NDS 101

HANDBOOK ON NAVIGATION

SECOND EDITION

2019

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A WORD OF CAUTION

This book has been prepared with an intent to collate the experiences of practicing Navigators and disseminate them to the wider naval community. While the book draws guidelines and inputs from BRs, Posts from FOST etc; it does does not intend to replace or supersede them in any way. Readers are advised to read the book in conjunction with associated BRs. In any matters of conflict, the BRs promulgated by IN would take precedence over the contents of this book.

Any suggestions for alterations in this book arising from inaccuracies or any other causes should be forwarded to the Officer-in-Charge, Navigation and Direction School, Kochi

FOREWORD

1. The first edition of ‘Handbook on Navigation’ (HON) was published by ND School in year 2010 as a need was felt for a ND school publication, which would ‘go beyond what is contained in the Admiralty manuals of Navigation’. It was aimed at overcoming gaps in understanding and practice, and for ‘encapsulating the experiences, knowledge and best practices developed in the *IN’*. The handbook was accordingly designed to provide a set of aide-memoire for the planning and conduct of navigation, based on the experiences, observations and recommendations of seasoned navigators.

2. The first edition has been used extensively by COs and practising navigators, both specialist as well as non-specialist. With almost a decade having passed since the publishing of the first edition, a need was felt to revisit the contents of the handbook and add more value to it, particularly in light of the changes in equipment, bridge organisation and pilotage procedures brought about by the increasing advent of technolgy into navigational processes. The significant revisions in the BR 45 volumes by the RN and the need to clear a few proverbial ‘cobwebs’ in the minds of the young navigators have also been key drivers for this revised edition.

3. The Second edition of the Handbook on Navigation retains the same rationale and ethos as envisaged in the publication of the original version. All chapters have been updated to incorporate the latest changes and a few new topics have been added. Some of the key changes/ topics which have been included in existing chapters are as follows:-

(a) Promulgation of new Indian Chart Folios and authorization of holding of Admiralty charts onboard ships.
(b) Updation of details of Mumbai, Karwar, Goa, Kochi, Chennai, Vizag and Portblair harbours.
(c) ENC installation and checking of updation in ECDIS NS 4000.

(d) Incorporation of ECDIS report in the reporting sequence.
(e) Updated Format of NO's Notebook.
(f) Practical usage of Radian rule and execution of manoeuvres.
(g) Man Overboard procedures.
(h) Alternate method for calculation of Foxtrot Corpen.
(j) Towing of Submarines.

4. Following new chapters have been added:-

(a) Shiphandling aspects of submarines.
(b) Use of Tugs in shiphandling.
(c) Preparation of pilotage claims.
(d) HATs/SATs procedures.
(e) Beaching Operations.
(f) Preparations for WEFDEP/EFDEP.
(g) Ready reckoner on pilotage.

5. Relevant references on various topics have been included in the footnotes. The primary resources for reference used in the Handbook are as follows:-

(a) Regulations for the Indian Navy Part I.
(b) BR 45 (1) (1) & (2) [ed. 2008]–The Principles of Navigation.
(c) BR 45 (3) [ed May 2011]–Navigation Systems, Equipment and Instruments.
(d) BR 45 (4) [ed Dec 2008]–Conduct of Ships at Sea.
(e) BR 45 (6) (1) [ed Mar 2002]–Ship Handling.
(f) BR 45 (7) [ed May 1999]–Publication and Paper Chart Upkeep Procedures.
(g) BR 45 (8) (1) [ed Dec 2006]–ECDIS Generic Principles and Procedures.
(h) BR 45 (8) (2) [ed Dec 2006] – ECDIS Navigation and ECS use.
(j) BR 45 (9) [ed Dec 2008] – Operational Navigational Techniques.

(k) Naval Ship Handling, fourth ed, by Capt RS Crenshaw, Navy Institute Press 1975.

6. This handbook is not intended as a standalone guide on Navigation, and does not in any way replace the tenets laid down in the Navigational BRs in force. Rather, it is to be read in conjunction with, and as a supplement to, the navigational BRs and publications. I hope that this handbook would provide a useful 'aide memoire' for all Bridge Teams.

7. I would like to acknowledge the efforts of the core team and the various contributors towards preparation and vetting of this edition. I would like to make a special mention of the original architect of the first edition of the handbook and the force behing nudging us to come out with this revised edition, Rear Admiral Sanjay J Singh, NM. I do hope the efforts of the School in bringing out this second edition would, in some measure, contribute towards enhanced standards of navigation and bridgemanship in the Navy.

Randhawa

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Date: 01 Nov 19

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SECTION I

THE NAVIGATING OFFICER AND BRIDGE ORGANISATION

CHAPTER 1

DUTIES AND RESPONSIBILITIES OF THE NAVIGATING OFFICER

1. **Authority**. Duties of the Navigating Officer (NO) are enumerated in the Regs Navy, Part I, Chapter 13 Art 1355 and BR 45 (4) (2016). Any executive officer can be called upon to perform navigating and pilotage duties onboard Indian Naval Ships, in case of non-specialist billets or absence of the Navigating Officer from a ship. The specialist/non-specialist officer called upon to carry out these duties shall participate in watchkeeping, divisional and general ship duties, but this is not to interfere with his special navigating duties and shall be arranged at the discretion of the Captain. A Commander, when borne for navigating duties will not be appointed as the Executive officer of the ship. The NO should be thoroughly acquainted with all relevant regulations, instructions, orders and references related to navigation. A list of frequently referred ones is placed at Appendix A.

2. **Charter of Duties**. The Navigating Officer has a charter of primary duties that inter alia include:-

(a) **Navigation**[1]. The NO has conduct of navigation of the ship and can have 'Charge' of the ship, under the direction of the Captain[2]. This is not only in pilotage waters but also in open oceans (Regs IN, Part I, Chapter XIII and Art 1302). He is to be guided by and comply with the instructions given in relevant BR 45 volumes, Admiralty Manuals of Navigation, which are in force for the Indian Navy.

(b) **Professional Advice**. The NO is to point out to the Captain every possible danger in or near the ship's

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[1] Art 1913, BR 45 Volume 1 ed 2008.

[2] Art 1312 (u) p 13-16, BR 45 (1) (Part II) ed 2008.

course or area of operations, and the ways to avoid it. (Regs IN, Part I, Chapter XI/I, Art 1302).

(c) **Advice to OOW**. If the danger is imminent, the NO should report it to the Officer of the Watch (OOW) with a view to immediate action (Regs IN, Part I, Chapter XIII, Art 1302). The charge of the ship remains with the OOW and the NO cannot take over the charge, without specific orders (verbal/ written) from the Captain.

(d) **Safety of Ship**. Whenever the ship is approaching land or shoals, or is navigating in pilotage waters, the Navigating Officer shall keep a careful lookout[3] and ascertain the ship's position frequently by employing the navigational aids at his disposal to their best advantage. He shall bear in mind the safety of the ship at all times, including the shipping and traffic situation, and the ship's manoeuvring characteristics and advice the Captain accordingly. While doing so, all available navigational aids at his disposal should be used, including visual, Echo sounder, Radar, Log, ECDIS, GPS/DGPS, ARPA/AIO, AIS, VTMS, MMB, etc. (Regs IN, Part I, Chapter XIII, Art 1302 and 1327).

(e) **Relations with Pilot**[4]. Even when the ship's movement is being undertaken by a pilot, he shall pay due attention. If he considers that the ship will run into danger, or doubts the very competence of the pilot, he must bring it to the Captain's notice immediately (Regs IN, Part I, Chapter XIII, Art 1303).

(f) **Dead Reckoning (DR)**. He should ensure that the entire passage is available on all concerned charts. He should study the largest scale chart available for the given area, to check for dangers enroute. The entire passage should be marked for DR as per the plan approved by the

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[3] Rule 5 IRPCS

[4] Article 1359, Regulations for the Navy Part I.

Captain. Any subsequent changes in the plan should be similarly approved by the Captain and amended plan marked on the relevant charts.

(g) **Work Book and Note Book**. The NO shall keep, in the work book provided for that purpose, the results of all observations and calculations connected in any way with the navigation of the ship. He shall also record in the note book supplied, all angles, bearings, and other information connected with navigation. These books will be examined by the Captain whenever he may think fit to call for them (Regs IN, Part I, Chapter XIII, Art 1305).

(h) **Reports of Lights**. On sighting a light, the NO shall compare it with the Admiralty List of Lights, or the latest official information on the subject, and if it should not agree with the description there given of it, or if the light be inefficient, he shall make a report thereof (Regs IN, Part I, Chapter XIII, Art 1306).

(j) **Ship's Manoeuvring Performance**. The handling and steering qualities of a ship including response to engines may vary as per prevailing conditions. It is imperative for a NO to be fully aware of these, including necessary precautions and corrections in a given situation. For this purpose, he should maintain a meticulous record of turning data, acceleration/ deceleration rate, sea keeping qualities, etc, under all conditions of wind and sea in the Navigation Data Book (NDB). The NDB is to contain the information indicated in BR 45 (1) Admiralty Manual of Navigation Volume I, and as further amplified in this handbook. The NDB is to be produced at inspections and transferred to successive navigating officers. On paying off, it is to be handed over to the Officer-in-Charge, Naval Chart Depot, Mumbai for custody (Regs IN, Part I, Chapter XIII, Art 1307).

(k) **Ship's Log**. The NO is the custodian of the Ship's Log (Form IN 472) and shall present it weekly for the

Captain's inspection. He shall take care that it is correctly and neatly written up and that all the required entries have been made. He shall ensure that it is initialled by the Officers of the Watch while the facts are fresh in their memories. After it has been signed by the Officer of the Watch, he shall allow no alteration to be made, however trifling, without the concurrence of the Officer of the Watch concerned and the approval of the Captain. Alterations so authorised shall be initialled by the Officer of the Watch concerned. He shall be particular that all entries required by the established form of the log are correctly inserted in the Ship's Log (Regs IN, Part I, Art 1308 and instructions for filling Ship's Log contained in form IN 472). At the end of each calendar month, the NO shall deliver to the Captain the completed Ship's Log, signed by him. If the NO is superseded, he shall sign the Ship's Log then in his possession and deliver it to his successor.

(l) **Gyro Compass Equipment**. The NO is responsible for the correct use of the gyro-compass equipment and shall give the Electrical Officer due notice when the compass will be required for use, and inform him of all settings. The Electrical Officer shall have the gyro-compass equipment, with the exception of the ship's repeaters and associated Azimuth circles, on his charge and is responsible for running and maintaining the compass, for lining up the repeaters, and for making the settings in accordance with the NO's instructions. In ships where no Electrical Officer is borne, the technical responsibility is to be assumed by the senior Electrical Branch sailor. In such instances, the Captain shall select an officer in whose charge the gyro-compass equipment is to be placed. The Navigating Officer is to ensure that all the repeaters are aligned correctly, the gyro error[5] is known at the earliest and all gyro sights are calibrated (Regs IN, Part I, Chapter XIII, Art 1309).

[5] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

(m) **<u>Magnetic Compass Equipment</u>**. The NO is responsible for the adjustment of magnetic compasses and of compass corrector coils. The Captain, NO, and the other executive officers of the ship shall keep a constant watch over the errors of the gyro-compasses and the deviations of the magnetic compasses. The NO is responsible for the proper stowage of spare magnetic compasses and gear. He will also have charge of the keys of binnacles (Regs IN, Part I, Chapter XIII, Art 1310). He is to ensure that the magnetic compass is swung periodically and that the deviation card is updated. Every given opportunity should be utilised to carry out a check swing. In case of refit/ structural changes near the magnetic compass, the full compass swing should be undertaken.

(n) **<u>Charts and Navigational Publications</u>**. The NO shall have charge of the charts, maps, navigational books and publications. He shall observe strictly the instructions contained in the Hydrographic Supplies Handbook (Hydrographic Publication H 51). When a Notice to Mariners or Navarea Warning is received on board, he shall at once cause the particulars to be inserted on all charts affected and in other navigational publications, in accordance with the above handbook[6]. Record of all Hydrographic supplies received on board and of corrections carried out shall be maintained in the Register of Hydrographical Supplies (Form IN 83) and Navarea Warning folder/ Register. He shall note carefully any inaccuracies in the charts supplied to the ship, so that the requisite alterations may be made. If the inaccuracies he may have detected in the charts are of navigational importance, he shall report them immediately to the Captain in order that they may be transmitted to the Chief Hydrographer at the earliest opportunity on form H-102. On supersession, he is to hand over the Charts and Publication to his successor iaw NO *06/2003. For Electronic Navigation Charts (ENCs), the NO is similarly

[6] INBR 1916 (Notes on Correction of Charts, Publications and ECDIS).

responsible for undertaking timely corrections on the ECDIS ENC data-base, and maintaining a record of the same (notwithstanding, this record being available in the system). ENC corrections are to be made as per those received from NHO / NCD or downloaded from NHO website, and Navarea warning received.

(p) **Time Check**[7]. The NO should ensure synchronisation of clocks between Bridge, Ops Room and MCR prior to sailing (preferably during Sea and Action). He should also check that these clocks are being regularly synchronised at sea, at the beginning of each watch and as soon as practicable after any unusual occurrence (Regs IN, Part I, Chapter XIII, Art 0315 and 1026). Additionaly the Officer taking over watch is required to give a time check on Con, particularly to synchronise the Bridge and Engine Room/ MCR watches, and to enable all watch keepers to synchronise watches at their respective posts (Regs IN, Part I, Chapter X Art 1026). A time check, apart from being given routinely twice a day at sea, is also to be given on all occasions when SSD[8] is closed up. The current practice is to synchronise all watches with GPS time. It is recommended that DMR/ DAT recorder is switched on prior giving a time check before any evolution viz. SSD for LH/ EH, UNREP, FLYEX etc. Further during flying stations, errors of video camera vis a vis GPS time should be noted down (if not already synchronised/ corrected).

(q) **Navigational Instruments**. The NO is to obtain, from the Logistics Officer, instruments and stores allowed for navigation of the ship, as laid down in the Establishment of Naval Stores. He is responsible for their custody. When a ship is ordered for refit, he shall see that the compass and gear retained on board are in a serviceable condition for the ship's immediate use on completion of refit. On supersession, he shall obtain a

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[7] Art 0315 p44 of INBR 2 (Regs Navy part 1).

[8] Art 1912(g) p 19-7, BR 45(1)(2) ed 2008.

receipt from the officer in whose charge the instruments are placed. All Navigational instruments should be calibrated as per schedule and the certificate obtained, from NCD should be kept onboard (Regs IN, Part I, Chapter XIII, Art 1313). `

(r) **Anchor and Cables**. It is the duty of the NO to ensure that the inner ends of the anchor cables are secured properly (Regs IN, Part I, Chapter XIII, Art 1315). He should personally inspect the same when the ship is in dry dock and cable laid out or removed/ re-joined from the cable locker, and make a notation in the ship's Log and NDB. When the ship is moored, the NO shall see that proper measures are taken to keep the hawse clear. Should the hawse become foul, the NO shall make the necessary representations to the Captain so that it may be cleared as soon as practicable, and shall also cause the Officer of the Watch to be informed. Further, if anchoring in an area which does not have an accurate chart, the NO is responsible to sound around the ship within a radius of atleast three cables to ascertain the fitness of the anchorage (Regs IN, Part I, Chapter XIII, Art 1330).

(s) **Sounding Equipment and Logs**[9]. The NO shall see that the hand lead lines are marked correctly and that they, as well as the sounding machines and logs, are at hand and in good order whenever they may be required. He is also responsible for issuing instructions for 'raising' and 'lowering' the log. Every opportunity should be availed to calibrate the log and echo sounder. The known errors should be marked on the display panels (Regs IN, Part I, Chapter XIII, Art 1316).

(t) **Degaussing**. The NO is responsible for the correct use of the degaussing equipment fitted and shall make himself acquainted with all instructions appertaining to its use. The Electrical Officer is responsible for the

[9] Chapter 4 BR 45 Vol (3) ed 2011.

maintenance of the degaussing equipment (Regs IN, Part I, Chapter XIII, Art 1317).

(u) **Action Information Organisation**. The senior specialist Navigation Direction Officer or the officer carrying out navigating duties, if no specialist Navigation Direction Officer is borne, is responsible for the general conduct of the Action Information Organisation. In Aircraft Carriers and AD Frigates, responsibility for the Action Information Organisation shall lie with the Direction Officer (DEE) provided such an officer is borne, irrespective of the seniority of the Navigating Officer. The DEE is responsible that the surface plotting organisation meets the requirements of the Navigating Officer. The DEE/ NO's duties with respect to AIO include: -

(i) Responsibility for the instruction and training of Radar Plot sailors in the Action Information Organisation.

(ii) The collective training of the Action Information Organisation crew.

(iii) General responsibility, in conjunction with the appropriate technical officers, that the equipment fulfils the function of the organisation and is in good order whenever it is required.

(iv) The use of all Warning Radars, which includes:-

(aa) The operational use of the warning radar equipment.

(ab) Responsibility that this equipment is switched on in good time and ready for instant use and working efficiently, whenever it is required.

(ac) Making the equipment available to the Electrical Officer for maintenance.

(ad) Individual and collective training of RP sailors onboard regarding the use of this equipment.

(v) Efficient distribution and control of traffic on voice waves allocated for use by the Action Information Organisation.

(vi) General responsibility for exchanging plots (including TRIGUN, LINK II, etc.) with other units, based on inputs from active as well as passive sensors, with the aim of enhancing domain awareness.

(vii) **Meteorological Duties**. In a ship in which no qualified Meteorological Officer is borne, meteorological duties shall be undertaken by the NO (Regs IN, Part I, Chapter XIII, Art 1321).

3. **Traditional Duties and Responsibilities**. Apart from duties specified in Regs IN, Part I, Chapter 13, there are many other duties, which include the following:-

(a) **Operations**. Since the NO is responsible for Navigation, AIO and the use of warning radars, he is closely involved with every operation and evolution at sea even where other specialist officers may be conducting the same. This includes seamanship, trials, weapons firings, tactical exercises and operations, which all rely on the conduct of navigation and functioning of the Ops Room. It is for this reason that the NO, on most ships, is additionally appointed Operations Officer by the Captain. The knowledge, skill and inter-operability of the NO and his RP rates lie at the core of a ship's operational performance. The NO must, therefore, develop these aspects in himself and the ND department. He must remain aware of, anticipate and be responsible to, the needs of other specialists/ departments and endeavour to provide the functional support and expertise required for developing a unified, seamless operations team.

(b) **Training**. The NO is responsible for training of junior officers, OOWs and OROs in navigation and AIO. He is also responsible for the training of all RP rates and quartermasters in the performance of their duties. Training is a continuous, ongoing process. The NO should plan for the same, bearing in mind the ship's programme and monitor the progress of personnel in these fields. He should endeavour to provide maximum opportunity for gaining practical experience supported by preparatory instructions/ training and debriefs. This is necessary not only for development of the individual, but also for developing the navigational and operational capacity of the ship.

(c) **Training of OOWs and OROs**. OOWs and OROs form the back bone of a warships' operations and safe conduct. Every opportunity should be given to them to gain experience and confidence in ship handling, engine exploitation, and ops room functioning/ management. Continual training should be in place to make them proficient in their job on the Bridge and Ops Room. It would be a good practice to conduct regular ROR and Aviation (OOW aspects) tests to enhance/ check knowledge of all OOWs/ OROs. Further, officers carrying out duties of ORO should be trained in urgent attack drills viz. chaff firing, ASW rocket firing etc.

(d) **Enhancing Cooperation**. The NO is the key element in enhancing interoperability between various posts. Continual training/ drills should be conducted on every given opportunity for enhancing Bridge-Ops Room-MCR- EW Office-Sonar-GDR-ADR-MSO integration.

(e) **Aviation**. Onboard ships that do not have an integral flight, duties of Aviation Officer are undertaken by a suitable officer, nominated by the Captain. If nominated for the same, the NO would be responsible for:-

(i) Training of the aviation core team and helo deck firefighting team.

(ii) Training of helo controllers and LSO.

(iii) Maintenance of helo deck, hangar and all aviation equipment.

(iv) Conduct of Flight Safety meeting towards enhancing flight safety and awareness of ship's crew.

(v) Training of helo lookouts, crash boat crew and marshallers on small ships.

(vi) Training of OOWs/ OROs and Ops Room team in procedures, safety and exploitation of helo.

(f) **Navigation and AIO Check Lists**. The NO is responsible for making Bridge/ Ops Room check lists for various evolutions, exercises and emergencies. The check list should be vetted at every given opportunity and should be refined based on new inputs/ equipment. While making check lists/ refining them, the concerned specialists should be consulted. All SOPs should be checked for correctness and all amendments should be inserted in good time. In this regard, ***INBR 1938*** attempts to standardise a comprehensive list of check off lists including evolutions, emergencies etc.

(g) **Ops Coordinator**. The NO is usually also the Ops Coordinator. He should maintain an overall view of operational requirements and dovetail evolutions to ensure that all requirements are met. Coordination by the NO with external agencies, like other ships, Fleet Staff, WAU, WATT, INTEG, COMCOS reps, Air station, etc., will be required for the same.

(h) **Enhancing MDA**. The NO is responsible for enhancing the MDA of the ship. Towards this, he has to coordinate with internal agencies (other departments, like communication and electrical) and external agencies to get the most out of available resources. NO/ NO II is also a member of ship's Network Centric Organisation. If better options, in terms of modifications, integration, bridge organisation[10], procedures, etc are available, the same should be studied in detail and brought to the notice of Captain, with the aim of enhancing operational capability of the ship.

Trainee Officers

4. The task of training young officers in navigation and bridgemanship falls upon the NO, as brought out in Para 3(b) above. Orders, regulations, syllabi, etc., are all laid down in adequate detail on the subject. However, the following tips may be considered while training young officers:-

(a) **Time Spent on Bridge/ On Deck**. Time spent on the bridge goes a long way in exposing the young trainee to bridgework. Try to chalk out a strict regime for them with emphasis on bridge time during serials. Similarly, the midshipman has to clear a seamanship board. Therefore, ensure that he gets adequate exposure to all seamanship evolutions on the deck, rather than merely using him for reporting and recording navigational information.

(b) **Conducive Atmosphere**. Try to create an atmosphere that encourages the trainee to participate. The trainee should be encouraged to con the ship and to learn

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[10] Ch 19, BR 45 (1)(2) ed 2008 and Ch 4 BR 45 (4) ed 2008 refers in this regard.

from the mistakes he makes, rather than develop a fear of making a mistake. At the same time, no laxity should be permitted and trainee officers must get into the habit of and be conditioned to maintaining a taut Bridge and Ops Room watch.

(c) **Daily Tasks**. The Navigator may himself be tied down with continuous operations throughout the day. It may, therefore, be useful to give each trainee an Own Time Work (OTW) task for the day. This should be limited to professional tasking, e.g. making a pilotage plan for a particular harbour, solving Rel-Vel problems, solving a pre-prepared question bank, study of allotted subjects, etc.

(d) **Task Books**. These provide a valuable means of inculcating knowledge in the trainee. Insist on a taut time frame for completion of the task books. However, setting too short a deadline may result in mere filling up of pages rather than increase in knowledge.

(e) **Mentoring**. The concept of mentoring has an established role in the Navy, and is also useful for monitoring the trainee's progress. Mentors need to interact with each other and the NO, and provide regular feedback on trainee performance and progress to the EXO and CO. Extant IHQ policy letter TR/0886/ND/P dated 06 Jun 14 mandates sailing requirements should be referred to well in time to plan their sea sorties. The current policy necessitates a mandatory sailing days requirement of 100 days for Officers borne onboard for award of Watchkeeping certificate and SLT Afloat Phase Officers.

CHAPTER 2

TAKING OVER AS NAVIGATING OFFICER

The previous chapter enumerated the main duties and responsibilities of the Navigating Officer. A precursor to effectively carrying out these duties is to take over correctly from one's predecessor. Towards achieving optimum efficiency, it is essential that one be equipped with the knowledge and awareness of the capabilities, limitations and peculiarities of the ship and the department. This chapter aims to provide an *aide memoire* to aid taking over as the Navigating Officer of a ship.

BRIDGE – OPS ROOM – MCR INTEGRATION	
1.	**Officers**
- Meet all HsOD and GO, SCO, ASWO. - How many officers are available for OOW duties? What is their experience level? Are there any specific orders from the Captain in respect of the Bridge watch keeping organisation on board? - Who are the SSD OOW and S/by SSD OOW? How long have they performed the duty? In the base port, at what point does the NO usually take over charge (as OOW) from the SSD OOW as per Captain's instructions? Check Platform Endorsement files/ register (if relevant) and ascertain which officers are cleared/ pending for certification of OOW/ OOD duties. Meet these officers, as soon as feasible. - Who is the Action OOW? Meet the officer, as soon as feasible. - Who are the BSO/ S/by BSO? How long have they been undertaking these duties? Meet these officers, as soon as feasible.	

- Which officers form part of the pilotage organisation [11] onboard and in what capacity? Meet these officers, as soon as feasible. .

- Who are the Sr Engineer / DLO / ALO (NDC)? Specifically, who is the SSD EOOW? How long have they been serving onboard? Meet these officers, as soon as feasible.

- Are any of the officers qualified and current in helicopter control? Meet these officers.

2.	**Trainee Officers**

- How many officers are borne for training? When are they due for WKC (if relevant)?

- How many are qualified helicopter controllers? What is the exposure / experience / capabilities available in this respect? Meet these officers and inspect their log books.

- What is their employment in the pilotage organisation?

- What is the state of their journals / task books / sight form books, etc? Inspect these.

- Is there a CTM existing enumerating their training schedule? Are there any shortfalls in execution of the same?

- Meet the Mentor Officers as per CTM and ascertain status of their Mentee. Meet project guide for SLT Afloat Phase Officers undergoing MSc.

- Where are the IN 707s of the trainee officers? Take personal custody of the same.

[11] Ch 19, BR 45 (1)(2) ed 2008 and Ch 4 BR 45 (4) ed 2008 refers in this regard.

3.	**Sailors**

- What is the manning plan (MP) for the department? Are there deficiencies in the current manpower allocation?

- Who is the ship's PRI? How much time has he spent onboard? Has he been tasked with and kept in-date with helicopter control? Inspect his log book.

- Who is the current Navyeo? Are there any other sailors qualified for the same?

- Who is the CHQM and the stand by CHQNI? How long have they been performing the duty?

- Who is the COT / Dept Chief? What is the divisional/ departmental organisation?

- Who is the MET sailor? Who is carrying out the duties of MET sailor if no qualified MET sailor is borne onboard?

- What is the watch organisation for the department in harbour and at sea? Who are the watch in-charges?

- Which sailors form part of the SSD / Pilotage organisation onboard and in what capacity?

- What is the state of training of sailors, with specific emphasis on radar work / CAIO/ TRIGUN / LINK S / ECDIS / Plots / RT procedures, etc.?

- Who are the best radar watch keepers? Is there a Radar Standing Party?

- Inspect the action pocket books of all RP sailors.

ORGANISATIONAL ISSUES	
4.	**Department**

- Inspect the watch and quarter bill of the department and review Ops Room organisation in various states.

- Meet and speak to all sailors of the department with the outgoing NO. Address them later, after taking over.
- What are the communal duties that the department is tasked with? What is the effect on manpower availability due to the same?

- Inspect the Divisional record book. Is it complete in all respects? Has it been inspected by inspecting authority / Captain /EXO?

- Is the departmental DOP register up to date? Inspect the same.

- What is the leave forecast for the department? State of leave availed?

- Are there any PET failures / obese personnel in the department?

- Are all SDs and CHBs held? Is anyone’s clothing issue overdue?

- Inspect the bring up diary in the Div record book to ascertain if any divisional action is pending e.g. promotion, award of GCB, etc.

- Are there any ACRs due for rendition?

- Are the Bridge, Ops Room and Gangway check lists complete and up to date as per INBR 1938? Peruse the same.

- Are all chart folios complete and up to date? Are all Navigational publications held and up to date? Form a team of 01 Sr and 02 Jr sailors to check the same, if not done by the outgoing

NO within the last month.

- Muster all confidential charts and take custody of keys to the confidential chart locker.

- Is the ships log filled up till date of handing over? (Outgoing NO to sign the log on back inner cover in NOs slot on handing over, with date).

- Read up Captain's, Ship's, ND, Aviation, NBCD, and relevant portions of EO Standing Orders, as soon as possible. Read other department's standing orders. Re-promulgate the ND standing orders with Captain's approval.

- Check if the Navigation Data Book is up to date. Read it, as soon as possible.

- Check details of anchor and cables and record of last inspection of inboard end of anchors. Take over keys to inboard end of cables (if applicable).

- Check state of boats, davits and life rafts under the charge of the ND dept, and date of last survey and load test.

- Check state of stores, life jackets, lifebuoys, books (form a team of dept. Sr. Sailors to muster and report, it not done by outgoing NO within the last month).

- Read relevant sections of the Command and Fleet Standing Orders and Fleet Reference Manuals.

5.	**Part of Ship**

- What is the specific part of ship allocated to the department? Walk around the same. Visit mess decks where inliving RP/ MET/ AVN (if applicable) are staying.

- Which are the compartments that fall under the department's purview? Who are the compartment in-charges? Take rounds of these compartments at an early date.

- What is the status of upkeep and maintenance of portable NBCD fittings in part of ship?

6.	**Bridge Watch Keeping**

- Familiarise yourself thoroughly with the bridge.

- Who is the senior watch keeper?

- What do the Captain's Standing Orders and ND Department Standing Orders say about the subject?

- Do the Captain's Standing Orders, include the directive to call the NO as well, in case of a navigational situation?

- Do the ND department Standing Orders and bridge checklists and include occasions to call the NO?

- Are there any specific directives from the Captain in respect of the watch roster?

7.	**Aviation**

- What are wind envelopes for the ship in respect of helicopters which the ship may embark (day and night)?

- What are the restrictions imposed during helo ops? Specifically, any special procedures, preparation required for various helo ops, e.g. HIFR/ VERTREP, etc.

- Who is the LSO? How long has he been carrying out the duties of LSO?

- Familiarise yourself with the IVCS/ VCS panel. When the GPI was last calibrated? What is the status of CCTV?

8.	**Seamanship**

- What are the layout of bollards, fairleads, cleats, etc. and the associated hawsers normally used?

- Where are the fuelling/ jackstay point, etc. located? Are there any shiphandling implications and any specific measures due to the same?

- Visit the foxle to understand the layout of anchors and cables. Are there any specific limitations imposed during anchoring, e.g. bow domes, etc.? What is the capacity of the capstan (s)?

- Visit the boat deck and understand the procedure for lowering / hoisting boats.

- What are the conditions to be provided, in terms of shiphandling for the evolution? If taking over as boat officer, when were the davits load tested? Where are the load test certificates?

- What is the towing arrangement onboard? What is the ship handling procedure used onboard during this evolution?

- Are there any restrictions imposed by PNM / CNM / Towed array, etc.?

- Is there an aft capstan available? What is its capacity?

EQUIPMENT AND NAVAIDs

9.	**Sea & Action**

- Carry out a sea and action at the earliest, with the outgoing NO, and familiarise yourself with the Bridge, Ops Room and other main ND Compartments layout.

- Check status of calibration/ comparison of NAVAIDs/ MET instrument.

10.	**Nav Radars**

Which are the Nav radars fitted? The following will be germane:-

- Antennae location, with specific reference to consequent blind arcs.

- Master / slave displays and limitations of user controls in slave displays, if any.

- Familiarise yourself with the switching on/off procedure, display controls, and range/ bearing correction controls.

- Are ARPA facilities available?

- Integration / lack there of with AIS[12]?

- Last range and bearing calibration undertaken and the method used for the same. It is essential that you **use the first available opportunity to calibrate the radar yourself**. It should be undertaken at the beginning of every sortie, if feasible.

- Performance of the radar, particularly for helicopter control (SCA, etc.).

- Perusal of the radar performance log would give a good idea of the ranges obtained against contacts of varying sizes.

- What is the performance of the radar during blind pilotage? What are the facilities available that aid blind pilotage?

- Who are the primary maintainers of the radars? A list of these personnel, along with mess deck / telephone / contact details should be available near the bridge (e.g. in the chart house) and in the Ops Room.

[12] Art 0954 (a) – (c) p 9-34, BR 45 (1)(1) ed 2008.

	- Are there any restrictions imposed on the exploitation of Nav radars (for tactical/ technical reasons)? - What has been the MTBF of the radars? A look at the departmental defect book would give a good idea of the same. - Are there any limitations imposed on the radar, in respect of continuous operation? - Are the radars interfaced with other relevant equipment, e.g. CTD, TRIGUN, etc.? - Is any SPTA held in the departments custody?
11.	**Gyro**
	- Which and how many are the gyros fitted? What is the location of the gyro compartment? - Who is the gyro EAP? (meet him) - Check the number of repeaters and their locations. Are there any restrictions imposed by the positioning or lack thereof of repeaters? - What are the average errors observed in the gyros? - What is the settling time in normal and emergency modes? A visit to the gyro compartment is essential. - When was the last overhaul / change of supporting fluid undertaken? When is it due next? - Is there a gyro failure alarm available on the bridge or elsewhere? What are the audio / visual characteristics of the alarm? - Any Gyro battery backup supply? Auto change over arrangement?

- What is the state of gyro sights? Are there any defects existing? Are there any demands in respect of the same pending? - When was lubber's line alignment last undertaken? - Carry out a check Lubber's line alignment during first sea and action.	
12.	**Magnetic Compass**
- Which is the compass fitted? Is the location suitable? - Are there any repeaters for the same? - When was the last swing / check swing carried out? What was the resultant deviation curve? Is the same available in the bridge / ECP, etc.? - Are there any correction rods, etc., available onboard?	
13.	**ECDIS/ ENCs**
- Is the ECDIS set up and functioning correctly? (Carry out functional checks as soon as feasible). - Are the ENCs on ECDIS corrected for the latest NTM? Important Navarea corrections[13]/ marking done? - Check if the GPS, Echo Sounder, Log and Wind indicator feeds are available (if wired)? - Is there a backup power supply arrangement? - Take over all CDs, passwords, toggle numbers, etc.	

[13] INBR 1916 (Notes on Correction of Charts, Publications and ECDIS).

14.	**TRIGUN/ LINK**
- How is the functioning of the Trigun - Link Configuration on board? - Who are the proficient operators and maintainers of the Trigun / Link? - Any record of difficulties/problems in developing transferring plots?	
15.	**GPS**
- How many GPS receivers are available onboard? - Which are the equipment fed by GPS? - What are the facilities available in the receivers, e.g. routeing, tidal data, astro data, selection of datum, electronic chart backdrop, etc? - What was the impact of GPS holiday on sensors?	
16.	**Log**
- Which is the log fitted? Are there any peculiarities of settings? - What is the organisation for lowering and hoisting the log (in case of retractable log rods)? - What is the underwater location of the log rod? Have there been instances of the log rod getting fouled by nets, etc.? - Are there any spare log rods available? Where and with whom? - When the log was last calibrated and what was the error observed? Note down potentiometer readings (wherever applicable) in NDB.	

- Have the errors been validated post calibration? - Have there been any defects in the log? A look at the defect register is essential. - What are the equipment to which log feed is provided? What are the implications of failure of this input at any stage?	
17.	**Echo Sounder**
- Which is the echo sounder fitted? What are the settings/ peculiarities of the system? What are the scales available? - Are there multiple frequencies available for shallow- and deep waters? If yes, then what is the organisation to ensure that the frequencies are selected correctly for pilotage, etc.? - Who is / are the echo sounder reporters during SSD? How much time have they spent on the job? - When the echo sounder was last calibrated? Has any variance been observed subsequently when compared with hand lead line? - What is the underwater location of the echo sounder transducer? Have there been any defects in the system? - Is the echo sounder recorder functional? - Is adequate paper held onboard for the same, if not has a demand been raised?	
18.	**Steering System**
- Read up on the steering system from NDB, Captain's and ND Standing. Orders, and any OEM manuals. - Close up the QMs, visit ASP and familiarize yourself with the steering arrangements, procedure and break down drills.	

- Check crew proficiency and time taken for steering break down drills, including steering from local/ manual and by magnetic.

- Check history of steering gear performance and defects.

19.	**Conning and Communication Arrangements**

- Familiarise yourself with the conning locations and any specific conning procedure on board, especially conning positions for UNREP, Ship handling (cast off/ alongside), TCP/ ECP, etc.

- Familiarise yourself with the internal communication arrangements between Bridge, Ops Room, MCR, DCHQ, Wheel House, ASP, ECP, Bridge op/wings, Captain's Cabin LSO, Gyro Compartment.

- Familarise yourself with the SPT from Bridge to Ops Room, MCR and ASP.

- Familiarise yourself with the external communication arrangements and RCU/ Channel Allocation for TP, CIP, Helo/ aircraft Communication in Bridge and Ops Room.

- Check the status of back up supplies to conning / communication facilities.

20.	**Degaussing System**

- What is the operational state of the degaussing system?

- When was the last calibration / noise measurement / degaussing carried out?

- Who has custody of the reports of the above?

- Who is the maintainer for the system?

- What are the specific settings used?

21.	**Binoculars**
	- How many binoculars and Night vision binoculars are held onboard? - What is the condition of the binoculars, with specific attention to the eye pieces, focus control and ocular distance control? - Are there any demands pending? If yes, since when and has there been any follow up action? - Are specific binoculars earmarked for the Captain, EXO and the NO? Are spare binoculars available for Flag embarkation, etc.? - What is the stowage system followed at sea and in harbour? Is it adequate? - What is the procedure for landing/ surveying damaged/ worn out binoculars?
22.	**Sextant**
	- How many sextants are available? - What is the serviceability of the same? - When were they calibrated, by what method and what were the errors observed? - What is the stowage system for the sextants? Is it adequate? - What is the procedure for repair / servicing / surveying the same? - Are there any demands pending? If yes, since when and has there been any follow up action? “
23.	**Distance Meter/ LRF**
	- How many are held onboard and what type / make?

- What is the state of the eye pieces/ scale, etc.? - Have the ranges been tallied with radar for checking accuracy? Are there any errors? - Are there any demands pending? If yes, since when and has there been any follow up action? - How many LRFs are held onboard? What is the state of calibration?	
24.	**Dictaphone**
- How many Dictaphones are available with the department? - Is the audio file being downloaded and stored in a PC? - Alternately, check if the DAT recorder is working properly and which all intercoms are interfaced with the DAT recorder[14]?	
25.	**Met Instruments**
- What and how many MET instruments are held onboard and what is their operational status? - When the instruments were last calibrated? Where are the certificates of calibration kept?	
26.	**Battenbergs/ Plotting/ Miscellaneous Instruments**
- How many Battenbergs are available onboard and what is their operational Status? - Are separate Battenbergs earmarked for the OOW and NO? - What is the state of plotting/ miscellaneous instruments held onboard? Does the ship hold Station Pointers and Douglas Protractors, etc.?	

[14] Ch 9, WENCO (Ops) ed

- Are any demands pending for any of the above?

27.	**Upper Air Sounding System (UASS)**

- Which is the UASS fitted onboard? What is the authorised quantity of hydrogen gas, cylinders, radio sonde and MET balloons? Status of pending demands if any.

- Status of AMC and details of the OEM.

- Organisation for launch of UASS balloons at sea.

MAIN PROPULSION AND PGD

28.	**Main Engines**

- Familiarise yourself with the characteristics of main propulsion, particularly notice for steam/ motoring, propulsion cycle, functional block sequence, etc.

- Time taken for preparing MEs, limitations on idling time, speed/ shaft rpm constraints for clutching in and changing over between various engine regimes, critical speed/ shaft rpm to be avoided.

- Main emergencies/ breakdowns, associated bridge actions and engine/ speed restrictions, record of recent/past emergencies/ breakdowns.

- Speed Vs. SRPM table, economical speed, economical engine regime, etc.

- POL, AVCAT and water capacities.

- Bridge- (Wheelhouse) - MCR- (TCR) procedures and communication during SSD for E/L harbour, UNREP, Towex and manoeuvres.

- Visit ASP, MCR and local control positions.

- Surge Distance and calculations for various guide and approach speeds, for own normal (50% fuel) and full load displacement (95% fuel). - Fuel consumption data in various engine/ shaft regimes.	
29.	**PGD**
- No. and types of DA's/ GTGs. - Switch board loading procedure. - Electrical load and distribution in Sea and action, SSD and Action stations. - Electrical supplies and backups to gyro, radars and navigation equipments/ aids. - Various PGD interruptions/ breakdowns and effect of the same with responses and procedures.	
SHIP HANDLING AND MACHINERY CHARACTERISTICS	
30.	**Ship Characteristics**
- Read up NDB including details of ships TTD and ship handling experience at sea / harbour. - Read up NO's remarks and Captains impression section. - Read and recheck at the earliest (first available opportunity) Advance, Transfer, Time of turn, stopping time / distance at 6 kn, 12 kn, 20 kn and other regimes. - Recheck point of no return[15] and turning characteristics at maximum wheel at economical speed.	

[15] Art 1312(k) p13-12, BR 45(1)(1) ed 2008.

- Recheck/ Revalidate surge at first opportunity (can be done with ECDIS/DGPS and stop watch. Also maintaining SRPM rate of change.

- Recheck stopping distance with MEs stopped (Dead slow astern/ slow astern/ Half astern) at first opportunity.

TAKING OVER AS NAVIGATING OFFICER OF NEWLY COMMISSIONED SHIP

Carrying out duties of 'Commissioning NO' of a ship has its own challenges. However, it is the most satisfying tenure one can get because of being associated with the ship's trials since inception. The first-hand experience of ship handling during ship's sea sorties leaves an everlasting impression. Whilst extensive guidelines for 'Commissioning Crew' are laid down in 'Orders for Standby Crew for Newly Commissioned Ships (ONCS)', salient points to be borne in mind whilst taking over and carrying out duties of 'Commissioning NO' are as follows: -

– Read the contract thoroughly.

– Obtain list of all approved modifications from Warship Overseeing Team (WOT) Understand the procedure for raising requirements of new modifications.

– Meet all DGMs/ GMs from yard responsible for navigational equipment to assess the progress of work

– Meet the project coordinator (from shipyard) and obtain list of compartments/ lobbies/ flats in the ship. Get together with the Ship staff and establish your part of ship.

– Obtain tonnage certificates from ship yard.

– Obtain First Outfit Allowance List (FOAL) and Yard/ MO Allowance List. Prepare list for all items pertaining to the department. Generally, items related to navigation and direction systems fall under Hull outfit allowance (viz. plotting tools) as well as Electrical allowance list (viz. binocular, NVBs, Laser Range finder etc.). The list can further be subdivided into items being issued by yard/ MO and 'Ship staff selection Items'. Place orders for procurement of 'Ship Staff Selection' items to approved vendors. Place demand for items under Yard/ MO allowance list.

– Obtain details of activities viz. keel laying, launching etc. carried out so far from ship yards for documenting in NDB. With initial fitment and STW, write down details about all nav-aids fitted onboard. Include details of maiden HATs/ SATs/ OP checks whenever completed.

– Before first sea sortie, clarify role of ship's crew with WOT and Commanding Officer. The first sea sortie (Contractor Sea Trial) aims at completing the SATs/ OP checks of all NAVAIDS. Obtain 'General Requirement of Acceptance of Quality' (GRAQ) for trials and work out internal organisation to monitor progress of these SATs/OP checks/ trials as per GRAQ.

– Based on FOST guidelines make a list of books and check off list to be maintained by the department. Prepare format for these books. Prepare format for gangway state boards and provide details to yard for manufacture post approval of Commanding Officer.

CHAPTER 3

COMMAND RELATIONSHIPS AND NAVIGATIONAL ORGANISATION

Introduction

1. **Safe Conduct of Warships at Sea**. The safe conduct of a warship at sea is more than accurate Navigation[16] from position to position. Controlling the movements of a ship at sea requires capable officers, good organisation and a clear understanding of the principles of safe conduct and precise ship handling. The purpose of this chapter is to reiterate the Command relationships and navigational organisation for the safe conduct of IN warships at sea, especially the bridge and pilotage organisation[17] and procedures supporting the same.

2. Most navigational accidents (collisions, groundings, berthing incidents) are attributable to human error of some kind. When these accidents are analysed, it is often evident that one or more of the following factors has played a major part:-

(a) Inadequate planning.

(b) Improper Bridge and Ops Room organisation.

(c) Unsound pilotage procedures.

(d) Failure to make full and proper use of the Navaids and information available, i.e. poor Bridge Resource Management.

3. Effective use must be made of the considerable information available to the mariner on the bridge. The DR or EP

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[16] Art 1913, BR 45 Volume 1 ed 2008.

