the system selected into joystick or manual mode. The DPO must now reaffirm that all propellers and thrusters are responding correctly to the joystick movements – once again proving the thrusters. With the first position-reference enabled and accepted into the DP, the DPO can transfer control of the vessel to full DP. This would be the time to complete the pre-DP checklist.

If the vessel is at the beginning of a charter, the client will require a programme of DP trials to be completed, in which all DP functions, facilities and peripheral equipment is tried and tested. On satisfactory completion of such trials, assuming no system deficiencies reported, the vessel is ready to commence the operation. Permission to enter the 500 m zone will be obtained and logged. The vessel can now commence the approach to the worksite.

The approach to the worksite

It may be more convenient to conduct the earlier stages of the worksite approach in manual (joystick) or partial manual control. The vessel may be navigated using the joystick control to a location perhaps 200 m away from her final working position. At this point she can be placed back into full automatic DP control with the vessel on the heading to be assumed for the first stage of the operation. A second position-reference system may be set up and enabled at this point. This position is a good location from which to make a number of checks. The DPO will monitor the vessel's position and heading keeping ability; is she maintaining position and heading comfortably, or (in marginal weather conditions) is she struggling? Are thruster and power levels within limits, or are they occasionally or frequently red-lining? The master and DPO will make the decision to continue the operation or abort at this point. If there is a need to abort, the client must be fully appraised as to the decision and the reasons.

Assuming that the decision is to continue the approach, contact can be made with the platform giving a revised ETA for the commencement of the operation. The vessel can now be moved towards the intended working position in steps of, initially 20 metres, reducing to 10 then 5 m as the final position approaches. The speed selected for each move will be progressively reduced as the vessel gets closer in. With the vessel moving in from 200 m distance, a speed of 0.5 – 1.0 knots may be appropriate, but when she is within 50 m of the final position speed should be reduced to 0.3 or 0.2 knots. This is especially relevant if the working position is close in to a fixed structure. When within 50 m to 100 m of the working position, the third position-reference (Class 2 and 3 operation requires three independent) will be deployed and enabled; this may be an acoustic system, a short range microwave or laser system, or a taut wire reference. With three position references enabled and accepted into the DP system, the final moves can be made to the working position.

Once into the final working position, the vessel should be allowed to 'settle' to this position for a minimum of 30 minutes. The main need for this period is to allow the system mathematical model to build to its optimum state, but the time is also useful for a variety of practical items. Again, the master and DPO should ensure that the vessel is maintaining position and heading comfortably, with no undue excursions. Again, power and thruster outputs should remain continuously at acceptable levels with due regard to the redundancy requirements. Escape routes should be reaffirmed. All onboard and external communications should be checked. Appropriate warnings will be passed on board regarding the vessel status, with revised indications of the time of commencement of operations. Similar information will be communicated to the platform staff. Pre-operational checklists will be completed and signed by the appropriate staff. If the operation is to be conducted under 'traffic-lights' (green, amber and red warning and alarm lamps), these must be tested at all operational locations. All personnel must be familiar with the correct and required response to amber and red lights.

Watchkeeping and communications

These notes are written to cover general DP operations. All operations are different and the vessels themselves differ greatly in type, configuration and capability. Some tasks require the vessel to maintain a static or relatively static position for days or even months on end (drill ships, flotels). Other vessels will be continually manoeuvring in order to support their tasks. The nature of the tasks differs widely and the operation must be planned around the requirements of the client. A

number of different types of operation are described in various modules of this handbook, but some general watch keeping procedures are included here.

The bridge team must be aware of the significant change in status once the go-ahead or green light is given for the operation to commence. Irrespective of the type of operation, prior to this moment the emergency contingency plan is one of safe escape from the location and its hazards. Once, however, the 'green light' is given, the contingency plan must allow for the vessel to maintain position and heading under all circumstances, until the task is aborted.

Some non-redundant DP-capable vessels may have a single-manned bridge when on DP, but the majority of DP operations are carried out with two operators manning the bridge. It is necessary that the DPO mans the DP desk exclusively, while the other watch keeper carries out all other bridge functions, and that these two individuals ideally swap roles hour about. Also, the watch relief arrangement should allow staggered watch changeover such that there are never two fresh DPOs taking over at the same time. Taking over the watch, the DPOs must familiarise themselves with many aspects of the management of the vessel at that time. The list of information that the bridge team must acquire at this time include (but is not limited to) the following:

- Position and heading of the vessel;
- Status and recent performance of the DP system and its peripherals;
- Details of PRS (position reference systems) in use and their performance;
- Availability of further PRS on failure of the above;
- Level of redundancy;
- Status of the operation in hand. Planned changes/progress for the coming watch;
- Details and status of any operational elements (eg if the vessel is a dive support vessel and diving operations are underway, then the status, position, depth of the diving bell or basket, the number of divers in the water, their umbilical lengths and expected return times, also detail of their operational task);
- Weather conditions and forecasts;
- Communications, on-board and external;
- Traffic in the area. Any planned traffic movements that may affect the vessel and her operation or positioning;
- Any planned helicopter operations.

The above is just an outline, of course. The specifics of any watch handover will include far more.

One of the items mentioned above is communications, which is a vitally important topic to consider. In a typical offshore support vessel, there may be a small number of marine crew providing a working platform for a much larger number of clients and their contractors. It is essential that the bridge team are totally appraised as to the progress of the operation, and any changes to the agreed plan are discussed and promulgated. This is the task of the 'client's rep' who liaises with the ship's staff.

Physical communication lines must all be working and regularly tested, whether they be simple telephone lines, open talk-back systems, or onboard UHF or VHF radio. With on-board radio systems, procedures must be followed to ensure no ambiguous reception of orders, or mis-interpretation of report-back. With in-field and external communications, all VHF stations in the area must be listed with name, calling and working channels, and call-signs. This listing must be posted on the bridge for quick reference, and must be amended as vessels enter and leave the area.