[17] Ch 19, BR 45 (1)(2) ed 2008 and Ch 4 BR 45 (4) ed 2008 refers in this regard

projected from the last time may well show up any misidentification[18] of shore marks. Radar and radio fixing aids provide a valuable cross check for visual fixes. The echo sounder frequently gives advance warning that the ship is being taken into shoal water. Clearing bearings will do the same. Tides and tidal stream data are essential for coastal navigation, pilotage and berthing. The errors of the compasses must be known and either applied or allowed for. Details of turning and stopping data are essential for the safe planning and execution of pilotage and berthing. The observation of the bearing of other ships, and the acquisition of their relative tracks on the radar display will identify those ships on a collision course. In order to achieve all of these, there is need for full, proper, planning and efficient execution through sound Bridge and Pilotage organisation and procedures.

4. **Bridge and Pilotage Organisation**. The Bridge and Pilotage Organisation would vary with characteristics and capabilities of the ship and crew. However, the purpose remains common, which is to harness the capabilities and coordinate the functioning of the ship (including both equipment and crew), so as to enable navigational capacity and performance that is always higher than the navigational challenges and threats. This would be the most effective way of ensuring safe conduct of the ship. In developing the appropriate bridge and pilotage organisation and procedures, it is important to consider the concepts and practices governing the ship's conduct at sea and the core role and responsibilities of the main players.

5. **Definitions**[19]. Certain terms - and definitions relevant to the *IN* are as follow:-

(a) **Command**. The authority vested in an individual of the armed forces for the direction, co-ordination and control of military forces.

(b) **Military Command**. The authority to exercise command of non-sea-going ships, naval shore

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[18] Art 0807 (d), p 08-21BR 45 (I) (2), ed 2008.
[19] BR 45 (4)/ 2016, Ch 1, Art 0102

establishments, aircraft and boats. Military command includes ‘Command’ authority.

(c) **<u>Sea Command</u>**. The authority to exercise command of sea-going ships of the Indian Navy. It includes both command and military command authority.

(d) **<u>Conduct</u>**. The direction of a team or management of a series of tasks in the performance of a function, eg conduct of the ship, conduct of navigation, conduct of operations. Conduct includes planning and may include execution.

(e) **<u>Charge of the Ship</u>**. The authority delegated by the Commanding Officer or the officer to whom command has been delegated, to the OOW for the safety of the ship at sea.

(f) **<u>Navigation</u>**. The process of planning and executing the movement of ships from one place to another. Navigation includes ocean and coastal movement and pilotage, giving due consideration to problems of ship handling and collision avoidance.

(g) **<u>Pilotage</u>**. Navigation involving frequent or continuous determination of position or a line of position relative to geographic points, and usually requiring the need for close attention to the vessel’s draught with respect to the depth of water. It is practised in the vicinity of land, dangers, and navigational hazards.

(h) **<u>Control</u>**. The action of a functional superior in issuing instruction and guidance in a clearly defined professional field.

(j) **<u>Planning</u>**. The predetermination of actions involving people and resources as an integral part of conduct.

(k) **Execution**. The act of putting into effect (the navigation plan, Captain's orders etc).

(l) **Conning**. The act of giving wheel, hydroplane or engine orders.

(m) **Advising**. The act of providing information to assist the recipient in making a decision.

Command Authority

6. **Military Command**.

(a) It is the Authority vested in officers of the Executive branch to Command one or more ships, according to their training and duties {Regs IN, Part III, Ch XI, Art 225 (1)}.

(b) Command of ships shall be limited to qualified officers of the Executive branch and seaman sailors, except when conferred by superior authority on another person qualified by ability and experience (Regs IN, Part III, Ch XI, Art. 225 (4)).

7. **Commanding Officer**. 'Commanding Officer' means the officer or other person in actual command of a ship, submarine, air squadron or establishment (Regs IN, Part II, Ch I, Art 2).

8. **Captain**. 'Captain' means the officer appointed to command a ship (Regs IN, Part III, Ch I, Art 2).

9. **Command in Temporary Absence of Captain**. The senior executive officer on board (other than an officer appointed additional for staff or special duties or an officer not qualified to command ships or boats) shall, in the temporary absence of the Captain, be responsible for everything done on board. As Commanding Officer for the time being, he shall assume the powers and duties of the Captain (Regs IN, Part III, Ch IX, Art 231).

10. **Command when Captain is Sick/ Absent**. If the Captain has ceased to exercise command whether through sickness or for any other reason, or because of absence on duty or leave during which he will be away from the ship, the officer next in command shall assume powers and duties as though he had himself been appointed in command. In such circumstances, he has full powers of punishment as Captain of the Ship {Regs IN, Part III, Ch IX, Art 232(1)}.

11. **Commanding Officer for the Time Being**. When the Captain, without having ceased to exercise command, is absent from his ship the officer next in command shall be responsible for everything done on board. He shall act as Commanding Officer for the time being and shall assume the powers necessary to carry out this duty other than the powers of punishment vested in the Captain {Regs IN, Part III, Ch IX, Art 232(2)}.

Command and Navigation

12. **Conduct of the Ship[20]**. The most important aspect of sea command is the CO's responsibility for the management and direction of the safe movement of the ship. The CO will be assisted by the Navigating Officer (NO), the Officer(s) of the Watch (OOW) and (where applicable) the Ops Room Officer (ORO). In very small ships the CO will fulfil all those roles personally at one and the same time. The CO will have to give careful consideration to the qualification, experience and competence of these officers regarding conduct, control and execution of navigation and of ship's movements to decide what degree of authority to delegate, and how much personal supervision they require. To achieve safe navigation, the Command organisation to conduct the ship's movements must be well established[21]. In particular, the CO must consider the following points (in no particular order):-

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[20] BR 45 (4)/ 2016, Ch 1, Art 0104(a)

[21] Art 1910 & 1912 p 19-4 to 19-7 BR 45 Vol (1) (2), ed 2008 and Ch 4 BR 45 (4) ed 2008 refers in this regard.

(a) The standing and temporary instructions for navigation issued to officers and sailors.

(b) The delegation of authority weighed against the qualifications, experience and competency of the officers. For instance, the CO will be able to delegate considerably more to a NO who is a qualified Long ND rather than one who is in their first appointment after WKC.

(c) The state of repair and effectiveness of the navigational equipment.

(d) The management of potential human errors, together with the state of training and teamwork achieved by the navigation teams and their ability to plan and execute the correct navigational procedures.

13. **Charge of Ship**. The Captain shall not entrust the charge of the ship when underway to any officer, unless he has satisfied himself that such officer is acquainted with the ship's fit (equipment and machineries) and IRPCS. The Captain shall take care that an officer whom he judges not to be fully competent is never left in sole charge of the ship, but shall be supervised by an officer of experience who, while not taking the ship out of the hands of the OOW, except in case of emergency, shall see that all orders given by him are correct and safe (Regs IN, Part I, Chapter III, Art 0306).

14. **Delegation of Authority to Officers**. The Captain has considerable discretion on the limits of independent action that the OOW and the NO may take regarding ship's movements. The Captain considers these limits, taking into account the qualifications, experience and competence of the officers. Circumstances in which the CO may delegate authority to officers include:-

(a) Conduct of the ship.

(b) Charge of the ship.

(c) Conduct of Navigation.

(d) Execution of Pilotage.

(e) Execution of Navigation.

(f) Conduct of Operations.

15. **Supervision of Navigation**. The NO has conduct of navigation of the ship under the direct supervision of the Captain[22]. His planning of navigation is required to be supervised and approved by the Captain before it is executed. During the execution of navigation (including pilotage), the Captain shall continue to satisfy himself with the accuracy of navigation and performance of the navigation/ pilotage teams, including its functions in conjunction with other actions that may be required for safe conduct of the ship (such as IRPCS, flying operations, force protection measures, tactical actions, etc.). In pilotage waters, the Captain shall take care that the NO keeps a good lookout[23].

16. **Con and Charge**. Charge relates to authority over the ship's movements and actions, and con is the act of giving orders governing the movement of the ship. Thus, charge is exercised through the con. Hence, when the con is no longer with or under the OOW, he can no longer exercise authority over or control the ship's movements, and cannot exercise the charge. So, if the Captain (or other officer specially authorised by the Captain) takes over the con from the OOW, he per force also takes away the charge and must de jure take over the same and become the OOW. However, the officer holding the charge may delegate the con to an assistant, e.g. a Midshipman/ Sub Lieutenant for keeping the ship in station or undertaking a manoeuvre. In such cases the charge remains with the OOW and does not shift to the officer who may be conning the ship. Similarly, during serials like

[22] Art 1312 (u) p 13-16, BR 45 (1)(Part II) ed 2008.
[23] Art 0132 (g) and (h), p 1-47 (original), BR 45 (4) ed 2008.

manoeuvres, where the con may shift among officers, the charge would still remain with the OOW. However, the OOW or officer holding the Charge and Con may relay the conning orders through another officer, such as Captain and NO, or OOW through AOOW. In this case, the Con remains with the officer giving the conning order, and not with the officer who may be relaying the same, such as on conning intercom.

17. **Captain's Standing Orders**. The Captain's Standing Orders must state how the CO intends to direct the Navigation and safe movement of the ship. The Captain should specify the authority, organisation, procedures and coordination amongst the EXO, NO, OOW and OROs at sea, both generally and for various situations, in amplification of the Regs IN and relevant higher instructions. He must, especially, specify the circumstances and personnel authorised to hold and take over the charge of the ship from the OOW. This should be followed by instructions for particular situations, both at sea and alongside, orders for calling the CO[24], and the reports the CO wishes to receive[25]. The Captain's Standing Orders should specify the precise meaning and content of ready for sea reports from the Heads of Department and the NO. Subject to class/ship specific requirements, the NO's report should include, SSD closed up, steering system[26] tested, navaids running and set-up/aligned correctly, appropriate navigational publications, charts and equipment held onboard and provided ready for use on the bridge, and 'OBEY TELEGRAPHS' or class equivalent passed. ***A copy of the conduct at sea section of the Captain Standing Orders[27] must be kept on the bridge***. The Captain Standing Orders must also specify the manning requirements and occasion for closing up the SSD personnel (extract of Section 19 of NDB). This should obviate the necessity to make SSD CTM before every sailing.

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[24] Art 0136(OOW -Reports to the Commanding Officer), p 1-53-54 change, BR 45 (4) ed 2008.
[25] Art 1120 p 11-5, BR 45 (9) ed Dec 2008.
[26] Regs Navy Part I Art 0515; BR 3000 Art 0114 & 0902and MSC 1/CIRC 1398 of 10 Jun 11.
[27] Art 0114 (d), p 1-16, BR 45 Vol (4), ed 2008.

Role of OOW

18. **Responsibility of OOW**. The OOW is responsible for the safety of the ship, both when underway and in harbour, subject to any orders which he may receive from the Captain {Regs IN, Part I, Ch X, Art 1025 (2)}.

19. **Authority of OOW**. "Every officer or other person under the rank of Captain, not being either the Executive Officer or the Commanding Officer of the ship for the time being, shall be subordinate to the Officer of the Watch, whatever may be his rank, in regard to the performance of the duties with which he is charged." (Regs IN, Part III, Ch IX, Art 234).

20. **OOW being Relieved of All or Part of his Duties**. All the duties and responsibilities of the OOW remain with him, whether the Captain is on the bridge or not, unless he is relieved of any or all of them by the specific order of the Captain (Regs IN, Part I, Ch X, Art 1026 (4)). Such specific orders may be in the form of written or verbal directives, passed by the Captain for anticipated situations in his Standing Orders, Temporary Memoranda, Navigation/ Pilotage briefings[28], etc., or made by him in response to a sudden/ emerging situation. BR 45(4)/ 2008 X Chapter 1 Art 0130(d) also refers.

21. **OOW's Responsibility for Navigation and Ship's Movements**. The OOW shall at all time when at sea, so far as is practicable, keep himself informed of the ship's position. He shall note all navigational information and keep account of the ship's movements. He shall never change the course or speed without directions from the Captain, unless to avoid immediate danger. He shall very carefully observe the IRPCS on all occasions. He is responsible that-at sea, the bridge clock is synchronised with the Engine Room (and Ops Room) clocks at the beginning of every watch (Regs IN, Part I, Chapter X, Art 1026). In pilotage waters, he shall ascertain whether land or lights are in sight, or likely to be seen, and all other particulars which may be of use in keeping the

[28] Art 1312(u)-(w) p 13-16, BR 45(1)(2) ed 2008.

ship out of danger. When soundings are being taken, he shall see that they are obtained with sufficient frequency (Regs IN, Part I, Ch X Art 1026). In coastal and open passage, the OOW will usually be responsible for executing the Navigation plan prepared by the NO and approved by the Captain. He would still require the Captain's approval to alter course or speed, unless already directed by the Captain, such as in the night order book/ Captain's Standing Order or to avoid immediate danger. Herein, the NO would exercise 'functional authority' over the OOW with respect to the execution of navigation, and would be required to periodically check the ship's correct position, fixes obtained by the OOW and OOW's actions for maintaining the ship on her navigational track IDR in terms of both time and space.

22. **Assumption by CO of OOW's Responsibility for Ship Safety**. Where the OOW cannot obtain information to accept responsibility for the ship's safety (e.g. during Blind Pilotage), the CO should be prepared to relieve the OOW of these responsibilities and take over Charge personally. In such conditions, the NO would continue to execute the Pilotage and also advise the CO on anti-collision actions. The SSD OOW, while relieved of Charge over the ship's movements, would continue to oversee the balance OOW responsibilities, including internal situation, external and internal communications, and support functioning of the CO and NO, including by maintaining a proper look-out.

Role of the Navigating Officer

23. **Responsibility of the Navigating Officer (Art 1302 of Regs Navy Part I)**.

(a) The Navigating Officer, under the direction of the Captain, shall have the Charge of navigation of the ship. He shall point out to the Captain every possible danger in or near the ship's course and the way to avoid it; and, if it be imminent, report it to the Officer of the Watch with a view to immediate action.

(b) Whenever the ship is approaching the land or shoals, or is navigating in pilotage waters, he shall keep a careful lookout[29] and ascertain the ship's position frequently by employing the navigational aids at his disposal to their best advantage. He shall bear in mind the safety of the ship at all times and advise the Captain accordingly.

24. **Primary Responsibility**. The primary responsibility of the NO is to conduct the navigation of the ship, whether in pilotage, coastal or ocean movements. He is responsible for planning and executing the movement of the ship through safe, navigable waters (i.e. maintaining safe under keel clearance from land, sea bottom and underwater hazards), whilst taking into account the requirements of ship handling and collision avoidance. His other tasks are secondary to this core responsibility. Hence, while the NO is required to take part in watch-keeping, this is not to interfere with his special navigating duties and shall be arranged at the discretion of the Captain {Regs IN, Part I, Chapter XIII, Art 1301(3)}.

25. **NO's Functional Authority**. In the conduct of navigation, the NO directs the navigation/ pilotage team in execution of their tasks. He is, thus, required to train and supervise the navigation team, which includes the OOW, Fixing Team, Blind Safety Officer, Anti-Collision Plot, Look outs, Echo Sounder Reporter, Quartermasters, communication members, etc., in so far as the execution of navigation/ pilotage is concerned. The NO must accordingly brief the team of his plan and their general role and specific tasks in execution of the same, including providing necessary information and instructions for their guidance.

26. **Execution of Navigation by NO[30]**. The NO should regularly assess the overall burden on the OOW in relation to the latter's experience, and never hesitate to take over the execution of navigation to ensure safe conduct of the ship. ***When executing the navigation, the NO must always take account of the***

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[29] Rule 5 IRPCS

[30] BR 45(4)/ 2016, Ch 1, Art 0117(b)

traffic/ anti-collision situation when forming advice to the OOW. Occasions when the NO should execute the navigation personally may arise under any one or a combination of circumstances as listed below, wherein the decision in every circumstance must rest with the professional judgment of the CO and NO, since no such list can be comprehensive:-

(a) When making landfall/ approaching or operating in the vicinity of shoal waters.

(b) When operating in restricted visibility/ high density of shipping.

(c) Executing Pilotage.

(d) Navigating in restricted waters, such as a narrow channel/ river/ canal.

(e) Operating in a complex warfare situation.

(f) When changes or modifications to the navigation plan, particularly at short notice, impinge on the OOW's responsibility/ ability for ensuring safety from collision.

27. **NO and OOW**. The NO and OOW must work as a team, discharging their respective responsibilities under the Captain, whilst supporting each other for the same. The NO and OOW cannot function independently. While the OOW has been delegated authority by the Captain over the ship's movements, it is the NO who has to plan those movements and supervise their execution, other than for IRPCS. The NO must check the position of the ship and, after taking into account all dangers, including from grounding and collision, provide the further plan for the ship's movements that would keep her safe, especially in restricted waters. The OOW, whilst following the NO's plan, is required to confirm that it would indeed keep the ship safe and can even depart from the same if he considers it unsafe. Whereupon, the NO is still duty bound to point out the dangers on/ near the course being followed and the best way to avoid it, to both Captain and OOW. In case of an ROR situation, the NO would play a complementary or advisory role, in pointing out the proximity of

navigational dangers and extent of clear water and advise on how best the dangers can be avoided. Hence, it is evident that:-

(a) The NO and OOW must be able to work jointly and efficiently, providing mutual support and checks, under the overall direction of the Captain.

(b) Both have to discharge their respective responsibilities to the Captain, and there is a certain overlap in the same.

(c) Although the NO has some functional authority over the OOW, in the OOW's execution of navigation or NO's conduct of pilotage to the extent of the OOWs involvement in the same, the OOW has the Captain's delegated authority over the ship's movement and can veto[31] the NO's plan or advice, whilst informing the Captain at once, i.a.w that authority .

(d) In certain stages of pilotage, and under certain conditions, the OOW would not have the wherewithal to independently confirm suitability of the NO's plan. Hence, at such stages it would be neither appropriate nor efficient for the OOW to retain independent charge over the ship and either NO or Captain should take over the charge.

28. **Handing Over of Charge by OOW**.[32] The stage of pilotage, at which, the NO takes over the charge from the OOW should be planned and approved by the Captain. Since, as per Regs IN {Part I, Chapter XIII, Art 1301(3)}, the NO's watch keeping duties are not to interfere with his special navigating duties, ***the point at which the NO takes over charge from the***

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[31] Art 1324 p 13 - 46, BR 45 (1)(2) ed 2008. Navigation and Pilotage voice procedures are outlined in Ch 11 BR 45 (9) ed 2008 (This ed of RN BR 45 (9) is available on ND School website on NUD. As on Jan 18, letter of promulgation for Indian Navy applicability hasn't been issued by IHQ MoD (Navy).

[32] POST FROM FOST DEC 18 VOL 20 ISSUE 4

OOW should be such that this would complement, and not hinder, the NO in his conduct of pilotage. When, the NO becomes the OOW, he must also carry out the conduct of pilotage. Hence, the NO should be able to efficiently and effectively conduct pilotage from the pelorus (with likely reduced scope for personally supervising functioning of the pilotage team), when he becomes the OOW. The recommended organization for change of charge/con in various serials is as shown:-

Scenario	**Charge**	**Con**
Cast Off/ Final Approach	CO	NO
Cast Off/ Final Approach – Low visibility	CO (NO on Blind Pilotage/ in advisory role)	
Manoeuvring in narrow channels/ restricted waters (Well marked/ ship's position visually discernible)	NO	
Pilotage Waters – Running on (visual) transits ahead/ head mark	NO	
Pilotage Waters – Stern transits/ Fix and Run	SSD OOW (Navigation with NO)	
Pilotage Waters – Low visibility/ Dense traffic	SSD OOW/ CO (NO on blind pilotage and in advisory role for IRPCS)	
Coastal Passage	OOW (NO in assistance, as required)	
Ocean Passage	OOW	OOW/ AOOW

Note:-

(a) NO should preferably, take the charge and con of the ship only when he can execute the pilotage using his note book alone.

(b) In coastal/ ocean passage, the captain may delegate the execution of navigation to the OOW. However, the NO should be readily available to assist/ take over the navigation if required.

(c) Conditions/ circumnstances wherein the CO desires the NO to relieve the OOW of the charge (and take over as OOW) must be stipulated / authorized in the Captain's Standing Orders and briefed to the bridge team.

This is more feasible in harbours with little traffic density and transits/ leading marks on each leg, and where ship handling becomes an intrinsic part of the conduct of pilotage. E.g. this would normally be the case for Vizag, Kochi (inwards of the 7th set of buoys), long winding rivers like Hooghly River, Saigon River (off Ho Chi Minh City), etc. In the case of foreign / unfamiliar ports, high traffic density and open harbours, this point would tend to be closer to the berth. **Once NO takes over the con and charge, he becomes the OOW and must discharge both responsibilities capably and fully**. While the NO retains the responsibility for conduct of Navigation (including pilotage), the following may be used as a guideline to delineate responsibility of Charge and Con under various scenarios with the shift, if any, to be as per directions/ discretion of the CO in prevalent circumstances/ conditions.

29. **Navigation with Pilot Embarked**. Notwithstanding the duties and obligations of a pilot, his presence on board shall not relieve the CO or officer of the watch from their duties and obligations for the safety of the ship[33]. The CO and the pilot shall exchange information regarding navigation procedures, local conditions and the ship's characteristics. The CO and officer of the watch shall cooperate closely with the pilot and maintain an, accurate check of the ship's position and movement (Regs IN, Part I, Chapter XIII, Art 1303 and 1359).

Bridge and Pilotage Organisation[34]

30. **Pilotage Team**. The CO is responsible for the management and direction of safe navigation, including Pilotage, of the ship. He is assisted by a team of officers and sailors from several departments, for handling various aspects of the evolutions. The 'Pilotage Team' is responsible to the Captain for the execution of Pilotage i.a.w. the plan prepared by the NO and as approved by the CO. The Pilotage Team functions under the

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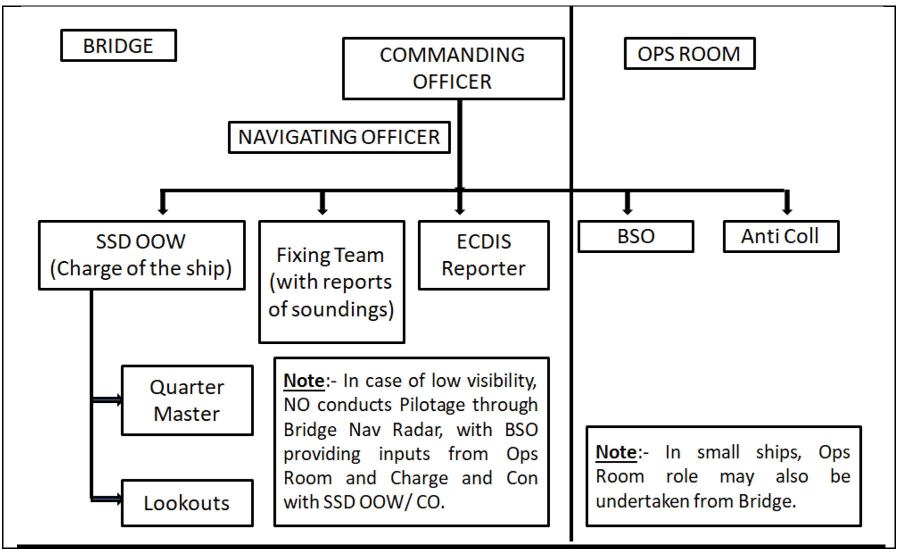
[33] Article 1359, Regulations for the Navy Part I.

[34] Ch 19, BR 45 (1) (2) ed 2008 and Ch 4 BR 45 (4) ed 2008 refers in this regard.

NO and comprises, inter alia, the OOW, Fixing Team (Visual and Radar), Anti-Collision Plotter/ Team, Blind Safety Officer, ECDIS Reporter and Echo Sounder Reporter. The Pilotage Team is closed up prior entering pilotage waters, in adequate time, to enable the team to settle down, increase the frequency of fixing[35] and enhance monitoring of the navigational situation. This is particularly required when approaching less familiar harbours, in conditions of lesser visibility or night, and heavier traffic. The Pilotage Team is part of the 'Special Sea Dutymen[36] (SSD) for Entering/ Leaving harbour and closes up prior to/ with SSD.

31. **<u>Pilotage Organisation</u>**[37]. The Pilotage organisation, for executing the pilotage plan, is depicted below:-



***<u>Note</u>**: - A Junior WKC/ WKO is to man the Bridge Blind display, which would be taken over by the NO in case of need to conduct Blind Pilotage*.

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[35] Art 0716 (c)p 07-16, BR 45(1)(1) and Art 1231 (f/h) p 12-27 and 1313 (a) p 13-18 BR 45(1)(2) both ed 2008.

[36] Art 1912(g) p 19-7, BR 45(1)(2) ed 2008.

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32. **<u>Responsibility for Pilotage</u>**. While the Commanding Officer is responsible for the overall safety of the ship, including navigation, the NO (whether specialist or nominated) is responsible for the Conduct (planning and execution) of Navigation, which includes pilotage. While the (SSD) OOW holds Charge of the ship, and controls its movement, he must do so in coordination with the NO, who holds functional authority with respect to pilotage and safety from grounding. Actions i.a.w IRPCS and for addressing risk of collision, one must cater to the ship's navigation position and available depth/ width of navigable water. The Captain's Standing Orders should specify the functional responsibilities between NO and OOW, and conditions for NO taking over the Charge. The Captain should, further, ensure that the NO and OOW function in a coordinated and complementary manner. The Captain should take over the Charge of the ship in case the OOW faces difficulty in his functioning/ is unable to effectively coordinate the ship's anti-collision movements with NO's pilotage directions, such as in low visibility/ Blind Pilotage conditions. While the CO may choose to let the NO take over Charge as OOW, he must do so in careful consideration of the navigational situation and if the NO would be able to effectively execute pilotage as OOW, i.e from the Pelorus with aid of only his NO's note book, such as when the navigational marks are easily discernible and visual pilotage (running on transit/ head mark) is feasible. In other conditions, and especially when operating in less familiar waters/ Blind Pilotage conditions, it would be preferable to keep the NO free from becoming the OOW and to focus on his specialist responsibility of executing Pilotage, including overseeing/ directing the functioning of the Pilotage Team.

33. **<u>Conduct of Pilotage Briefing</u>**. The Pilotage briefing[38] is to be done by the NO, **from two to 24 hours prior closing up of SSD**. The Entering/ Leaving Harbour Briefing should be crisp, including only the essential points relevant to Cast Off/ alongside plan, traffic, pilotage updates (if any), restrictions (if any), risks (ORM), coordination instructions and Emergency for the Day. The

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[38] Art 1312(u)-(w) p 13-16, BR 45(1)(2) ed 2008.

briefing should be completed within 10 minutes, including comments from the Captain.

34. **Special Sea Duty Men**. Special Sea Duty Men[39] (SSD) means a nominated team that is closed up when a higher degree of navigational readiness is required. This would aim to provide higher navigational alertness and awareness, to provide quicker, comprehensive responses in case of possible emergencies and break downs, and ensure the safe and efficient conduct of the evolution. SSD is normally closed up for entering/ leaving Harbour, passage through restricted waters, restricted visibility with higher traffic density, close distance manoeuvres with other ships (UNREP, TOWEX, Manoeuvres, etc.), about 30 min prior to commencing the evolution. The composition of the SSD team should be laid down in Section 19 of NDB, Captain's and Departmental Standing Orders/ Temporary Memoranda (Ty Memo). The Ty Memo need not be made prior every sailing, rather once along with the master CTM, bringing out clearly which HOD is responsible for training and nominating personnel for which post. Thereafter, the performance and co-ordination of this team should be constantly monitored and built up by respective HsOD and collectively by NO[40].

35. **SSD OOW**. The designated OOW during SSD, as approved by Captain, is known as SSD OOW. He is, in fact, the OOW. He takes over the charge from the then OOW when SSD is piped. His additional duties are usually laid down in the Captain's Standing Orders, and would include completion of SSD preparations/ check lists, whereupon he will make a formal report to the Captain. He works in close coordination and synergy with the NO, and ascertains particulars that may be of use in keeping the ship out of danger (Regs IN, Part I, Art 1026(10)). After the NO takes over charge from him, he continues to provide all support actions including all other OOW actions, primarily the internal situation.

[39] Art 1912(g) p 19-7, BR 45(1)(2) ed 2008.
[40] POST FROM FOST DEC 18 VOL 20 ISSUE 4

36. **<u>NO Taking Over Charge from SSD OOW</u>**. The point at which the NO takes over charge from the SSD OOW (and becomes the OOW) should be briefed in advance and approved by the Captain. The SSD OOW then continues with all other supportive actions, including internal situation, monitor tactical and navigational situation, oversee Bridge - Ops Room - MCR reports and functioning, monitor implementation of conning orders, etc., as specified in the Captain’s Standing Orders. On some ships, the Captain may allow an experienced NO to relieve an OOW in times of urgency without prior consultation with the Captain. If so, this should be specifically authorised by the Captain in his Standing Orders/ Temporary Memoranda, including further actions/ responsibility of the OOW thus relieved, and about subsequent intimation/ report to the Captain regarding the circumstances or urgency.

37. **<u>ORO</u>**. In many, especially larger/ Capital, ships there is an Ops Room Officer nominated per watch/ evolution. Such ORO’s duties and responsibilities need to be specified in the Captain’s Standing Orders/ by Temporary Memoranda. These would usually include development of Maritime Domain Awareness (MDA), overseeing functioning of the Ops Room (under supervision/ direction from the NO), conduct or control of exercises/ evolutions, etc. This may at times require issuing of manoeuvring instructions to the OOW. However, the OOW retains overall charge and has the authority to query, delay, modify or veto[41] any control order passed by the ORO, if he deems it would jeopardize the ship’s safety. Such authority to OOW, to query or delay orders from blind positions, should be considered even where command is exercised from Ops Room and so specified in the Captain’s Standing Orders.

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[41] Art 1324 p 13 - 46, BR 45 (1)(2) ed 2008. Navigation and Pilotage voice procedures are outlined in Ch 11 BR 45 (9) ed 2008 (This ed of RN BR 45 (9) is available on ND School website on NUD. As on Jan 18, letter of promulgation for Indian Navy applicability hasn’t been issued by IHQ MoD (Navy).

38. **Fixing Team**. A fixing team is nominated for pilotage functions under the direction of the NO. The visual and radar objects to be used are briefed/ indicated by the NO, with the prevailing gyro and radar index errors[42]. The fixes are noted and plotted by the Fixing Team and reported in the pilotage sequence. It is a good practice for the NO to personally note and plot a fix, at least once, on each leg, especially after altering course.

39. **Blind Pilotage**. The NO remains the ship's Blind Pilotage Officer (BPO). He must be ready, at any stage, to shift over from visual to blind pilotage (Radar or ECDIS with Radar Overlay), especially at night and in restricted visibility, notwithstanding, the Blind Safety Officer (BSO) continues to give his reports (as far as feasible from Ops Room). He must ensure due calibration and functional checks of the main and standby radar displays for blind pilotage, and loading of his blind pilotage plan therein. The NO should regularly practice and exercise blind pilotage, including Anti Collision Plot (ACP)[43] functions, for any eventualities. In case of blind pilotage, it is possible that the SSD OOW may not be in a position to independently exercise charge of the ship. In such cases, the Captain should be prepared to take over the charge and, if need be, also the con from the OOW, with the NO exercising conduct of blind pilotage.

40. **Blind Safety Officer**[44]. The BSO is an important member of the pilotage team. He works under the direction of the NO, who should personally check the radar display for correctness and known errors. The BSO should incorporate these known errors whilst transcribing the NO's blind pilotage plan onto the BSO's display. The NO should train the BSO in his duties and, integrate him into the pilotage team, through preparatory checks, monitoring of reports/ performance, live feedback and subsequent debriefs. The BSO usually operates from the Ops Room. An additional BSO may be positioned on the Bridge, on NO's blind pilotage display

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[42] Art 1316(e) p13-27, BR 45(1)(2) ed 2008.

[43] Art 1931 (h), p 19-15, BR 45 (1)(2), ed 2008.

[44] Art 1931(c) p19-15, Art 1932(d)(f) p19-17, Art 1933(h) p19-18, BR 45(1)(2) ed 2008.

with the NO's plan. This would facilitate the NO checking blind pilotage personally, and would also be useful for him to guide and take over conduct of blind pilotage as required.

41. **Anti Collision Plot (ACP)**. ACP is another essential ingredient of the pilotage team. A suitably trained ACP maintainer should be positioned on a, preferably, ARPA display, with facility for switching over between relative and true motion. The ACP should operate on the appropriate range scales. In case of large harbours, the ACP could be maintained by a team across two displays, which may include the BSO, on different range scales. The ACP should also have the blind pilotage plan marked, so as to appreciate the effect of traffic on both current and next legs. The ACP should advise the NO on traffic and clearance on the next leg, including any need to reduce speed / delay the turn. The BSO and additional BSO should also be trained to monitor and independently, but simultaneously, carry out ACP functions on their displays. In case of conduct of actual blind pilotage, such expertise and correlation would be necessary.

42. **ECDIS Pilotage Safety Officer (EPSO)[45]**. The role of the EPSO is to support the NO in their execution of the pilotage, by providing an independent cross-check on the NO's commentary (including through the plotting of operator fixes), and to give Command confidence that ECDIS is operating correctly by continually proving the system correct. To do this, the EPSO must be fully competent at operating ECDIS in general and specifically must be able to plot and report operator fixes (including visual and radar fixes, using all techniques such as transits and running fixes), managing AIS[46] and ARPA data, and using all other electronic tools quickly and accurately. In the event of a failure or emergency such as GPS/DGPS denial, the EPSO must be able to switch the system to the INS (if fitted and available) or to DR/EP modes. All this must be achievable in the short timescales required in pilotage waters.

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[45] BR 45 (8)/ 2017, Ch 5, Art 0511 (a)

[46] Art 0954 (a) – (c) p 9-34, BR 45 (1)(1) ed 2008.

43. **Safety Officer**. In accordance with Regs IN, Part I, Art 0306, a less experienced OOW may need to be supervised by another officer of suitable experience and ability. This is especially required in case the Captain himself is not available on the Bridge, such as in a tactical situation, wherein, he is exercising Command and Conduct from the Ops Boom. A suitable Safety Officer should be nominated by the Captain, with his responsibilities and authority defined in Captain's Standing Orders. This should preferably include monitoring of OOW's actions, advising the OOW as required, keeping the Command informed of the visual situation, issuing instructions to the OOW as warranted, including to query or delay implementing instructions from the blind position/ Ops Room Command, if these risk the ship's safety, and also relieve the OOW and take over the charge of the ship in case of an emergency. Usually, when the Captain is in blind position, the EXO is the Bridge Safety Officer. However, other officers may be additionally nominated and authorised by the Captain, as per the requirement.

44. **Calling the Captain[47], EXO and NO at Sea**. A sound navigational organisation must specify the range of occasions for OOW and ORO to call the Captain, EXO, and NO at sea. (It must, in fact, encourage the OOWs and OROs to call them as and when required, and in sufficient time, before a situation develops or gets out of control. The occasions for calling the Captain should be listed in Captain's Standing Orders and an extract of the same placed in the night order book.

Shift of Conning Position

45. The conning position and con/ charge would need to be shifted during the course of shiphandling evolutions. Such shift should take place in sufficient time to allow the Command team and con/ charge relations to properly settle in prior to commencement of the shiphandling run. The exact sequence and positions will vary as per ship, evolution, conditions, and

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[47] Art 0136(OOW -Reports to the Commanding Officer), p 1-53-54 change, BR 45 (4) ed 2008.

preferences/comfort of the command team. As a generic guide, the following could be considered: -

(a) **Cast-Off**. The Captain, XO, NO, SCO and other required personnel shift to Bridge Top/ Wings (whichever is the preferred cast-off conning position) at least 10 mins prior to cast-off.

(i) As the ship casts-off, clears the berth and turns around, the Charge and Con remain with the Captain, who usually relays the conning orders through the NO.

(ii) Once clear of the berth and settled on (first) leaving harbour leg, the Captain will normally (as per harbour and briefing) shift to the Bridge. He, accordingly, hands over the Con and Charge to the NO, who confirms the same to SSD OOW and advises on Conning intercom "Command shifting to Bridge".

(iii) Once Captain is on the Bridge, the SSD OOW advises "Command in Bridge". He, thereafter, takes permission to assume Con and Charge, and informs the NO of readiness to take over. The NO reiterates the course, speed and any impending movements/ actions on conning intercom, and (hands over con/ charge to the SSD OOW. The NO, thereafter, shifts to the Bridge.

(iv) Once on the Bridge, the NO takes charge of conduct of pilotage. He may, if required for the harbour and prevailing conditions, and as approved by Captain, also take over the Con/ Charge, especially if this complements his conduct of pilotage. In this case, he also becomes the OOW. As and when the ship is in clear waters, or when the NO can no longer conduct pilotage from the pelorus with his notebook, he takes permission from Captain and hands over Con/Charge to the SSD OOW.

(v) The NO then continues with conduct of pilotage, with SSD OOW holding Con/ Charge, till ship is in clear waters and SSD is secured.

(b) **Going Alongside**. The pilotage team closes up, when the ship approaches pilotage waters. The NO takes charge of the conduct of pilotage. Briefing[48] for entering harbour/ going alongside is conducted. SSD is closed up, and the SSD OOW takes over con/ charge.

(i) As per briefing and the harbour/ conditions, when the NO can conduct pilotage from the pelorus - with his notebook, he takes over con/ charge of the ship and directly controls movements of the ship for pilotage. The SSD OOW continues to provide him with all support, and continues with other OOW actions.

(ii) At a suitable pre-determined point, the NO would need to shift to the Bridge Top/ Wings. In case he held the con/ charge, he takes Captain's permission and hands this over to the SSD OOW. The NO (and other command support team members) shift to the Bridge Top/ Wings.

(iii) Once NO has settled in, he reports readiness to take over Con/Charge to the Bridge. The SSD OOW, with Captain's approval, hands over Con/Charge to the NO, reiterating the course, speed and any other important information.

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[48] Art 1312 (v &w) p13-16, BR 45 (1) (2) ed 2008

(iv) The Captain now shifts to the Bridge Top (Wings), and SSD OOW advises "Command shifting to Bridge Top/ Wings". Once on Bridge Top/ Wings, the NO intimates "Command on Bridge Top/ Wings". The NO continues with Con Charge as the OOW and also with the Conduct of pilotage.

(v) At a suitable, predetermined point, when the ship commences approach to the berth, the, Captain takes over the Con and Charge of the ship from the NO. However, he normally continues to relay his conning orders through the NO.

(vi) The Captain handles the ship till alongside.

(c) **UNREP**. In UNREP, post briefing and with closing up of SSD, the SSD OOW takes over Con/ Charge form the OOW. He completes the SSD check-list and establishes the base SRPM for keeping in station.

(i) The NO (along with support team) shifts to the Bridge Wing about 05-10 mins prior to taking up standby station.

(ii) Once settled in, the NO reports readiness to take over Con/ Charge to SSD OOW. The SSD OOW hands over the same, with Captain's permission.

(iii) The Captain then shifts to the Bridge Wing, and NO informs "Command on Bridge Wing".

(iv) On being ordered to standby station, the CO takes over the Charge, whilst NO retains the Con and (with Captain's approval) manoeuvres the ship to standby station. On commencement of run (Guide closing up 'Romeo'), which is normally before the ship has slowed down to base speed, the NO continues to con the ship to UNREP station (alongside/ astern). The Captain orders NO for any adjustment in course, as required in approach phase.

(v) At a pre-determined distance, with Captain's approval, NO orders the speed reduction. The ship is manoeuvred into alongside station by the NO, as monitored and checked by the Captain, who retains the Charge. Thereafter, the Captain normally controls the course, and the NO controls the speed. The overall charge remains with the Captain, while the NO may retain the Con for speed and relays CO's conning orders for the course.

(vi) On disengaging, the CO takes both Charge and Con, whilst continuing to relay conning orders through the NO. He manoeuvres the ship to safe (distance from the Guide, and may then hand over (Con and Charge to the NO/SSD OOW to take the ship to her next station.

(d) **Towing**. In Towing, post briefing (deciding the method of approach[49]) and closing up of SSD, the SSD OOW takes over Con/ Charge from the OOW and completes the SSD check-list.

(i) The NO (along with support team) shifts to the Bridge Wing/ Top about 05-10 mins prior commencing the run.

(ii) Once settled in, the NO reports readiness to take over Con/ Charge to SSD OOW. The SSD OOW hands over the same, with Captain's permission.

[49] BR 45 (6)1/ 2002, Ch 5, Art 0524 (c).

(iii) The Captain then shifts to the Bridge Wing/ Top, and NO informs “Command on Bridge Wing/ Top".

(iv) On being ordered to commence run, the CO takes over the Charge, whilst NO retains the Con and (with Captain’s approval) manoeuvres the ship to go around the disabled ship, to assess the drift rate[50] and the lay of the disabled ship.

(v) The NO with the approval of the CO aligns the ship to the pre-determined method of approach. The Captain orders NO for any adjustment in course, as required in approach phase.

(vi) At a pre-determined distance, with Captain’s approval, NO orders the speed reduction. The ship is manoeuvred to pass at about 30 - 50 m and be stopped at a distance of about 50 - 100 m ahead of the disabled ship, by the NO, as monitored and checked by the Captain, who retains the Charge. Thereafter, the Captain shifts to the Towing Conning Position[51] (TCP), which may remain bridge wing/ top or else adjacent position overlooking the tow point and controls the engine/ wheel orders to maintain position while the towing gear is being passed and connected. The NO may shift to the TCP with SSD OOW maintaining lookout from the Bridge. The overall charge remains with the Captain, with NO on the Con.

(vii) On disengaging, the CO takes both Charge and Con, whilst continuing to relay conning orders through the NO. He manoeuvres the ship to safe (distance from the disabled ship, and may then

[50] Calculated by tracking small radar conspic objects in sea stabilization mode.
[51] BR 45 (6)1/ 2002, Ch 5, Art 0523 (q)

hand over (Con and Charge to the NO/ SSD OOW to take the ship to her next station.

Conning Positions

46. **Shifting of Conning Positions**[52]. The choice of conning positions and the timing of any move between them (such as moving from the centre line pelorus to the Bridge Wing / Top) is of the utmost importance when shiphandling in restricted waters or in close proximity to other ships (UNREP). The timing of movements between conning positions should be addressed at the planning stage. The following may be used as a guideline:-

Evolution	**When to Move**
Going Alongside	Before altering to the final approach leg/ 10 mins from berth, whichever is earlier
Cast Off	After the ship is settled on first leg
UNREP	At least five minutes before commencement of run
Towing	To bridge wings at least five minutes before commencement of the run. To Towing Conning Position (TCP), after the ship has stopped close to the casualty (bearing in mind that the towing conning position may be much further from the centre line pelorus than the Bridge Wing). The CO is to decide the TCP, which is normally either Bridge (Wings/ Top) or Helo/ Quarter Deck for CO and NO, while the EXO preferably moving to the other position.

Handling Emergencies

47. **Stages of Handling Emergencies**. While the actions to handle emergencies may be different, the stages towards

[52] Suggested measures include a bearing sight, ECDIS display, data aggregators showing shaft RPM, rudder angle, Hdg, COG, SOG and log speed

mitigating the emergency can be broadly classified as the following:-

(a) **<u>Identification</u>**. The first step is to correctly identify the emergency, and its effect on navigational safety and ensuing operational limitations.

(b) **<u>Response</u>**. Thereafter, appropriate actions (undertaken near simultaneously) in response to mitigate the emergency need to be undertaken as follows:-

(i) **<u>On-Con</u>**. This implies immediate '***On-Con***' actions comprising alteration of course and/or speed to ensure own ship safety. E.g. Reduction of speed for machinery emergencies, alteration of course and speed for TCM, alteration of course for man overboard, etc.

(ii) **<u>Off-Con</u>**. Concurrently, the ship is to inform the nearest unit (ship, aircraft or submarine) that is likely to be affected by own ship's emergency by all available means. E.g. Sounding six short blasts, hoisting appropriate flags/ day shapes, signals on TP/ RT, wave off lights for helo on finals, etc.

(iii) **<u>Follow-up</u>**. The concerned maintainers/ additional operators (as required) are to be announced to the appropriate post for rectification/ enhancing manpower to handle the defect e.g. Off Watch QM ASP, Off Watch ERAs MCR, etc.

(iv) **<u>Intimation</u>**. An initial assessment of the emergency enumerating the operational limitations along with estimated time for undertaking defect rectification should be made to OTC and ships in company.

(c) **<u>Mitigation</u>**. On identifying and ensuring proper response to the emergency, appropriate mitigation actions need to be undertaken, such as exploring alternate positions (Ops Room/ ECP/ ASP/ ESP/ RSP) for steering[53], locking/ braking shaft, steering by magnetic in case of gyro failure and using relative head-up mode on Radar for anti-collision, etc.

[53] Art 0510 (e)-Steering, p 5-5, BR 45 (6) ed 2002.

SECTION II

CHARTS

CHAPTER 4

CHART CORRECTIONS

1. The existing seven Folios have been reviewed and the revised list of Six Folios is as follows:

FOLIO	COVERAGE	TOTAL
(a)	South Africa Coast to Persian Gulf, Mauritius, Seychelles, Maldives and INT Charts of Indian Ocean	44
(b)	West Coast of India (Sir Creek to Gulf of Khambhat)	51
(c)	West Coast of India (Gulf of Khambhat to Kundapura)	42
(d)	West Coast of India (Kundapura to Cape Comorin) and Lakshadweep	42
(e)	East Coast of India (Cape Comorin to Sandheads)	57
(f)	Andaman and Nicobar Islands	52
Total Number of charts in Revised Folios		288

2. **Withdrawal of IN Charts and Provision of BA Charts**. A total of 93 charts of the existing Folios 1, 4 and 7, covering foreign waters, are discontinued as they are outdated due to the lack of data sharing agreements with the respective coastal states. To address the gaps resulting from the withdrawal of these charts a total of 352 BA charts of scale 1:60,000 and smaller, covering *IN*'s *AOR* (excluding coverage provided by Indian charts) are being permanently provisioned.

3. These BA charts are to be accounted for in separate 17 BA Folios. The Admiralty NTMs are Weekly and can be accessed by downloading from **admiralty.co.uk/msi** or the searchable website **www.ukho.gov.uk/nmwebsearch**. The Weekly NTM's are at least 100 pages long so only relevant pages can be printed

by referring to the index or chart-wise updation can be undertaken.

4. NHO will upload weekly BA Notices to Mariners on IHQ NUD Home Page (OTHER SITES-NHO Updates-BA NTM). Ships are to update BA charts by downloading BA Notices to Mariners either from NUD or UKHO website. The authorised scale for demand and supply of Indian navigational charts, ENCs and publications for Indian Naval units is promulgated vide NO (Star) 02/2018.

5. Details of the procedure and importance of chart corrections are adequately covered in INBR 1916. This chapter is to be read and used in conjunction with the INBR, and provides only an aide memoire for the Navigator.

PROCEDURE FOR CHART CORRECTIONS

1.	**On Receipt**
- Read the NTM thoroughly—try to create a mental picture of corrections that may immediately and directly affect your passage. Perusal of the list of charts affected would be ideal for the same. - Note the new charts and publications that have been published with specific emphasis on those that may immediately affect you. - Check for general information — some of them may be more relevant than you think. - Give your Navyeo a deadline for incorporation of the corrections. - It may be useful to task your PRI / Dept Chief with ensuring, overseeing and checking the Navyeo's work, from time to time. -	

2.	**Procedure**

A ‘for correction’ folio should be made, drawing all the charts affected from respective folios.

The charts should be placed in the following sequence:-

- Large scale charts of own immediate area of ops.
- Medium scale charts of own immediate area of ops.
- Small scale charts of own immediate area of ops.
- Large scale charts of adjacent folios
- Medium scale charts of adjacent folios.
- Small scale charts of adjacent folios.
- Charts on the opposite coast.
- INT / Admiralty charts not of immediate use.

Entry in respect of the NTM should be penned into the register of Hydrographic documents (IN 83).

Pencil entry should be made on pages corresponding to each chart in the chart correction log.

Check if all corrections prior to the current NTM have been incorporated.

Commence correction using the following procedure:

- Read off correction from the NTM.

- Mark the corrections using violet ink for permanent corrections and pencil for T&P corrections.

- Recheck the co-ordinates from the NTM.

- Make the entry for the correction at the bottom left hand corner of the chart using violet / pencil as relevant.

- Ink in the earlier pencil entry on the corresponding page of the chart correction log, for permanent corrections, and tick the entry for T&P corrections.

	- Initial the IN 83 next to the chart no. and write the date of correction and the Navyeo's name. - Proceed with the next correction. A Sr Sailor should periodically cross check the corrections have been properly and correctly done especially for pilotage charts.
3.	**Post Correction**
	- Check the charts and books for correct procedure and corrections. - Make sure you check the charts in use completely - the most sincere individual may also make a mistake. Though this would take up some more of your time, it is better to be safe than sorry.
4.	**Navarea Corrections**
	- Maintain a separate 'Navareas in Force' folder. This folder should be checked with each 'Navareas in Force' signal and cancelled Navarea Warning[54] signals should be crossed out and moved to the main Navarea file. - Navarea corrections should be undertaken immediately with priority being given to charts of own immediate area of ops, with the largest scale chart being corrected first. - Entry of the Navarea correction should be made on the bottom left hand corner of the chart and the chart correction log with pencil. - The Navarea quoted in the sailing order should be personally checked and sighted by the NO.

[54] INBR 1916 (Notes on Correction of Charts, Publications and ECDIS).

<u>Note</u>:

(a) The NTMs are now being uploaded into LAN or are on internet. This requires Navyeo to download fortnightly NTMs and take colour printout and put up to NO. This also ensures minimum time delay between promulgation of NTM and availability at end user.

(b) The ENC updates are also available for all IN units from LAN which are to be copied to a CD/ S-drive for updating ECDIS. The Navyeo should also maintain a ENC correction Log book where manual entries along-with ECDIS screenshot of 'updates installed' is to be filed.

(c) The NHO has produced a number of Paper charts and ENCs of foreign waters based on joint hydrographic surveys and cooperation. The ships proceeding on OSDs in *IOR* routinely demand foreign/ BA charts which are outdated and vintage. Therefore it is prudent to avail NHO produced latest charts of Indian National series i.a.w NHO Policy letter HO/ S&D/ 7539 dated 20 Mar 18.

(d) The NHO hosts 'online catalogue of charts and Electronic navigations charts' which is kept updated on its website **<u>www.hydrobharat.gov.in</u>** which is to be utilized for ascertaining the latest products of foreign waters.

6. **<u>Ships Proceeding for OSD</u>**. The ships proceeding for OSD/ Op deployment may need to demand charts/ publications at short notice. Certain guidelines are as follows: -

(a) Prepare a list of charts/ENCs and publications in consultation with the Op authority to cover the Mission based deployment including diversionary ports.

(b) Obtain approval to demand from the Op Authority.

(c) Ascertain availability from NCD. Obtain NAC for charts/ ENCs and publications not held with NCD.

(d) Procure charts/ ENCs/ publications from authorised vendors only. It would be prudent to load base CD and permit for ENCs prior proceeding to sea to obviate requirement of consultation with vendor later. Liaise with vendor/ MOCs for regular updates for relevant charts/ ENCs/ publications.

(e) Obtain relevant NAVAREAs for area of operation. Liaise with MOC for regular updates.

CHAPTER 5

CHECKING A CHART

Ascertaining if the charts to be used for pilotage / passage are corrected up to date is an essential part of preparing for a passage / pilotage. Details of the same are enumerated in INBR 1916, and are summarised here under-

PROCEDURE FOR CHECKING CHARTS

(a)	**Annual NTM**	Check the date of publication on the chart and chart correction log against that in the ANTM. Match the corrections in force, as given in the ANTM, to those entered in the chart correction log and, more importantly, to those entered at the left hand bottom corner of the chart itself. Note any notice numbers that may be missing on the chart / in the log.
(b)	**Quarterly NTM**	Undertake a comparison as in step 1 above with the quarterly NTMs issued after the ANTM in the year.
(c)	**Fortnightly NTMs**	Undertake comparison with each NTM issued after the last quarterly NTM.
(d)	**NAVAREAS**	Check the latest NAVAREA warning in force signal for corrections affecting the relevant charts. Check all NAVAREAS issued after the above NAVAREA warning for the relevant charts.

(e)	**Subsequent Actions**	Extract the NTMs pertaining to corrections that appear to be missing/ in doubt. Compare/complete the corrections. Carry out random checks of corrections noted and done, for correctness/ completeness, of a few charts / corrections every month.

Note: For checking a BA chart Weekly Admiralty NTMs can be accessed by downloading from **admiralty.co.uk/msi** or the searchable website **www.ukho.gov.uk/nmwebsearch**. The search option includes search by chart number which will immediately show all the corrections in force for a BA chart.

CHAPTER 6

INSTALLATION OF ENCs AND CHECKING FOR UPDATION

1. **Overview**. The ECDIS is a useful tool for navigation. When integrated with other navigational sensor and systems, even while in pilotage waters. The system is very useful for passage planning and execution. It can be used for monitoring the progress of a passage, while simultaneously providing the cross track error, the course to steer, time to next alteration, time ETA position, etc. In addition, it also has multiple functions like tidal data etc. However, the accuracy and performance of ECDIS is dependent on several different factors and there can be both inherent and induced error.

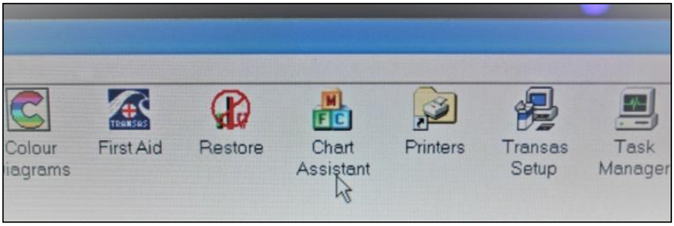
2. It is important to remain cognisant of the fact that improper setting-up, gaps in functional checks, and incorrect use would get reflected inaccurate performance / output from the system. Lack of knowledge / experience and expertise on the system would also increase the chance of such error. Hence, even as the IN increasingly uses this latest navigation technology and progressively moves towards its use in ocean and coastal navigation and eventually pilotage **the scope for inherent and induced errors in the system should always be borne in mind**. It is important to use this equipment, gain familiarity with it and learn how to operate it efficiently, whilst simultaneously catering to its inherent error and developing procedural safeguard against any induced error. This chapter aims to enumerate the procedure for installation of ENCs in the ECDIS and checking the status of chart correction thereafter.

3. **Installing Charts.** The procedure for chart installations/updation of ECDIS 3000 and 4000 is as follows:-

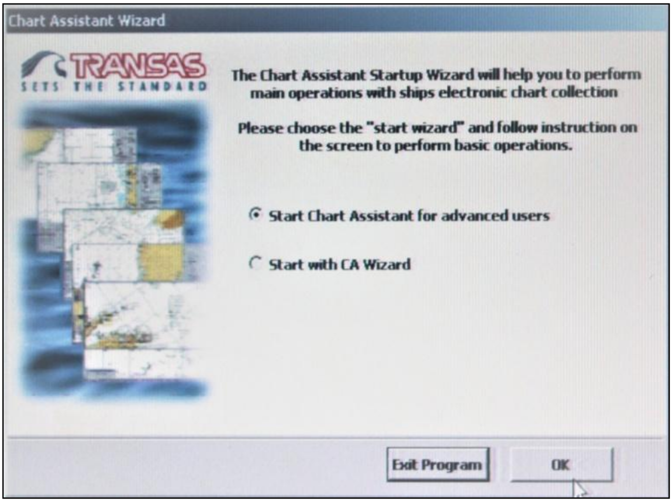
(a) **ECDIS NS 3000**.

(i) Switch on ECDIS 3000 and load ‘Chart Assistant’ by selecting the appropriate item in the

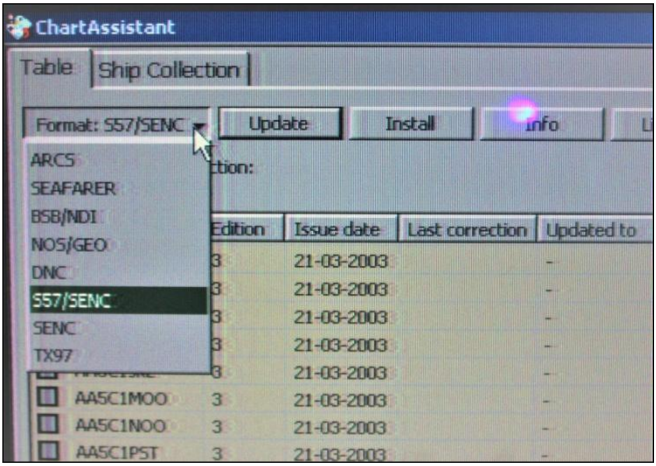
Main Menu in TRANSAS integrator window as shown below.



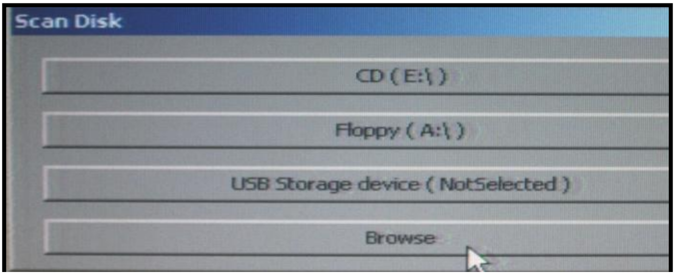
(ii) After clicking on Chart Assistant icon, a new dialog window of Chart Assistant wizard will opened. Now click on 'Chart Assistant for Advanced Users' followed by **'OK'** button.



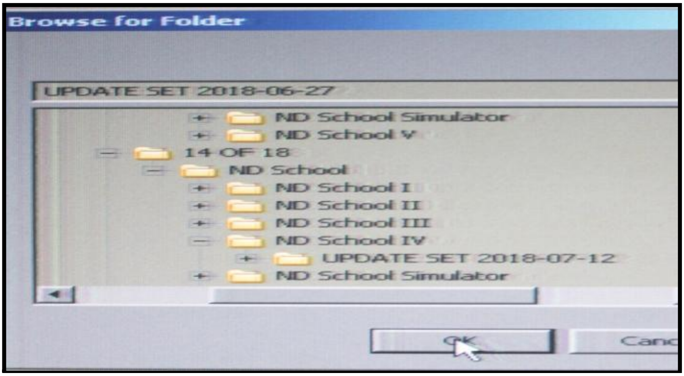
(iii) Now select the format of chart as S57/SENC on 'Chart Assistant 'window and then click on update icon.



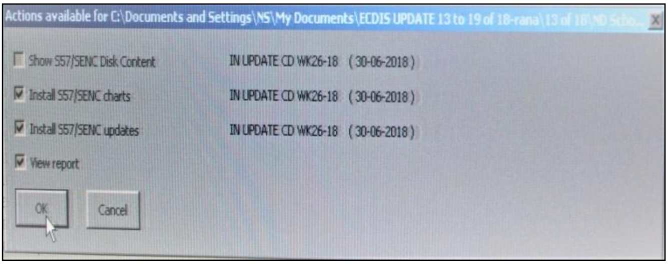
(iv) On clicking update icon the below mentioned window will be opened, after this click on browse option.



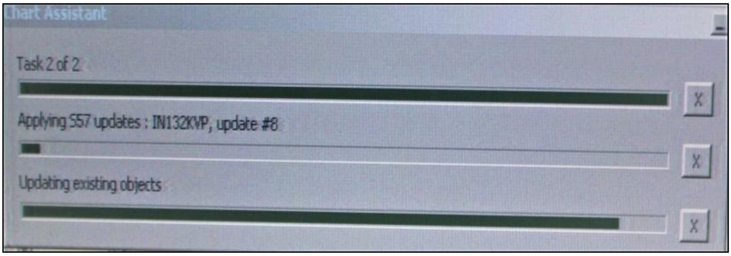
(v) After clicking on browse option, below mentioned screen will pop up on the main window of NS 3000. Select the desired folder and go to the respective update folder which you want to update.



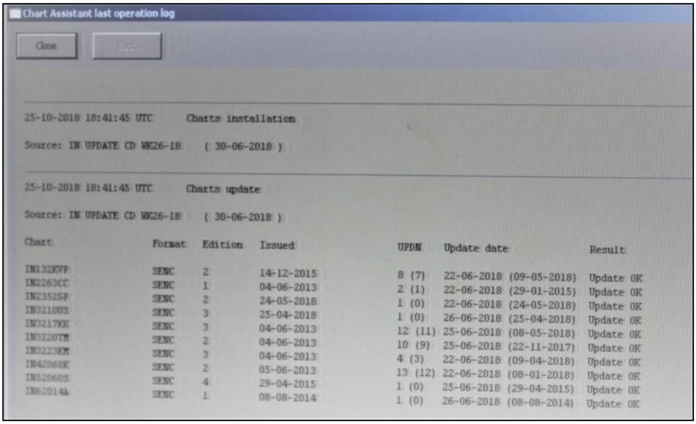
(vi) Next window as shown above will show the Action available on the respective Drive. Click on the actions which you want to perform, after clicking on OK.



(vii) Next window as shown below will automatically run/ perform the commands which were assigned to it in sub paragraph (vi).



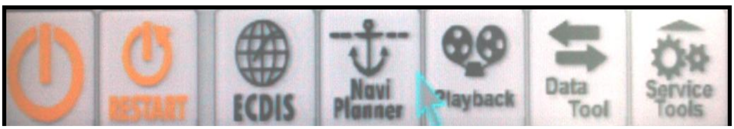
(viii) Next window as shown above will show the chart updation process completion report on the Chart Assistant Last Operation Log Menu screen of ECDIS NS 3000. This is the complete procedure of updation of charts in ECDIS 3000.



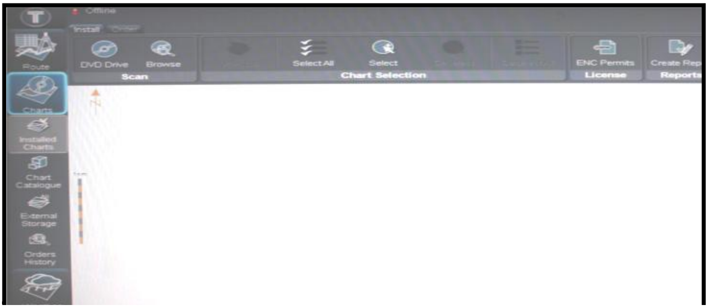
(ix) On completion of ENCs updation, click on ‘Chart Assistant’ and select ‘Chart Assistant for Advanced Users’. Select the format S57/SENC of chart on ‘Chart Assistant’ window. Now select on last correction dialogue window, this will show the ENCs with latest updated week with date.

(b) **<u>ECDIS NS 4000</u>**

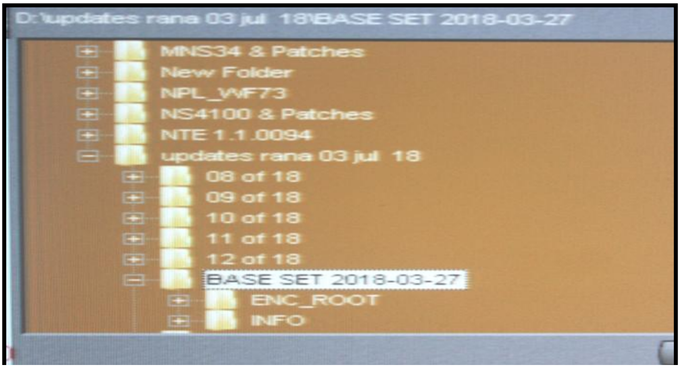
(i) Switch on ECDIS 4000 and load ‘Navi Planner’ by selecting the Navy planner symbol in the Main Menu of Transas integrator window as shown below.



(ii) Now click on the Installed Charts icon on tool bar and then go to browse option.



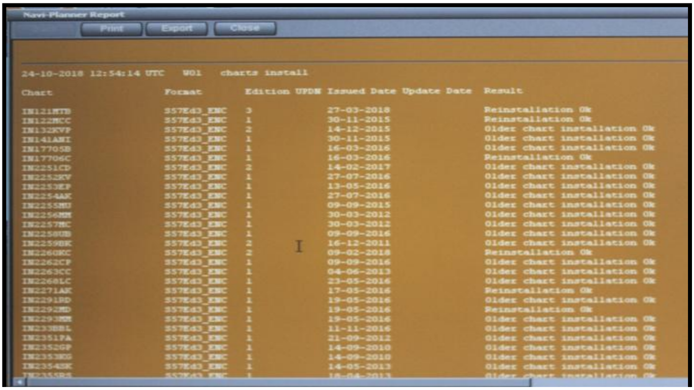
(iii) After clicking on Browse option, the screen shown below will pop up on the main window of NS 4000. Select the desired folder and go to the respective update folder which you want to update.



(iv) Next window shows 'Source Scan Completed'. During this selection click on the desired sub menus (sub menus icon colour will turn to green from white after selection). After that click on installed selected items on the same screen.

(v) If the window ask that a particular chart is equal or older than the available one in your collection, then click on 'Yes' icon as shown above.

(vi) Next window will show the chart updation process completion report on the screen of ECDIS NS 4000. This is the complete procedure of updation of charts in ECDIS 4000.



(vii) Point to remember is that, on completion of ENCs updation, update your tote on ECDIS for the latest correction with NTM and date.

(viii) For checking the date of last correction, select 'Navi Planner' and then click on 'Chart' Icon, which will further reopen a new dialogue box on the bottom of the same window. Click on last update icon, this will show the ENCs with latest updated week with date.

4. **Installation and Updates for IBS**. Procedure for installation and updates for Integrated Bridge System (IBS) is platform specific and differs from the common procedure used in TRANSAS ECDIS. Hence, it has not been covered in this chapter. Users/ operators onboard ships fitted with IBS viz. Kamorta class etc. are advised to go through the operator manual/ SOPs set in force in consultation with OEM.

SECTION III

NAVIGATIONAL EQUIPMENT

CHAPTER 7

NAVIGATIONAL EQUIPMENT

I. RADAR ERRORS

1. **Radar**. Radar performance is dependent on the characteristics, features and accuracy of the radar in use and correct operation of user controls. Ranges in excess of 5/ 6 Nm are rarely required for Blind Pilotage. Therefore, the radar used for (blind) pilotage should be adjusted for optimum performance at short range. Where available, short pulse length and narrow beam width will improve accuracy of bearing and range measurement. Some of the main issues that must be borne in mind in adjusting and using the radar for conduct of pilotage are summarised here under:-

(a) **Suppression Controls**. These can be used to reduce or remove rain clutter, sea returns and side/ black echoes. But, care must be taken not to eliminate all small contacts. Weather and sea state are constantly changing, as are ranges from large radar echoing areas; so these controls need frequent adjustment.

(b) **Range Errors**. The various errors in measured radar range, and their causes, are as follows:-

(i) **Index Error (I.E)**. The I.E is caused by receiver delay (a fixed quantity) and calibration error (applicable to a particular display). Index error should be regularly measured for each display and on each range scale, both in harbour (Sea and Action / CRC) and at sea. It should be marked on the display and used in all fixes, cross index ranges, etc. Do remember that, by convention the sign of the Index Error (I.E) and correction is the same. So, an I.E of + 0.2 C implies you have to **add** 0.2 C to the displayed range.

(ii) Operator error can result from parallax with an engraved scale or due to the limits of accuracy of the strobe.

(iii) Error may be introduced by certain controls that alter the range of the contact (e.g. "clip").

(iv) Inaccuracy can be caused due to not using the correct scale on the range strobe.

(v) Errors due to the radar horizon; first detections are usually of a high land inland and not of the coastline.

(vi) Errors due to the varied reflecting properties of different objects and their incidence to a radar beam. For example, a vertical granite cliff will give a much stronger echo than a sloping sandy beach. Buoys and beacons will not paint if the sea is so rough that it’s reflecting power swamps the receiver.

(vii) Incorrect calibration may also produce errors. **The display used for blind pilotage must be set up correctly**.

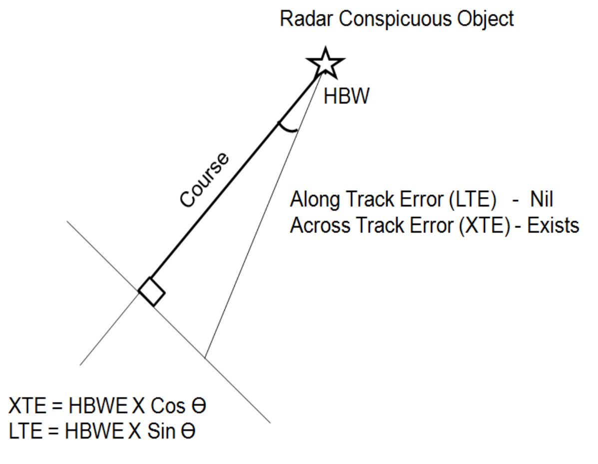
(viii) In addition, the average standard deviation of radar range is generally $\pm$ 50 yards.

(c) **Bearing Errors**.

(i) Horizontal beam width causes an incorrect picture to be painted. Bearings of points of land lying across the beam will be distorted by approximately half the beam width. If the radar object selected is ahead / within 30 degrees of the bows, the major component of the Half Beam Width Error (HBWE) will be perpendicular to/ across the track, i.e. Cross Track Error (XTE). Hence, objects ahead on the bows are unsuitable for maintaining track, while they are better suited for Distance to Go (DTG), especially for anchoring.

(ii) The XTE = HBWE x Cos Θ, where Θ is the angle of the radar object from the ship's head. So, for a radar object on the beam (i.e $\Theta = 90°$), the XTE will be nil. Whereas, for a radar object right ahead (i.e $\Theta = O°$), the XTE will be equal to HBWE. Hence, CIR should always be taken for a radar object on near the beam, to minimise XTE due to HBW errors.

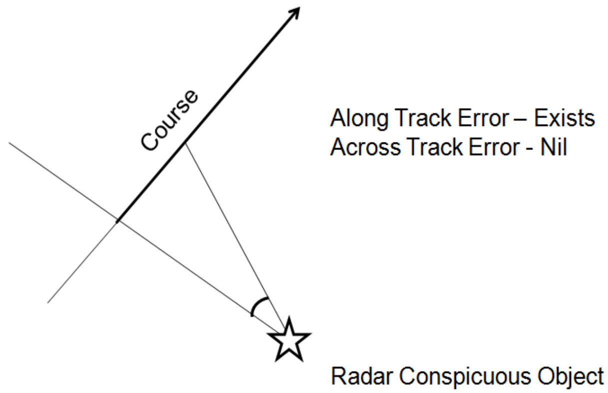
Fig 7.1: XTE - Object Right Ahead



(iii) On the other hand, for radar objects on the beam / within 30 degrees of the beam, the major component of HBW error is along the track. Hence, beam objects are better suited for maintaining track and should preferably be avoided for determining DTG, especially for anchoring and in narrow channels. Here, the Along Track Error (LTE) = HBWE x Sin Θ, where Θ is the angle of the radar object from the ship's head. So when running on a radar object (DR ahead), the LTE will be nil, while it will be equal to HBWE for a beam object. Hence, DFI for Let Go is always to be taken w.r.t. an object right ahead / astern, as it minimises HBW error along the track.

Fig 7.2: LTE - Object Abeam

XTE = HBWE X Cos Θ
LTE = HBWE X Sin Θ



(iv) HBWE increases with the range of the object. Hence, closer objects should be selected to reduce the HBWE.

(v) Operator error due to parallax with an engraved cursor will cause bearing errors, and consequent erroneous appreciation of ship's position line.

(vi) Error due to the physical limitations of the equipment, for instance:-

(aa) Difficulty in lining up the ship's head marker to an accuracy of less than $^1/_2{}^0$.

(ab) Difficulty in lining up the radar aerial on the masthead to an accuracy of less than 1°.

(ac) Gyro error[55], unknown or incorrectly set/ adjusted in the radar display.

(ad) Backlash in aerial training motor.

(vii) Incorrect centering of the display produces bearing errors when read from the cursor.

(viii) The Average Standard Deviation of bearing for a single point object is $\pm$ 1^0.

(ix) Errors in bearing are invariably present and are hard to estimate, so radar bearings should always be treated with extreme caution (1° at 1 nm - error is 33 yards, and at 6 nm - error is 01 cable).

2. **Radar Accuracy Checks**

(a) **Linearity**. A linear display is essential for accurate parallel indexing. With dividers, compare the physical distances between range rings on the display. This should be done on each of the range scales that are likely to be used. If, on any one scale, they are not equidistant then the display is not linear.

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[55] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

(b) **Alignment**. At regular intervals during blind pilotage, the alignment of the picture and display must be checked by:-

(i) Comparing ship's head marker with a gyro repeater.

(ii) Comparing radar and visual bearings of a point object.

(iii) Centering the display.

(iv) Comparing the radar bearings and charted bearing between two contacts.

(c) **Index Error**. Index error (range error) is not constant and every opportunity should be taken to obtain a check. After each check the revised error must be marked on the display and applied to all subsequent ranges measured.

3. **True Motion - Limitations**. True motion has the advantage of making stationary contacts readily identifiable, but the limitations to be borne in mind are:-

(a) Contacts closing on steady bearing are not immediately apparent.

(b) There are breaks in compilation and control every time the position is reset.

(c) Adjustments to remove the effects of TS and leeway are difficult to determine.

4. **True Motion - Cautions**. If true motion is used, the following points should be borne in mind:-

(a) Shifts of pictures must be carefully planned to take place after the ship is settled on a leg and has been fixed on the chart, so that the pilotage continues by EP during the short break entailed.

(b) Shifts of picture should not be left to the last moment in case this coincides with a close quarter situation, which requires constant watching.

(c) An even closer liaison with the anti-collision plot must be maintained because the BPO/ BSO will be unable to properly cope with the shipping situation in this case and he has no time to do the requisite plotting to determine CPA.

II. GPS/ ECDIS ERRORS

Errors in GPS

5. A multitude of electronic positioning systems are in use across the world, including, GPS, GLONASS, Galileo, etc. Within the Indian Navy, the GPS has become an important facet of not only navigation, but also operations. GPS onboard *IN* Ships is now integrated with a wide array of equipment, e.g. ECDIS, CTD, Trigun, etc. The positional errors that may occur in the GPS are generally, widely known. A few, common issues that may affect the accuracy of GPS are covered in this section. It bears reiteration that, continued use of visual, radar, and other traditional methods of ascertaining position remain equally, if not more, important, and must never be ignored.

6. In addition to the inherent positional errors, the following common problems may occur with the GPS[56]:-

(a) An unexpected fault can occur in GPS at the system level (for example on a satellite), giving inaccurate or erroneous positions. In general, such faults should be flagged by a modern receiver, but users should never be complacent.

(b) The GPS receiver or the navigation equipment displaying the position (for example an ECDIS), may develop a fault which may not be automatically monitored and flagged to the user and may cause accuracy problems.

(c) A badly sited GPS antenna may cause accuracy problems.

(d) Unintentional 'jamming' of the GPS signal may occur from interference on board the ship or an external source, which may or may not trigger a positional alert.

(e) Intentional jamming of the GPS signal may cause inaccuracies in position, which may not trigger a positional alert.

(f) Intentional spoofing of the GPS receiver may create positional inaccuracies. This is unlikely to trigger a positional alert.

7. In addition, older or substandard GPS units:-

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[56] Dr. Andy Morris, Integrated Bridge Systems, Vol 2, ECDIS and Positioning (London, The Nautical Institute, 2010)

(a) May not have RAIM (Receiver Autonomous Integrity Monitoring) and therefore, may be unable to warn users promptly of an integrity issue because of possible satellite failures.

(b) May not provide an alert, either within the unit itself or may not transmit correctly to the ECDIS, which has the following fault or special conditions have arisen:-

(i) A specified HDOP has been exceeded.

(ii) A new position has not been calculated for more than one second.

(iii) Whether or not DGPS corrections are being applied.

(iv) That a satellite fault message has been received.

(v) Whether a RAIM 'caution' or 'unsafe' situation has risen.

ECDIS[57]

8. Similar to other electronic navigational equipment, the ECDIS can fail, either outright or in a way that can give misleading information. An outright failure may at times be better than a 'softer' failure, which may not attract immediate attention. When an ECDIS is switched on, it goes through a series of checks and any detected anomalies will result in an error message, generally as an indication on the screen, rather than as a navigational alert. Any such message should be noted and addressed appropriately (guidance for the same should be available within the user

[57] Dr. Andy Morris, Integrated Bridge Systems, Vol 2, ECDIS and Positioning (London, The Nautical Institute, 2010)

manual). During use, an ECDIS will attempt to self-monitor problems that, if detected, will result in an indication or a navigation alarm, depending on its severity. However, the equipment is unlikely to be able to detect all faults, which could give rise to the display of incorrect navigational information, and emphasizes the need for continued vigilance on behalf of the OOW.

9. If there is a perceived problem with the primary ECDIS, it would be prudent to immediately initiate working with the backup facility. Many faults can often be cleared simply by restarting the ECDIS. For instance, blank or corrupted display, ultra slow response to commands, or an inability to remove system error messages (rather than navigation alerts) may be corrected by switching off the unit and after a short wait, of say five seconds, switching it on. During this shutdown and restart sequence, the ship should be navigated on the backup system and the OOW should not be directly involved with the restart procedures. If it is possible, the standard menu command to shut down the ECDIS should be utilised, as this will reduce the possibility of restart problems.

10. The user manual, for each specific ECDIS, may give guidance on the preferred procedure when the normal menu for shut down is unavailable or fails to work. For instance, on some systems, it is possible to affect shut down by simultaneously pressing the Control, Alt and Delete buttons on the key board. As a final resort, it may be necessary to switch off the main supply to the equipment. Re-starting after a nonstandard shutdown can take rather longer than normal, emphasizing the need to first concentrate on transferring navigation to the backup system. If the original problem persists, then the backup must continue to be used until the unit can be repaired. However, it may be

appropriate to attempt the restart procedure at least a second time.

Common Errors

11. The following common errors may occur in the ECDIS and its usage:-

(a) Ship's dimensions not/ incorrectly fed into the system, particularly while operating in narrow, restricted waters.

(b) Time zone settings incorrectly fed in the system.

(c) Audio alarms kept muted, leading to attention not being drawn to a particular failure.

(d) Inappropriate safety contour/ safety depth selected, leading to depth alarms being disregarded.

(e) Units for depth, height, etc selected incorrectly.

(f) Primary Positioning System incorrectly selected to DR, rather than DGPS/ GPS. Alternately, this may also happen automatically, if the DGPS/ GPS feed to the ECDIS is interrupted. At times, this may escape attention if the alarms are muted. This may give a false indication of the ship proceeding correctly (as calculated by DR), while she may actually be getting set towards dangers.

(g) Width of nav track entered incorrectly, leading to alarms not being raised on going off track. This would be particularly relevant while undertaking pilotage.

(h) Corrections on the ECDIS not being up to date, particularly Navarea warnings[58].

(j) Nav track not checked for dangers, which can be done by simply using the automatic route checking facility in the system.

(k) Not correlating the nav track on ECDIS with that on the paper chart.

12. **Ring Laser Gyro**. The term ‘Ring Laser Gyro (RLG)’ is somewhat misleading as it is not a ring and it has no rotating mass (as in a conventional Gyroscope or Gyro Compass), it therefore has no conventional Rigidity in Space and Precessing of the Spin Axis is not possible. The RLG operation is based on relativistic properties of light such that it can measure any rotation about its sensitive axis. This implies that the orientation in inertial space will be known at all times. The elements that measure actual accelerations can therefore be resolved into the appropriate direction.

[58] INBR 1916 (Notes on Correction of Charts, Publications and ECDIS).

CHAPTER 8

CALIBRATION/ CHECKS OF NAV EQUIPMENT

Radar

1. **Radar Range Error Checks**. Whilst alongside, compare radar and charted ranges of conspicuous objects.

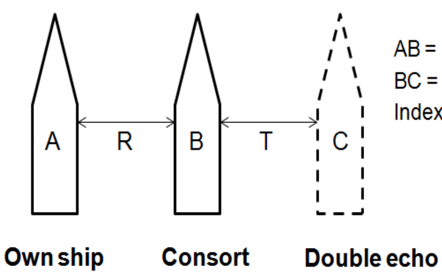
I.E = True Range - Radar Range

Example: For true range of 1'.0 and radar range of 0'.98, the IE = 1.00 - 0.98 = + 0'.02. Hence, I.E of + 0'.02 is to be added to the radar range to obtain true range.

2. **Two-Mark Method**. When passing directly between two conspicuous objects. Measure the two ranges, add them together and compare them with the charted distance. The index error will be half the difference between the radar and charted distance because two radar ranges have been used.

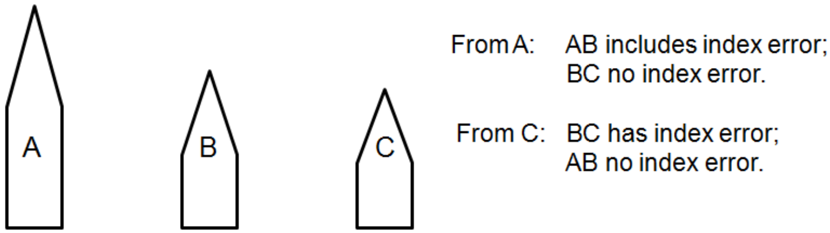
I.E. = [(Charted Rge between two objects)—(Radar Range + Radar Range2)]

3. **Two-Ship Method**. Two ships proceed in line abreast and close in until a double echo appears on the radar.



AB = True Range ± Index Error
BC = True Range (AC-AB)
Index Error = BC-AB
= True Range — Radar Range

4. **Three-Ship Method**. Three ships proceed in line abreast and simultaneously measure ranges one from another.



Ship A provides true range B to C and ship C provides true range A to B, so all three ships can obtain their index error.

5. **Radar Bearing Checks**. Apart from range errors, it is essential to determine the bearing error of the radar as well. This may be determined, whilst at anchorage/ along side, by taking the visual and radar bearings of a suitable object (which should be conspicuous visually and on the radar) and comparing the two. E.g. if the gyro bearing of an object is 180 and the radar bearing is 179, the bearing error = 180 - 179 = +1 degree, indicating that the radar bearing needs to be adjusted by +1 degree. However, the element of gyro error may still be present in this calculation, if not catered for initially.

6. **Radar Calibration Chart**. Take an HSA fix and compare charted and radar ranges from a conspicuous object. This may also be done by fixing your position using any other suitably reliable method and comparing the ranges thereafter.

7. **Reduction of 'Cocked Hat'**. If three radar ranges produce a 'cocked hat', the radius of a circle contained within the hat provides a check on index error (this is not as accurate as the other methods above).

II. LOG

8. **EM Log**. EM log is the most common log being used in Indian Navy. The accuracy of EM log depends on the type of sensor being used and its position on the hull. The signal output from the sensor is directly related to water flow and is rarely linear over the whole speed range of the vessel. EM log works on the principle of Faraday's law of electromagnetic interference.

9. **Occasions for Log Calibration**. The log should be calibrated on the first installation and thereafter on following occasions -

(a) Annually.

(b) On completion of refits.

(c) On any addition/ alteration to the underwater outfit of the ship.

(d) When in doubt in respect of log performance.

10. **Considerations during Calibration**. The following considerations are germane while undertaking log calibration:-

(a) Calm sea conditions with no/ minimal swell and Nil or known tidal conditions.

(b) Winds below 10 kn.

(c) The ship should be in normal loading conditions, with all equipment fitted as in actual, e.g. Sonar dome lowered, etc. However, in the case of ships fitted with towed arrays, the same should be housed.

(d) The rudder should be used sparingly during the calibration.

(e) The propeller RPM and pitch (if relevant) should be maintained constant during the runs.

(f) The log is required to be calibrated across the entire spectrum of speed regimes to obviate the possibility of any undetected errors. This is generally done for speeds in multiples of 6 kn viz. 6, 12, 18, 24 etc through the full range of speed.

(g) The log speed should be noted every 15 sec for speeds below 20 kn and every 10 sec for speeds above 20 kn.

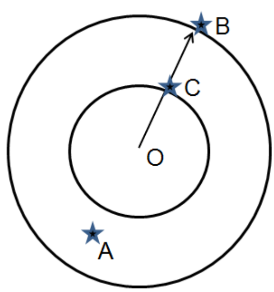
(h) Irrespective of the method in use, the ship should settle on the desired course for about 05 min to permit all parameters to settle, prior commencing the actual measured mile.

11. **Methods of Calibration**. Calibration involves concurrently ascertaining the mean speed of the ship as displayed by the log and the mean speed over ground. Various methods for calibration are available as follows:-

(a) **The Measured Mile Run**. This method entails running on a measured mile, normally marked with transits. The course selected should be along the direction of prevailing set, if any, and should be free of traffic/ navigational hazards. ‘Speed through Water’ (Log speed) needs to be noted. In case of error in ship’s log, accurate assessment of set is to be made (estimated from ECDIS), prior building up to full power, by conduct of one-mile run measured by DGPS/ GPS, on reciprocal courses along the prevailing set in the area. In the event that DGPS/ GPS is used for determining speed attained in FPT, it is to be the correct 'Speed through Water', that is to be recorded by adjusting the 'Speed over Ground' noted on DGPS/ GPS for the prevailing set.

(b) **<u>The DGPS/ GPS Method</u>**. In this method, a reference position may be fed into the DGPS and the ship thereafter proceeds with two/ four runs as in sub Para 6 (a) above.

(c) **<u>Danbuoy Method</u>**. The use of a danbuoy accrues the benefit of permitting the calibration to be done in deep waters, precluding shallow water effects, etc.



A	–	POSITION OF FIRST DANBUOY
B	–	POSITION OF SECOND DANBOUY AT COMMENCEMENT OF RUN – 2.5 nm – **START STOP WATCH**
C	--	POSITION OF SECOND DANBUOY AT COMPLETION OF RUN – 1.5 nm – **STOP STOPWATCH**
O	--	CENTRE OF RADAR PPI

<u>Fig 8.1 : Danbuoy Method</u>

(d) In this procedure, the ship lays two danbouys about 3 Nm apart along a radial perpendicular to the direction of the prevailing wind. Thereafter, the ship commences from one of the danbouys and sets course for the other. Once settled on course, it should not be changed, irrespective of relative change in the position of the buoy. The range of the buoy is measured on the Nav Fire Control radar and the ship undertakes a measured mile run to the target buoy, e.g. if the range of the dan is 2.5 Nm at the time of commencement the VRM is put to 1.5 Nm and the speeds measured till such time that the dan reaches the 1.5 Nm circle.

12. Normally, two runs at each speed suffice, but in case a tidal stream or winds prevail, then it is advisable to undertake two runs each on both headings. The difference between the mean log speed and the mean speed over ground is the log error and should be calculated both in knots and as a percentage of the log speed. For detailed procedures for the above method, the navigator should refer to BR 45 (3)/ 2011.

13. **Calculation from Speed Log Calibration**. The vessel's mean as shown by the speed log is compared with the Ground Speed actually achieved and from this the Percentage Speed Log Correction may be calculated. The Percentage Speed Log Correction must always be calculated as a percentage of (Speed Log) Water Speed and Not of Ground Speed.

(a) **Observation and Recording of Log Speed – Method**. For Speed Logs providing a direct measure of speed, the reading of the speed indicator should be noted every 15 seconds (every 10 seconds for speeds of 20 kn and over). The readings of the distance recorder should also be noted so that any discrepancy may be identified and corrected.

(b) **Calculating of Percentage Speed Log Correction**. The mean Ground Speed and Speed Log mean Water Speed at each calibration speed should be calculated for each run, both in knots and as a Percentage Speed Log Correction, where:

C = Percentage Speed Log Correction

V_1, V_2, V_3, V_4 = Ground Speeds Measured on runs 1, 2, 3 and 4 respectively.

L_1, L_2, L_3, L_4 = Mean Water Speed measured on runs 1, 2, 3 and 4 respectively.

(i) **Two Run Formula**. If it is only necessary to carry out two runs at each calibration speed (when the Tidal Strem may be assumed to be zero or constant), the Percentage Speed Log Correction is given by formula

$$C = 100 \left(\frac{V_1 + V_2}{L_1 + L_2} - 1 \right)$$

(ii) **Four Run Formula**. When the Tidal steram is changing, an accurate Percentage Speed log Correction can only be obtained if 4 runs (i.e 2 in each direction) are carried out. In this case the Percentage Speed Log Correction is given by formula:

$$C = 100 \left(\frac{V_1 + 3V_2 + 3V_3 + V_4}{L_1 + 3L_2 + 3L_3 + L_4} - 1 \right)$$

(c) **Keltron V3**. The problem being faced with Keltron V3 is that the correction is only available for fixed error. Therefore the log is to be corrected closer to economic speed and residual % error for 2-3 speed groups should be done again and noted for reference.

III. LUBBER'S LINE ALIGNMENT

14. **Importance of Correct Alignment**. Compass repeaters on the bridge, bridge wings and elsewhere in the ship are aligned to the main gyro ship's head. It the lubber's line on the relative bearing ring of the repeater is not on the fore and aft line of the ship, then gyro bearings taken from the repeater will be inaccurate. It is important therefore to check the orientation of the lubber's line as it can easily be displaced by maintenance work or gunfire.

15. **Method of Alignment Check**.

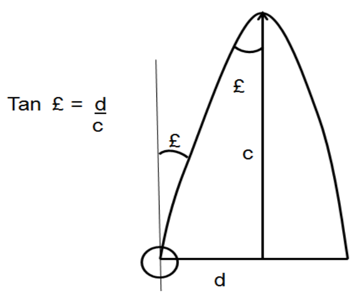


Fig 8.2: Toe-in Angle

(a) A centre line repeater from which the Jackstaff (or some other fixed centre line object) can be seen may be checked by direct comparison of the lubber's line bearing with that of the Jackstaff.

(b) For a repeater displaced from the centre line, as in the diagram, one method of checking is by knowing the toe-in-angle, E, from the fore and aft line and the bearing of the Jackstaff. This can be calculated by finding the displacement of the repeater from the centre line, d, and its fore-and-aft distance from the Jackstaff. The wing repeater is to be aligned so that the bearing of the Jackstaff reads as the ship's head $\pm$ £.

(c) An alternative method for checking a repeater displaced from the centre line is by taking the relative bearing of a distant object simultaneously, from both the displaced repeater and a correctly aligned centre line repeater. With a displacement of 6 metres, the angular difference is less than half a degree at ranges over half a mile, and insignificant at ranges of more than 1 mile. However, the toe-in angle method is more accurate.

(d) It is recommended that the repeater supplies be switched off, prior checking the toe-in angle, to obviate any errors that may creep in due to ships movement alongside.

16. **Occasions for Checking Repeater Alignment**. Repeaters lubber's line alignment should be checked at regular intervals and especially on the following occasions: -

(a) After work on the repeater or in its immediate vicinity.

(b) Before sailing or berthing.

(c) Before replenishment.

(d) In the event of heavy shock such as that caused by gunfire, collision, etc.

IV. SWINGING SHIP

17. This part is intended as an aide memoire to specialist Navigating Officers on swinging ship. The reference books (Navigation Vols. (BR 45(1), 45(3), 45(4)) and BR 100) should be read beforehand to refresh the memory on points of detail.

18. **Swinging Ship**. This expression is used to describe the whole operation of adjusting the magnetic compass. This includes ascertaining the deviation, the adjustment (during which correctors are placed to reduce the same), and observation of the residual deviation.

19. **Occasions on Which a Ship Should be Swung**. A ship should be swung on the following occasions: -

(a) Before sea trials of a new ship.

(b) After extensive structural alterations near the compass.

(c) After considerable change of magnetic latitude.

(d) After refitting, or lying in one direction for a long period.

(e) If any other corrector magnets have been altered.

(f) After modification or repair of D.G. equipment.

(g) After wiping or flashing treatment.

(h) At least once a year.

20. **<u>Methods of Swinging Ship</u>**. Methods of swinging ship depend on the methods of comparing compass bearings with magnetic bearings so that the values of deviation can be obtained. Since deviation changes with heading, the ship is turned to appropriate headings (normally the cardinal points) and necessary adjustments are carried out to reduce the deviations. Thereafter, the ship is swung through 360^0 to obtain the deviations remaining after correction. There are five methods of swinging ship as follows:-.

(a) **<u>By Bearing of a Heavenly Body</u>**.

(i) The elevation of the body should be less than 30^0.

(ii) The rate of change of bearing should be small.

(iii) The sun is a suitable body during morning and evening hours.

(iv) True bearings can be obtained from Sight Reduction table or from Weir's Azimuth Diagram for the period of swing and tabulated beforehand at intervals of about 4 minutes and converted to magnetic bearings.

(v) Using this method, the ship is not restricted in her movement.

(b) **<u>By Bearing of a Distant Obiect</u>**.

(i) This method requires the ship's position to be known.

(ii) The magnetic bearing of distant object is then obtained using chart from the ship's position.

(iii) The accuracy of this method will depend on the accuracy of bearing obtained from chart.

(iv) This method may be used when at a buoy, at single anchor or underway.

(c) **<u>By Transits</u>**.

(i) The ship is made to turn on a known bearing of two or more conspicuous objects in line.

(ii) This method involves turning the ship through various headings maintaining the ship on transit, which becomes very difficult particularly if there is wind, sea or stream.

(d) **<u>By Reciprocal Bearing</u>**.

(i) This involves taking bearing of a shore compass or bearing plate set up ashore.

(ii) The bearings obtained by the shore are signaled by radio. The reciprocal of this bearing is to be used for comparison with compass bearing of ship.

(e) **By Gyro Compass**.

(i) The ship's head by Gyro and Magnetic Compass can be compared on different headings.

(ii) The Gyro error, if any, must be accurately known and allowed for[59].

(iii) This method is convenient for use while placing corrector magnets but should only be used for obtaining deviation if no other method is practicable, as the accuracy of deviation is dependent upon the accuracy of the Gyro Compass.

21. **Obtaining Deviation of Between—Deck Compasses**. The deviation of between decks compasses are obtained by comparison of ship's head with the standard compass.

22. **Methods of Obtaining Variation**. The variation can be obtained from the chart for the swinging ground. The variation can also be calculated from the mean compass error.

23. **Planning**.

(a) Decide the method to be used for swinging ship.

(b) Select suitable swinging ground.

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[59] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008 and Good practice mandates establishing gyro error prior cast off, in pilotage waters and daily. Art 1312 (m) p13-12, BR 45(1)(2) ed 2008.

24. **<u>Time for Swinging Ship</u>**. As a general rule the following minimum time should be allowed for swinging ship:-

(a) Harbour adjustment - 1 hour

(b) Swinging without DG - 1.5 hours

(c) Swinging with DG on

(i) Compass with DG corrector coils - 3 hours

(ii) Compass without DG corrector coils - 1.5 hours

25. **<u>Preparations</u>**. Inspect the compass, about a week prior to the swing. The points to be checked are as follows:-

(a) Before undertaking the first swing of a new ship. Refer pages 363 & 364, Chapter XXVI of BR 45 (3) / 2011.

<u>Note</u>: *It is highly desirable that an inspection on these lines is carried out by the swinging officer before all occasions of swinging. This is particularly necessary after long refits.*

(b) **<u>Before Subsequent Swinging of the Ship</u>**.

(i) Record of last swing should be checked to:-

(aa) Note any remarks.

(ab) Adjust positions of spheres (coefficients D & E).

(ac) Line up steering compass lubbers line (coefficient A).

(ii) Lubbers line of standard compass.

(iii) Binnacle keys.

(iv) **Testing Compass Card for Friction**. To test the card for friction, the card should be deflected about 20^0 by a magnet and then released. If it comes to rest in its original position the card is reasonably free from friction. The test should be carried out when there is no chance of the ship's head moving, i.e. the ship should be secured fore and aft.

(v) **Presence of Bubble in the Compass Bowl**. A bubble generally indicates a leak and therefore a defective compass. This should be returned and replaced by a new one. The presence of bubble makes the compass less accurate and harder to read. If the bowl cannot be replaced then the leakage should be stopped and the bubble removed. The bowls are fitted with a mixture of alcohol and distilled water. The alcohol is added to reduce the freezing point of the mixture. To remove the bubble, the bowl will have to be first unshipped. Then remove the plug from the filling hole, keeping it uppermost, and fill the bowl with the mixture till it overflows. Flock the bowl from side to side to assist any air to escape and replace the plug after ensuring all air has been removed.

(vi) Spare magnets, spanners, screw drivers and Azimuth ring etc. should be available.

(vii) **Communication**. Communication with various compass positions, Bridge and DG operating panel should be available and tested.

(viii) **DG Equipment**. The DG equipment should be serviceable and available for operation. Necessary current settings for the area should be known.

26. **Conditions for swinging ship**. The following conditions should be ensured before swinging ship: -

(a) The funnels should be at their normal sea-going temperature.

(b) The ship should be upright to avoid heeling error.

(c) All moveable iron should be in its sea-going position, e.g. guns, boats, cranes etc. in stowed position.

(d) The ship should be clear of other vessels by at least 3 cables during the swing.

(e) If swinging with DG ON, then it should be switched on for at least four hours before the swing, to allow DG to reach its operating temperature.

27. **<u>Harbour Adjustments</u>**.

(a) **<u>Soft Iron Correctors</u>**.

(i) Check and adjust the amount of FLINDERS BAR if required (Flinders bar corrects for c rod coefficient - B). This is normally not required to be adjusted for subsequent swings, unless there is a large change in magnetic latitude.

(ii) Check and adjust the position of SPHERES (spheres correct a & e rods. Coefficient - D & E). The record of previous swing should be consulted to ascertain this.

(b) **<u>Permanent Magnet Correctors</u>**.

(i) **<u>Heeling Error Correction</u>**. Heeling error is corrected by vertical permanent magnets. The required number and position of these magnets is determined by using the heeling error instrument.

(ii) If there is no ‘g’ rod effect at the compass, as is usually the case at a well designed compass position, the ship’s heading for this correction is immaterial. In case a ‘g’ rod is present, however, it is preferable to place the ship's head within 109 of East or West (Magnetic) before correcting the heeling error.

<u>Note</u>: *For swinging ship with DG ON, the heeling error correction must be carried out with DG operating*.

28. **At Sea Adjustments**.

(a) **Adjustment**.

(i) Correct Heeling error if not already done.

(ii) Place ship's head East or West by compass and insert to adjust fore and aft magnet, to correct coefficient B until there is no deviation.

(iii) Place ship's head North or South by compass and insert athwart -ship magnets, adjust the magnets until there is no deviation.

(iv) If there was large uncorrected deviation at (iii) repeat (ii).

(v) Place the ship's head on the opposite heading to (ii) and halve the remaining deviation by re-adjusting the fore·and aft magnets.

(vi) Place the ship's head on the opposite heading to (iii) and halve the remaining deviation by re-adjusting the athwart-ship magnets.

(vii) Place the ship's head on the inter-cardinal point between those used in (v) and (vi) and check the setting of spheres.

(c) **The Swing**. Turn the ship slowly round and obtain deviation on at least eight, but preferably sixteen points.

<u>Note</u>: *If possible the ship should be steadied on each heading, rather than maintaining a continuous swing and at least 40 min. should be taken for the complete swing*.

V. ECHO SOUNDER

29. **<u>Occasions for Calibration</u>**. The echo sounder is one of the most important navigational aids available towards ensuring safe navigation. Hence, its reliability has to be beyond doubt and complete at all times. Towards this end, calibration of the echo sounder is required to be undertaken on the following occasions-

(a) Every time the ship enters dry docks.

(b) Annually.

(c) Post each refit.

(d) Post any major modification / repair on the equipment.

(e) When in doubt of the accuracy.

(f) **Preferably, every time prior cast off, with the aid of a hand lead line**.

30. The echo sounder may be calibrated using any or all of the following methods-

(a) **While dry docking**, prior shutting down of power supply for change over and before the ship rests on the chocks. The calibration is done by comparing the depth of the dock as marked and that indicated by the echo sounder*. It is important to note that the sounding should be* *checked when the transducer is in line with the dock markings. However, if this happens to be in vicinity of the dock gate, the possibility of sludge accumulated cannot be ruled out, which may lead to false echoes*.

(b) With **hand lead line**, preferably on each occasion prior leaving harbour. This practice is important not only for calibration of the echo sounder, but also as a cross check on the exact depth available at the berth. *Maintenance of hand lead lines is also a duty that falls on the navigator as per the Regs I.N, Part I, Art 1316*.

(c) The **'Bar Check Method'** is commonly used in a large part of the world. This entails positioning a metal bar below the echo sounder transducer and lowering it by measured distance from the transducer while simultaneously comparing the readings provided by the echo sounder with respect to the bar. This method, however, is currently not in vogue in the Indian Navy.

31. When *Special Sea Dutymen* (*SSD*) or their equivalents are closed up, or at any other times when ordered, an additional person should close up to monitor and report depths / soundings[60]. ***Standard reports should be at intervals of not greater than 1 minute***, or as follows:-

(a) Report every 01 meter change when operating in area under 0-20 m.

(b) Report every 05 meters change when operating in area under 20-40 m.

[60] Art 0924(a)-(b) p9-12, BR 45(1)(1) ed 2008.

(c) Report every 10 meters change when operating in area above 40 m.

The operator should suffix the depth / sounding with 'Steady', 'Deepening', 'Shoaling' or 'Below Minimum Depth / Sounding'.

SECTION IV

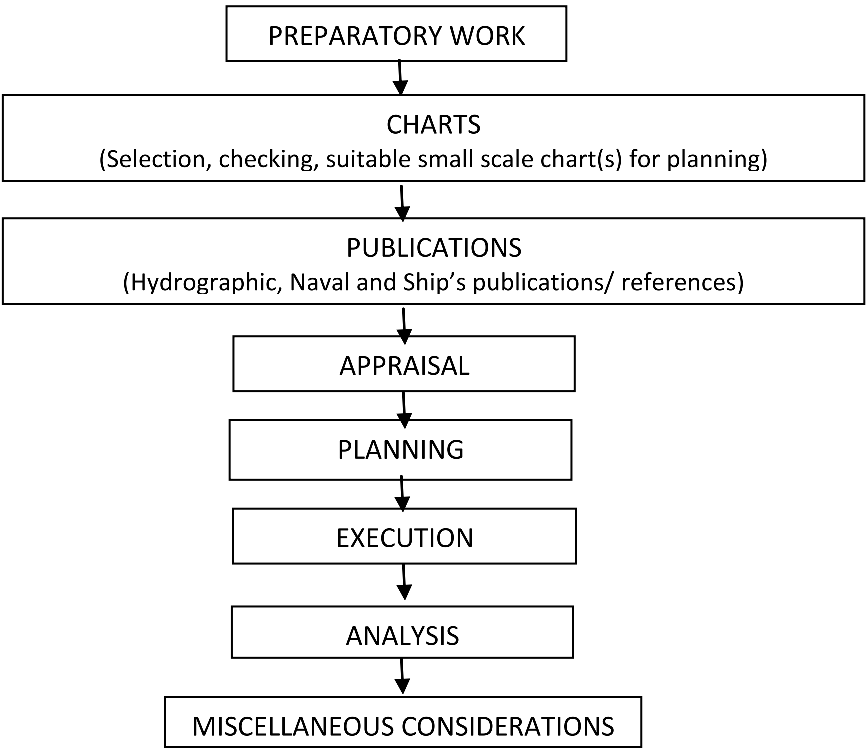
NAVIGATIONAL PLANNING

CHAPTER 9

PASSAGE PLANNING

1. This chapter is to be read in conjunction with and amplification of the instructions and guidelines provided in the Regulations for the Indian Navy, BR 45 (1) and other relevant orders. It is intended as a reference/check off list for the NO to ensure that he has not overlooked any important aspect during passage planning. It endeavours to lay down the steps, procedures and aspects of passage planning in a logical sequence, with a-view to make the job of planning a passage simpler, while retaining the comprehensive nature of the plan.

2. The logic flow of a passage plan is as under:-



References:- BR 45(1) I 1964

BR 45 (1) I 1987

BR 45 (1) & (2)/ 2008

Dutton's Navigation and Piloting

PREPARATORY WORK AND APPRAISAL

(a)	**Charts**

Consult the catalogue of charts and relevant Sailing Directions to select charts to be used for the entire passage.

Select a suitable small scale chart / charts to cover the entire passage.

Are the charts the latest edition?

Are the charts corrected up to the latest NTM /NAVAREA? Any Ty Correction or Navarea warning affecting the passage?

Note and mark all dangers.

Does the chart give any information on the tidal stream, ferry-traffic, fishing areas, etc.?

Place the charts as per consecutive number in the passage folio.

List the charts in the NO's work book.

(b)	**ECDIS**

Is the time synchronised with GPS? (GPS settings to be in WGS 84 datum)

Is the ship's data correctly fed in ECDIS settings?

Are all inputs (GPS, Log, Gyro, Echo sounder, Nav radar, AIS etc.) available into the ECDIS? Are all relevant charts (up to the largest scale) loaded? What is the status of corrections of the electronic charts? Are they corrected up to the latest NTM? Also, presently the Navarea warnings would need to be manually plotted on ECDIS as they are not promulgated for e-charts by NHO. Specific information regarding naval berths/ anchorages, etc. may need to be manually plotted on ECDIS.	
(c)	**Pilots**
Is the edition of the pilot current? Is the latest supplement to the pilot available? Is the pilot corrected up to date? Read the relevant portion of the pilot in conjunction with the charts. Insert suitable extracts / reference in the work book. Ascertain the route recommended by the pilot. What are the hazards to navigation along the route? Are the depths along this recommended route sufficient in relation to' your draught? Ascertain the normal currents, winds, pressure and tidal flow patterns along the intended route. Possibility of encountering TRS during the passage Ascertain visibility conditions for the time of the year as estimated by the pilot.	

Ascertain the harbours, berths and anchorages available enroute and list in the work book (the pilot may not have information on details of naval berthing). What are the prominent navigational features (lights, etc.), which may be encountered enroute? List the same in the work book. Include a description of structures provided by the pilots. Are there any areas of dense traffic expected? Are there any TSS to be navigated? Tab all relevant portions for ready use. Do the wind/ weather conditions affect operations / exercises enroute? E.g. NEly winds would entail a flying course in that generic direction, hence planning SCAs/ DLPs while on a SWly route may affect the SOA. Would the weather conditions be suitable for UNREP, if relevant? Similarly, would they affect the choice of ‘R’ Corpen?	
(d)	**Ocean Passages of the World**
In case of an ocean passage this publication would be useful as it links of the various pilots (which are mainly for World coastal waters). Ascertain the recommended route. What is the distance indicated? What are the winds / weather that may be encountered for the relevant passage?	
(e)	**Routing Charts**
In case of Ocean Passage, these charts will be very useful.	

Ascertain Ocean Currents and wind direction/ strength from these charts	
(f)	**Ship's Routeing**
To be used in case of Ocean Passage. This provides information about TSS, Deep water routes, Areas to be avoided, mandatory no anchoring areas and mandatory ship reporting system.	
(g)	**Distance Tables**
Ascertain the distance between ports from the Indian/ Admiralty distance tables. What is the difference from the distance given along the recommended ocean passage if relevant?	
(h)	**List of Lights**
In conjunction with the pilots and charts, identify the lights likely to be available enroute. Calculate Geographical range and ascertain nominal range from chart. The estimated estimate range of raising / dipping of a light will be based on estimated visibility. List the lights along with characteristics and ranges in the workbook. Drawing of visibility arcs may be done prior departure, if there is certainty of visibility being as estimated. Else, it is recommended that the arcs be drawn during the passage based on recalculated ranges as per current visibility.	
(j)	**Tide Tables**
Calculate the times and heights of tide along the route.	

Does the range or period of tide have any implications on the passage?	
(k)	**Port Orders**
What are the ETA/ ETD positions? Is there a signal required to be made for the same? What are the working hours of the civil port, if relevant? What are the Naval berths available in the port, including lay, length, depth, bollard placement, fendering, etc.? What are the number and type of tugs available, including characteristics (bollard pull, VSP, etc.)? What are the communication frequencies in the port? Are there any specific flag hoists to be flown? What are the recommendations of the port orders vis-a-vis navigation? What are the ceremonials to be followed? Do these affect ETA/ ETD in any way? Where is the Gun Salute position, if relevant? What are the logistic facilities at the port (If non naval port)? Where is the National Flag to be raised/ lowered? Where are the 'part of ship' men to fall in/ fall out? Any restrictions on dumping sewage/ clearing bilges and instructions for STP use, etc.? Any speed restrictions specified within harbour limits?	

Any orders for Force Protection Measures and lowering of Vanguard Boat? **<u>Note</u>**- *For major naval harbours, some amplifying instructions while entering/ leaving harbours may also be promulgated in publications like (W) EFSO and (W) ENCO (Ops). The NO needs to be aware of these instructions. In addition to the Port Orders, for some of the harbours, some Navigational Advisory may also have been promulgated by the local Naval Authorities based on inputs received from Port Control.*	
(l)	**Guide to Port Entry**
This publication provides all the information about a specific port.	
(m)	**NDB**
Tabulate turning data for ease of availability while plotting tracks and wheel over. Check past history of entry/ exit from the same ports if available. Extract relevant advice therein. Tabulate fuel consumption tables. Previous passage analyses would prove useful if the same / similar passage has been undertaken by the ship at an earlier stage. *(In addition to NDB, any past reports on the port entry may also serve as a useful means of reference. in case the ship has never entered that port/ Undertaken the passage earlier it may be useful to go through the NDB extract/ report of a ship which has done so.)*	
(n)	**List of Radio Signals**
Which is the NAVAREA region to be transited?	

Details of NAVTEX stations.

Which are the coast radio stations enroute, including call signs/ frequencies and hours of service?

What are the RACONS / RAMARKS that may be encountered enroute?

When / in what position would you need to change over from one to the other, if transiting through more than one region?

What are the relevant time zones?

Are there any daylight saving hours in force, if relevant?

When and where would you need / plan to adjust watches?

What are the sources of receiving weather reports / warnings?

Extract information in respect of port operations, pilot services and VTMS as relevant.

(p)	**Weather Forecast**

The weather forecast available in open source as well as with Cd Met Office will also be very helpful in planning the passage

On completion of preparatory work and appraisal, the Navigator should have developed a mental picture of what to expect along the passage. He should appraise the Captain at this point and seek his directions.

(q)	**ETA/ ETD/ SOA Calculation**

Calculate the SOA required / the ETD/ SOA ETA required, as relevant.

ETA/ ETD should be checked for correct time zone, daylight

saving hours, etc., if applicable. Have you catered for the currents/ tides / weather/ winds and their effect on your SOA? Have you catered for sufficient time for exercises and operational commitments? Remember, too much time may also be detrimental. Is the divergence taken realistic? You may fall short or have too much time in hand, both of which could be embarrassing. Have you catered for unforeseen eventualities? Calculate the time in hand for various speed/ engine regimes. Is there a requirement for fuelling during the sortie? If yes, then where and how is the same to be undertaken?	
(r)	**Selection of Route – Passage Chart**
Are ETA/ ETD subject to extraneous Route - factors, viz. ceremonial/ tidal/ weather/ port operations, etc.? Is the weather likely to affect the choice of route? Is the recommended route suitable, in terms of time and space, operational requirements (e.g. Exercises scheduled, etc.), economical speed/ Endurance considerations? Are there any operational commitments that need deviation from the recommended route? Identify the areas of dense shipping / fishing traffic expected. Identify areas of low visibility anticipated. Determine the times of passing above areas. Does the passage	

need to be amended for time or space to pass such areas? E.g. One may prefer to transit through the greater part of the Malacca and Singapore Straits during day light hours and at the general traffic speed.

Do the territorial waters of any country fall enroute? Do you want to undertake a passage through such waters? Is it qualified by operational reasons / higher directives? Any legal / operational implications on route, reports, flying, etc.?

Select the final route based on above considerations.

Endeavour to keep the tracks in round figures and parallel / diverging from the coast as far as possible.

Determine positions for change of operational command (CHOP), if relevant.

Plot all relevant positions viz. R/V, exercise areas, etc.

Keep the track sufficiently clear of dangers to obviate the possibility of endangering the ship in the eventuality of a breakdown.

Plot the tracks on the passage chart (s).

Mark the courses neatly and ascertain the positions of course alterations.

Measure the distance along the track and compare with that obtained from distance tables/ ocean passages.

Mark distances to go at suitable intervals, while taking care that your chart does not become cluttered.

Mark the following:-

- Times of course alterations.

- Suitable time intervals along the track.

- Important exercises with PIM.

- Positions and times of adjusting watches.

- Positions for changing over NAVAREA regions.

- Tidal streams / currents if relevant, along with courses to steer if relevant.

Select the method of fixing along the passage. E.g. Radar/ visual fixing in pilotage / coastal waters, GPS / Astronomical fixing in open ocean.

Select suitable fixing marks[61], as relevant.

Ascertain the frequency of fixing [62]required based on the chart scale of large/ medium scale charts used.

<u>*Note*</u>*:- It is recommended that time intervals on the Passage chart (NO's chart) be marked with the SOA, and the large scale charts, to be used by OOWs, be marked with the speed ordered. The latter should be done during the passage.*

(s)	**Duration of Daylight**

Calculate the astronomical data for Daylight positions as per planned track.

Mark the same on the passage chart.

Ascertain the periods of darkness, moon phase and twilight.

Do the above affect operations, specifically flying operations?

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[61] Art 0716 (c) p 07-16, BR 45(1)(I) and Art 1231 (f/h) p 12-27 and 1313 (a)p 13-18 BR 45(1)(II) both ed 2008

[62] Art 0716 (c)p 07-16, BR 45(1)(1) and Art 1231 (f/h) p 12-27 and 1313 (a) p 13-18 BR 45(1)(2) both ed 2008.

(t)	**Passage Graph**[63]

Construct the passage graph and cross check with plotting and times on the passage chart.

Use a graph of suitable size, dependent on the length and duration of the passage, so as to avoid a cluttered graph, which may be unusable.

(u)	**ECDIS**

Plot the planned route on the ECDIS. It is important that the track plotted on ECDIS matches with that on your paper chart.

The following methods may be adopted:-

- Using bearing/range from a nearby charted object to plot the tracks.

- Determining the Lat/Long from the paper chart and plot it on the ECDIS after applying appropriate datum shift correction.

- After plotting the track on ECDIS, the track should be tallied with the track on paper chart w.r.t. Course and Length of Leg.

- The width of the Navtrack may be specified in ECDIS.

- Confirm all parameters for route monitoring (such as XTE, ETA, etc.) have been set as required.

- Check the route for dangers.

- Set the route schedule for monitoring the passage including XTE error, etc. Plot all relevant areas and positions.

[63] Art 1112, p 11-8 original, BR 45 (1)(2) ed 2008.

	- All dangers may be highlighted (as on paper chart) - LDL should be fed in by feeding a safety contour in the ECDIS. - The LDL limits may also be visually shown by changing the contour colours on the chart from that sounding (safety depth).
(v)	**Radar**
The route may be fed into the AIO Display / radar. Check the route as for ECDIS above.	
EXECUTION	
(w)	**Monitoring the passage**
Put the Navigator's fix immediately on arriving on the bridge each morning. A noon and sunset fix is the minimum required for monitoring of the passage. Preferably, the Navigating Officer should plot a fix personally in each watch, if feasible, in ocean passages. The frequency of fixing would bear increase in case of coastal or restricted waters. The NO's instructions to OOWs on the execution of Navigation[64] during passage should cover type and periodicity of fixing, Nav equipment use and performance, the times / occasions for change of navigational chart, and other issues affecting the conduct of navigation. Use the passage graph to check progress of passage and for any corrections required therein.	

[64] BR 45(4)/ 2016, Ch 1, Art 0117(b).

Brief and close up pilotage team, in case of passage through congested or restricted waters. Advise Captain on closing up SSD[65], if required.

The NO should observe and note down his observations with regard to wind, sea, current, weather etc on regular intervals for compilation and forwarding passage report.

[65] Art 1912(g) p 19-7, BR 45(1)(2) ed 2008.

CHAPTER 10

PILOTAGE OVERVIEW

1. Pilotage is the process of planning and executing the ship's movement in the vicinity of land, dangers and navigational hazards, by means of continuous or frequent determination of the ship's position and maintaining the ship's movement accurately along predetermined, planned, lines of position relative to geographical points, such that the ship is able to safely traverse the dangers and remain in safe navigable waters. The central aspects of pilotage are:-

(a) Ascertaining the required depth and width of navigable waters for the ship, with respect to the ship's draught and turning characteristics.

(b) Noting all underwater dangers for the ship in the area of pilotage.

(c) Considering the traffic density and direction of flow, tidal stream and current, wind, weather and visibility, characteristics and capabilities of the ship's navigational equipment, proficiency of ship's pilotage team and their familiarity with the pilotage area/ harbour, degree of availability, reliability and usability of navigation marks, points, systems, and hydrographic and navigational information related to the pilotage area / harbour.

(d) Determining the required speed(s) during pilotage, considering all of the above and any operational requirement.

(e) Determining the optimum navigational tracks to be followed by the ship for pilotage into/through the area or harbour, considering all of the above.

(f) Controlling the movement of the ship so as to keep it on the above tracks and directing the ship safely through the pilotage waters to the planned berth / open waters, by best use of the pilotage team and, tools available to provide accurate, frequent information on the ship's position.

2. The planning and execution of pilotage is one of the most important duties of the Navigating Officer onboard *IN* ships. In the conduct of pilotage, the key lies in thorough planning and efficient execution. These require knowledge, experience and skills on part of the NO and pilotage team, and optimum use of the pilotage team and tools through an effective and efficient bridge and pilotage organisation[66]. BR 45 volume 1 provides a detailed knowledge base on all aspects of pilotage, which need to be honed through observation and experience into the required degree of skill. To aid this process, tips and comments have been provided in succeeding chapters, in amplification of information and instructions in BR 45 volume 1, on some key aspects of pilotage.

3. The efficacy of pilotage is assessed from its results, i.e. the ship completing its pilotage movement safely and efficiently. Hence, the vital aspect of pilotage is the ship's movement along a planned, predetermined, navigation track. Fixing and keeping the ship on a line of position are the essence of pilotage. The NO must employ the navigational aids at his disposal to their best advantage and ensure that the ship is constantly fixed by the best means available, including radar and other radio aids/ equipment for position fixing, in addition to visual fixing, sounding or other methods (Regs IN, Part I, Art 1302 and 1327).

4. BR 45 volume 1 adequately covers the selection of track, various methods of fixing a ship, and means for determining a line of position. All of these methods, would, ideally, be used by the NO in best ascertaining the position of the ship, giving due

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[66] Ch 19, BR 45 (1)(2) ed 2008 and Ch 4 BR 45 (4) ed 2008 refers in this regard.

consideration to their inherent errors and those introduced by the human element. The NO must also consider the navigational characteristics of the pilotage area/ harbour that may suggest which method would bear relatively higher accuracy for that particular movement. Importantly, no single method of fixing and pilotage bears the assurance of accuracy that warrants implicit faith in the same. Further, a combination of methods, giving due heed to the foregoing, would provide a better way of executing accurate pilotage. In all cases, a constant check of sounding and good lookout[67] must invariably be maintained.

5. The various methods of pilotage in the *IN*, prioritised on the basis of their proven accuracies and familiarity of pilotage teams with the same, but excluding the effect of possible human errors, especially by lesser skilled crew (due to gaps in training, experience and application), are as follows:-

MAIN METHODS OF PILOTAGE

(a)	**Transits**
Selection of a track with a suitable transit to run on (ahead / astern) is the most appropriate for pilotage. The transit gives an instant indication of the position of the ship w.r.t the planned track. A transit ahead would be better suited than one astern. In the absence of transits, which have been specifically erected for pilotage, the navigator should ascertain if a transit of any two charted objects would be suitable. The sensitivity of a transit would differ along the length of a pilotage track. The same should be borne in mind while using them, particularly for tracks that may be of an extended length.	

[67] Art 0132 (g) and (h), p 1-47 (original), BR 45 (4) ed 2008.

While a sensitive transit gives an accurate assessment of XTE, and facilitates continuous maintenance on the transit line of position (LOP), it does not provide the exact position on that line. For this, additional LOPs are required, by means of beam/ near beam bearings and dead ranges ahead/ astern to provide a good ‘cut'.

In cases where the succeeding track is also on a transit, it affords a good means of judging wheel over (W/O). In other cases, head marks on the next track, or lines of bearing through W/O position that are parallel to the next track, may be used effectively.

At night, and in low visibility, due consideration is required to the possibility of not sighting/ identifying or even misidentifying the transit. This is especially so where adjacent limiting line transits are present, or several similar lights/ objects are present in vicinity of the main transit.

A cross check by other pilotage means, including sounding and visual lookout, is hence warranted. Even a transit should not be trusted implicitly due to ever present scope of human errors and limitations, and any unknown changes.

(b) **Headmarks**

In the absence of transits, a head mark would be the next appropriate qualification in selection of tracks. The head marks, so chosen, should be clearly discernible and conspicuous.

This provides an immediate reference in respect of the ship’s position w.r.t her planned track, using bearing of the head mark.

However, unlike a transit, this method is prone to errors of the gyro, both known and unknown.

The scope of errors would increase with the range from the head mark.

A transit that is not sensitive is, at further ranges, more like a head mark albeit with visual indication of moving off track.

It requires to be supplemented by fixes by means of beam / near beam bearings and dead ranges ahead / astern.

As in the case of transit, a head mark on present course does not provide knowledge of w/o and DTG. For this fixing and w/o bearings of next head mark/ parallel to next track are required.

Errors in identification[68] of head mark must be considered and other means of pilotage used to cross-check, including sounding and visual lookout, particularly at night, low visibility, or if traffic obscures/ covers the head mark.

(c)	**Fix and Run**

In the absence of both a transit and a head mark, the next best option is to establish a proper fix on the track, and simultaneously identify a fixed object ahead / astern that lies along the bearing of the planned track.

This object can be used as a local/ opportune 'head mark' to assist keeping the ship on the planned track/ established bearing.

However, such an object should be fixed, conspicuous and clearly discernible.

Use of such a head mark must be supplemented by frequent fixes by cross bearings and ranges of suitable objects.

In case no such local/ opportune head mark is available, then frequent fixing must be supplemented with blind pilotage and

[68] Art 0807 (d), p 08-21 BR 45 (I) (2), ed 2008.

other means of pilotage, including sounding and visual lookout. Inherent errors in the fix due to gyro error[69], observation error and time late can be reduced considerably by taking a larger number of bearings and ranges, to provide more LOPs for a better fix.	
(d)	**Blind Pilotage**

In the absence of any of the above, though the BR 45 volume 1 mentions bearing / range/ HSA lattices, use of Blind Pilotage may be given a thought ahead of these methods.

This would, however, depend on the quality and quantity of blind/ radar conspicuous objects available. It is not recommended in places with widespread drying heights, etc.

In the presence of suitable marks, blind pilotage may well be more reliable, accurate and faster than lattices.

The accuracy of blind pilotage is dependent on proper radar range/ bearing calibration and the selection of suitable radar objects in the appropriate relative sector w.r.t. the ship.

For minimising XTE, the radar object used should always be on / near the beam. Herein, the HBW error is nil across the track (XTE component of HBWE = HBWE x Cos Ө, where Ө is the angle of the radar object from the ship's head).

For the same reason, the dead range of a radar object right ahead, would have nil along track error, but have full HBWE as the XTE. Hence, objects ahead/ astern are not suitable for maintaining track. However, for Letting Go anchor by blind, a radar object right ahead or astern (if latter is not in blind arc) is best suited, since it has nil along track error.

Radar objects that are closer are better than those further, as

[69] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

the accuracy of measurement is higher and effect of HBW error is lesser.

The accuracy of blind pilotage is also contingent upon accurate plotting of parallel index lines at the correct CIR, and gyro alignment/ correction between radar display and the gyro, including for any known gyro error.

In case of change of radar, display or range scale during blind pilotage, there would be corresponding differences from the radar range and bearing errors calibrated/ incorporated in the blind pilotage plan. This will affect the accuracy of blind pilotage. Where such change is planned, and electronic mapping is available (CAIO/ ARPA), then separate blind plans for those pilotage sections can be drawn, saved and recalled, incorporating the relevant errors.

When using blind pilotage, preferably it should be done in parallel from at least one more position/ display, as a cross check and back-up. In case only blind pilotage is being exercised, and other means are not available, then the above must be ensured and reports from both positions sought, with feasibility explored of manning a third display as back-up.

(e)	**Lattices**

In the absence of any of the above during selection of tracks, use of lattices, for speedy and frequent fixing may be used as the next best solution.

This is especially useful, and accurate, in narrow harbours with several prominent Nav marks that offer good range / bearing ‘cuts’ (such as in Port Blair and Vizag).

Within the various options available for lattices, a combination of range and bearing lattices would possibly be the most accurate and the fastest, albeit prone to gyro errors, etc., unlike an HAS lattice.

The objects for the lattice need to provide adequate angles of

cut between their LOPs. Lesser internal between LOPs and higher numbers of crossing LOPs should be endeavoured to provide minimal gaps, to enhance accuracy of plotted fix.
A lattice system remains a 'fix and run', with the advantage of speedier plotting facilitating more frequent fixing. However, since the lattices are drawn on fixed measures, necessitating some interpolation in the plotting, even though this is speedier than the traditional fix and run method, its accuracy is mostly somewhat lesser.

Lattices can be used as a check/ backup to other methods of pilotage. If used as the primary means, then it should at least be supplemented with another means and incorporate at least one multiple - LOP, cross angled, fix on each leg / post alteration of course. Close watch on sounding and proper
visual lookout must also be maintained.

(f)	**ECDIS/ DGPS**

The availability of the ECDIS onboard *IN* ships has vastly improved the ease and speed of geographical orientation.

The GPS and, consequently, the ECDIS would have both inherent and induced errors and should be used with due caution and back up, ***particularly in pilotage waters***.

If remaining cognisant of possible errors, the ECDIS and the DGPS can provide an accurate method of position fixing / determination. The great difference being that a bearing / range fix tells you where you were, while the DGPS on the ECDIS tells you where you are.

In any event, the navigator is expected to know where he is at all times. The fixing team and blind merely confirm or challenge the navigator’s determination of ship’s position.

As per FOST guidelines, ECDIS report is to be included in the sequence of reporting during pilotage. It is recommended to have the ECDIS report at the end of sequence preferably after visual report, so that the exact position of the ship at that movement is known to command and the navigator.

The ECDIS – DGPS combined offer high levels of positional accuracy and utility for navigation / pilotage. The degree of reliability and accuracy in providing positional data by the system in the Indian waters has been fairly accurate except near Andaman and Nicobar and L & M islands.

Hence, while ECDIS with DGPS as a means of pilotage, ~~it~~ should be used as such only as an additional method, to supplement/ cross check the other means. Herein, the DGPS feed must be constantly available to the ECDIS[70], and the same should be constantly monitored.

The above does not hold for an ECDIS with mere GPS, which should not be used for pilotage for the same reasons as above and its known lower accuracy.

Note:- *Post commissioning of GAGAN system, the GPS positional error is being broadcast through GSAT-8 and GSAT-10 satellites. All the ships with GPS (not DGPS), need to enable SBAS functionality in their receivers so as to get increased positional accuracy and reliability which will be at par with the position obtained from a DGPS.*

(g) **Migration to Paperless Navigation**

Migration to paperless navigation is planned to be implemented across *IN* in three phases. ***Phase I*** of IHQ MoD (N) policy (*IHQ Mod (N)/ DNO letter OP/OPD/4471/ECDIS dated 07 Jun 12*) for migrating to paperless navigation was implemented in Jan 13.

The policy is currently under deliberation at IHQ and a new policy is likely to be promulgated for IN's migration to complete paperless/ digital navigation

[70] IHQ MoD (Navy)/DNO Letter OP/GN/5764/BOI(ii) dated 27 Jul 15 – Advisory No SBII/DNO/007/15.

CHAPTER 11

PILOTAGE PLANNING

1. This chapter is intended as a reference/check-off list for the NO to ensure that he has not overlooked any important aspect during his pilotage planning. It follows a sequential logic flow, which a navigator may follow when carrying out his pilotage planning. It also addresses the often ignored but extremely vital aspect of following an equally stringent check-off list with regards to electronic charts and the ECDIS system installed onboard ships.

2. The logic flow of a pilotage plan is as under:-

PRELIMINARY CHARTWORK

↓

PUBLICATIONS
(Hydrographic, Naval and Ship's publications/ references)

↓

DECIDING / PLOTTING THE PLAN ON CHART

↓

BLIND PILOTAGE PLAN

↓

ECDIS PREPARATION

↓

MISCELLANEOUS CONSIDERATIONS

↓

SHIP HANDLING CONSIDERATIONS FOR PILOTAGE

↓

SUBSEQUENT ACTIONS

References- BR 45 (1) / 1987 and 2008

BR 45 (6) / 2002

PRELIMINARY CHARTWORK

(a)	**The Chart**

Select the largest scale charts suitable for the conduct of pllotage.

Are the charts the latest edition?

Are the charts corrected up to the latest NTM /Navarea? Any Ty Correction or Navarea warning affecting the plan?

What is the reliability of the charts, in respect of date and method of survey[71], etc.?

Are there any limitations imposed on fixing marks due to scale of chart? E.g. A conspicuous object may be just beyond the chart limits.

Identity the recommended navigational channel and the system of buoyage therein.

Highlight all dangers.

Insert brief description/ obtain photos of conspicuous objects if required.

Does the chart give any information on the tidal stream, ferry-traffic, fishing areas etc?

Note: A pilotage plan should not be made on chart with tracing paper. It will have inherent errors.

[71] Art 0613, p 6-5, BR 45 (1) (1) ed 2008

PUBLICATIONS	
(b)	**Pilots**

Read the relevant portion of the pilot in conjunction with the chart. Insert suitable extracts in the work book.

Identify all dangers indicated in the pilot and highlight the same on the chart (In case of a discrepancy between the pilot and the chart, confirm the date of publication of both. Also confirm the status of corrections).

Identify cross channel ferries, barge routes, etc. that may be a danger identify if there is need to pass under a bridge, etc.

Identify the landmarks and topography, indicated in the pilot, on the chart.

Obtain photographs of landmarks, buoys, etc., for ease of identification[72] by pilotage team.

Ascertain the route recommended by the pilot.

Are the depths along this recommended route sufficient in relation to your draught?

Are there any special conditions affecting your movement? E.g. Peculiar tidal pattern and range.

Are there any special orders vis-à-vis movement of deep draught vessels, special purpose vessels, etc., which may affect own movement?

Ascertain the normal currents, winds and pressure in and around the port for the relevant time of the year. Also ascertain tidal flow patterns it given in pilot and tally with those indicated on the chart.

[72] Art 0807 (d), p 08-21 BR 45 (I) (2), ed 2008.

Ascertain visibility conditions for the time of the year as estimated by the pilot. Ascertain the berths and anchorages available in the port (the pilot may not have information on details of naval berthing) Are these berths suitable for the ship vis-a-vis length, depth, tendering, etc.? What is the volume of traffic in the port in the relevant month and at the time of the planned movement? Ascertain the position of the pilot boarding ground and tally the same with the chart.	
(c)	**List of Lights**
Identify the lights available in and around the port Calculate the Luminous/ Geographical ranges and ascertain the estimated range of raising/ dipping. Draw the relevant arcs on the chart. Check if any Navarea/ port advisory on a light house being non operational.	
(d)	**Tide Tables**
Calculate the tide for the date of arrival/ departure and for the duration of stay if going to anchorage. What is the range of tide and any implications?	
(e)	**Port Orders**
What is the ETA/ ETD position? Is there a signal required to be made for the same?	

What are the working hours of the civil port, if relevant?

What are the Naval berths available in the port, including lay, length, depth, bollard placement, fendering, etc.?

Any restrictions (timing, day/night, tide, etc.) in entering harbour/ basin and in going alongside any berths?

What are the number and type of tugs available, including characteristics (bollard pull, VSP, etc.)?

What are the communication frequencies in the port?

Are there any specific flag hoists to be flown?

What are the recommendations of the port orders vis-a-vis navigation?

What are the ceremonials to be followed?

Where is the Gun Salute position, if relevant?

What are the logistic facilities at the port (if non naval port)?

Where is the National Flag to be raised / lowered?

Where are the ‘part of ship’ men to fall in / fall out?

Any restrictions on dumping sewage/ clearing bilges and instructions for STP use, etc.?

Any speed restrictions specified within harbour limits?

Any orders for Force Protection Measures and lowering of Vanguard Boat?

Note: *For major naval harbours, some amplifying instructions while entering/ leaving harbours may also be promulgated in publications like (W)EFSO and (W)ENCO (Ops).* ***Also there***

***may be harbour advisory issued by the Local Administrative Authority for some harbours**. NO needs to be aware of these instructions.*	
(f)	**NDB**
Ascertain berthing information, including berthing alongside other classes of ships, if relevant. Tab turning data for ease of availability while plotting tracks and wheel over. Check past history of entry into same port and same berth if available. Extract relevant advice therein. *(In addition to NDB, any past reports on the port entry may also serve as a useful means of reference. In case the ship has never entered that port earlier it may be useful to go through the NDB extract/report of a ship that has done so.)*	
(g)	**Nautical Almanac**
Calculate astronomical data, with specific reference to hours of darkness	
DECIDING/ PLOTTING THE PLAN	
(h)	**LDL**
Ascertain the ship's draught. Ascertain if the safety margin needs to be increased (due to pipelines, negative surges, etc.) or decreased (due to width of channel, operational reasons, etc). Calculate the LDL for the movement. If the pilotage legs are very long and the range of tide is more, then the initial LDL may be calculated till an intermediate point and second LDL calculated for rest of the pilotage based on HOT.	

Plot the LDL on the chart, covering the entire harbour/ pilotage waters. Ascertain sea room along the navigable channel. *<u>Note</u>: The HOT taken for calculation of LDL for pilotage needs to be lowest HOT likely to be encountered during pilotage.*	
(j)	**Clearing Bearings**[73]
Plot clearing bearings and "box in" the track. What is the amount of sea room available? Clearing bearings are to be drawn w.r.t. the LDL and not the track. The clearing bearing should be displaced atleast by L/4 from LDL (L is the distance between Stern and Pivot point/ Bridge).	
(k)	**Selection of Track**
Refer back to the recommendations of the pilots and port orders vis-a-vis tracks. Ascertain transits / head marks available. Also assess their suitability during day/night. Draw the track on the chart. Check the selected track for following:- - Stbd side of channel, or as recommended in pilot or local port order - Usable by day and night. - Usable and same for visual and blind pilotage. - Clear of all dangers.	

[73] Art 0715 (e) (f) p7-14 of BR 45(1)(1) ed 2008 and Art 1316 (j) p13-27, Art 1328(a) p13-49 of BR 45(1)(2) ed 2008.

<table>
<tr><td colspan="2">- Clear of LDL.

- Are there any constrictions?

- Ascertain proximity of dangers on each leg. Is there adequate sea room to manoeuvre within the clearing bearings?

- CTS should cater for any tidal stream/ current prevalent.

- In narrow channels, do the clearing bearings provide adequate margin for alteration of course?

- Likely to experience any crossing traffic?

- Is this track clear of ships at anchorage?

- How would the position of the sun affect the ship during pilotage?</td></tr>
<tr><td>(l)</td><td>Depths</td></tr>
<tr><td colspan="2">Calculate ‘Minimum Expected Depth[74]’ for each leg (apply HOT and transducer draught to depth) and where? The HOT taken for the calculation should be for the expected time of transiting on that leg.

This will be the minimum Echosounder depth you would be expecting on each leg during pilotage.</td></tr>
<tr><td>(m)</td><td>Wheel Over</td></tr>
<tr><td colspan="2">Extract turning data from NDB pages tabbed earlier.

Plot wheel over position using Advance and Transfer / DNC data.

Select suitable object for wheel over bearing - parallel to new course and relatively rapid change of bearing.</td></tr>
</table>

[74] Art 1312 (o), p 13-13 BR 45 (1) (2) ed 2008.

Cater for tidal stream while plotting wheel over position. For larger alteration of courses, if visual marks area available, also plot/ plan for monitoring of turn[75].	
(n)	**Fixing Objects**
Select suitable fixing objects for each individual leg, and sections thereof in case of longer legs. Is the angular separation[76] between selected objects sufficient? Preference should be given for objects ytahead rather than astern and those nearer rather than farther. Select objects preferably on the same side of the channel and those that may be observed from the same pelorus. The objects should be usable by day and by night. Take into account effect of backscatter as also any temporary disruption of lights in harbour (promulgated in Navarea/ Ty Notices).	
(p)	**Chartwork**
Erase all old tracks and fixes. Check track is accurately transferred between charts, where more than one is being used. Ensure charts are sequentially arranged. Mark position for change over of charts. Write the course clearly on the track. Indicate the planned speeds adjacent to the track.	

[75] Art 1314 (i), p 13-23, BR 45 (I) (2) ed 2008.
[76] Art 0807 (a) p 8-20, BR 45(1)(1) ed 2008.

DR the track. Mark gates along the track as relevant to aid in maintaining ETA/ SOA. Measure bearings for distances to wheel over on each leg. Note down all visual references, nav dangers, checking of transit, etc. in the Remarks column of your visual plan against distance to wheel over.	
(q)	**Point of NO Return**[77]
Ascertain the point of no return vis-a- vis ship's draught, width of navigable channel and proximity of dangers. Mark PNR on the chart.	
(r)	**Study the chart**
Study the navigable channel and build a mental picture of the passage through the same. Prepare a small scale copy of the chart and navtrack for ready reference of the Captain.	
(s)	**Cut out of Ship**
Cut out of A cut out oi the ship, as per the chart scale, may be made and run along the recommended / planned tracks, to build a mental picture of the sea room available.	
BLIND PILOTAGE PLAN	
(t)	**CIRs**
Ascertain radar conspicuous objects to be used.	

[77] Art 1312(k) p13-12, BR 45(1)(1) ed 2008.

Are there drying heights in vicinity of the objects?

Are the selected objects clearly discernible in the midst of other vessels / objects? E.g. A solitary object in the midst of a heavy fishing area may be difficult to identify.

Ensure that objects selected for blind pilotage lie within 30° of the beam, and preferably within 15°/ as close abeam as possible. In case of longer legs, select multiple CIR objects, catering to the above.

Draw and measure the CIR on each leg.

Draw a sketch of the radar PPI for ease of BSO.

Make a Radar Identification Card (RIC) for all radar conspicuous objects.

(u)	**Clearing Ranges**

Mark the clearing ranges commensurate with the clearing bearings.

(v)	**Wheel Over CIRs**

Mark the W/O position for each leg.

Are these radar conspicuous objects easily identifiable? Are they parallel to the next course/ suitable for use as a wheel over object?
If not, then is a suitable Dead Range available? (as close ahead/ astern on current leg).

Select the W/O CIRs and measure them for each leg.

(w)	**Radar Display Work**

Ascertain the gyro bearing and range errors of the displays to be used by BPO and BSO. Preferably, keep them adjusted to highest accuracy/minimal errors.

Plot the Blind Plan personally on the BPOs display, catering to the residual Index Errors [78]for range and bearing, and known Gyro Error. Brief the BSO on the blind pilotage plan and display controls in detail. Ensure he is proficient in methods and conduct of BP. Check the accuracy of Blind Plan plotted/ saved on the BSO and BPO displays, prior to commencing pilotage. Get the pilotage track plotted on radar. <u>Note</u>: *Several modem radars have the facility of getting GPS inputs and marking GPS positions. While these features may be used as required, It is important that the Blind Pilotage plan is based on ClRs/ DRs and is independent of GPS inputs.*	
ECDIS ACTIONS	
(x)	**Setting**
Is the time synchronized with GPS/ DGPS? (GPS settings to be in WGS 84 datum) Is the ship's data correctly fed in ECDIS settings? Are all inputs (GPS, Log, Gyro, Echo sounder, Nav radar, AIS, etc.) available into the ECDIS?	
(y)	**Electronic Charts**
Are all relevant charts (up to the largest scale) loaded? What is the status of corrections of the electronic charts? Are they corrected up to the latest NTM? Also, presently the Navarea warnings and T and P corrections are to be manually plotted on ECDIS as they are not promulgated for e-charts by NHO.	

[78] Art 1316(e) p13-27, BR 45(1)(2) ed 2008.

Specific information regarding naval berths/ anchorages, etc. may need to be manually plotted on ECDIS.

(z) Plotting the Dangers

All dangers may be highlighted (as on paper chart).

The feature of plotting clearing bearing is available and these may be plotted as per the paper chart. The boxing up of turn is also feasible by plotting clearing bearings.

The LDL limits may also be visually shown by selecting the four shade feature and defining minimum safe depth in settings.

(aa) Plotting the Track

It is important that the track plotted on ECDIS matches with that on the paper chart. The following methods may be adopted:-

- Use bearing/range from a charted object to plot the tracks

- Determine the Lat/Long from the paper chart and plot it on the ECDIS after applying datum shift correction.

After plotting the track on ECDIS, the track should be tallied with the track on paper chart w.r.t. Course and Length of Leg.

(ab) Setting safety limits and Route Monitoring

The width of the Navtrack may be specified in ECDIS.

Confirm all parameters for route monitoring (such as XTE, ETA, etc.) have been set as required.

Check track / position history save settings have been put to once every 10 sec.

Check Track feature available on ECDIS can be used to check the tracks for all kinds of nav dangers, cautionary area, depth limits etc. The feature is very usefull.

(ac)	**ECDIS Utilisation**
	The ECDIS report needs to be the part of reporting sequence along with Visual Fixing, Blind and Anti-Col. reports. Availability of radar and AIS [79]inputs in ECDIS could enhance situational awareness in Anti-Col situations. **It is vital to prevent over-reliance on ECDIS by ensuring that visual and blind pilotage organisations work independently of ECDIS inputs.**
MISCELLANEOUS CONSIDERATIONS	
(ad)	**Gyro Check**
	What are the sensitive transits available (for checking the gyro'? (These transits should also be highlighted on the chart). What will be the position of the ship at these times? Extract details of the gyro check objects for providing to the pilotage team. Carry out a Gyro check prior cast off.
(ae)	**Alternate Plan**
	Prepare an alternate plan – anchorage / alternate berth[80].
(af)	**Change of Charge/ Con**
	Decide the position where the NO would take over charge and con from the SSD OOW. In case the alongside approach is to be done from a different

[79] Art 0954 (a) – (c) p 9-34, BR 45 (1)(1) ed 2008.
[80] Art 1312 (t), p 13-16 BR 45 (1) (2) ed 2008.

position (like bridge top/wings), decide when/where would CO/NO shift to that position.

Discuss with the Captain to ascertain position of shifting charge and con to the Captain or vice versa in the initial / final stages.

(ag)	**Manning**

Any critical shortfall/ change in SSD which affects the conduct of pilotage?

(ah)	**Boat**

Decide the position for lowering/ recovering boat. Assess the effect of wind/tide when reducing speed for boat lowering/recovery.

(aj)	**Anchors**

Amount of cable to be let go in case of anchoring in an emergency?

Which anchor is to be lowered A' cock' bill (if any).

(ak)	**Exercises**

In case of leaving harbour, what are the exercises immediately on leaving?

In case of helo embarkation/ disembarkation, on which leg will ship recover the helo? Are the winds suitable to give a feasible Foxtrot Corpen, catering for traffic and sea room available?

SHIP HANDLING DURING PILOTAGE

(al)	**Natural Elements**

Have you understood the expected effect of tidal stream, wind and current during pilotage (as well as going alongside)?

The effect of Wind and Tide and actions to mitigate/ best utilisation must be deliberated upon.	
(am)	**Berth**
What is the planned final approach heading onto the berth? The pilotage plan should enable you to turn correctly for final approach leg onto the berth.	
(an)	**Tugs/ Hawsers**
Discuss the handling of tugs and hawsers with the EXO. Wherefrom (w.r.t pilotage track) would the tugs be available? Any requirements for additional lines, tugs, etc.? It may be useful, particularly with strong wind conditions, to pass a lazy hawser to the tug at the first instance, with the tug following your movement and being ready at short notice, if required. Where do you want to position the tugs when in attendance? How do you want (the tugs to move to that position relative to your planned movement (from ahead / astern, etc.)? When two different tugs are available, where would you position the stronger tug? Will the tugs be passing lines or ship has to pass lines?	
(ap)	**Machinery**
Any machinery or equipment limitations affecting the movement?	
(aq)	**Engines/ Rudder**
What are the envisaged engine and wheel orders during the shiphandling phase of pilotage	

SUBSEQUENT ACTIONS	
(ar)	**Briefing**[81]
Prepare pilotage and entering / leaving harbour briefings as per formats.	
(as)	**Work Book**
Discuss the plan with the Captain[82]. Put up Work Book to Captain for scrutiny, as required by him.	
(at)	**Note Book**
Extract relevant parts of the pilotage plan into the note book. Specifically, distances to go with bearings, blind plan, sketch of radar PPI, chart view, etc.	

[81] Art 1312(u)-(w) p 13-16, BR 45(1)(2) ed 2008.
[82] Art 1312 (u) p 13-16, BR 45 (1)(2) ed 2008 and Art 1913, BR 45 Volume 1 ed 2008.

CHAPTER 12

PLAN FOR SHIP HANDLING ALONGSIDE

1. Each ship has its own handling characteristics. The NO needs to have a thorough understanding of the engine responses, steering characteristics and propeller wash effects peculiar to his ship. Also the effect of wind, current and tidal stream at various speeds and various berths / harbours should be understood. Peculiarities / limitations imposed by the design of the ship (such as bow dome, excessive flare, etc.) should always be borne in mind.

2. This chapter serves to provide some generic guidance to the NO in preparing a ship handling plan, while going alongside/ casting off. While the basic principles remain the same in both cases, the key difference between the two is that while planning for going alongside, you have to estimate the natural conditions likely to be encountered on the berth, while in cast-off you have the opportunity to accurately measure them and cater for them. This chapter focuses mainly on the planning aspects for ship handling. Some additional tips for the actual conduct are covered in Chapter 21.

References:- **BR 45(6)/2002**

Naval Ship handling (Crenshaw)

<table>
<tr><th colspan="2">GOING ALONGSIDE</th></tr>
<tr><td>(a)</td><td>Berth</td></tr>
<tr><td colspan="2">What is your berth?

Are you going alongside another ship or a jetty?

What is the depth alongside?

What is the lay of the jetty?</td></tr>
</table>

How is the fendering on jetty? Are you being provided with a Yokohama fender/ pontoon? What size?

Is there any likely obstruction on jetty which you need to be careful about? E.g. Overhanging cranes, junction box, etc. –

In case going alongside another ship, what is the recommended alignment to enable positioning of brow?

Is there anything you need to be cautious about, such as missile containers, stabilizer, fins, etc? Check NDB for past records.

(b)	**Clearances**

What is the clearance ahead/astern on berth? (Information about ships ahead/ astern may be available only when ship establishes communication with Navy Control. Cater for this and be prepared to modify the plan if required).

Has a stem bollard number been specified? If so, what are likely to be the bridge and stern bollard numbers?

Where do you want the Yokohama fender/pontoon to be positioned? (This should be briefed to SCO/XO to enable repositioning by berthing party if required).

How much clear water do you have in terminal stages of approach?

How much room is available for manoeuvring inside the tidal basin? Note the clearing bearings.

(c)	**Tugs**

How many tugs are available for the movement?

What is their power?

Where do you want them to be positioned? (Cater for differences in power between them. Where do you want the more powerful tug?). What is the communication channel with the tugs? It is a good practice for the NO to keep a whistle ready to draw attention and indicate orders, in case of failure of the primary communication. Do you want them to be available for pushing or do you need to pass a line? Who will provide the lines for the tugs? *Remain aware of the Tug crew change over timings.*	
(d)	**Natural Conditions**
What is the expected wind on the berth? How will it affect the ship at different stages of the final leg? What is the likely tidal stream to be experienced? Are there any peculiarities of the harbour (such as an opposing undercurrent to the surface flow)? In case of a night entry, what is the moon phase and likely ambient visibility?	
(e)	**Internal**
Are there any machinery limitations affecting the movement (such as engine non-availability, steering problems, etc)? Are there any key personnel who have recently changed in the SSD organization, such as CHQM, SSD OOW, NICR watch keeper, etc.?	

Decide what inputs are vital for you in the terminal stages and how you will get them. For example - Speeds - By log /GPS /Visual assessment. - Distances - Visual estimate/ jackstaff markings/ radar/ ECDIS etc. - Head on bearings - Of which object, to be taken from which pelorus and by whom (self/nominated officer). Any key inputs required from other parts of ships (such as clearances astern from QD, positioning for brow, etc.) Where will the CO/NO be positioned for the final approach? At which stage will you move there? *Any key limitations of this position (such as non-availability of pelorus) should be and briefed to the CO.*	
(f)	**Approach Leg**
The final turn onto the approach leg has to be carefully planned, catering for expected effect of wind and tidal stream. Also, in case of large turns (such as off tidal basin in Mumbai while approaching SBW), the turn should be monitored at intermediate [83]stages to avoid over/undershooting. What is the length of your final approach leg? What is your angle of approach w.r.t. lay of jetty? What is the sea room available on either side? What are the clearing bearings? What are the visual reference points to indicate distances to go to berth? What is your head on object (such as Yokohama fender,	

[83] Art 1314 (i), p 13-23, BR 45 (I) (2) ed 2008.

bridge marker flag, stern of ship ahead, etc)? Speed management on final leg is vital. Have visual cues to decide when to stop engines/order astern, etc. Develop a feel for when the rudder becomes ineffective and the sideways forces become predominant.	
(g)	**Contingency Plan**
Be prepared for unforeseen eventualities. Mentally rehearse the options available to you in case of an engine failure, steering breakdown, etc.	
Cast Off	
(h)	**General**
Many of the points as enumerated for going alongside remain relevant. They are nonetheless repeated again for ease of reference.	
(j)	**Berth**
What is your berth? Are you casting off from alongside another ship or a jetty? What is the depth alongside? Have you cross tallied with hand lead line? What is the lay of jetty? How is the fendering on jetty? Are you provided with a Yokohama fender/ pontoon? How many/ what size? Is there any likely obstruction on jetty which you need to be careful about? E.g. Overhanging cranes, junction box, etc. In case alongside another ship, is there anything you need to	

be cautious about, such as missile containers, stabilizer, fins, etc.	
(k)	**Clearances**
Measure clearances ahead/astern. Check for any obstructions/dangers such as boats secured alongside, cranes, etc. How much clear water do you have? How much room is available for manoeuvring inside the tidal basin? Note the clearing bearings.	
(l)	**Tugs**
How many tugs are available for the movement? What is their power? Where do you want them to be positioned? (Cater for differences in power between them. Where do you want the powerful tug?) What is the communication channel with the tugs? Do you want them to lie off or do you need to pass a line? Who will provide the lines for the tugs?	
(m)	**Natural Conditions**
The advantage while casting off is that unlike while going alongside, you can accurately measure and factor the natural conditions prior castoff. Tidal flow (on surface) can be measured by a Dutchman's log. True wind can be measured. However, take into account that you may be in the shelter of another ship/structure, at various	

stages of the manoeuvre. It is a good practice to observe /measure the wind/tidal stream pattern at the planned cast off berth and time over the preceding 2-3 days. Are there any peculiarities of the harbour (such as an opposing undercurrent to the surface flow)? The strain on ship's hawsers indicates the net effect of wind and tide acting on the ship. In case of a night cast off, what is the moon phase and ambient visibility?	
(n)	**Internal**
Are there any machinery limitations affecting the movement, (such as engine non - availability, steering problems etc)? Are there any key personnel who have recently changed in the SSD organization, such as CHQM, SSD OOW, MCR watch keeper, etc.? Any key inputs required from other parts of ships (such as clearances astern from Quarter Deck, clearance from jetty, Stern Rope clear of water, etc.)? Where will the CO/NO be positioned for the castoff? At what stage will you move from there? What is the timeline for the movement? Timings of starting engines, capstan availability and readiness to obey telegraph, etc. (to be also entered in the Sailing Order Book).	
(p)	**Equipment**
What is the planned preparation of anchors? Do you want any anchor to be A'cockbill? When will the log be lowered (if housed)?	

Are the radar displays calibrated and functioning properly? Have the gyro repeaters been aligned and gyro error checked? Have all Navaids /equipment and internal communication been switched on and tested, and functioning properly?	
(q)	**Canting**
Prior to cast off, the Yokohama/pontoon may need to be re-positioned for getting the desired cant (this may need to be done at a time when the ship is not bearing onto the fender). *Also, in case alongside another ship, own position may need to be adjusted to avoid dangers such as flare, missile containers, etc.* Do any lines need to be moved to get a proper pivot point for canting?	
(r)	**Ship safety**
It is important to box-in your planned turning circle for turning around after cast off (if required). You must also be aware about the clearing bearings to keep you clear of dangers.	
(s)	**Contingency Plan**
Be prepared for unforeseen eventualities. Mentally rehearse the options available to you in case of an engine failure, steering breakdown, etc.	

CHAPTER 13

NOTES ON MAJOR INDIAN HARBOURS

1 This chapter is in amplification to the available information for these ports. The berthing conditions and arrangements at various harbours and jetties have been tabulated in respective port/ local orders. They are also comprehensively covered at the ND School during PCT/ long courses, including provision for practical exposure through the Ship Handling simulator. Some salient aspects of Mumbai, Goa, Karwar, Kochi, Chennai, Vishakhapatnam and Port Blair harbours are covered in this chapter for consideration by the ship handler. As a note of caution, the wind and tide conditions described are based upon the personal observations of just a few navigators over the years, and have not yet been validated by any scientific or sufficiently empirical study. Due allowance for inaccuracies may please be made, in view of the same.

MUMBAI HARBOUR

2. **Berthing**. The details of various berths at Mumbai harbour are shown at Figure 13-1. The sounding at all berths is affected by constant silting, and frequently falls at low spring tides. It is advisable, therefore, to monitor the sounding at berth regularly, particularly pre/ post movement. The latest tidal basin sounding chart is to be referred to, prior asking for suitable berth.

3. **Berthing requirement of ships**. The increasing number of ships and submarines has demanded a meticulous berthing plan by the NO/ Ops Officer, as "**first ship berth**" has become a premium opportunity for all operational and refit ships. The ships are required to plan for berthing two weeks ahead and forward berthing requirements to FNO (West) every week by Monday/ Tuesday. The priority for berthing is accorded based on Ops/ Refit considerations.

4. Few points for berthing planning in Mumbai harbour are as follows:

(a) The Outer side of SB/W is not utilised during Monsoons (Mid June to end Aug) view inclement weather conditions. However, may be allotted for duration less than a day with hurricane hawsers provided at berth.

(b) The SB/W Outer and inner berth (exempt SB/W 7 & 8), Cruiser wharf berths A and B and Inner B/W berths P/Q are mainly utilized by Capital ships of the fleet. While Refit ships are berthed at M/N and Barrack wharf berth H. The newly built South wharf is being utilized for submarines and flotilla/ CG ships.

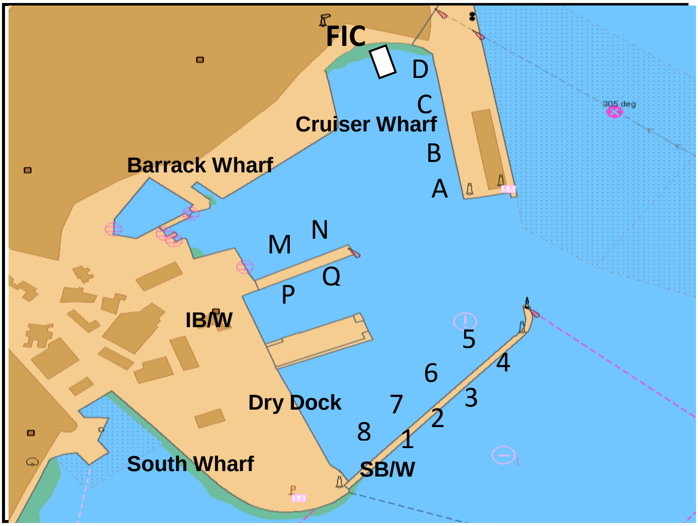

Fig. 13.1: Layout of Naval Tidal Basin

(c) The construction of new dry dock between IB/W and SB/W has reduced the tidal stream strength and circulation inside however, the manoeuvring space for approach onto P/Q and outer side of the dry dock walls are likely to be utilized for berthing of suitable ships in future.

5. The wind pattern at ND (MB) is diurnal for most of the year, with the land sea breeze alternating during the day, in winter months from end Oct to early Mar, and from mid Apr to end May. Variable winds have been noticed during the months of end Mar to early Apr, and from end Sep to mid Oct. The prevailing winds dominate during the SW monsoon, from mid Jun to mid Sep. Elephantas have been experienced prior to the onset of the SW monsoon, in the month of May, and also on its completion in Sep. A description of the various wind patterns is given below:-

(a) **Land Breeze**. The land breeze is the night breeze. It is ***NE'***ly and is light. The wind starts turning around from sea breeze to land breeze in the first watch, from around 2000h. At this time, the direction is ***N'ly***, with a strength of about 8-10 kn. The wind speed falls to 6-8 kn during the watch. In the middle watch, the wind direction changes slowly to NE, and the strength abates to 4-8 kn. In the morning watch, the wind strength drops below 4 kn, with the direction remaining ***NE/ENE***. After 0700h, the wind picks up again, going up progressively from 4 kn to 8 kn during the course of the forenoon watch. The direction also starts shifting back towards North, as the wind starts turning around from land to sea breeze. This pattern is noticed during the winter months, from end Oct till early Mar. The visibility during the first and middle watches, during these months, is good at about 8 Nm as a consequence of the sea breeze blowing the smog and dust onto land. Similarly, it starts deteriorating in the morning watch, due to the dust riding on the land breeze, to about 5 Nm. In the forenoon watch, the visibility is at its lowest, below 3 Nm, with a marked haze over the harbour.

(b) **Sea Breeze**. The sea breeze is the day breeze. It is ***NW***''ly in direction, and its strength varies from 8-16 kn depending upon the time of the day. It starts setting-in towards the second half of the forenoon watch, as described above. Around noon, the wind is Northerly, with strength of about 8-10 kn concurrently, the visibility starts improving, to about 5 nm. In the afternoon watch, the sea breeze gathers strength to about 12-14 kn and the direction shifts to NW. This pushes the dust and haze towards land, and visibility over the harbour improves rapidly to 8 Nm. The sea breeze reaches its peak in the first dog watch, remaining ***NW*** with the strength sustaining between 14-16 kn. During the second dog watch, the sea breeze starts abating, and comes down to 8-10 kn by 2000h.

(c) **Variable Winds**. Variable winds have been observed at ND (MB) during certain months, particularly in the transition from Spring to Summer, and from SW monsoons to Autumn. These are day winds, affecting the pattern of the sea breeze. The wind direction is generally SW during the day, with an average strength of about 4-8 kn. Gusting and rapid shift in wind direction are occasionally experienced when the wind strength is lighter, at about 4-6 kn. This phenomenon is the bane of the ship-handler, for the wind strength has been seen to gust up to 10-12 kn with the direction shifting between South and WNW, all within 05 min. So, when the wind at ***SBW*** whilst making your approach, is observed to be 'light' down the 'deck' during these months, beware! (it may prove prudent to keep a broader angle of approach to berths 5&6 at such times).

(d) **SW Monsoon**. The SW monsoon sets in by early Jun, and the wind remains steady SW, about 6-16 kn. 'During thunder storms, the wind picks up to 20-25 kn.
The visibility is subject to rain, and reduces to 3-5 cables in heavy rain. An observed characteristics of the thunder storms is the onset of heavy rain in 'waves' lasting about 20 min, followed by an interlude of clear weather and improved visibility lasting about 5 min (often permitting ' the transition from off Middle Ground till Ballard Pier).

(e) **Elephantas**. The name Elephantas is given to the local phenomenon wherein a strong wind develops from the direction of the Elephanta Islands and gusts to the west, carrying along a dust storm. The Elephantas last for 4-6 hrs, with sustained wind strength of about 30 kn (winds up to 50 kn have also been experienced during the Elephantas). The warning signs are a sudden increase in the wind strength, accompanied by a large amount of dust swirling in from the east, and a sudden pronounced coolness in the air. The Elephantas take only about 45 min to develop fully from the initial signs, and usually blow themselves out in 4-6 hrs.

6. **Tide**. The tidal flow in the Tidal Basin is indicated in Figure 13.2 and 13.3. The salient characteristics of the tidal flow pattern are summarised below:-

(a) The strength of the neap tide is ~ $^{3}/_{4}$ -1$^{1}/_{2}$ kn at its peak, and the strength of the spring tide is ~ 2-3 kn at its peak, at the entrance to the Tidal Basin off SBW knuckle.

(b) The ebb stream is stronger than the flood stream.

(c) The tidal flow off SBW outer side at knuckle changes direction ~30-45 min before the time of high/ low water. E.g. if time of high water is 1800h, the ebb stream would set-in off SBW at about 1715-1730h. During springs, this time interval may reduce slightly, to about 15 min before high low water time.

(d) The range of tide varies from less than 1.0m during Equinoctial neaps (Mar/ Sep), to above 5.0m during Solstice springs (Jun/Dec). The height of tide falls below chart datum, and the springs are particularly strong, during the month of May-Jun and Nov-Dec.

(e) The duration of high/ low water is about 6 ¼ hrs, and the high/ low water time are approx 40 min later each day.

(f) On SBW outer side, the set is along the lay of jetty (see Figures 13.2 and 13.3). In neap tides, a counter flow is experienced at 50-100 ft from the jetty, particularly during ebb, due to the stream hitting the jetty and flowing outwards. In spring tides, this is less noticeable, due to the strong flow restricting the counter stream to within 50 ft from the jetty. An approach to berths 2/3/4 (stbd side to) is best made in flood/ slack, and avoided in all conditions of ebb.

(g) Off SBW knuckle, an eddy is formed during both flood and ebb. It is prudent to keep a safety margin of at least 75 m from the knuckle under all conditions.

(h) The tidal flow near the knuckle is relatively stronger than along the rest of SBW. The increased tidal strength is marked after (north of) bollard 40, where the SBW starts curving left, to the north. An approach passing close to SBW north of bollard 40 may, thus, experience a strong push towards the jetty knuckle, even when it appears that there is negligible set at berths 2/3/4.

Fig. 13.2 : Tidal Pattern – Flood

(j) Similarly, off Ballard Pier, there is a push towards the Ballard Pier during flood. About 200-300 ft off Ballard Pier, this push is also experienced during ebb, due to out flowing stream from JNPT side. During casting off, it is prudent to keep more than M cable off the Ballard Pier for turning around.

(k) During ***SW'ly*** monsoon, a phenomenon called freshets is often experienced during flood tide, wherein the ebb stream may set in as much as 2-3 hrs before the time of high water. The ship, thus, experiences a tidal push towards the SBW knuckle from the north, in the 'turning circle' off the tidal basin entrance, as for an ebb, despite a rising tide.

(l) In the tidal basin, the flood stream sets in anti-clockwise direction during flood, and in clockwise direction during ebb.

(m) At berths 5 and 6, the ebb is keenly experienced. The ebb stream at these berths hits the jetty and flows outwards. Thus, a ship making an approach to berth 5 or 6, will first experience a set towards the SBW knuckle, while entering the tidal basin, and then away from the SBW immediately on crossing the knuckle. In a strong ebb, therefore, the ship will experience a sheer on crossing the knuckle, with the stern being pushed towards the SBW and the bows getting pushed away from it. Since there is practically no 'run' between the knuckle and berth 5, the opposing sets make approach to this berth very difficult in strong ebb. Destroyers/Frigates have made superlative approaches in a spring ebb, with bold use of power, brought in the ship beautifully to within 50 ft of berth 5, passed all lines and then remained stuck at that position for a long time, due to lateral outwards push of spring ebb, despite engines, lines and strong on-shore wind. At SBW 6,

Fig. 13.3 : Tidal Pattern - Ebb

the effect is somewhat lesser, as it is further from the 'sheer zone', and because the ebb stream angle incident on and reflected from the berth is also lesser. The effect of the flood tide on berth 5 and 6 is diminished due to the flow pattern. As a general principle, therefore, it is more comfortable to cast off in an ebb stream and come alongside in a flood at berth 5 and 6.

(n) At berth P/Q, the ebb stream allows an easier approach than the flood. After the ship has cleared the 'sheer zone' inside the tidal basin mouth, the effect of the ebb is greatly diminished during the balanced approach to berth P/Q. There is only a gentle push into berth, which is experienced closer to the berth, and assists the alongside. In the case of flood tide, it is directly impinging on the IBW. An approach to berth P/Q in a flood, therefore, gives the ship a set from the quarter. If the approach is rendered broader, as is sometimes necessitated by submarines berthed at berth P, the flood can catch the inner (stbd) quarter and tend to broach the ship, with the bows running in towards the berth and stern getting pushed out. It is best to approach this berth in slack or light ebb, rather than a strong flood, and cast off in a light flood slack.

(p) At Cruiser Wharf berth C/D, there is no 'run' available. Ships have to enter tidal basin, turn around and then approach the berth with just a ship-length's run. In a flood, the ship has to keep closer to SBW and gets a marginally longer run. But, this is more than offset by V a much larger angle to turn around as also that the ship gets pushed into a position necessitating a broad approach with flood on inner quarter. Hence, it is relatively easier to go alongside in an ebb stream onto this berth, and cast - off in a flood stream.

(q) At Barrack Wharf, berth G/H, the flood is on the inner quarter. This is felt a little more at berth G than H and, if combined with an offshore wind, opposes going alongside and getting the stern in. In stronger conditions, a planned use of tug may be more prudent. Also, similar to the case for Cruiser Wharf, in a flood tide, the ship tends to get pushed broad on entering tidal basin, making the approach to Barrack Wharf, especially berth G, difficult. Hence, in this case also, it is easier to enter tidal basin and go alongside in an ebb, and cast-off / leave tidal basin in a flood.

7. **Anchorage**. The Frigates and above normally anchor in the NP / NQ series of berths of the Naval Anchorage. The depths at these berths are adequate. However, during fair weather, a large number of merchant ships anchor in the A/B/C/D and E lines of the inner civil anchorage. It is therefore advisable to plot all ships at anchorage/ operate radar and ECDIS to correlate the clearance at berth and along the approach, prior deciding the final approach leg.

8. **Traffic**. Over recent years, merchant traffic in Mumbai has witnessed a quantum increase. VTMS on Ch 12 and JNPT on

Ch 13 are quite responsive and advice on movements planned underway. However, particular caution needs to be exercised in respect of barges transiting to and from the outer anchorage. This has the capacity to foul the final approach into the tidal basin. Caution is also required for vessels (especially, 'Ambuja' series) transiting from JNPT, from behind the anchorage line east of the 030-210 leg, through the pilot boarding ground towards Prongs reef buoy TSS. These vessels usually man Ch 13.

9. **Wrecks**. A multitude of wrecks dominate the seas of Mumbai and its approaches. Many of these have been cleared, whilst others are still in place. Hence, due care needs to be exercised and the charts kept updated always, for both NTM and Navarea Warnings[84].

10. **Transits**. Multiple transits are available in Mumbai, which may be used optimally for visual appreciation of the progress of pilotage. The 305 transit (MPT transit) proves useful in the transition from east of Middle Ground. The transit may be sighted by looking for a pista green coloured water tank atop the port office building in Ballard estate. The aft mark of the transit may be sighted right below this water tank. At night, these transits are conspicuous as they are lit.

11. **Traffic Separation Scheme**. The DG Shipping has established new Safety fairways, recommended routes and traffic separation scheme (TSS) in restricted Indian waters including the offshore development area to enhance safety of navigation. The details of coordinates for the above have been published in the fortnightly Indian Notices to Mariners Edition No 07 of 2018(01stApril 2018). The TSS off Mumbai harbour is mandatory for all Indian and foreign flag ships and vessels entering and leaving Mumbai harbour and Jawaharlal Nehru Port Trust (JNPT)/ Nhava-Sheva harbour irrespective of size. The Figure below illustrates the promulgated TSS safety fairway off Mumbai:

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[84] INBR 1916 (Notes on Correction of Charts, Publications and ECDIS).

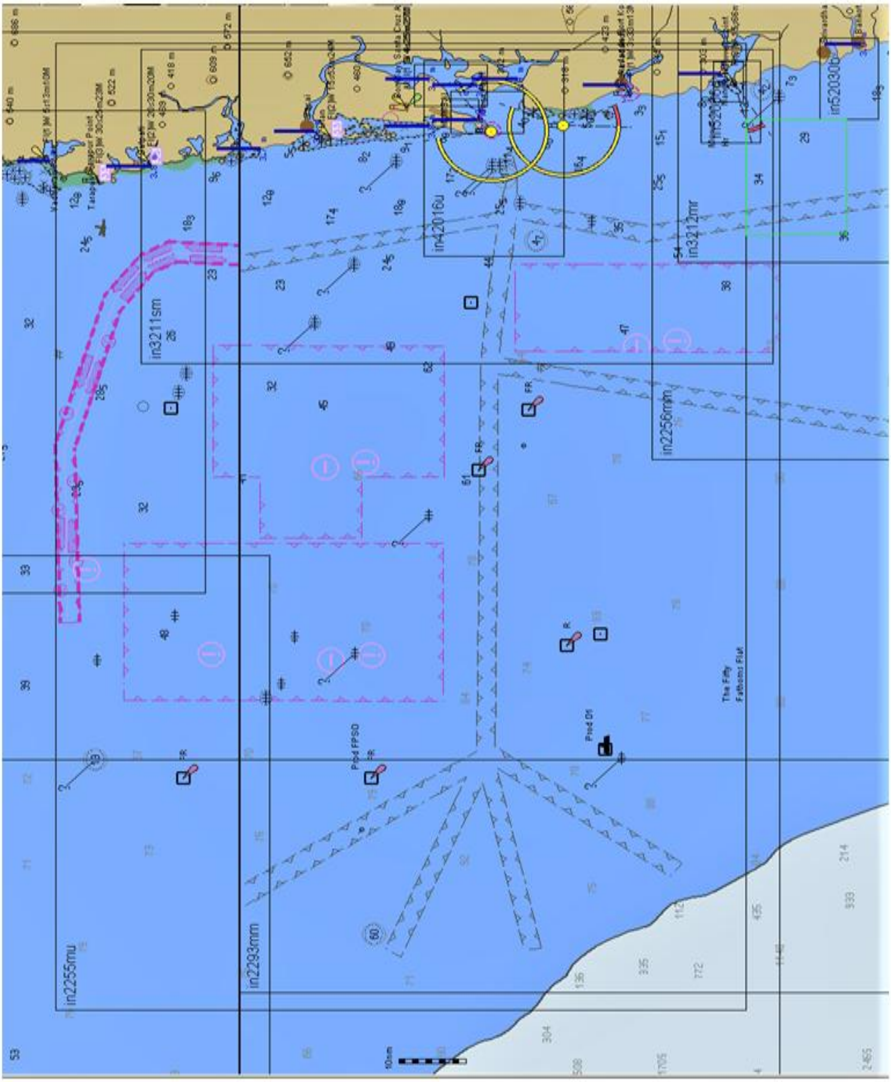


Fig 13.4 : Traffic Seperation Scheme Off Mumbai

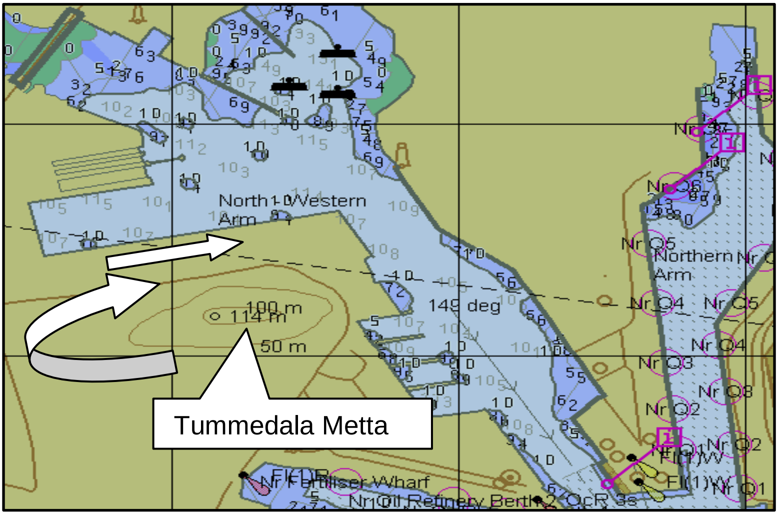
VISAKHAPATNAM HARBOUR

1. **Berths**. A total of 34 naval berths and 21 civil berths exist in the Visakhapatnam harbour with two new berths under construction. The civil berths are numbered from East Quays 1-10 including EQ 1A, West Quays 1-8, REWQ 1 and Fertilizer Berth. The berths are numbered in ascending order from seaward to landward. An overview of the civil berths is important to understand implications of in/out bound merchant traffic while leaving/ entering harbour on movement of naval ships. Ships on all berths except finger jetties need to be berthed with their bows pointing towards harbour exit in order to leave harbour without any assistance/ delay. The minimum alongside depth at all berths is in excess of 6.2 m, minimum being at berth N3. The inter bollard distance between different bollards on the same jetty also is different and the confidential chart of the harbour needs to be consulted for exact dimensions while preparing the alongside plan.

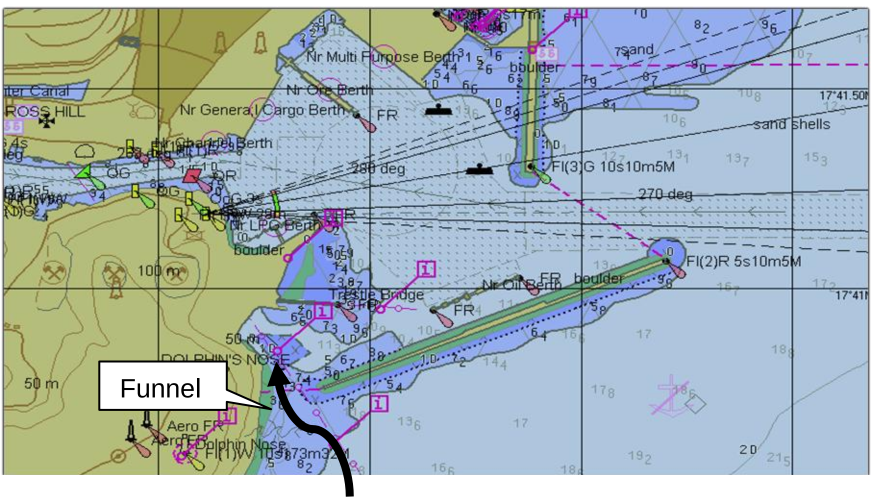
2. **Winds**.

(a) The mean direction of wind and mean wind speed throughout the year at Visakhapatnam is in consonance with the details provided in the Port Orders.

(b) **Peculiarities.** The winds on jetties inside harbour are at variance with the existing true winds and are governed by the presence of land features. The wind pattern on finger jetties and N 14A to N 21 is directed by the 114 m hill *Tummedala Metta* inside Naval Dockyard. The fetch provided by flat grounds of Garuda dictates the wind pattern on West Wall and Refit jetties. The winds on berths N 17- N 21 generally blow along the length of the jetty during afternoons.



3. **Tidal Streams**. The effect of tidal streams inside harbour is minimal as it is a well sheltered harbour. However, strong set may be experienced off breakwaters specially during monsoons.



4. At OTB a funnel exists at the southern end of SBW formed between Dolphin Hill and the Breakwater edge which allows ingress and egress of water during high/low tides. Thus a set may

be experienced by ships at OTB on leg $278^{1/}{}_{2}$ while heading on the Temple Transit. The corrections applied to counter this offset need to be removed as soon as the ship comes in lee of the Dolphin Hill closer to the LPG berth.

5. **Berthing on N 14 A**. The berth at N 14 A has a protruding ramp where pontoons and barges are often secured and thus makes the approach on the berth as a first ship tricky. In addition, the clearances ahead and astern are minimal for Shivalik Class and SNFs due to presence of the ramp at one end of the jetty and the boatpool entrance at the other end. Once alongside, the clearance from the the ramp works out to be approximately 7m from the ramp and 5-7 m from the boat pool entrance. Length of the ropes needs to be accurately adjusted to cater for movements which may be caused due to turbulances created by tugs and barges moving in and out of the boat pool.

6. **Berthing on VPT Berths**. There may be requirement of berthing ships on Visakhapatnam Port Trust berths to meet specific requirements of ships. Ships are required to hire services of port's tugs and pilots for berthing on VPT berths (such as for Barak RBC for Shivalik Class). All these movements are hot moves and thus a ships should have her engines available for manoeuvre. The requisition is forwarded to VPT by the Port Coordinator (NOIC) upon approval from HQENC. The requisition needs to be sent atleast one week in advance of the scheduled requirement to cater for berth availability amidst heavy load of container ships. Although one movement should suffice to meet the requirement, in some cases, there may be a need to turn the ship around on the berth. It is therefore advisable to send pilot and tug requisition for turn around on the berth even if the possibility of such need is minimal, as no requests are entertained by the port without routeing through the proper channel requiring a week's time.

KOCHI HARBOUR

1. **Reference**: -

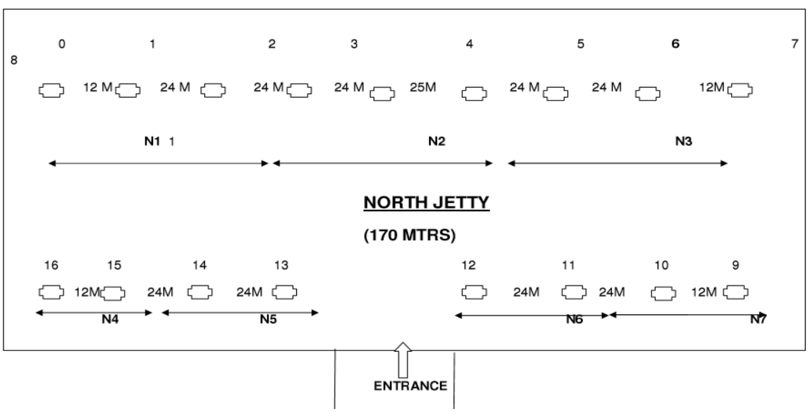
(a) Kochi Port Order.

(b) Nav Advisories promulgated by HQSNC.

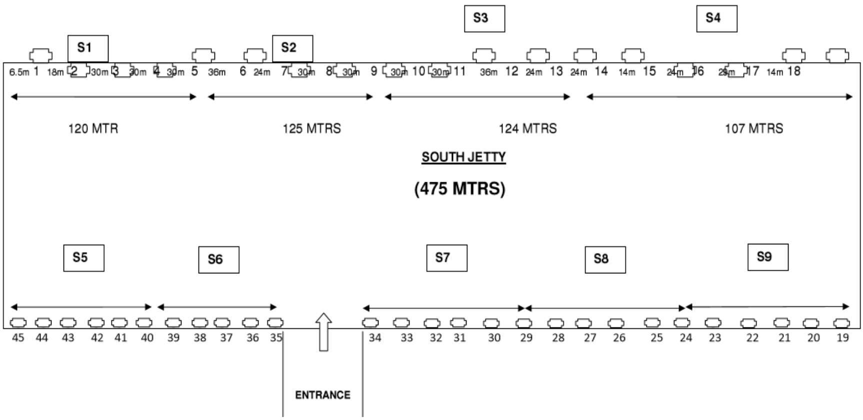
2. **Berthing Facility in Naval Harbour Kochi**. The berthing arrangements for ships calling at Kochi Naval Harbour are augmented at:-

(a) **South Jetty**. The South Jetty is 475 m (1535 ft) long and can accommodate ships drawing upto 7 m. Four berths S1, S2, S3 of length 400 ft, S4 of length 335 ft are available on the outer side and five berths S5, S6, S7, S8 and S9 each of length 290 ft are available on the inner side for shallow draught vessels.

LAYOUT OF NAVAL BERTHS (NORTH JETTY)



LAYOUT OF NAVAL BERTHS (SOUTH JETTY)



(b) **North Jetty**. The North Jetty is 170 m (583 ft) long and can accommodate ships drawing upto 5.5 m. Three berths N1, N2 and N3 of length 194.25 ft each are available on the outer side and four berths N4, N5, N6 and N7 of length 85 ft are available in the inner side for shallow draught vessels.

(c) **Mooring**. In addition, a mooring is available to the east of North Jetty with a space of 199 m (631 Ft) between the buoys.

3. **Catamarans**. Catamarans need to be positioned at North /South jetties for ships with bow flares. However, due caution needs to be exercised in respect of the catamaran. Ships have, in the past, sustained minor damage due to scraping along the catamarans while making approach/ casting off. Two lattice masts have come up within the naval base (in vicinity of Signal school), which serve as a good reference for the final bridge position at berth S3. These masts, in transit or just open for transit, could be used for achieving the correct bridge position, for large frigates / destroyers.

4. **Depths Available**. Specific details of depth available alongside the two jetties and in the main channel are available with HQSNC/ COO.

5. **Speed While Entering and Leaving Harbour**. Naval ships are not to exceed **07 knots** within the Kochi Port Limits, having due regards to its safety and catering for shallow water effect. However, bigger ships when passing Ernakulam/ Mattancherry channel wharfs are to proceed at even slower speeds, consistent with their own safety and paying due regard to the safety of vessels berthed on wharfs.

6. **Clearance from Diver Detection Sonar (IUHDSS)**. Integrated Underwater Harbour Defence and Surveillance System (IUHDSS) have been installed at each end of North and South Jetty. The installation is proud of the jetty on the jetty edge perpendicular to the berthing side. The structure is painted fluorescent orange and has a red flashing light for recognition at night. Ships are to give wide clearance to DSS during coming alongside, cast off and cold move so as to avoid damage to the system.

7. **Winds**. The winds in Kochi follow largely the same pattern as for Mumbai. For the most part of the year the land and sea breeze are predominant. However, during the monsoons the winds are largely SWly. The following are relevant:-

(a) **Land Breeze**. The day winds die down towards the first watch (-2100h) and thereafter the land breeze sets in. The period between 2100h and midnight are generally calm, with the wind slowly building up in the middle watch, the direction of winds is largely NEly during this time. These winds build up to about 10 kn by the end of the morning watch and thereafter die down. A relatively calm period may often be experienced once again from ~ 1000h to 1200h with the winds slowly shifting NWly.

(b) **Sea Breeze**. The sea breeze is largely NWly and may shift between NW and SW during the day. This phenomenon may be more prominent during the transition months of March to May. The winds in the early afternoon build up to ~ 10 kn, with the strength increasing to ~ 15 kn by the first dog watch. During this period one may experience gusts of upto 20 kn as well.

(c) **SW Monsoons**. Between the months of June and September, SWly winds are dominant over the land/ sea breeze. The winds are largely from SW and may shift W/ NW for brief periods. The wind speeds are generally between 10 to 15 kn, however, frequent gusts may be experienced for extended durations.

8. **Nav Advisory**. HQSNC is promulgating time to time Nav advisory on Kochi Harbour. The same are available on HQSNC/COO website. The some of the important aspects covered in Nav advisory dated 04 Aug 14 are as follows:-

(a) **Tidal Information**. Tidal information on Kochi Harbour is as follows:-

(i) The port and the backwaters are subject to two tidal cycles occurring within 24 hours. Of these, the ebb stream is more predominant than the flood stream due to the upland discharge from the rivers.

(ii) The flood stream may continue to run one to two hours after the high water and the ebb stream may continue upto two-three hours after low water. However, during the period of ‘Full Moon’ and ‘New Moon’ and near spring tides, the ebb stream may continue for 3 to 4 hours after the low water. Further, during monsoons, due to heavy rain in the ‘backwaters’ the ebb stream may run on the surface throughout the day, while the flood stream enters the harbour under the surface ebb. In the winter months, from Dec to Feb, the tidal stream is fairly weak due to lesser range of tide.

(iii) The maximum rate of the ebb stream at springs throughout the year is 2-3 knots and at neaps varies between ¾ to 1 ¼ knots. The rate of the flood stream at springs throughout the year varies between 1 ¼ knots to 2 knots, and at neaps between ¾ knots to 1 ¼ knots.

(iv) The range of tide off naval jetties varies on an average between 0.1 m to 1.1 m.

(v) The tidal stream generally follows the lay of the channel, except during the change of the tide. The ebbing/ flooding starts earlier on the outer side of the channel than in the centre.

(vi) The direction of the tidal stream at the approaches to the channel is different from the inner channel. In the outer channel (west of Buoy No. 11 and 12) the flood stream flows in a northerly direction whereas the ebb stream flows in a southerly direction. In the inner channel (east of Buoy No 11 and 12) the tidal stream flows approximately in an East-West direction.

(vii) However, during existence of a system or during monsoons especially during heavy rains a strong northerly set may be experienced west of Buoys No. 11 & 12.

(viii) Under monsoon conditions, strong eddies and cross currents are experienced in the channel, especially at the harbour entrance after crossing Vypin Island and off the NW point of Willingdon Island.

(b) **<u>Special Conditions</u>**.

(i) **<u>Maintaining in the Centre of Channel</u>**.

(aa) Rule 9 of the International Regulations for Prevention of Collisions at Sea 1972 ('ColRegs') states that in narrow channels, vessels should keep to the starboard side as far as is 'safe and practicable.' This is to reduce the risk of collision with vessels meeting end-on.

(ab) However, the rule also states that depending on the circumstances (eg. one-way routes/ depth of water/ Interaction effects, etc) it may be necessary to plan to use the centreline, while being prepared to move to starboard, if required.

(ac) The Kochi port authorities advise that vessels should maintain in the centre on the channel. Should there be a situation where a ship is uncertain of its position wrt centre of the channel it may contact Kochi VTMS for clarification since all vessels in the port area are being tracked by VTMS. A Pilot is on-duty round the clock in VTMS for assisting ships navigating in the channel.

(ii) **<u>Shallow Patch West of Fort Kochi</u>**. A shallow patch (sand bank) exists towards south of Buoy No. 13 and Bouy No. 15 as depicted in Figure 2 below. This sand bank may extend upto the southern limit of navigable channel. Hence, extreme caution must be exercised whilst navigating close to these buoys. The following is advised in vicinity of these buoys:-

(aa) Avoid crossing vessels in this area.

(ab) If a situation arises where ships have to cross each other between last two set of buoys (7^{th} & 8^{th} set) the crossing should be done with extreme caution, and in case of unavoidable requirement the approaches to the new LNG/ Petronet Terminal north of the channel (as marked on the chart) may be utilised.

(iii) **Pilotage in Vicinity of Vypin**.

(aa) During ebb, large vessels entering harbour experience a sheer off the Eastern edge of Vypin and as such prefer to keep to the northwards to counteract it. The intensity of the sheer depends on the strength of the ebb and can be considerable during the monsoon months, Often it takes time to counteract these swings to either side and this may confuse a vessel coming out of the Ernakulam Channel as to the real intention of the incoming vessel.

(ab) Also, it is advisable that outward bound naval ships should not stop and wait in this area (channel between Vypin and Dufferin Point) since they are liable to drift southward. Such vessels may utilise the area south of Vallarpadam Container Terminal Berth, i.e. approaches to the Vallarpadam berths, where 14.5 m depth is maintained. The size of this area is sufficient for naval vessels to stop, remain adrift for short duration or turn around if required.

(iv) **Mattancheri Channel**. Merchant vessels leaving Mattancheri channel normally keep to the port of the channel upto No 14 outer channel buoy to avoid crossing the bows of an incoming vessel. Consequently, vessels may have to pass each other starboard to starboard in the area between 7th and 8th set of buoys. This should be done after establishing concurrence of the other vessel.

(v) **VTMS**. The port generally follows the international regulations with respect to IRPCS. Pilots embarked on all vessels are prompt and should be contacted on MMB to clear intentions regarding crossing. In case a situation is not understood clearly and in case of doubt/ no contact with embarked pilot VTMS must be contacted to de-conflict the situation.

(vi) **Caution in Ernakulam Channel**. Cross currents are experienced at the entrance to the Ernakulam channel. Being a bend in the inner harbour, it is prudent not to pass each other in this area. Naval ships are also cautioned to be particularly vigilant when meeting a tanker making an approach for tanker berth(s). Due to the tides and insufficient water below the keel, these vessels at times develop violent sheer on either side while going astern to check the ahead movement. These vessels are single screw ships and they are under powered for their enormous size and hence they carry considerable headway before coming to a stop. In such situations, a wide berth may be prudent while passing these ships.

(vii) **Slowing Down**. As a thumb rule, vessels must avoid slowing down in the channel as the effect of tidal stream and wind will increase and they may drift outside the channel.

(c) **Summary of Safety Advisory**. Following points are to be borne in mind for safe navigation in Kochi Channel/ Harbour :-

(i) Maintain in centre of the channel as safe depths exists only within the channel. VTMS may be contacted to check own position wrt to centre line. VTMS is manned by a pilot round the clock.

(ii) Do not slow down in the channel except in case of an emergency/ machinery breakdown. During such circumstances it is advised to use anchors keeping VTMS informed. This may prevent the ship from drifting on to the shallow depths.

(iii) The position of Channel buoys is fixed. Their position generally remains unchanged. Changes, if any are promulgated through NAVAREA / NTM/ VTMS. However, it is better to confirm from HQSNC/COO prior entering Kochi harbor.

(iv) In the outer channel general pattern of tidal stream is such that the ebb flows south and flood flows north. However, during bad weather conditions a strong northerly set may be experienced irrespective of existing tidal stream.

(v) Avoid crossing vessels at the harbour mouth. Should this be unavoidable, a vessel on the north edge of the channel may utilise the approaches towards the new LNG terminal berths to give a wide clearance.

(vi) Exercise caution for strong tidal stream and areas where eddies and cross currents are experienced.

(vii) Area south of Vallarpadam Container Terminal berths (i.e., approaches to the Vallarpadam berths) is dredged to 14.5 m and may be utilised by ships for stopping and holding position to give wide clearances to other vessels.

(viii) Ship’s should avoid coming alongside on Berth S4 (South Jetty) port side to, in flood stream due to limited manoeuvring space and reduced distance from shallow depths towards Ernakulam Bridge.

(ix) Ensure that the ECDIS and charts are updated for T&P Corrections and NAVAREA warnings[85].

9. **Pilotage Aspects**. The approach channel to the berth is susceptible to large scale siltation, due to the backwaters flow. Hence, depths encountered may, at times, be lesser than charted. Details of the port are adequately covered in the port orders, which should be referred to for all planning. Additionally, the following issues may be considered during pilotage:-

(a) **Buoyed Channel**. The angular separation between visual conspicuous objects near the seaward end of the channel may not be optimum. Hence, visual fixing should be undertaken with due care. Further, objects available for CIR (Blind Pilotage) may also not be completely accurate, due to drying heights. Further, these objects lie fine on the bows during initial transit and hence may be susceptible to HBWE. Further, the buoys have been known to frequently be shifted, without advance warning, and may at times even be missing. Also, since the buoys are single line moored, with about 30m cable, they swing around their ground position by upto 25m as per tide/current. It is also prudent for ships to regularly check with the Port Control about any recent changes in buoys' positions. Therefore, it is essential that all available navigational aids and means be used to continuously determine the ship’s position, and no single method be

[85] INBR 1916 (Notes on Correction of Charts, Publications and ECDIS).

trusted implicitly. The sounding must be monitored continuously.

(b) **Wrecks**. Two wrecks lie North of the channel, with the closer wreck lying in vicinity of 4th and 5th set of buoys. Due care needs to be exercised while crossing the 3rd and 4th set of buoys. If feasible, ships should avoid crossing other ships in this area.

(c) **Single Point Mooring (SPM)**. An offshore crude oil receipt facility consisting of an offshore single point mooring (SPM) facility and an associated Shore Tank Farm (situated in Vypin). The SPM is located at a water depth of 30 m, 10.5nm from the coastline of Puthuvypeen. Coordinates of Single Point Mooring are 09^0 59’ 49.93” N, 076^0 02’ 30.73” E. The ship should exercise caution while navigating close to SPM.

(d) **Movement of Dredgers**. Dredging is generally a continuous practice at Kochi harbor due to silting. Therefore, dredgers keep operating between harbor and duming ground. The ships to exercise caution for the same. The photographs depicting Outer harbor, Inner harbor, Position of berths and Navigational dangers are depicted below:-

KARWAR HARBOUR

1. Karwar is the district headquarters of Uttara Kannada district of Karnataka state. The town lies 15 Km south of Karnataka – Goa border. The name ‘Karwar’ derived from a nearby village called Kadwad.

2. **MARPOL Compliant Harbour**. The Karwar naval harbour is a MARPOL compliant harbour. STP fitted ships are to ensure that STP is operational and no sewage and bilge is discharged inside the naval harbour. Ships in harbour are to strictly follow discharge and survey of dirty oil using the facilities of ashore ETP. Non STP ships are to ensure that all W/C outlets are closed and

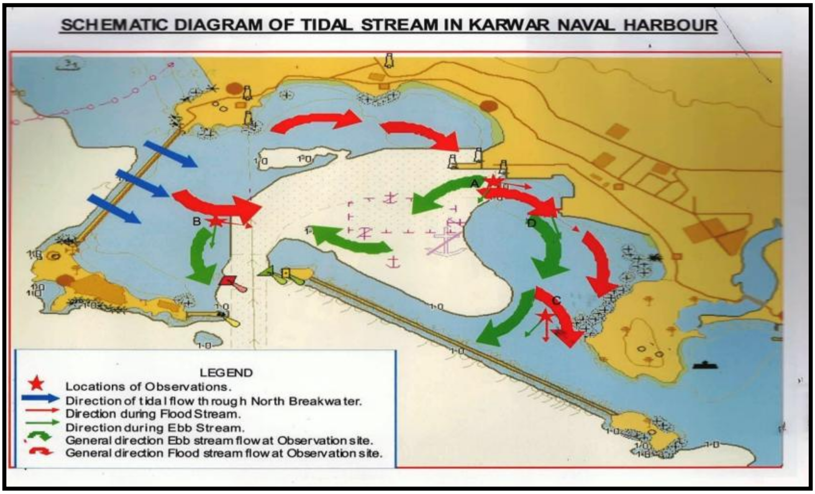
that no sewage is discharged during their stay alongside or at inner anchorage.

3. **Weather**. Karwar experiences hot and humid summers and moderate cold winters. During summer the temperature reaches to 37*C and in winters it is usually between 24*C to 32*C. Karwar receives maximum rainfall during SW monsoon in the months of Jun to Sep with maximum rainfall in the month of Jul.

4. **Sea Condition**. The current during either flood or ebb tide does not generally exceed 1 Kn. During monsoons, swell/ waves are from South west with maximum height up to 3m. In non-monsoon season the swell is generally from North West and rarely exceeds 2m. The density of sea water during monsoons is about 1005 kg/ cubic meter and during non monsoon season it is 1015 kg/ cubic meter.

5. **Tides**. The harbour witness semi-diurnal tide with two low water and two high water in 24 hours. The flood and ebb pattern inside Karwar habour is placed at Appendix A. The state of tides at the Karwar Naval harbour is as follows:-

Ser	State of Tide	Height
(a)	Mean HH Water	1.90 m
(b)	Mean LL Water	0.32 m
(c)	Mean LH Water	1.64 m
(d)	Mean HL Water	0.92 m
(e)	Mean HH Water (Spring Tide)	2.13 m
(f)	Mean HH Water (Spring Tide)	0.04 m



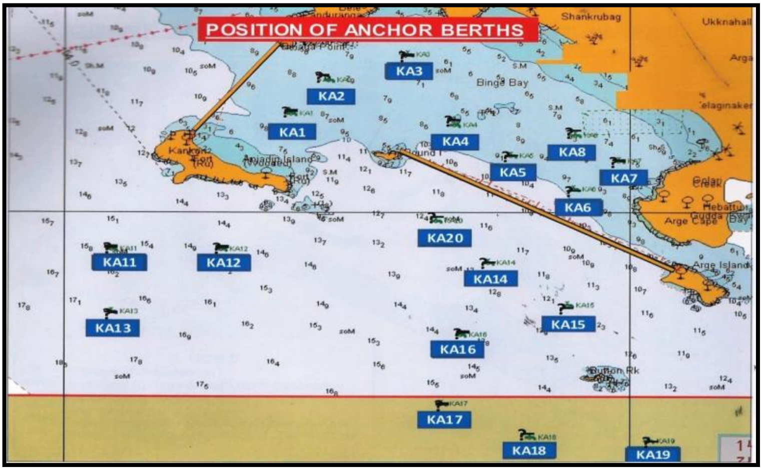
6. **Winds**. The winds are negligible during early hours. The average wind speed experienced is 08-10 Kn. At times the wind picks up in the afternoon to about 13-15 Kn. During monsoons, from May to October, the harbour experiences West to West South Westerly winds. From November to Apr winds are generally from N-NE or N-NW.

7. **Navigable Channel**. The channel is well marked and ships can enter/ leave harbour both during day and at night. The lay of the channel is 000-180 marked by transit. The width of navigable channel is 300m. Navigational marks consist of Four sets of channel buoys, one transit mark and three beacon marks (Round Island, Spur and Kwada Lt). Two sets of buoys are placed outside the harbour mouth and other two sets are placed inside the harbour with alignment of all buoys with respect to 000-180 leg.

8. **Available Jetties**. The harbour presently has one pier which also houses the Ship lift system. It has two jetties namely, South jetty with a length of 420m and North jetty with a length of 185m. The lay of the jetties are 090-270. Bollards are provided at the jetties at a distance of every 30m.

9. **Harbour dangers**. Two shallow patches exists to the west of the 000-180 leg. The first one is a 2m patch near to the 2nd set port hand buoy and the second patch is near to the third set port hand buoy.

10. **Anchor berths**. The pictorial depiction of anchor berth is as follows:-



11. **Phase-II work**. As part of Phase-II, new jetties are being constructed inside the naval harbour. The details of which are not being mentioned here.

MORMUGAO HARBOUR

1. **ETA**. The ETA needs to be signaled at least 24 hours in advance. The ETA point is '270 Breakwater Light 2 Nm'.

2. **Navigational Facilities**.

(a) **Approach Channel**. The port is entered through a marked channel about 3.5 miles long and 250 m wide; it has a dredged depth of 14.4 m. The channel is marked by light buoys. The buoys are positioned about 25 m outside the charted channel.

(b) **Tidal Range**.

(i) Springs – 2.3 m
(ii) Neaps – 0.6 m

(c) **Turning Basin**.

(i) Diameter – 480 m

(ii) Depth – 14.1 m below Chart Datum

3. **Sea Conditions**. The strength of the current either at flood or ebb tides does not generally exceed 1 kn. Swell/ waves during the fair seasons rarely exceed 2 Nm in the open sea. The direction being mainly from the West and North West. However, during the monsoons, the swell/ waves go upto 3 m the direction being mainly from the South West. Normal wind forces varies from 4 to 7 on Beaufort scale.

4. **Local Weather**. Between the middle of February to the end of March, occasional strong NE winds cause a heavy swell in

the bay; these winds usually last from three days to one week, they fall light from sunset to sunrise.

5. **Tugs**. Port has four VSP tugs, Ocean Spirit and Shiv (50 T bollard pull) and Terecol II and Chapora (45 T bollard pull).

6. **Pontoons/ Yokohomas**. All berths at MPT and IN Jetty are provided with yokohomas. However yokohomas are not available on Mole jetty. Additional fenders/ yokohomas cannot be provided and ships are to use own fenders in the event of inclement weather. Catamarans cannot be provided to the ships however, submarines are provided with catamarans.

7. **Fresh Water**. Supply of fresh water is to be arranged through Mormugao Port Trust. The ships are to project requirements for fresh water 72 h in advance. Fresh water would be supplied through barges.

8. **Fuelling**. Two 1000 T barges available with MPT and one 300 T fuel barge is available with MO (Goa). Fuel is also supplied by M/s Indian Oil Corporation by lorry tankers.

9. **Brow**. No Gangway/Brow is available with MPT for visiting ships. Ships are to use their own brow/ gangway.

10. **Anchorage**. The large roadstead to the west and North West of the harbour provides the anchorage to about 20 ships during the fair seasons (Oct to May). About eight ships can be accommodated inside the breakwater during monsoons. The inner anchorage is provided in depth of about 07 m, East of breakwater and also in depth s of about 04 m in the south South East of Vasco Bay. Outer anchorage in depths of about 16 m, 3km west of Aguada Headland is feasible during fair season. Naval ships are generally required to anchor East or West of breakwater as convenient since fixed anchor berths has not been promulgated.

11. **Moorings**. There are two mooring buoys East of breakwater. They are buoy No 5 and 6. In addition there are six

mooring dolphins available East of the channel with maintained depth of 14.1 m.

12. **Breakwater and Mole Berths**. The IN ships are also berthed on Mole (Inner / Outer) and breakwater berth. For berthing on Mole outer berth the ships are required to turn around in turning circle and align for LH legs and subsequently align for making approach on jetty. The berth is not lit and same should be factored whilst making approach at night. There are no fixed fenders on the berth.

13. **Berths at IN Jetty**. This jetty is located at Vadam Bay. Minor war vessels many be berthed at IN jetty. A maximum of two LCUs/ Waterjets or two SDBs or four Inshore Mine sweepers can be berthed on the jetty.

14. **Berths at MPT**. The berths at MPT (berth 5 to 11) are also used for berthing and are adequately marked on chart.

15. **Berths at WISL**.

(a) **Floating Dock**. Mormugao Port Trust (MPT) berth 1 to 4 were handed over to M/s Western India Shipyard Limited for construction of Floating dock. The particulars of floating dock are as follows:-

(i) Length – 210 m

(ii) Breadth – 35 m

(iii) Lifting Capacity – 20000 Ton (Maximum)

(b) **Wet Repair Berth**. Ships may be berthed on either side of the wet repair berth, namely Wet repair berth East and Wet repair berth West. The details are as follows:-

(i) **Wet Repair Berth East (WRBE)**.

(aa) Length – 180 m

(ab) Draught – 07 m

(ii) **Wet Repair Berth West (WRBW)**.

(aa) Length – 200 m

(ab) Draught – 07 m

16. **Berths at Goa Shipyard Limited (GSL)**.

(a) The berthing spaces at the outfitting berths at GSL are normally occupied by the ships under construction. The ships based at Goa are also berthed at GSL during monsoon and bad weather. Though the approach channel is marked, it is advisable to navigate in and out of the channel only during high water. Since the depths in the marked channel are not uniform and there are few shallow patches, ships navigating in and out of the channel under their own power are to be in possession of a copy of the latest sounding chart, which can be obtained from GSL authorities.

17. **Caution**.

(a) While approaching the dredged channel a Sly set may be experienced.

(b) In SW monsoon condition, there may be heavy swells at the approaches, care should be taken to maintain adequate steerage way when making the turn around the breakwater head to avoid being set E, also sufficient under keel clearance should be allowed for swell manoeuvring.

(c) The buoys marking the channel may be removed without notice.

(d) At MPT 10, due caution needs to be exercised in respect of barges, which cast off (without warning) from the barge berths. Additionally, barges may be secured at the

North end of berth 10 with the stern proud, which makes the final alongside cumbersome.

18. **Berthing**. Sea room in the turning basin adjacent to the berth is adequate, and the turn post cast off may be achieved using engines in opposition. Ships have made good use of tugs pushing the bows and stern (akin to Kochi above) to execute the turn within a period of 5 min. The effect of tide inside the harbour is minimal, with the rate not known to exceed 1kn. The winds however, display characteristics similar to the generic wind pattern at Mumbai, except that in the months of Nov to Jan the winds have been found to be predominantly NE with a minimal shift to NW during the day. During the period when the sea breeze is dominant (forenoon to second dog watch), particular attention needs to be paid while going alongside MPT 10. As the ship turns in the turning basin and makes the final approach, she is subjected to offshore winds from the Stbd qtr / beam (NWly). However, due to the presence of large port buildings on MPT 10, the moment the ship moves into the lee of the buildings, the effect of the winds reduce. In fact, it has been observed that when the stem crosses the jetty edge, the wind acts on the after part of the ship tending to swing the bows towards the berth. This could be used to advantage but needs to be controlled by an outward wheel.

CHENNAI HARBOUR

1. **Chennai Port**. The Chennai harbour is situated on the Coromandel Coast at 13^0 06’ N, 080^0 18’ E and is the third largest port in India. It is all weather artificial harbour with round the clock navigation facilities. It is situated on a low and sandy coast and is exposed to heavy surf.

2. **Port limits**. The seaward boundaries of the port are lines joining the following points. The fisheries harbour, though within port limits, is under the jurisdiction of the Tamil Nadu state government.

(a) 13^0 07' 58.8" N 080^0 17' 57.9" E

(b) 13^0 09' N 080^0 20’ E

(c) 13^0 09' N 080^0 22' E

(d) 13^0 03' N 080^0 22' E

(e) 13^0 03' N 080^0 20' E

(f) 13^0 03' 54" N 080^0 17' 15" E

3. **Anchorage**. Ships waiting for entry into harbour, may anchor South of the fair channel at the outer anchorage. They are required to anchor South of 13^0 06’ N latitude. The anchorage is open. There is generally a swell from seaward causing vessels in the roadstead to labour and roll considerably. Good anchorage has been observed with the breakwater light bearing between 240^0 and 300^0 from 1 nm to 3nm.

4. **Wreck**. ‘MV DECCAN PIONEER’ sank on 11 Nov 1985 in position 13^0 05’ 52’’ N 080^0 19’ 11’’ E.

5. **Arrival at Chennai**.

(a) The point of arrival at Chennai is off the first set of buoys. ETA is to be signaled to the FOTNA atleast 12 hours in advance if it differs more than 4 hours from the ETA given by the sailing authority. Ships/ Senior Officers are to obtain permission for entering harbour from NOIC (TN&P) atleast one hour before ETA.

(b) Notwithstanding the grant of permission to enter harbour by the naval authority, ships are to obtain channel clearance from Port Signal Station by VHF on Channel 16 prior to entering harbour.

(c) A 600 feet wide (at its narrow end) channel exists for entry and exit from the harbour. This is open at all times and ships can enter both during day and night.

6. **Departure from Chennai**. Ships/ Senior Officers are to request permission to leave harbour at least one hour before casting off. They are to request permission to proceed in

execution of previous orders before getting underway. Channel clearance from Port Signal Station must be obtained prior to casting off.

7. **Tugs**. Large ships are normally provided two tugs and smaller ships one tug. The tug is deemed to have been used even if it ids in attendance only. The tug join the ship just inside the breakwater. Ships are usually required to use their own lines to connect up the tugs. The tug lines are also used if required by the pilot. As a rule, ships required to shift berth in harbour, would do so by hot moves. Ships at times have been damaged during cold moves owing to general communication gap which prevails between the local tug crew and the ship staff. Movements of ships and requirements for the tugs/ pilots are coordinated by the Staff Officer (Operations) at Navy Office and Harbour Master at Chennai Port Trust. The following tugs are available at Chennai Port Trust:

Ser	**Tug**	**BHP**	**Bollard Pull (in Tons)**
(a)	Sekkizhar	1775 X 2	32
(b)	Sundarnar	1775 X 2	32
(c)	Bhararhiyar	2481 X 2	45
(d)	Singaravelar	1700 X 2	32
(e)	Netaji	1700 X 2	32
(f)	Ocean Melody	1800 X 2	35
(g)	Ocean Fame	1800 X 2	40

8. **Entering/ Leaving Harbour Speed**. The speed limit is not specified. However, ships are not to enter and leave harbour at high speeds. A large number of fishing boats may be operating in the channel and ships are advised to exercise caution. Ships entering harbour should have enough stern power to check their headway within their length.

9. **Berths**. Being a commercial port, berthing at Chennai port is at a premium. Naval ships based at Chennai are berthed at Chokhani Jetty. Berths for the visiting naval ships are arranged by the Navy Office as and when required. Berthing is coordinated by

the Staff Officer (Operations). Berth particulars at Chennai Port are given below:-

Ser	Name of Berth	Type	Depth (mtrs)	Quay Length (mtrs)
Ambedkar Dock				
1.	North Quay	Passenger/ General	8.50	198
2.	West Quay – 1	General/ Liquid Bulk	11.0	170.6
3.	West Quay – 2	General	12	170.6
4.	Centre Berth		12	170.6
5.	West Quay – 3		12	170.6
6.	West Quay – 4		11	170.6
7.	South Quay – 2	General/ Fertilizer	9.5	246
8.	South Quay – 2		9.5	179
9.	SCB 1			
10.	SCB 2			
11.	SCB 3			
Jawahar Dock				
12.	Jawahar Dock - 1	Bulk Cargo	11.5	
13.	Jawahar Dock – 2		11.5	
14.	Jawahar Dock – 3		11.5	
15.	Jawahar Dock – 4		11.0	
16.	Jawahar Dock – 5		11.5	
17.	Jawahar Dock - 6		11.0	
Bharathi Dock				

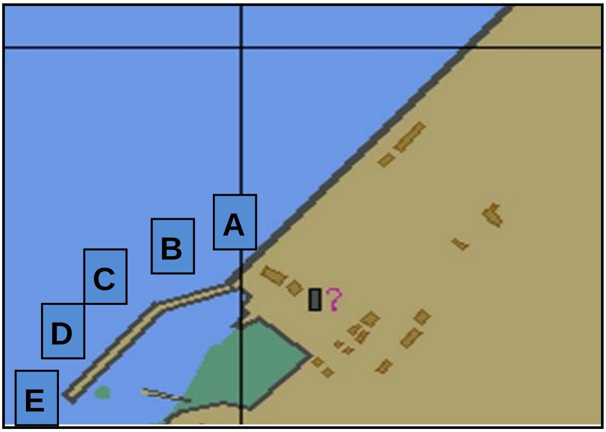
18.	Bharathi Dock – 1	Oil	14.0	338.94
19.	Bharathi Dock – 2	Ore	16.5	274.32
20.	Bharathi Dock - 3	Oil	16.5	304.00
Container Terminal				
21.	Container Terminal – 1 (CT 1)	Container Berth	13.4	200.0
22.	Container Terminal – 2 (CT 2)			200.0
23.	Container Terminal – 3 (CT 3)			200.0
24.	Container Terminal -4 (CT 4)			285.0
Others				
25.	Madhusudan Jetty	--	9.0	135.00
26.	**Chokhani Jetty**	**Inner Side**	**9.0**	**218.00**
27.	**Chokhani Jetty**	**Outer Side**	**9.0**	**218.00**

10. **Gun Salute**. Chennai is not a saluting port. No gun salutes are to be fired here.

11. **Communication**. The Port Signal Station (PSS) is situated at the end of North Quay. It maintains a continuous V/S and Radio watch. The calling channel is MMB Channel 16 (Alternate 10) and the working channels are MMB Channel 16 (Alternate 10) and the working channels are MMB Ch 12 and 14. Ships entering/ leaving harbour are required to contact PSS/ Port Control and obtain channel clearance. The Port Control (PSS) does not accept PSS/ Port Control

PORT BLAIR HARBOUR

1. **Berthing**. Naval ships are normally berthed at Naval Wharf (Southern of Haddo Wharf), commencing from gate dividing Haddo and Naval Wharf. The bollards are numbered from 1 to 46 commencing from the gate between Haddo and Naval Wharf. The wharf is further divided divided into five berths as follows:-

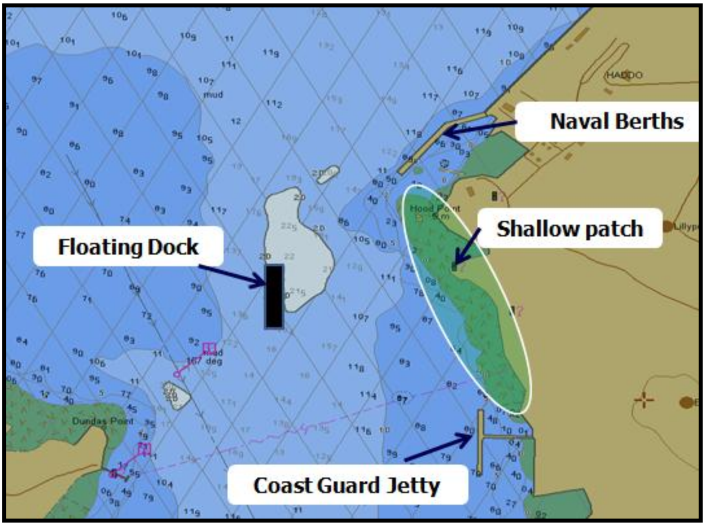


NAME OF THE BERTH	BOLLARD NOS	LENGTH OF BERTH	LAY OF BERTH
A	1-7	91 M	040-220
B	8-13	91 M	040-220
C	14-22	103 M	080-260
D	23-34	91 M	040-220
E	35-46	91 M	040-220

2. **Coast Guard Jetty**. A ‘T’ shaped jetty of 190 m length is built for the exclusive use of Coast Guard ships, 4.7 cables West of Dundas Point. Minimum depth of 6 m is present alongside Coast Guard Jetty.

3. **Floating Dock**. A floating dock (FDN) belonging to Indian Navy lies moored mid stream, 3.3 cables NE of Dundas Point. Ship should pay utmost care and attention to shallow patch east of FDN, while proceeding to Coast Guard jetty. Ships may

proceed to CG jetty keeping FDN to West or East as per the draught of the ship in relation to the depth available.



4. **<u>Wind and Tide</u>**. The tidal stream inside the harbour is generally minimal and depends on the prevailing winds. The rate of tidal streams usually does not exeed 1 kn. The outer harbour may experience swell during the NE monsoons, but the inner harbour is relatively sheltered. During the NE monsoons, the tidal stream sets Sly and shift to between Nly and Ely during the SW monsoon. In Port Blair the winds generally reach maximum strength in the late afternoon. The winds from May to Sep are predominantly SWly and may attain strengths of up to - 15 kn. Further, strong gusts may be experienced during squalls accompanied by a sudden drop in visibility.

SECTION V

BRIEFINGS

CHAPTER 14

FORMAT FOR PILOTAGE BRIEFING

1. While the previous Section dealt with the actions for a Navigating Officer in planning his pilotage and ship handling, this Section deal with the conduct of briefings[86]. These briefings understandably are based on extensive preparation/study carried out by the NO in the planning stage. However, it is important for the NO to discern the key elements that need to be briefed to his pilotage team, as also the parts of ship/other concerned personnel.

2. It is, therefore, recommended that the NO carry out two briefings. The first is a detailed Pilotage Briefing, which can be carried out 4-24h before the movement. The subsequent Entering/ Leaving Harbour briefing should be short and crisp, with the briefing carried out closer to ETA/ETD and normally just before closing up the SSD[87].

3. The Pilotage briefing is intended to walk through the entire evolution of entering/ leaving harbour for benefit of the entire pilotage team and other key personnel involved in pilotage. The aim of the pilotage briefing is to ensure that all personnel are on the same grid with regard to the Navigating Officer's plan. Important actions / reports requiring emphasis should be covered at relevant portions of the briefing. The scope of the Pilotage briefing would depend on several factors such as familiarity with harbour, state of workup of Pilotage Team, nature of harbour, etc. However, the following broad sequence / format is recommended for the briefing, using relevant charts/ electronic depiction and photos to assist the same:-

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[86] Art 1312(u)-(w) p 13-16, BR 45(1)(2) ed 2008.
[87] Art 1912(g) p 19-7, BR 45(1)(2) ed 2008.

(a) **General**. Position of harbour, ships in company, likely stationing and sequence of entering/ leaving, ETA/ ETD and details of jetty/ berth.

(b) **SSD Organisation**. Briefing on SSD organisation, including mention points for newly inducted personnel.

(c) **Charts**. Charts to be used and the sequence thereof. Specific mention should be made of any Navarea warnings in force that affect the charts.

(d) **Met/ Astro/ Tidal Data**. Complete data to be covered, including weather forecast / conditions to be expected and any actions required thereof.

(e) **Overview**. Geographical overview of harbour; nature, density and areas where traffic is expected; approach and pilotage courses; pictorial/ photographic overview of landmarks and other navigational features.

(f) **Port Orders/ Sailing Directions**. Salient aspects of Port Orders, Sailing Directions and other publications affecting pilotage and going alongside (special Naval/ port orders, communication, ETA point, signals / flags, MARPOL, tugs, berths, depths, set/ drift, ceremonials, etc).

(g) **Approach Phase**. This part of the briefing should cover the approaches to a harbour. The following may be covered- .

(i) Details of approach course and speeds planned.

(ii) Visual fixing marks available/ to be used, including photographs to aid identification. Characteristics of lights/ beacons.

(iii) Radar conspicuous objects including photographs of the same and a sketch of the radar PPI.

(iv) Navigational dangers.

(v) Clearing bearings and ranges in approach phase.

(vi) Anchorage areas/ TSS/ Fairways/VTMS, etc.

(vii) Pilot boarding ground.

(h) **Pilotage Phase**. This part of the briefing should cover information and actions for the entire pilotage phase, including the following-

(i) Details of pilotage courses, including speeds/ engine regimes planned on the same.

(ii) Calculated set and- drift, and course / speed adjustments for the same.

(iii) Details/ characteristics of visual fixing marks available/ to be used. Use photographs to aid identification.

(iv) Radar conspicuous objects. Use photographs and sketch of radar PPI to explain.

(v) Transits/ head, marks available/ to be used. Use photographs to aid identification.

(vi) Frequency of fixing[88].

(vii) Available depth and width of navigable water on each leg.

[88] Art 0716 (c)p 07-16, BR 45(1)(1) and Art 1231 (f/h) p 12-27 and 1313 (a) p 13-18 BR 45(1)(2) both ed 2008.

(viii) Navigational dangers in harbour and proximity on each leg.

(ix) Calculation of LDL and minimum expected depth for each leg.

(x) Buoyage system in force, number and details of buoys. Use photographs to explain.

(xi) Sequence of reporting by fixing team(s), blind safety officer[89], ECDIS, anti collision reporter, echo sounder reporter.

(xii) Planned shift of Charge / Con (OOW - NO).

(xiii) Point of no return[90].

(j) **Pilotage Plan**. This part of the briefing should cover each individual pilotage leg, in greater detail. This part could be merged with the earlier part in case of lesser number of legs (2-3). In case of a longer pilotage phase or larger number of legs (>3), it may be preferable to describe them separately in this part. The following should be covered:-

(i) Clearing bearings, wheel over positions and bearings, CIRs and Clearing ranges for each leg.

(ii) Blind pilotage plan for each leg, including CIR objects and W/O marks / CIR.

(iii) Positions and transits for gyro checks.

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[89] Art 1931(c) p19-15, Art 1932(d)(f) p19-17, Art 1933(h) p19-18, BR 45(1)(2) ed 2008.

[90] Art 1312(k) p13-12, BR 45(1)(1) ed 2008.

(k) **Berthing**. The following should be covered:-

(i) Details of berths available.

(ii) Ship's berth including length and lay.

(iii) Photographs of berth.

(iv) Fendering available at the berth/ plan for use of own fenders.

(v) Anchorages available, including depths/ nature of bottom and dangers in vicinity.

(vi) General set and drift[91] at / near the likely berth.

(vii) Alternate plan for alongside berth / anchorage.

(l) **Tugs**. Details of tugs available, their capabilities, communication frequencies, tug control organisation and plan for employment.

(m) **Part of Ship Actions**. The following should be covered:-

(i) State of anchors, including amount of cable to be used in emergency.

(ii) Use of berthing hawsers, including requirement of additional lines if required for berthing / for use of tugs.

(iii) Stem bollard/ position and brow position.

---

[91] Calculated by tracking small radar conspic objects in sea stabilization mode.

(n) **Ceremonials**. Ceremonials in the port and details of personnel nominated for the same.

(p) **Ship-handling**. Brief description of alongside plan, including inputs required from parts of ship during the evolution. Planned shift of charge/ con (OOW-NO-CO).

(q) **Instructions to Pilotage Team**. Specific/additional instructions to members of pilotage team, with respect to individual tasks and overall coordination.

(r) **Miscellaneous**. Any other relevant issues.

4. A tabular format / checklist is placed at Appendix B.

CHAPTER 15

FORMAT FOR ENTERING/ LEAVING HARBOUR BRIEFING

1. The Entering/ Leaving Harbour briefing is normally carried out shortly before closing up the SSD[92]. It should be short and crisp (ideally around 5-10 minutes) (It needs to be attended by the key SSD personnel, Heads of Departments and other key personnel as specified in Captain's Standing Orders.

2. Following timeline with regard to sea and action and conduct of briefing is recommended for a capital warship (This is a generic timeline, and may vary depending on the ship/ operational requirements) before leaving harbour:-

Ser	**Time (H – cast of time)**	**Activity**
(a)	H-02 hr to H-1hr 15min	Sea and Action
(b)	H-1hr 15min to H-01hr	Writing of defects in Sea and Action defect book
(c)	H-1hr to H-45min	Leaving Harbour Briefing
(d)	H-45min to H-30min	Reports by HsOD, check availability of tugs, crane and unberthing party, assess the traffic
(e)	H-30min	Close up SSD

3. The briefing should start with a time check[93]. The following issues **must** be covered, in all cases, with relevant charts/electronic depiction used to assist the briefing:-

---

[92] Art 1912(g) p 19-7, BR 45(1)(2) ed 2008.
[93] Art 0315 p44 of INBR 2 (Regs Navy part 1).

(a) **General**. Purpose/ ETA/ ETD/ Berth, ships in company, sequence of entry/ leaving harbour along with their berth, traffic obtained from VTMS and whether permission obtained to leave harbour.

(b) **Met/ Astro and Tidal Data**. Only relevant data to be covered, e.g. lunar data may not be required if entering in the afternoon. Discuss if any weather warning exists. Closest HW and LW timing, state of tide/ LDL.

(c) **Communication and Ceremonials**. Briefly cover manning of intercoms by pilotage team during SSD, external communication channels and ceremonials to be exchanged.

(d) **Pilotage Overview and Highlights**. Flash one slide covering key SSD posts and personnel manning it as per the latest SSD CTM. Mention of entering/ leaving harbour legs, including length of each leg and speeds planned, clearance/state of anchors, amount of cable, shifting of con/ charge. Highlighting of dangers along each course, minimum expected depth for each leg, brief mention of objects to be used for visual and radar fixing / blind pilotage on each leg, mention of course corrections mandated by tidal/wind conditions, gyro check. This part could just be a glimpse as pilotage briefing is done prior for the pilotage team.

(e) **Ship-Handling Phase**. Lay of the berth, clearances at berth/ approach, adjacent ships, availability/ positioning of tugs including tug communication, description of plan for casting off / going alongside, including berthing hawsers, fendering, set and drift[94] off/ at berth.

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[94] Calculated by tracking small radar conspic objects in sea stabilization mode.

(f) **<u>Other Relevant Issues</u>**. Brief mention of issues pertaining to ship's safety, lowering/ recovery of boat, organizational changes affecting pilotage, Latest NAVAREA, NAVAREAs affecting harbour, defects/ limitations observed during Sea and Action, position of yokohomas and gangway, etc.

(g) Emergency for the day.

(h) ORM (Any unusual conditions/limitations that enhance risk and caution mitigation actions).

4. The following issues should be covered **as required** by the situation:-

(a) Ships in Company. Ships in company and sequence of entering/ leaving harbour, if relevant.

(b) SSD Organisation. Only changes need be mentioned.

(c) **<u>Pilotage Highlights</u>**. Mention of course corrections mandated by tidal/ wind conditions.

(d) **<u>Other Relevant Issues</u>**. The following may be among those covered if relevant:-

(i) Miscellaneous issues, such as MARPOL compliance, etc.

(ii) Higher directives, if any.

(iii) Additional reports required, if any, e.g. clearance from jetty / ships, etc.

(iv) Lowering / hoisting of boat if planned / directed.

5. A tabular format / checklist is placed at Appendix C.

SECTION VI

CONDUCT OF PILOTAGE

CHAPTER 16

PRACTICAL TIPS FOR CONDUCT OF PILOTAGE

This chapter lists out some tips for the conduct of pilotage. They are to be considered in conjunction with information/ instructions contained in standard works on navigation and pilotage.

PRELIMINARY ACTIONS	
1.	**Natural Conditions**
If Leaving Harbour Observe the wind and tide alongside on the previous day (two days if feasible) at the same time/ similar conditions as the scheduled cast off, to properly assess the natural conditions. Observe the lay of vessels at anchorage on the previous day. **If Entering Harbour** Observe the lay of anchored vessels in the approaches. Observe the flow of water alongside buoys as you cross them. Observe the flow of floating objects / water hyacinth, etc. Observe the flags on anchored ships / ashore to ascertain the wind direction.	
2.	**Berthing**
If Leaving Harbour Take a walk on the jetty to observe the following:-	

- Are your lines clear of the bollards and any obstructions?

- What are the clearances ahead and astern?

- Are there any boats / barges secured alongside your ship / ships ahead / astern?

- Are there any unnecessary shore umbilicals?

- Are the fenders positioned correctly for cast off?

- Are the yokohoma lines secured to the ship or the jetty?

- Are bottom chains placed? If yes - when do you plan to remove them?

- Is the brow clear for removal?

- Is the un-berthing party available?

If Entering Harbour

- Ascertain ships ahead and astern at the berth from Navy Control/ ship alongside.

- Sight the berth through binoculars if possible prior the final approach.

- Ascertain correct placement of yokohoma fenders vis-a-vis bollards/ adjacent ship.

- SCO to establish communication with boat pool/ ships at berth to confirm availability of berthing party.

- Brief the Berth Sanitisation Team (BST) for any inputs required from the jetty.

- Obtain wind/ tidal stream conditions at berth from the ship you are going alongside.	
3.	**Equipment Readiness**

All key equipment are checked in Sea and Action checks. However, some points are repeated below for, emphasis:-

Personally check your gyro sights and repeaters for correct alignment and clear vision.

Check echo sounder reading with hand lead line prior leaving harbour.

Ascertain the gyro error[95].

Check radar index error and radar bearing error. Minimise the same and annotate residual errors on the display(s).

Check your personal equipment - binoculars, note book, torch, etc.

Load your blind pilotage plan on relevant displays in Bridge and Ops Room and check these are matching with visual plan. Also check the radar range/ bearing errors and known Gyro Error have been addressed in marking the blind pilotage plan.

Check bridge windows for clear vision.

Cross check GPS feed to ECDIS, radars and other bridge equipment.

Check communication with alternate conning position (bridge top, bridge wings, ECP, etc.).

[95] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

Ensure steering gear and ROT/ EOT checks done and satisfactory. Ensure clutching in trials have been carried out in both ahead and astern modes prior cast off. Ensure ship's siren has been tested in all modes and is operational.	
4.	**Bridge Organisation**[96]
Check charts placed in correct sequence in folio for use during pilotage (have the list of charts, as per sequence, placed above the chart table for easy reference of OOW). Ensure Time check given post closing up of SSD, and Bridge - Ops Room - MCB watches reported synchronised. Check SSD recorder functioning correctly. Check look outs and other bridge personnel closed up. Traffic monitoring in channel (by radar/ MMB/ AIS) can be commenced prior to cast off to build up situational awareness. Ensure that your Ops Room is 'on top' of the tactical situation and aware about the movements of other naval units.	
CAST OFF	
5.	**Cast Off**
Monitor preparation/ starting and availability of Main	

[96] Ch 19, BR 45 (1)(2) ed 2008 and Ch 4 BR 45 (4) ed 2008 refers in this regard.

Engines on time.

Start canting out in time. With experience, you should be able to work out the time required for canting out in the given conditions. Commence your movement accordingly, so that the last line is let go at the designated time for cast off.

Use local/ opportune transits for judging set/ drift[97] and headway/sternway.

Mark your 'turning box' and carefully monitor that you are turning within it. Remember that the ship is highly subject to the effects of wind/ tide at this stage.

After giving an engine order, ensure that the engines have responded and in the correct direction (based on confirmation by MCR, tacho-reading from bridge, etc.)

Ensure echo sounder is switched on. Monitor echo sounder reports and be quick to take corrective actions if required (be aware of the peculiarities of the equipment. For example, some echo sounders don't give accurate soundings when ship has sternway on).

As the ship turns/ cants, also keep a track of movements on/ across the first leg for leaving harbour.

The tugs should be released only when it is deemed that there is no further requirement. Don't needlessly hold on to the tugs, but don't be in a hurry to secure them.

The Fixing Team needs to start fixing early, even during the initial turning around.

The NO should clearly brief his pilotage team as to when

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[97] Calculated by tracking small radar conspic objects in sea stabilization mode.

the pilotage reporting sequence is to be commenced (it is a good practice to specifically order "Commence pilotage sequence"). Monitoring of the SMG / CMG while casting off or going alongside may provide an assessment of the set / drift[98] being experienced.
GOING ALONGSIDE
6. **Going Alongside**
Settle on to the final approach heading early as this bears the advantage of better appreciation of the set and drift. Warn MCR - 'Final approach commenced'. Minimise noise levels and intercom traffic. Look for natural transits to aid in ascertaining the set and deceleration. Monitor the bearing of the catamaran / yokohoma, to ascertain if the ship is on the correct approach path or getting set off the same. Watch a flag or yokohoma lines at the precise berth to confirm the wind and tide alongside. Keep monitoring the same to determine any shift that may occur. Remember an astern order on the engine will suddenly increase the effect of wind sheer. Monitor the tacho meter/ SRPM to ensure that the engine has responded in the correct direction. Keep. an eye on the lines astern being clear of the

[98] Calculated by tracking small radar conspic objects in sea stabilization mode.

propellers. Usage of lines must be coordinated with adjustments-with the main engines.	
DANGER ASSESSMENT DURING PILOTAGE	
7.	**Charted Dangers**
Take frequent bearings of clearing marks to ascertain ship is in clear waters. Remain aware of the nearest danger and the estimated time of it's passing abeam. Regularly correlate clearance from dangers with Blind reports. Constantly monitor the echo sounder reports and if tallying with expected depth.	
8.	**Other navigational Dangers**
Monitor set and drift, particularly in vicinity of anchored vessels and buoys. Estimate the strength of the tide / wind and adjust the course to steer. Frequently monitor the traffic, including small boats, etc., on the next leg and correlate with Anti-coll reports.	
MAINTAINING TRACK	
9.	**Head Marks/ Transits**
Sight and identify head marks / transits for the next leg well in time. Use bearings, transits, DR for the same. Monitor the head mark closely to ascertain being on or off track. Account for the gyro error of your repeater.	

If on a fix and run leg - make an early assessment of a suitable object ahead for 'running on'. When running on a transit or a line of bearing - always follow the head mark. Check blind pilotage reports are being made w.r.t. the correct/ planned object. Account for blind range/ bearing errors, if different from and not incorporated earlier in marking the blind plan on display. Check that there are no alarm indications or interruptions in DGPS / GPS feeds to ECDIS, whilst checking indicated position / XTE. Regain track boldly if off track - set a time for yourself (e.g. plan to regain track in two minutes), and calculate the course to steer using radian rule for quick corrections.	
10.	**Radian Rule**
Use the radian rule in conjunction with bearings of the head mark and radar ranges of the same to ascertain position w.r.t. the track.	
11.	**Fixing and Records**
Ascertain Gyro Error. Check if gyro error is being applied in noting bearings/ plotting fixes, as per briefing. Check quality of fixes plotted (angles of cut, cocked hat, number of LOPs, etc.). Plot at least one fix per leg personally, if feasible and length of the leg is adequate.	

Regularly check recording of fixes by the fixing team in the OOW note book.	
12.	**Altering Course**
Monitor wheel over bearings regularly. Using the primary wheel over object as one of the fixing marks may be useful. Cross check for traffic on the next leg prior to W/O, by visual, radar and AIS. Assess CPA/ track clearance. If not comfortable, adjust speed and alter early/ late, as suitable. Always look in the direction of alteration, ensure the quarters are clear prior alteration. Check the wind direction - the ship will usually turn well into the wind, but will resist turning away from it. Use more wheel to start the turn – ease it later to gain the track. If turning across the wind / away from it, you may need to maintain more wheel to turn correctly. Monitor the turn by observing objects coming up right ahead at predetermined bearings. If the objects do not come up on the correct bearing - adjust the turn/wheel. During large course alterations, get the Fixing Team to plot fix. Fixing Team and BSO should advise on adjusting the rate of turn. If altering course away from the planned track - plot the new track and generate a DR / EP immediately. Ascertain the nearest danger and the sea room available on the new unplanned leg.	

13.	**Actions on setting on the New Leg**
Put a fix immediately. Ascertain if the ship has turned correctly - cross check the same with the blind plan and the blind safety officer. Ascertain the set and drift on the new leg and estimate the course to steer. Cross check the nearest danger from the chart/note book. Recheck the CPA of traffic on the new leg.	
REPORTS TO CAPTAIN[99]	
14.	**Track**
What is the head mark bearing and consequently where is the ship placed? How much is the XTE'? What is the recommended course to regain track if not on track?	
15.	**Natural Conditions**
What is the effect of tide and wind (estimate of set and drift being experienced)? Are you taking any corrective action and what/ how much, to counter the same?	
16.	**Dangers**
What is the nearest danger and the CPA for clearing the	

[99] Art 1120 p 11-5, BR 45 (9) ed Dec 2008.

same? What is the minimum depth expected? Are there any ships, boats, buoys, etc., along the track? If yes - what is the plan for clearing / crossing the same?	
17.	**Alteration of Course**
What is the distance to wheel over? Is the next leg clear for alteration (w.r.t. hazards/ shipping/ fishing, etc.)? What would be the estimated effect of the wind / tide on the alteration? What is the plan to counter the same?	
18.	**Traffic**
What is the state of traffic in the channel? Where do you expect I plan to cross vessels? · What would be the sea room available to you at that point (especially any proximity of nav dangers therein)? Is the crossing in contravention of IRPCS'? If yes - why, and what is the rule position on the same? What is the best action/ option for you to avoid the danger, i.a.w IRPCS? In case your track gets you into too many crossing situations with merchant ships, you might consider working out a fresh track for subsequent movements, catering for the general route followed by merchant shipping.	

19.	**Mistake**
If a mistake / blunder has been made - report the same to the Captain immediately.	
20.	**Position**
If in doubt of the ship's position, inform Captain immediately. Do not - "bash on regardless". **If required, stop ship to reassess and reorient.**	

CHAPTER 17

PILOTAGE ERRORS

This chapter enumerates the most common errors that may be committed and/ or experienced, and the corresponding checks and cautions required by the navigator and pilotage team, in the course of navigating the ship through pilotage waters.

TYPES OF ERRORS	
1.	**Faults**

(a) Unnoticed errors/ mistakes during planning result in confusion during execution. Have the detailed planning and turning data in use cross checked with respect to:-

(i) Plotting of Tracks, wheel over andclearing bearings.

(ii) Noting down reciprocal bearings for distance to L/G while anchoring with a short approach leg.

(iii) Incorrect Tidal calculations.

(iv) Use of smaller scale chart during planning when a larger scale was required.

(v) Requisite clearance kept between clearing bearing and LDL.

(b) Incorrect execution of pilotage is likely due to :-

(i) Incorrect correlation of where the ship is w.r.t the track, and the direction in which the correction must be applied.

(ii) Inappropriate correction during cross TS/ Wind, especially during large turns.

(iii) Failure to monitor large turns.

(iv) Failure to look in the direction the ship is going to turn and also on the quarter.

(v) Failure to treat local knowledge with a proper degree of caution.

(vi) Inadequate attention to shipping situation in conjunction with safe navigation in crowded harbours.

(vii) Implicit faith in any one means of pilotage, without proper cross check and correlation with other inputs.

(viii) Failure to monitor functioning and reports of pilotage team.

(Ix) Improper co ordination of actions amongst the pilotage team.

(x) Failure to anticipate situations, especially traffic and break downs, and provide correct, timely responses.

(xi) Malfunction in equipment such as gyro, which may go unnoticed for some time.

(c) In addition to avoiding the primary faults above, pilotage errors can be precluded by attention to the following:-

(i) Information from multiple sources should be cross checked before arriving at a conclusion.

(ii) Breakdown of equipment can be guarded against by monitoring inconsistent behaviour. Critical

	equipment during pilotage such as Gyro and radar should be frequently checked for errors. (iii) Do not cut corners in making and executing a plan. (iv) Do not deviate from the plan, unless there is a proper alternate plan prepared and the conditions warrant change over to the alternate plan. This should be approved by the Captain and also briefed in advance (with pilotage briefing) to the pilotage team, and changeover of plan informed to the Command, Bridge and pilotage teams. (v) Ensure the organization for lookouts[100], radar, echo sounder, etc., is adequate.
2.	**Systematic Errors**
These follow a regular pattern and may be predicted. Such errors change slowly with time and may be measured. These must be established and known at all times:- (a) Misalignment between Lubber's Line of the compass and the fore-and-aft line of the ship. (b) Gyro error. (c) Deviation error in magnetic compass. (d) Residual radar range and bearing error on each display.	

[100] Rule 5 IRPCS

3.	**Random Errors**

Errors that cannot be predicted include random errors:-

(a) Taking and Plotting of a visual bearing is subject to small unpredictable errors. For instance, if there is an unknown error of 1 degree in your gyro, the position lines obtained will have an error proportional to the distance of the fixing mark, e.g. in case of a simple two point fix, it the marks are at 2 Nm from (the observer, the error would be 66 yd on either side of both position lines.

(b) Sun's bearing during SR/ SS calculated using tables is expressed using one decimal point. The final value is again rounded off. Hence the gyro while presumed to be correct may still have some unknown error. This error is also accentuated by the fact that the least count in gyro repeaters is generally ½ degree. Further, the observations are made by the human eye, which in itself would introduce approximation in taking bearings.

4.	**Gyro**

(a) Aspects of obtaining and using Gyro error[101] should include considerations for the following:-

(i) Treatment of azimuths of the sun for finding gyro error. Errors made in observations and in rounding off, particularly when tables are used for the calculation may become significant in very narrow channels.

(ii) Misalignment of the ship's azimuth circle during Refit.

(iii) Least count in the gyro sight / repeater.

[101] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

(b) Exercise care while taking bearing of distant objects with Gyro error. Least Count of measuring Gyro error can be taken as ½ - ¼ degree. Thereby taking a bearing of an object at a distance of 6 nm would give an error of 100 yd on either side of the track. This error would be of significance:- (i) In very narrow channels. (ii) When using combination of near and far objects for fixing.	
5.	**Charts**
(a) Accuracy of earlier surveys, done with old/ vintage equipment and related procedures may not be as accurate as modern surveys, and should be treated with due caution for possible gaps in information, especially in coral regions. (b) Charted depths on isolated shoals could be much lesser than charted. (c) Maintain DR/ EP from the fix up to the next wheel over point (know the time and relevant bearing of wheel over). (d) Identify marks well in time. (e) Relate echo sounder reports to charted depths[102]. (f) Do remember that datum shifts (for plotting GPS/ DGPS fixes) are w.r.t a shore datum, and accuracy of calculated shift will change slightly with distance from the	

[102] Art 0923 p 9-10, 0924 (c) p 9-12, BR 45 (1)(1) and Art 1312 p13-13, BR 45 (1)(2) ed 2008.

datum. Further, since datum shift is noted only to second decimal of nm (e.g. 0.09 N, 0.01 E), the actual shift could be 10 yards from that promulgated even at the datum point.

(g) The scale of the chart will affect accuracy of plotting a fix. E.g. on a 1: 25,000 chart, the pencil mark of a 0.5 mm reflects a difference of $\pm$14 yards.

(h) Various chart and plotting errors can compound or counter each other.

(j) Possibility of gaps in charted information must always be borne in mind. These could occur due to the inherent intervals / distances between sounding lines, as also possibility of hitherto undetected changes that have occurred since the survey was done.

6.	**Fixing**

The greater the distance of an object from a ship with gyro error, the greater would be the displacement of the position line from the ship's actual position.

(a) It is not necessary that the ship would lie inside or at the edges of a cocked hat. It may also lie outside the cocked hat, especially in case of a delay / error in plotting the fix.

(b) Cross bearing fix using closer objects is better than further ones, especially when gyro error is unknown. Approximate error can then be obtained.

7.	**DGPS/ GPS**

Reliance on the GPS for pilotage is not recommended, even with known datum shift, due to inherent inaccuracies and scope for non correction of datum shift.

However, GPS positions may be used as inputs as a check w.r.t. other fixes and to aid assessment of:-

- Course Made Good
- Speed Made Good
- Set and Drift

However, remember that these are instantaneous and temporary in nature and do not provide the average values that are required for pilotage.

DGPS

The DGPS is more accurate than the GPS and, if integrated with the ECDIS, can be used as a backup for other means of pilotage. However, caution needs to be exercised herein that many errors can creep in for various reasons, which must be borne in mind even for using it as a backup. These include (also see Chapter 7):-

- Loss of power to DGPS / ECDIS.

- ECDIS / DGPS set up incorrectly, such as for chart datum, gyro, log, time, ship's dimensions, ship's tracks, ref position, etc.

- Disruption of DGPS feed to ECDIS.

- ECDIS / DGPS malfunction, with alarm subdued / not noticed.

- Inadvertent/ unnoticed changes to ECDIS / DGPS settings, resulting in incorrect display / output of ship's, position / track.

8.	**ECDIS**

(a) ECDIS time not matching with GPS.

(b) The secondary source of position system not selected in ECDIS. In case the primary GPS fails, the system will automatically go to DR mode.

(c) ECDIS not updated.

SECTION VII

CONDUCT OF SHIPHANDLING

CHAPTER 18

MANOEUVRES

1. **Safety**. Manoeuvres involve ships being in close quarters with one another and, therefore, safety is paramount. The following must always be borne in mind:-

(a) When a manoeuvre is executed, watch the nearest ships closely in order to ascertain that they are moving in the correct direction.

(b) Beware of using standard methods for proceeding to a new station, if not actually in station at the moment of execution. This can be dangerous, particularly when ahead of station on the beam of the Guide and being ordered to a station astern.

(c) Conning the ship, manoeuvring and maintaining station requires complete and continued attention. The SSD OOW / AOOW should be fully utilized to assist the NO, who cannot afford to be distracted. Conning by the "Starboard 15 steer ...... “method is advised, and leaves the navigator free to concentrate upon the problem at hand.

(d) Always have the disengaged side manned.

2. **Tips on Manoeuvres**.

(a) Always keep the Guide identified on radar, and its position marked on the Battenberg.

(b) Consider using the Battenberg without its arms, like a plotting sheet, as this significantly reduces the time taken and facilitates incorporation of advance/transfer for more advanced manoeuvres (such as station from the bows, Corpen S, Screen stations, etc).

(c) In calculating the course to steer, check the CPA from other ships during the manoeuvre. When proceeding to a-new station, go there by the most direct route and not a "curved approach", whilst ensuring you remain clear of other ships.

(d) Always check clearance on the side towards which you intend to alter, both visually and on radar before actually ordering the wheel.

(e) Cater for own advance, transfer, and guide‘s run for both initial and final alterations of course.

(f) Commence altering course and speed as soon as the stationing signal is received, alter checking the points noted above. Turn with a tighter wheel initially, so that the movement of the ship is apparent.

(g) In case other ships are given a station concurrently check that their track is clear of own ship and monitor their movement till well clear. Bear in mind that new stations may be pending and may be executed whilst you are enroute to your station.

(h) Continue plotting range and bearing of the guide whilst proceeding to station, and check that the ship is following the correct relative track.

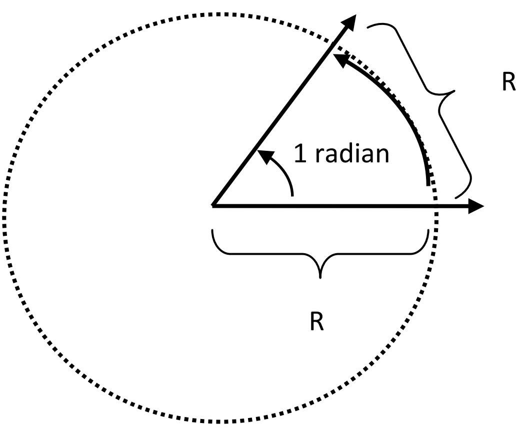
(j) Determine the point of alteration to base speed and course. It is better in this regard to make one bold alteration rather than a series of minor alterations. While opening/closing on the beam, a handy thumb rule is alter course and reduce speed one cable short of station for a final turn of 30 degrees, two cables for 60 degrees and three cables for 90 degrees. This will of course have to be marginally adjusted for each individual type of ship.

(k) Do not cross the wake of the column or ship ahead, when getting into column.

(l) When taking station from the bows, keep a lateral safety margin of at least 0.5 cable away from the guide column. This is particularly important if slotting in between two ships at standard distance. However, do also remember that you will have to adjust your wheel in the final stages of the turn to ease into the guide's wake if in column.

(m) Any manoeuvre where the initial station is forward of the Guide's beam should be treated as a 'taking station from the bow'. In such cases, particularly at stationing distances of less than 02 Nm, the direct battenberg course (or the much relied upon ARPA/CTD) will not provide the answer. This is due to own initial and final turns, the time taken to turn, own advance/transfer, and the Guide's run, all serving to overturn the notion of a single relative triangle which is what the Battenberg/ ARPA/ CTD solves. Of course, if the Battenberg is used as suggested at sub-para (b), it can provide not only the CTS, but also the point of wheel over. In taking station from the bows, where the final station is also abeam / forward of the beam, try and make the final alteration of course outwards.

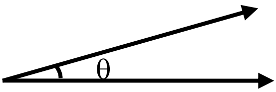
(n) While using ARPA, remain aware of any drift in synthetic tracks that may be in use, as such drift will result in erroneous vectors / CPA, etc. Also, in case of any error in speed input, such as if manual speed is selected and not updated, or if the log is not calibrated, then the resultant ARPA/CTD solution will also be incorrect.



3. **Radian Rule**. This article attempts to look at the radian rule in practical and simple application including a fresh approach to its principle. This requires at

first to define the root word radian itself. *The **RADIAN** is a mathematical unit of angular measurement wherein one radian is defined as the angle subtended at the centre of a circle by a length of its arc equal to its radius.*

4. From the definition it emerges that if 'l' is the length of the arc and 'r' the radius then the angle subtended is l / r radians. Since the circumference of a circle is 2 π r, a full circle is, conventional 360^0.



5. In terms of conventional measurement of degrees one radian is 57º 17' 44."81. In our utility of radian rule this is considered as approximately equal to 60º. Conjoining the definition of radian with this approximation we have that an arc of one mile will subtend 60º in a circle of radius one mile. This is the theory of radian rule.

6. Only when the arc of the circle can be assumed to have the same length as the straight chord from that very arc, radian rule remains mathematically correct.

7. With the preceding background, the most common enunciation of radian rule flows:-

One degree at one mile subtends 33 yards."

8. ***What is the mathematics here***? One nautical mile is defined as 1852 m. From a definition of one nautical mile as the arc subtended at the surface of the earth by one minute (1/60 degrees) we get the figure of one degree = 2000 yards. One degree being approximately one-sixtieth of a radian, it will define an arc (or chord) of 2000 yards / 60 = 33 yards.

9. A simple tool to radian rule type calculations is explained in succeeding paragraphs.

Angle	**Range**	**Perpendicular Distance**
1 degree	60 nm	1 nm
1 degree	6 nm	1 cable
1 degree	1 nm	33 yards
2 degree	5 cables	33 yards
4 degree	2.5 cables	33 yards

Radian Rule Formulae

- CPA in nm = Range in nm $\times$ Angle on bow/ 60
- Throw off required = CPA (nm) $\times$ 60/ range (nm)
- Lateral separation = Angular separation (in degrees) $\times$ Range (cables) $\times$ 10 (in feet)

10. The radian rule helps to see two most common applications. The first is to find the CPA at which a ship would pass a stationary object, say, Fairway Buoy. The second is also related to the same – to find the throw off required passing the same object at a given distance. Another use similar to the second one is to know at what bearing to come down to base speed when coming up to a station on the beam.

"Radian Rule as fraction of Sixty!!!"

11. Radian rule may be approached with following two questions:-

(a) What fraction of sixty is the present angle?

(b) What fraction of present range is the intended CPA?

The two questions combine to the calculation – Fraction of sixty.

12. **Requirement I** – Present angle as a Fraction of Sixty. Some examples would simplify this:-

(a) Range = 2.’5. Ships course = 092º. Bearing of Fairway Buoy = 080º.

The angle between the ship’s course and bearing of Fairway Buoy is 12º. This is 1/5 of 60º. CPA is 1/5 of 2.’5 [Present Range] i.e. 0.’5 or 5 cables (Approximately!).

(b) Range = 7.’2. Ships course = 210º. Bearing of Stationary object = 213º.

The angle between the ship’s course and bearing of the object is 3º. This is 1/20 of 60º. CPA is 1/20 of 7.’2 [Present Range] i.e. 0.’36 or 3.6 cables.

(c) Range = 4.’2. Angle on the bow = 18º.

Now 18º does not give a simple fraction of 60 [3/10]. One may calculate it in the same way and do 4.’2 X 3/10 = 1.’23. The same result is also obtained by considering 18º / 60º as 0.3. So 0.3 X 4.’2 = 1.’23 or 12.3 cables. Here there is greater approximation as 18º is not so small an angle. However for manoeuvring calculations it does not give errors.

13. **Requirement II** = CPA as fraction of Range. Again we take some examples.

(a) Present range of a buoy right ahead is 3.’6. What throw off is required to pass it at 6 cables?

- 6 cables = 0.’6.
- 0.’6/3.’6 = 1/6
- 1/6 X 60 = 10.
- So 10º is the throw off required.

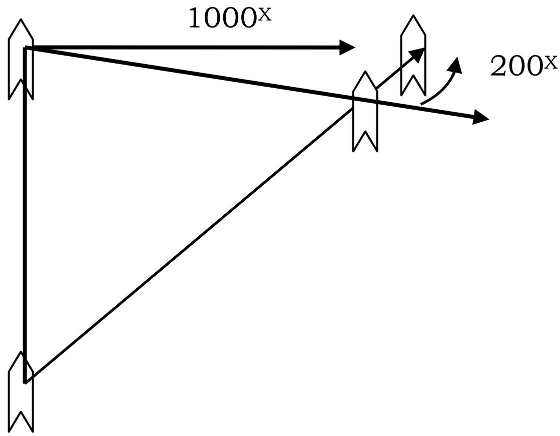
(b) Range = 4.'5. Ships course = 210º. Bearing of Stationary object = 214º. What throw off is required to increase CPA by 1.5 cables?

- Angle on the bow = 4º.
- 4/60 or 1/15 of 4.'5 = 0.'3 = 3 cables.
- Increased CPA = 3 + 1.5 = 4.5 cables.
- 4.5 cables = 0.'45 as a fraction of 4.'5 i.e. Present Range is 1/10.
- 1/10 of 60º or 6º is the new angle on the bow. So course will be 210º + 6º = 216º.

14. Example similar to 13 (b) is given below with the solution:-

Ship is stationed 5 cables astern of guide on Course 245º, speed 12. New station is 5 cables on starboard beam. If the stationing speed is 18 kn and deceleration is 33 yards per knot, when must the ship come down to base speed.

- Deceleration for 6 kn drop in speed = 6 X 33 = 198 yards = 200 yards approx.
- 200 is 1/5 of 1000 [Final Range]
- 1/5 of 60º = 12º



- So commence order speed reduction 12º short of final bearing [155º].

- Answer 155º + 12º = 167º.

15. **<u>Applications of Radian Rule in Navigational Situations</u>**

(a) If an object bears 5 deg on the bow and the radar range is 6 nm then the object will pass abeam at a distance of 5 cables.

(b) If you sight an island ahead whose extent on the chart is 2 nm and subtends an angle of 12 deg at the observer then the island is 10 nm away.

(c) If the ship whose length is 300 feet when abeam subtends 3 deg at the observer then the ship is at 1nm distance.

16. **<u>Applications of Radian Rule in Ship Handling Situations</u>**

(a) While taking up station if your ship is moving from stern to take up station abeam of the Guide at 5 cables with 4 knots speed advantage, and the deceleration rate is 35 yards/knot, then speed should be reduced to base speed 8 deg before the correct station. This is based on the fact that one knot speed advantage will require 35 yards to lose and at 5 cables distance it is 2 deg and hence with 4 knots advantage it is 8 deg.

(b) During Replenishment at Sea, since the ship should approach keeping outside 100 feet to avoid interaction, the radian rule can be effectively used to check the correct approach by comparing the range and bearing of RAS position of supplying ship continuously. Using radian rule it can be ascertained that at 3 cables distance 100 feet will be 3 deg, at 1.5 cables 100 feet will be 6 deg and at 1 cable 100 feet will be 9 deg.

17. **<u>Speed Time and Distance Application</u>**

(a) **<u>3 Minute Rule</u>**. The distance covered in three minute is given by the formula.

Distance in yards = Speed (Knots) $\times$ 100

(b) **<u>6 Minute Rule</u>**. The distance covered in six minute is given by the formula.

Distance in nm = Speed (Knots) $\times$ 10

(c) **<u>Knots/Minute Rule</u>**. If out of station by one cable, increase speed

By 12 knots for ½ min

By 6 knots for 1 min

By 4 knots for 1.5 min

By 2 knots for 3 min

By 1 knot for 6 min

18. **<u>Relationship to Remember</u>**.

1 Knot	-	33 Yards/ min
6 Knots	-	200 Yards/ min
15 Knots	-	500 Yards/ min

19. **<u>Tips on Station-Keeping</u>**.

(a) Maintain the ship within ¼ cable and ½ degree of station, when at standard distance.

(b) Frequently check bearing and range of the guide. Between bearing and range, it is more important to maintain the correct bearing. Also, it is better to be ahead (gain bearing) than astern of station (lose bearing), and to be slightly in rather than out for range.

(c) Having lost or gained bearing whilst on the bow/ quarter, it is easy to get confused about whether to increase or decrease speed in order to regain station, especially during a turn. This confusion could be resolved simply by looking along the bearing that the Guide ought to be on.

(d) Figure 18-1 provides a mnemonic for maintaining station, shown with Guide on the port bow. The same mnemonic can be used for all stations and, with a little practice, can also be visualised. The diagram is used as follows:-

(i) The range arc and bearing line for own station is drawn from the Guide. Own station is at the intersection of the two.

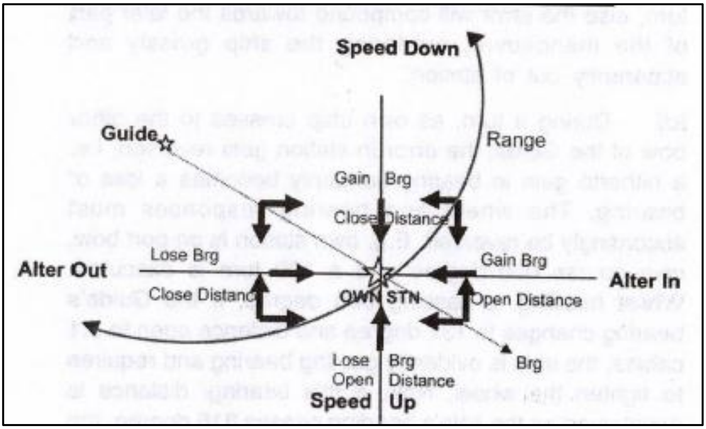
(ii) The X and Y axes are drawn through own station. While the X-axis represents the base course, the Y-axis represents the base speed.

(iii) When the ship starts moving from her station, the range and bearing of the Guide will, obviously, change.

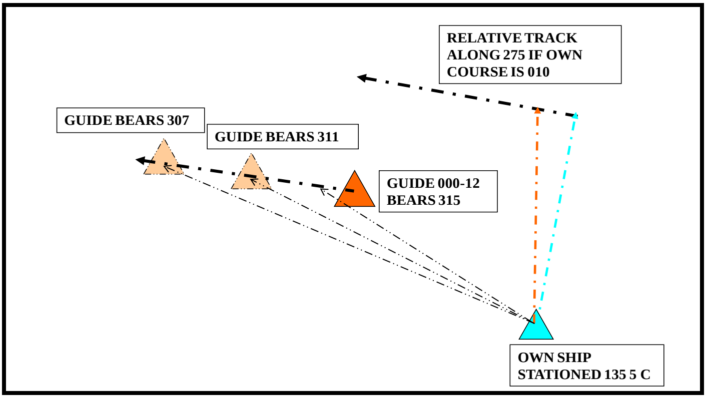
(iv) Mark the present position of the ship on the diagram, from present range and bearing of the "Guide”. This position will not be at the centre of the intersection of the X and Y axes, since that represents the correct station. The displacement of the present position from the centre represents the error in station-keeping, and also shows the correction to be applied.

(v) The displacement along the X-axis represents the course alteration (in/out), and the displacement along the Y-axis represents the speed alteration (up/down) requires for regaining station.

(vi) If own ship has gained bearing and closed distance, evidently the ship's position is along the +Y axis, and we need to reduce speed to regain station. Also, if the ship alters to stbd (out), in the station shown, she will gain bearing / open distance.



(vii) One point to note here is that, **when on quarter alteration of course outwards would result in gaining bearing or moving ahead in station.** This is one aspect that does not sound logical – but it is! To elaborate this further, one needs to just play around with the Batten berg. Assume the guide to be on course 000 12 kn and you are stationed on stbd quarter. Thus the guide is on bearing 315 at 5c. If now the own ship alters course by 10 degrees to stbd at same speed, the relative motion of the guide comes along a track 275. Drawing the relative track through the guide's position indicates that as the range increases, the guide keeps moving back with respect to original position i.e., the own ship continues to gain bearing.



(viii) The problem of station keeping gets compounded with respect to the corrective action that is required to be applied. The two aspects of range and bearing or the speed or course alteration are to be simultaneously catered for. Generally speaking if alteration of one aspect has got you off the station, the corrective action of same would get you back

(ix) **Beam/Bow/Quarter Station.** A little reflection on stationing on beam/bows or quarter would reflect that the ship is stationed on a **circular arc of Stationing Distance** from the guide. This realization is very important for an OOW to be able to maintain station. Take the example of stationing on beam. If correct for station, a slight increase or decrease in speed would invariably result in increase in range from the guide.

(x) The final thumb rule when stationed on the bows or quarters is- ‘If out for both bearing and range, alteration of either the course or speed would help you regain the station. However, if you were out only for range or only for bearing, alteration of both the course and speed would have to be resorted to regain station.

20. **Turn Manoeuvres**. A turn manoeuvre is amongst the most exacting, and requires closest attention -for maintaining station. The following may be borne in mind, during a turn:-

(a) **Turn at the same rate as the Guide**. It is by no means enough to simply use the tactical rudder, as the time taken to turn by ships of different classes will vary, as will be the loss in speed during the turn, even if the tactical diameter is the same. All this will tend to push own ship out of station. In a 180 degree turn with a Carrier or Tanker as the Guide, only applying the tactical rudder may take a Frigate / Destroyer out of station by almost 10 degree and 2 cables! Hence, the wheel and speed must be adjusted during the turn to replicate the turning circle and turning rate of the Guide, so that station is maintained at all times.

(b) Watch the Guide's aspect during all stages of the turn it is often the best indicator of its rate of turn.

(c) Endeavour to keep the Guide's aspect similar, with bearing and range being constant throughout the turn, else the error will compound towards the later part of the manoeuvre, rendering the ship grossly and apparently out of station.

(d) During a turn, as own ship crosses to the other bow of the Guide, the error in station gets reversed, i.e. a hitherto gain in bearing suddenly becomes a loss of bearing. The wheel and bearing responses must accordingly be reversed. E.g. own station is on port bow, own course 000 degree and a 180 turn is executed. Whilst heading is passing 330 degree, if the Guide's bearing changes to 137 degree and distance open to 5.1 cables, the ship is evidently gaining bearing and requires to tighten the wheel. Now, if this bearing/ distance is maintained as the ship's heading passes 315 degree, the ship would then be relatively astern of station, i.e. it would have lost bearing, and needs to ease the wheel and increase speed.

(e) With a little practice, the mnemonic described at sub para 3 (d) and Fig 18.1 above can be applied for maintaining station during the turn, with good result.

(f) During a standard 90 degrees turn, say from line abreast formation into a column, remember that:-

(i) In the first 30 degrees, the change in Guide’s bearing is not sensitive, i.e. by the time the bearing starts changing the situation is probably already getting out of control. Here, the Guide’s aspect will give the best indication, particularly in the earlier stages. Endeavour to give the wheel at the same time as the Guide, and the rudder that will best replicate the Guide’s turning characteristics.

(ii) In the next 30 degrees, watch the bearing and range closely, as both are very sensitive. Any shift in these will require a response in both wheel and speed to regain station.

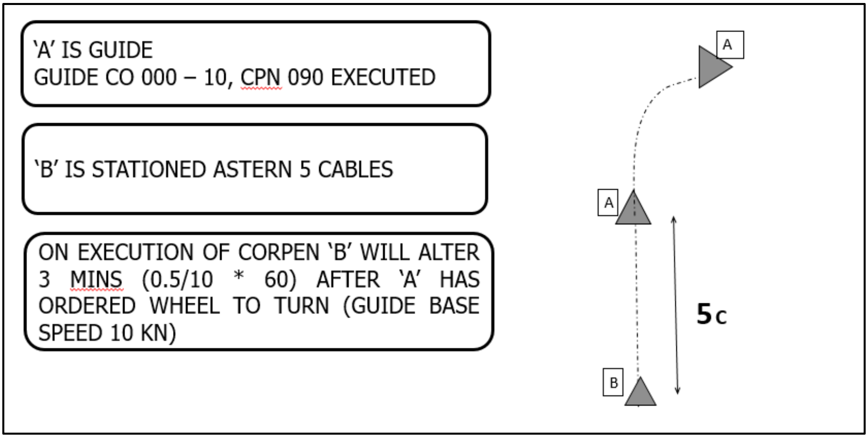
(iii) In the last 30 degrees of the turn, the bearing is extremely sensitive. Watch the aspect of the Guide carefully and endeavor to complete the turn together, otherwise the ship will rapidly go out of station after completion of the turn.

(g) The above is particularly significant when the Guide is a Carrier or Tanker. The turning pattern of these ships can be better understood by imagining them to have a pivot point that is constantly shifting aft during a turn. Consider these ships carrying out a 90 degree turn. The initial turn is sluggish, with their aspect showing little change, as if the pivot point is well ahead of the stem. After about 20 degrees of turn, the rate of turn picks up and becomes noticeable, as if the pivot point has stirred and moved to the standard 1/3 rd distance from stem. After the ship has turned about 45 degrees, the bows and stern are moving at the same rate, as if the pivot has moved to the ½ way mark from the stem. And, alter about 70 degrees of turn, the bows move very rapidly to the new course leaving the stern way behind, as if the pivot point was less than 1/3rd distance from the stern. A ship that is following in their wake would find their stern 'mushing' at this point, making a very sharp angle to the earlier turning arc, and requiring the ship following to smarten her turn a fair bit. So, in a standard 90 degree turn at 12 kn with these ships as Guide, a destroyer would normally start with a 5 degree rudder and reduce speed by ½ kn. As soon as the Guide's first movement becomes noticeable, tighten to 10 degree wheel. After 45 degrees turn, tighten further to 12-15 degree wheel, and reduce speed by another ½ kn. After 70 degrees turn, tighten to 25 degree wheel till settling on the new course, and then go up in speed slowly as the guide regains base speed.

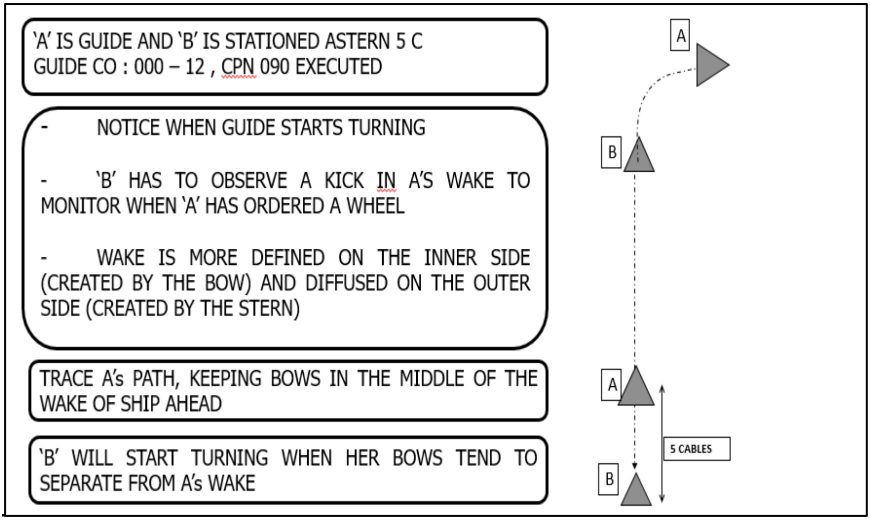
21. **Corpen**. A Corpen, though relatively less complex than a tum, can go embarrassingly wrong if not calculated and executed correctly. It is always better to turn with a tighter wheel when commencing a corpen and thereafter easing it to fall into the guide's wake. Own ship's bows should be kept in the middle of the slick that the ship ahead leaves and well inside the wake left by it's stern. If the bows move outside this part, the stern will perforce go outside the wake. At night, use time and DR to assist in determining the point of wheel over. Calculate your point of turn correctly using advance, transfer, etc., the radian rule may also be put to use here. A rough thumb rule for determining wheel over is: at 5 cables stationing distance, alter 35 degree short of the final bearing, at 10 cables, 18 degree short.

22. Primarily there are four ways of doing the manoeuver depending on what situation one is in. The first method is the **time-tested use of "Stop Watch**". Depending on what range a ship is stationed behind the guide; the time difference between the guide and ship can be worked out. For e.g., if the ship is stationed

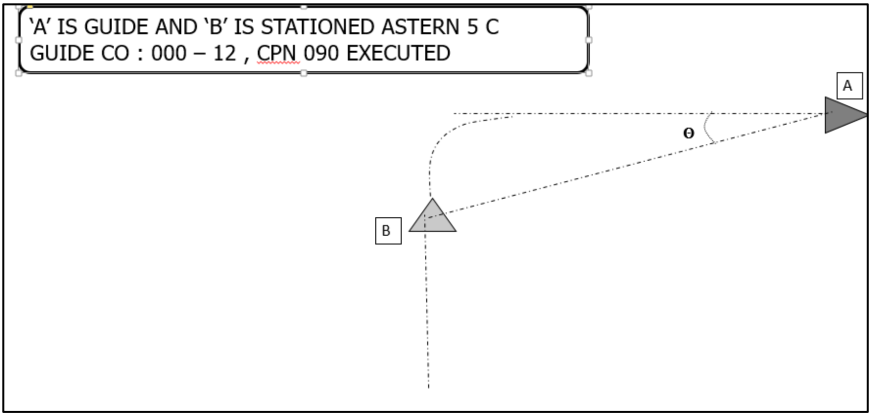
5 Cables behind the guide at speed 10 kn, if a Corpen is executed, own ship needs to order wheel after nearly 90 seconds. The only thing to note is the exact time of execution of the wheel by the guide. If the ship is directly behind the guide, the exact moment of rudder order can be judged by observing the “kick” in the guides wake. In all other cases probably, one would have to take the signal DTG as the occurrence time.

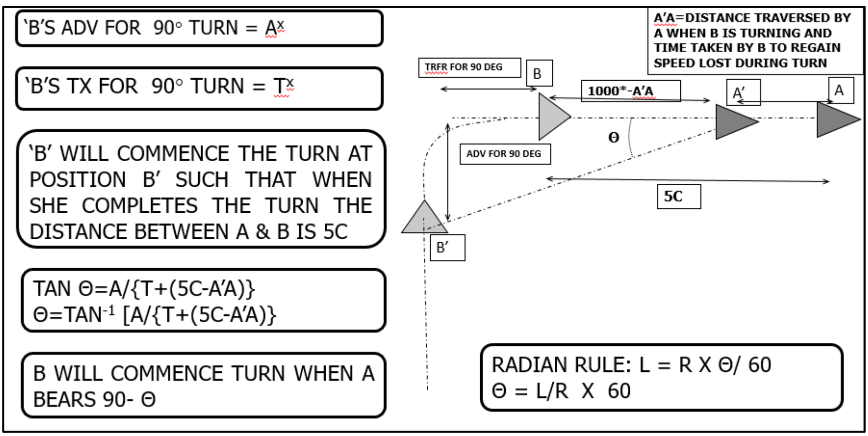


23. The second method is the ‘**Eyeball Mark One’** of observing the guides wake and turning with respect to it. A ship while turning leaves a wake behind which is more defined on the inner side (created by bow) and diffused on the outer side (created by stern). While turning by the wake method, start turning, as the bows tend to separate from the wake. Thereafter just maintain the attitude, by varying rudder, to the bows just inside the wake. Needless to say this method is applicable if you can see the wake. In addition if you have a ship/number of ships between you and guide, a misjudged order by the previous ship will disturb your arrangements. You now have an option of turning in the wake of the previous ship – which may or may not be turning correctly or resort to the third method.

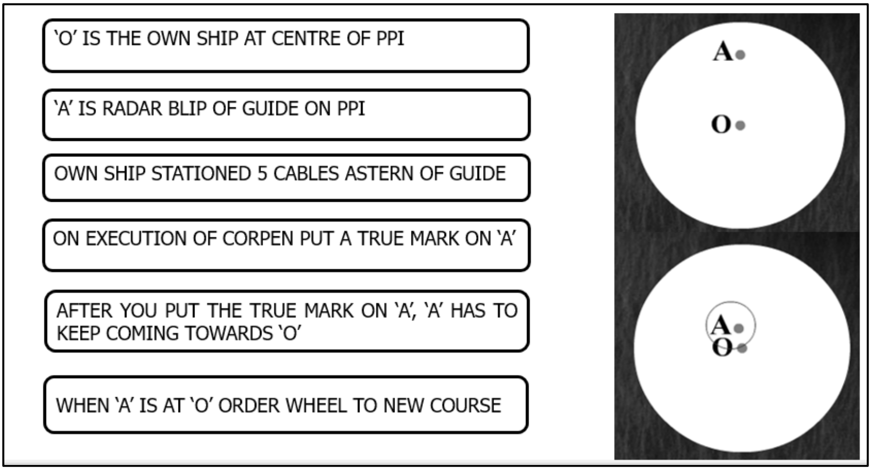


24. The third method makes the **use of the radian rule**. This caters for the advance of a ship while turning. Consider a ship, which is steering a course 000 at 12 kn. Consider yourself on ship on bearing 150 at 5 c heading 270. That means you are approaching the guide wake at right angles with the guide on your stbd side. If you were to turn by 90 deg to stbd and land up dead astern, obviously you would commence turning when you are that distance short of the wake that equals your advance for 90 degrees. Because there is no reference in the wake from where you can measure range, you can use radian rule to your aid. If the advance in this case is 340 yards, then all you got to do is find out what angle subtends 340 yards at 5c. A little reflection would reveal that 1 deg at 5 cables subtends an arc of 17 yards. By this yardstick, 340 yards would be subtended by 340/17 i.e., 20 degrees. That means when you 20 degrees short of guides bearing, you have arrived point of turn. In this case it is 360-20 i.e., 340.

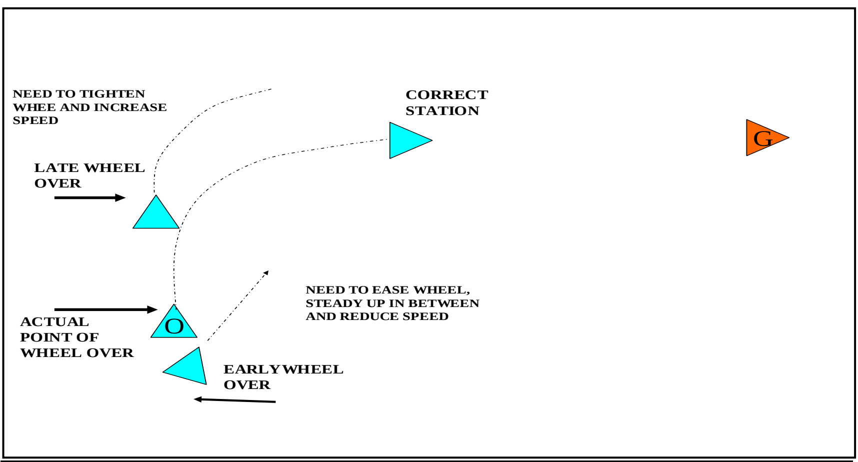




25. The fourth method is drop mark. Wherein a true mark is dropped on radar when guide turns. When mark comes over to the centre of display order wheel.



26. That kills one issue regarding when to turn. That's just the beginning of a wheel. Probably beginning of your troubles if you don't keep your wits about. Say you are wheeling by 90 degrees to stbd and you alter early. How are you for station? **Definitely you would land up stbd and close for range**. So how do you correct? The answer would be **ease wheel** and **reduce speed marginally,** and observe. What if you turn late? You would land up port and also open for range. You would need to go up in speed.



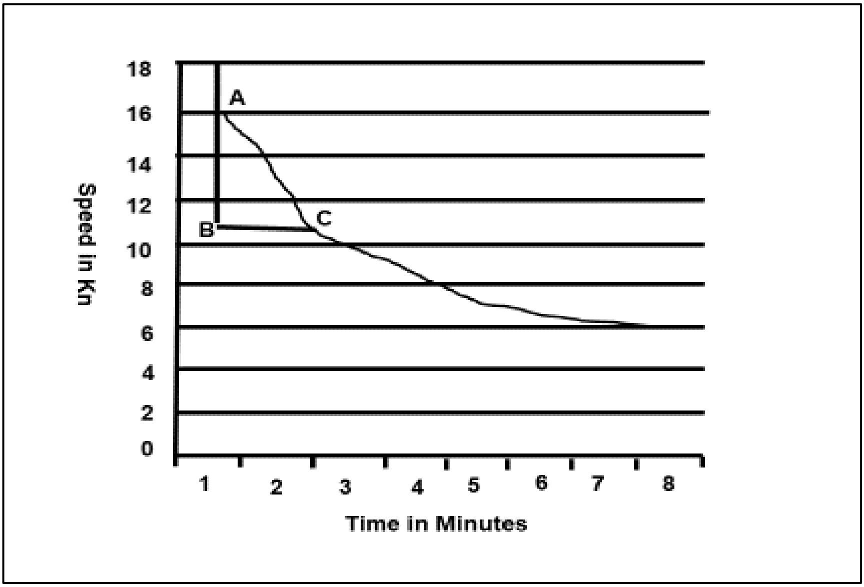
27. As you continue turning and near the end of the turn, watch for the bearing of the guide. Ease or tighten as required to land up in station. **Your aim should be to correct during turning and land up correct in station by the time turn is completed. Completing the turn and thereafter correcting would slow down your manoeuver and show you in poor light.**

28. Are there any drawbacks of the methods of time and the wake with regard to the radian rule one? Actually in the time method, one is trying to achieve the same spot as the guide where she put her wheel over. As long as your advance is comparable to the guides advance, it would suffice. However if your advance figures are different than the guides, then even though you reach the exact spot for turning, because of dissimilar advance, you may not land up astern of the guide. This would also hold true for the eyeball mark method. Therefore while using the two methods, one would have to consistently monitor the guide and manipulate the rudder.

29. How does one find for wheels less or more than 90 degrees? Again it is just the advance which one needs to approximate. An interesting variation is how to wheel 180 degrees. To be able to correctly execute this manoeuver one would require knowing the advance of ships manoeuvering in company. As the guide executes a 180-degree turn, if you are the second ship and daytime, you could depend on the wake or the time method. But if one still wants to work with respect to bearing and distance, how is it done? To begin with find out what is the time taken by you to turn by 180 degrees and what is the advance. Then calculate what is the distance moved up by the guide in that duration. You would add/subtract the advance by you to this figure depending whether it is positive or negative. Say for example, you are stationed at 1.5 NM behind the guide on heading 000 at speed 12 kn. Time taken by you to turn is 4 Min and advance is 100 yards. (Remember that we are using tactical rudder to achieve the same transfer and to land astern). In the time you take to turn, the guide moves up by 1600 yards (8C). As the advance is 100 yards this would be required to be added to the guides advance. That makes the total range as 1700 yards or

8.5 C. This means that after the guide turns through by 180 degrees and goes abaft your beam, you need to wait, till she is 1.5 NM or 15 Cables – 8.5 Cables abaft your beam. This can be put on the Batten berg and the bearing of the guide obtained to enable you to alter by bearing and range. You may also cater for your speed loss as discussed earlier.

29. **<u>Calculation of Surge</u>**. Surge is defined as the distance gained or lost while changing speed. In practical usage, however, we use it as a rate rather than a distance, e.g. 30 yds/kn, which is colloquially referred to as 'surge rate'. It is important to note that the surge does not remain the same across the entire spectrum of speed change. For instance, the surge while reducing from 28 to 20 kn would be different than while reducing from 18 - 12 kn. The surge for a particular ship (class of ship) may be derived from the acceleration / deceleration curve in the NDB. An example of surge calculation is illustrated below:-



Formation Speed - 12 kn

Own approach speed - 18 kn

Change in speed - 06 kn

On the graph - Change in speed is shown by the line AB = 6 kn.

- Time taken is indicated by the line BC = 2 min.

The surge for the change of speed is given by the area of the triangle ABC.

Therefore, surge = BC x AB /= 2 x 6/2 =6

To convert this into yards we multiply by the conversion factor of 100/3.

Therefore, surge = 6 x 100/3 = 200 yd.

Therefore the surge rate = 200 / 6 = ~ 33 yd / kn

Alternate Method

Formation Speed - 12 kn .

Own approach speed - 18 kn

Change in speed - 06 kn

Mean speed during reduction - 15 kn

Therefore, distance travelled during reduction = 2 min @15 kn

= 1000 yd.

Distance travelled by guide in the same duration = 2 min @12 kn

= 800 yd.

Hence, surge distance = 1000-800 = 200 yd.

Surge rate = 200 / 6 = ~ 33 yd / kn.

30. **Calculation for Manoeuvres**. Whilst proceeding to take up a new station, the point where one should reduce to base speed needs to be calculated. This may be done as follows:-

(a) **Station Astern in Column**. In this case, the surge needs to be simply added to the stationing distance.

E.g. if taking up station 5 cables astern, with the surge being 200 yd (1 cable), one should order base revolutions at a distance of 5 + 1 = 6 cables from the guide.

(b) **Station Abeam**. In this case, the angle for reduction of speed needs to be calculated. E.g. if taking up station 01 nm on the beam of the guide, with surge being 200 yd (1 cable), the angle may be calculated using radian rule and works out to 06 degrees prior the final bearing.

31. **Calculation for UNREP**. Whilst making approach for UNREP, the point for reduction to base speed, needs to be worked out, similar to Para 7 above. This may be done as follows:-

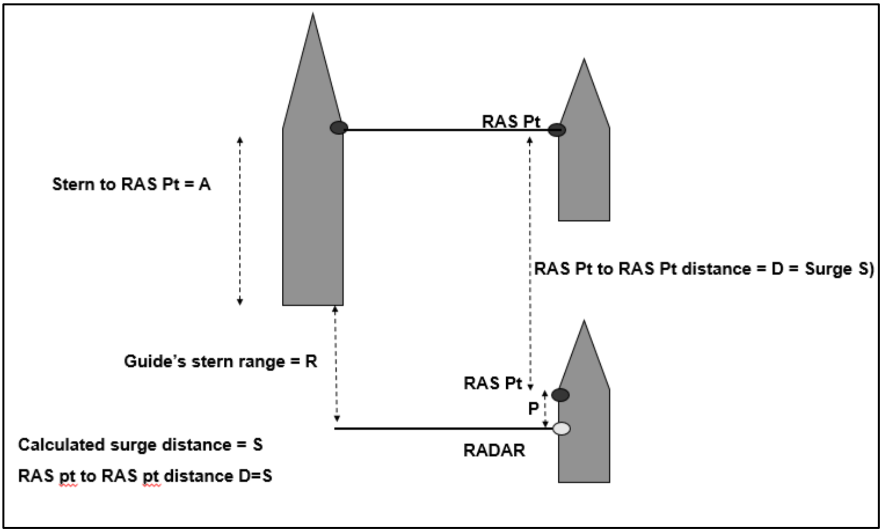


Fig. 18.3 (a): UNREP Calculations - Using Radar

However, since range is measured form the guide’s stern, in most cases, and the measurement itself is done using the nav radar, the antenna of which may not be co-located with the bridge, hence, the guide’s stern to RAS point distance (A) and own RAS pt to radar antenna distance (P), will also come into play. Consequently, we need to calculate the distance at which to come down in speed (R), based on the above factors. As evident from the figure above:-

R+A=S+P, (since S=D)

Therefore R (range of the guide’s stern) at point of speed reduction = S + P - A. Hence, speed should be reduced at the distance R, as measured by the radar and catering for the radar’s index error. However, if using the Stuart’s distance meter, from the bridge wings, P = Own RAS Pt to Bridge distance. Further, as the range measured is from the guide’s mast/ bridge, we need to cater for her bridge to RAS Pt distance to replace the stern to RAS Pt distance. Hence, in this case A = guide’s Bridge to RAS Pt Dist.

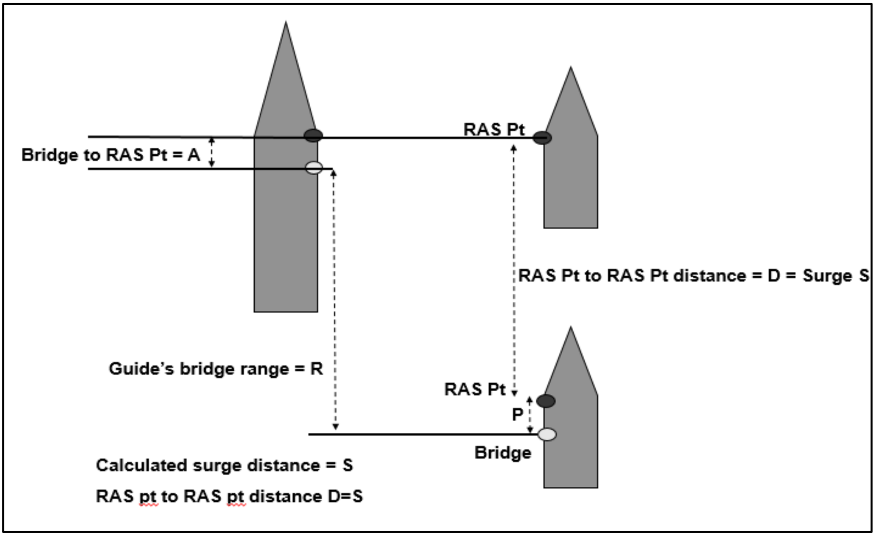


Fig. 18.3 (b): UNREP Calculations - Using Dist. Meter

38. **Conducting Manoeuvres as OTC**. Conducting manoeuvres demands proper and meticulous planning and therefore it is preferable to plan all intended manoeuvres in advance with some in spare. They also need to be linked with the PIM. In general, keep the manoeuvres simple and avoid ones that take a long time to execute. It may be advisable not to keep one ship as the Guide throughout the serial so as to accrue training benefit to the teams onboard all ships. For conducting manoeuvres, the following are relevant: -

(a) Don't execute the next manoeuvre before all ships have completed the current one.

(b) Watch the positions of all ships relative to their correct stations and delay executing a manoeuvre, if `necessary'.

(c) Don't alter formation course or speed whilst a manoeuvre is being executed.

(d) For lengthy manoeuvres, a reduction in the Guide's speed will assist in cutting down the time required.

(e) Keep an eye on the navigational safety of all ships.

(f) Try and avoid the use of the Immediate Execute Method, other than for scheduled maneuvering serials.

Battenberg

39. **Tips on Using Battenberg**. The battenberg is a most useful tool on the bridge. Mastery over the battenberg and quick, correct utilisation can greatly assist the navigator in marioeuvring the ship at sea. Using the battenberg without the arms, akin to a plotting sheet, can lead to a fair amount of time being saved and consequently the ship's reactions to a station being quicker and smarter. Use of the battenberg for various situations is enumerated in succeeding paragraphs.

40. **<u>Changing Station</u>**. Proceed as follows:-

(a) Always keep the guide's present position (A) marked on the battenberg.

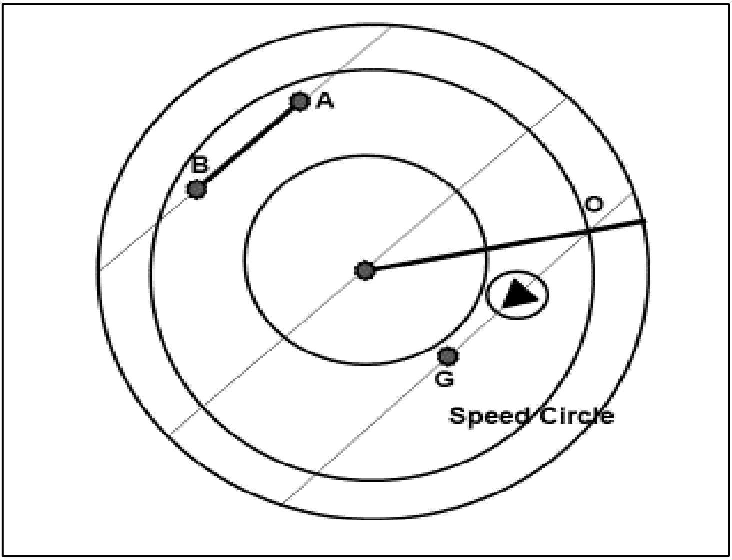
(b) Keep the guide's course and speed (G) marked at all times.

(c) On receipt of the new station, mark the guide's new position (B).

(d) Align the base plate parallel to AB.

(e) Mark the relative vector on the line parallel to AB, leading through G.

(f) Mark the point (O) where this line cuts the circle corresponding to own stationing speed. Read off the radial bearing of point O, which is the course to steer.



<u>Fig 18.4: Battenberg - Changing Station</u>

41. **Calculating True Wind**. Proceed as follows:-

(a) Mark your own course and speed (A) on the battenberg.

(b) Mark the direction of relative wind (B), in the actual direction from where it is observed. E.g. If you are on course 090 - 12 and the wind on deck is observed to be Green 30 - 18 kn, mark the relative wind along true bearing 120 at 18.

(c) Turn the base plate in the same direction as the relative wind (i.e. to the right in the above example), till it is aligned parallel to AB.

(d) The radial bearing AB is the True Wind direction (where the wind is from), and the distance AB is the True Wind strength.

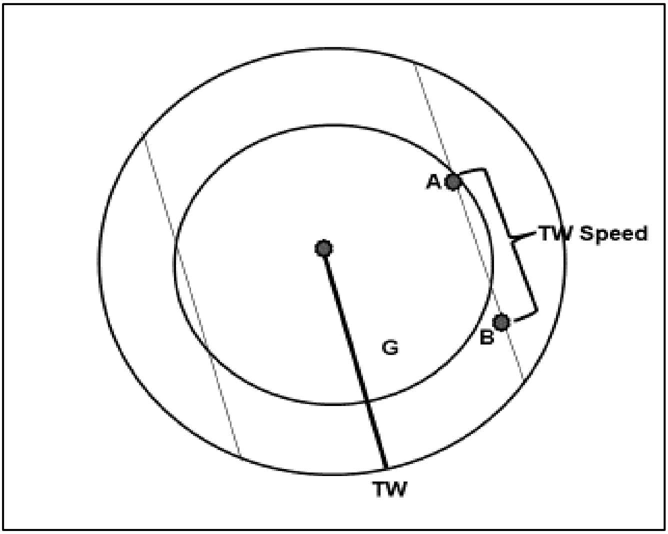


Fig 18.5: Battenberg - True Wind

42. This may be used when taking up station from a position ahead of the guide to a new station abaft the beam. Let us assume we are stationed 5 Nm ahead of the guide, with the

guide’s course being 000 - 12 kn. It you are now, given a station 5C astern of the guide (180-5C) and decide to proceed to the station on a course reciprocal to that of the guide (approach course 180}, proceed as follows:-

(a) Assume the guide to be at the centre of the battenberg (G).

(b) Align the base plate parallel to the guide’s course and speed, i.e. 000.

(c) Mark own final station w.r.t the guide, i.e. 180 - 5C (A).

(d) From your final station (A), mark off a point 100 yd (safety margin), perpendicular to the guide’s course towards your chosen side of approach, i.e. in a direction 090 - 100 yd (B), if approaching from the starboard side of the guide.

(e) From ‘B’, mark off your transfer (let us assume 500 yd) for a 180 degree turn at 12 kn (25 deg wheel), perpendicular to the approach course and reciprocal to the direction of your final turn, i.e. 090 - 500 yd from ‘B’. Let this position be ‘C’.

(f) From ‘C’, mark off your advance (let us assume 50 yd) for a 180 degree turn at 12 kn (25 deg wheel), along the reciprocal of the approach course, i.e. 000 - 50 yd from ‘C’. Let this position be ‘D’.

(g) From ‘D’, mark off the guide’s movement during your time to turn 180 degrees (let us assume 3 min), along the direction of the guide’s course, i.e. 000 - 1200 yd (3 min @12 kn) from ‘D’. Let this position be ‘E’.

(h) From ‘E’, mark off the distance required to make up speed lost during the turn (let us assume 80 yd), along the direction of the guide’s course, i.e. 000 - 80 yd, from ‘E’. Let this position be ‘F’.

(j) From ‘F’, measure the relative bearing and range of the guide (centre of battenberg). This would be the position at which you need to start turning w.r.t the guide. In case you are not on the exact reciprocal course the relative bearing would need to be adjusted to cater for the same.

(k) Due to the safety margin incorporated in the calculations, you mayhave to ease the wheel in the final stages of the manoeuvre to ease into the guide’s wake. In cases where taking up station between two ships in column, it may be prudent to parallel out outside the column and thereafter ease in. It is essential that the requisite lateral separation be maintained for safety. If the ships are too close laterally, the manoeuvre is best aborted and the ship turned away in the safe direction.

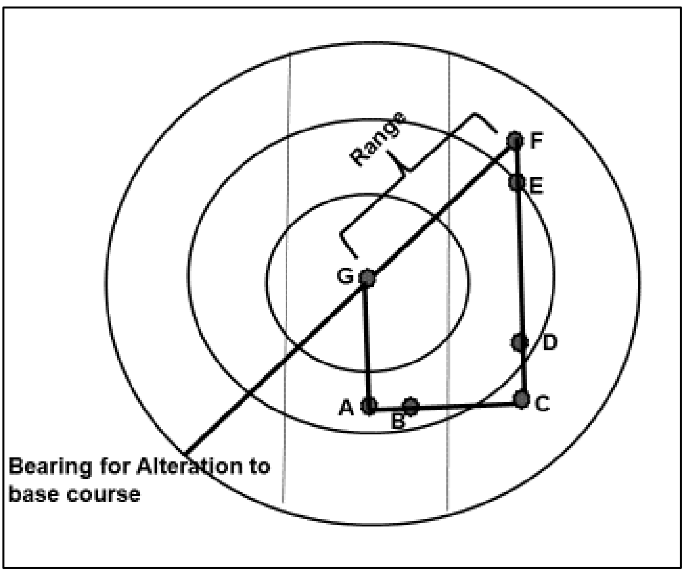


Fig 18.6: Station from the Bows (Reciprocal Course Method)

43. **Stationing from the Bows (Direct Course Method)**. This method may be used when taking up station from such a position that the reciprocal course method cannot be used. Let us assume we are stationed 030 - 3.5 Nm from the guide, with the guide's course being 000 -12 kn. If you are now, given a station 1 Nm astern of the guide (180-1 Nm) you need to calculate the battenberg course to steer (CTS), say 220, and alter to the same and increase to stationing speed (18 kn). For calculation of the point at which to turn to the base course, proceed as follows:-

(a) Assume the guide to be at the centre of the battenberg (G).

(b) Align the base plate parallel to the guide's course and speed, i.e. 000.

(c) Mark own final station w.r.t the guide, i.e. 180 - 1 Nm (A).

(d) From your final station (A), mark off a point 100 yd (safety margin), perpendicular to the guide's course towards your chosen side of approach, i.e. in a direction 090 - 100 yd (B), if approaching from the starboard side of the guide.

(e) From 'B', mark off your transfer (let us assume 500 yd) for a 140 degree tum at 12 kn, using 25 degree wheel (from 220 to 000), perpendicular to the CTS and reciprocal to the final turn, i.e. 130 - 500 yd from 'B'. Let this position be 'C'.

(f) From 'C', mark off your advance (let us assume 200 yd) for a turn to the base course, at 12 kn, along the reciprocal of your CTS, i.e. 040 - 200 yd from 'C'. Let this position be 'D'.

(g) From 'D', mark off the guide's movement during your time to turn from CTS to base course (let us assume 2 min), along the direction of the guide's course, i.e. 000 - 800 yd (2 min @12 kn) from 'D'. Let this position be 'E'.

(h) From ‘E’, mark off the distance required to make up speed lost during the turn (let us assume 50 yd), along the direction of the guide’s course, i.e. 000 - 50 yd, from ‘E’. Let this position be ‘F’.

(j) From ‘F’, measure the relative bearing and range of the guide (centre of battenberg). This would be the position at which you need to start turning w.r.t the guide.

(k) Using ‘F’ as the amended station w.r.t the Guide, rework the CTS. This is to ensure you pass through ‘F’. Then repeat steps (e) to (h) to confirm there is no significant change in ‘F’, else carry out another iteration.

(l) It is important that you pass exactly through point ‘F’ at the planned speed and on the planned CTS, else the manoeuvre will not be accurate and can even be embarrassing. Passing through point F is more important than the exact CTS, as being off the CTS by a few degrees would still provide a more precise solution than missing point F altogether.

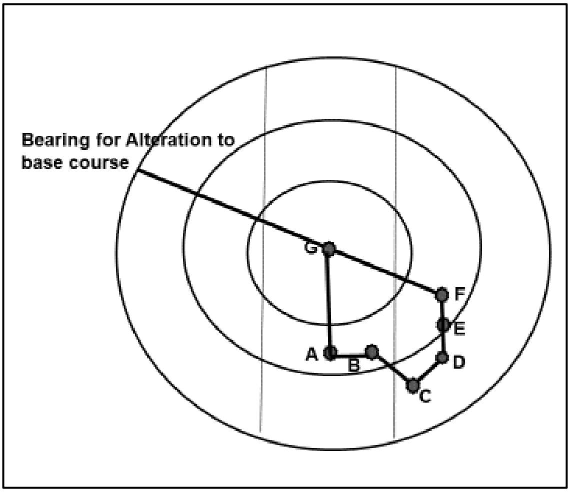


Fig 18.7: Station from the Bows (Direct Course Method)

44. **Corpen S (90 degrees)**. This is also termed as a 'search turn'. The amount of alteration that can be done using this manoeuvre is between 45 to 135 degrees. It is promulgated as Corpen S (course). This manoeuvre is executed when ships are in line abreast / Form 'Y'. Upon execution, the ship that is furthest away from the bearing indicated automatically becomes the guide and alters to the promulgated course. The other ships, meanwhile, continue on the previous heading and time their turn so as to land up on the opposite beam of the guide. This point of turn may be worked out on the Battenberg as follows:-

(a) Consider four ships in line abreast, 5 cables apart, with base course being 000 - 12 kn. The guide is the ship on the stbd flank. You are the second ship from left (adjacent to new guide). Corpen S 090 is executed. The ship furthest from bearing 090 i.e., towards bearing 270, will alter to 090 and become the guide. The other ships continue on the previous heading.

(b) Assume your own ship to be at the centre of the battenberg (O).

(c) Mark the guide's final position, on completion of your alteration to the new course 090, i.e. in a position 180 - 5C from 'O'. Let this position be A.

(d) From A, mark off your advance for a 90 degree alteration (assume 300 yd), inthe direction of the original course, i.e. 000 - 300 yd from 'A'. Let this position be B.

(e) From B, mark off your transfer for a 90 degree alteration (assume 350 yd), in a direction perpendicular to the original course, in the direction of turn, i.e. 090 - 350 yd from 'B'. Let this point be C.

(f) From C, mark off the distance travelled by the guide, during the time taken for you to turn 90 degrees (assume 1½ min@ 12 kn = 600 yd), in a direction reciprocal to the new course, i.e. 270 – 600 yd from 'C'. Let this point be D.

(g) From D, mark off the distance required to make up speed lost during the turn (let us assume 50 yd), along the reciprocal of the new course, i.e. 270 - 50 yd, from ‘D’. Let this position be E.

(h) Read off the bearing and range of point E from the centre.

(j) This is the bearing and range of the guide, at which you need to commence alteration.

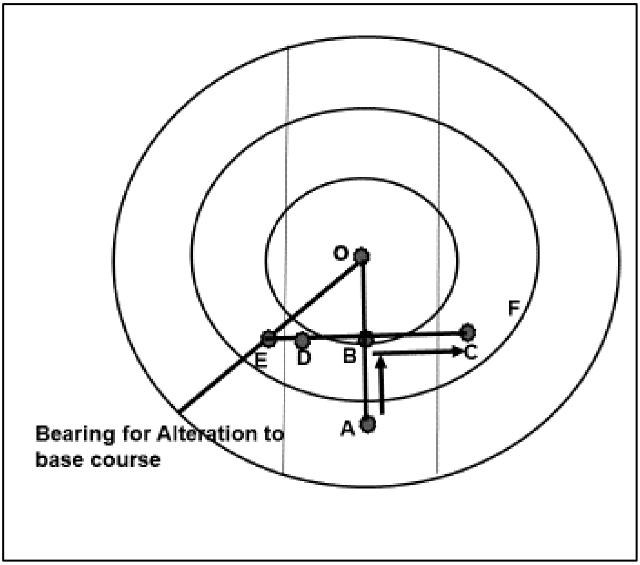


Fig 18.8: Corpen S (90 Degrees).

45. **Corpen S (135 degrees)**. The calculation for a Corpen S, involving a 135 degree alteration, is similar in principle to that for a 90 degree alteration. However, the difference is in the execution, wherein you would need to start turning almost simultaneously with the ship adjacent to you (if stationed at 5 C). Consequently, due care and caution need to be exercised in respect of adjacent ships. For calculating the point of turn, proceed as follows:-

(a) Consider four ships in line abreast, 5 cables apart, with base course being 000 - 12 kn. The guide is the ship on the stbd flank. You are the second ship from left (adjacent to new guide). Corpen S 135 is executed. The ship furthest from bearing 135 i.e., the ship on the port flank, will alter to 135 and become the guide.

(b) Assume your own ship to be at the centre of the battenberg (O).

(c) Mark the guide's final position, on completion of your alteration to the new course 135, i.e. in a position 225 - 5C from G. Let this position be A.

(d) From A, mark off your advance for a 135 degree alteration (assume 150 yd), in the direction of the original course, i.e. 000 - 150 yd from 'A'. Let this position be B.

(e) From B, mark off your transfer for a 135 degree alteration (assume 500 yd), perpendicular to the original course, in the direction of turn, i.e. 090 - 500 yd from 'B'. Let this point be C.

(f) From C, mark off the distance travelled by the guide, during the time taken for you to turn 135 degrees (assume 2 ½ - min@ 12 kn = 1000 yd), in a direction reciprocal to the new course, i.e. 315 -1000 yd from 'C'. Let this point be D.

(g) From D, mark off the distance required to make up speed lost during the turn (let us assume 80 yd), along the reciprocal of the new course, i.e. 315 - 80 yd, from 'D'. Let this position be 'E'.

(h) Read off the bearing and range of point E from the centre.

(j) This is the bearing and range of the guide, at which you need to commence alteration.

(k) You will notice that this position may be in close vicinity of the guide's position on commencement of the manoeuvre. Therefore, you would have to start turning, almost immediately after the new guide.

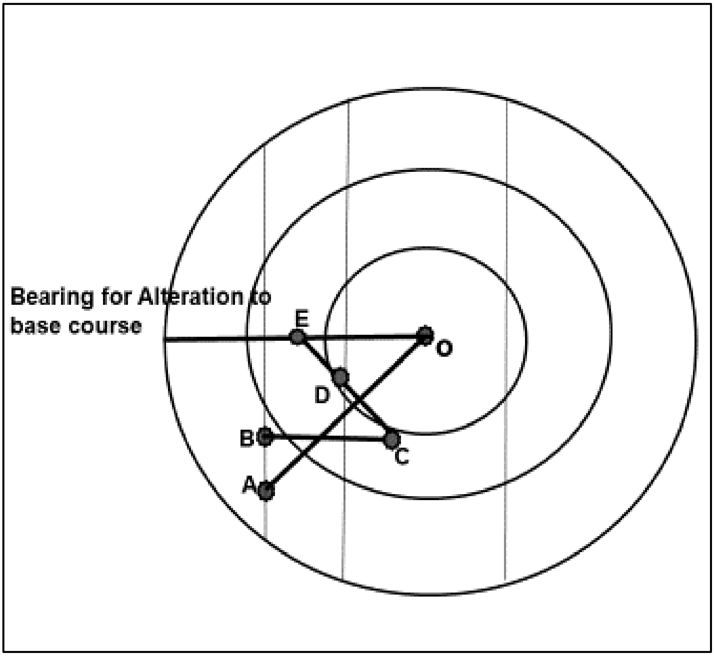


Fig 18.9: Corpen S - 135 Degrees

46. **F- Corpen**. Proceed as follows:-

(a) Align the base plate parallel to 000.

(b) Mark the required 'wind on deck', e.g. Green 20-20. In this case it would correspond to 020 - 20. Let, this point be A.

(c) Mark off the points, on the parallel line passing through A, that intersect the circle corresponding to the true wind speed. E.g. if true wind is 330 - 10 kn, then mark the two points that intersect the 10 kn circle on the battenberg. Let these points be 'B' and 'C' respectively.

(d) Measure the angle made by ‘B’ and ‘C’ with respect to 000.

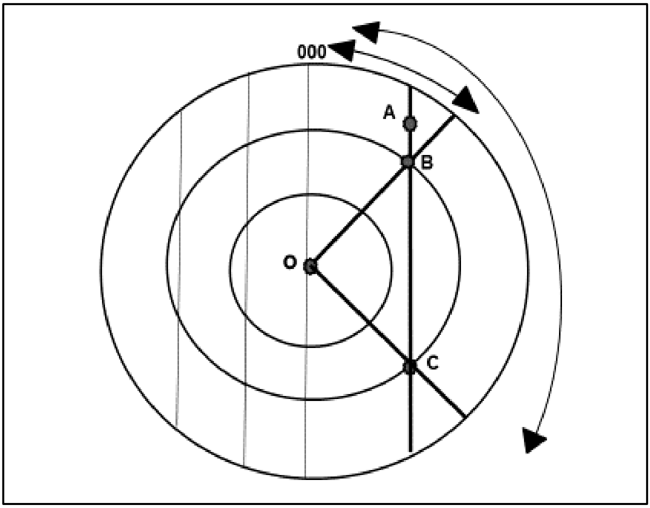


Fig. 18.10: ‘F’ CORPEN

(e) Now use the PASS rule (Port Add — Starboard Subtract), to apply the angle to the true wind direction, i.e. 330. In this case, since we want winds from stbd, we subtract the angles from 330 (true wind direction) to arrive at the two options for F- Corpen.

(f) The distance AB and AC would be the two corresponding own speeds for the F- Corpen courses.

(g) The more feasible of the two results obtained would be the F- Corpen.

47. **F Corpen**. It can also be calculated by an alternative easier and faster method. Consider a scenario where you are on course 060 – 15 kn with relative winds green 20 - 25 kn. You require winds R 20 – 20 kn for F Corpen. The procedure is as mentioned below:-

(a) Calculate true wind as given in para 41.

(b) The true wind is 105 – 12 kn.

(c) Align base plate of Battenberg to true wind direction OG (i.e. 105).

(d) Draw a circle of true wind speed (12 kn) from the centre of Battenberg ’O’.

(e) Now plot opposite of relative winds required for F Corpen. For example if relative winds required are R 20 – 20 kn then plot G 20 – 20 kn ‘A’ (125 – 20 kn).

(f) From this point draw a tangent to the true wind speed circle intersecting at ‘B and C’.

(g) Read off the true bearing of this point intersecting the circle at two positions ‘OF1 and OF2’ (F Corpen 141 and 249 respectively).

(h) Measure the length of tangent AB and AC. This would be the speed for F Corpen (09 kn and 29 kn).

(j) The more feasible of the two results obtained would be the F- Corpen.

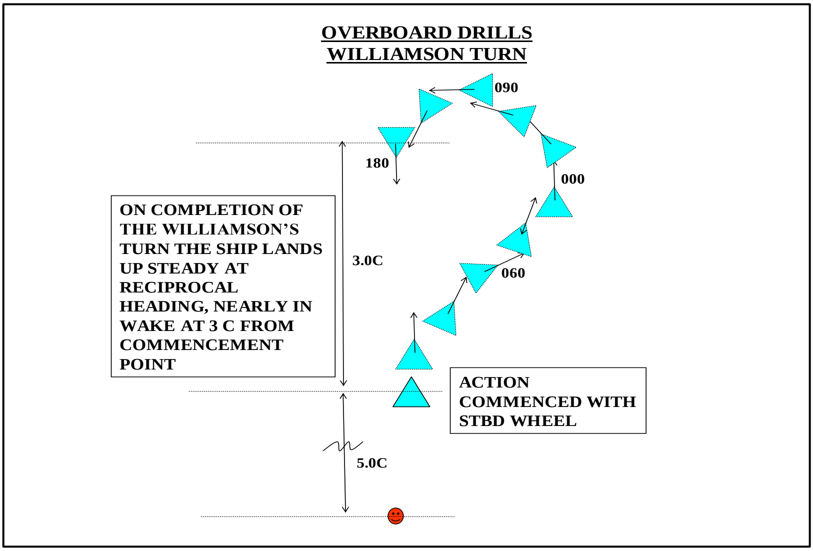
48 **Man Overboard Drills**. One manoeuver which every officer standing watch on the bridge should be conversant and well versed is the man overboard procedures. The references in this regard are available in the INMI and other publications. Let’s discuss some aspects of this drill

49. **Putting Rudder**. The first issue of manoeuvre in case of man overboard is in which direction to initially put the wheel . One guiding factor, in deciding which direction to turn - **is the need to keep the man out of the propellers**. One needs to relate the reaction time available, the ship’s speed and the length of the ship to ascertain if actually this consideration would be required or the man actually has gone past your propellers before you react. Say,

if a man gets overboard near the bridge of a G Class at 12 kn, it would take him less than 10 sec to reach the stern. Thus, if the reaction time or the time elapsed after actually man was overboard is more than this the consideration of using rudder is inconsequential. **Only in the case where the OOW actually sights the man going overboard, he could react to keep the man out of the propellers.**

50. The man overboard drill followed in the navy is based on whether; the incident was detected immediately or after lapse of some time. In **case it is immediately discovered and the location of man is known**, then the manoeuvre to be carried is based on the fact that on completion as the ship approaches the man, he is in the lee. Thus the OOW has to be particularly aware as to what is the direction of true wind as that would decide what manoeuvre would be carried out depending on the diagram.

51. **Williamson's Turn**. In case the man overboard is **detected after lapse of some time** and ship would be required to retrace her path so that there is a possibility of sighting the man. For this the ships generally resort to a manoeuvre termed as **Williamson's Turn**. In this manoeuvre, the ship initially alters course away, in a direction that is clear, by 60 degrees with a constant wheel. As the ship's head is approaching the said heading, the wheel is removed and countered by an equal amount of opposite rudder so that the ship's head just touches the said heading. The opposite rudder is now maintained till the course is reversed (i.e. a further alteration of 240 degrees). This manoeuvre results in generally the ship landing back in her wake. Plotting and trial would show what rudder would actually put the ship in wake.

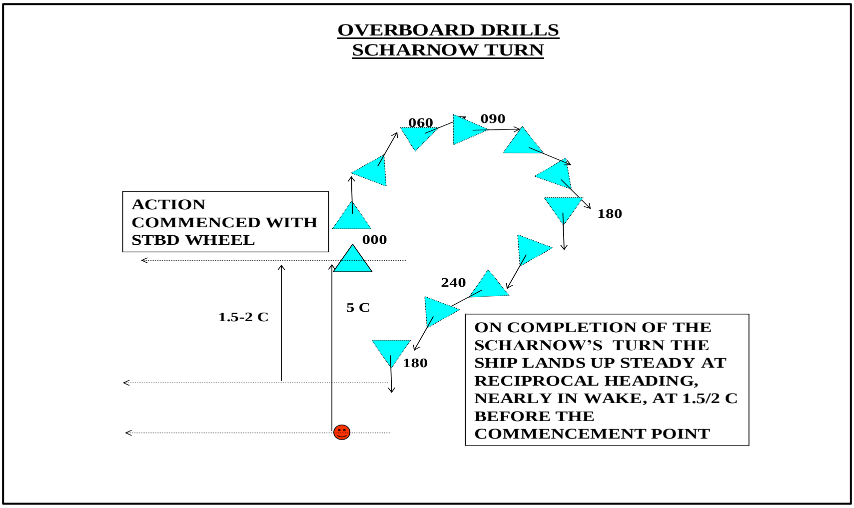


52. **The point to note here is that on completion of the manoeuvre, the ship lands er ahead from the original position of commencing the manoeuvre.** At 12 kn and 20 degree rudder, a G Class, lands up to 3-4 cables ahead of the point of commencement of manoeuvre. **As the ship is putting her stern across the man (at times not sighting) and the fact that ship opens out, there is a possibility of losing the sight of the man.**

53. **<u>Scharnow's Turn.</u>** The drawbacks of the Williamson's turn, as drawn out above, can be corrected or negated by a manoeuvre which is practiced by the merchant mariners and is termed as **Scharnow's Turn.** A similar manoeuvre to Williamson's turn with the difference that the ship **initially alters course by 240 degrees to the side that is clear.** As the ship's head is approaching the said heading, the wheel is removed and countered by an equal amount of opposite rudder so that the ship's head just touches the said heading. The opposite rudder is now maintained till the course is reversed to the original heading (i.e. a further alteration by 60 degrees). The advantage here is that on completion of the manoeuvre**, the ship lands up short from the original position of commencing the manoeuvre.** At

12 kn and 20 degree rudder, a G Class simulated in SHS lands up to 2-2.5 cables **before the point of commencement** of manoeuvre. As the ship is turning towards the contact, the man or object is maintained in sight all the while

54. It is fairly evident from the discussions above that the man overboard drill that a ship needs to follow will clearly depend on the **period elapsed since the actual time of incident.** Keeping this in mind, we could classify our overboard recovery procedures as per following situations:-



(a) "**Immediate Action Situation**" The incident is noticed on the bridge and action is initiated immediately.

(i) Single turn will take the ship back to the scene of the casualty most quickly.

(ii) Williamson's Turn requires more time and will temporarily take the ship farther away from the scene of the casualty.

(iii) Scharnow's Turn is not appropriate

55. **<u>Reversing Order of Column</u>**. This is a manoeuvre, which is often carried out during a VIP commitment or bidding farewell to a senior officer. The manoeuvre is called if formal term as **Formation F.** The manoeuvre is executed by a signal Form F Stbd/Port. This may also be qualified by Speed.

56. On execution of the signal, the last ship in the column hauls out to the side indicated to separate her laterally by 1 cable (or range indicated) and increases speed to one kn less than stationing speed. The rest of the column decreases speed to 7 kn (or such other speed if indicated). The last ship in the column, now, has to time her manoeuvre, by means of increasing speed and hauling out, so that she lands up exactly at the standard distance. It's clear that, if one does not time her manoeuvre well, the whole column will be disturbed. If she hauls out early, she may embarrass, the ship already steaming up at high speed by landing close to her (remember your lateral separation is just about one cable or less!). If she hauls out late, she will be embarrassing other ships astern of her. Also remember, the speed margin available to you to catch up is just 1 kn.

57. Thus it is very important to time one's move so that you correctly land up in station. The way to go about is enumerated below. Consider yourself in column of 5 ships, you being the last ship on heading 090 speed 12 kn (S Speed 18). If Formation F Stbd is executed

(a) The last ship A increases speed to 17(one kn less than stationing speed) and hauls out to stbd to create a lateral separation of 200 yards. The rest of the ship drop speed to 7 kn. and continue to remain in column

(b) You begin your calculations, by finding out the time taken to accelerate from 7 to 17 kn. Say this is equal to 2 min 30 sec

(c) Remember that A has to first catch up the distance of 5 c astern of you and move up by another 5c. The distance travelled by A in 2 min 30 sec at 17 kn would be 1417 yards.

(d) We now need to calculate the distance moved by own ship during this period. Again going statistically, we can assume that the ship is approximately doing a speed of (7+17)/2 through the entire range i.e. 12. At 12 kn, the distance moved by own ship in 2 ½ min would be 1000 yards.

(e) This means that while you build up speed from 7 to 17 kn , the A is surging ahead of you by 1417-1000 yards i.e. 417 yards

(f) As you need to maintain a range of 5 c 0r 1000 yards, when astern, of her, you should haul out, when the range (CIR, not slant range) of A is 1000 – 417 = 583 yards.

(g) For getting separation by 200 yards, you can give a throw off of 10 degrees and resume base course or probably using a rudder 30 stbd followed by reversing. This should separate you out depending on type of ship. If you are looking for further precision, then you can also cater for your manoeuvre to separate out by 200 yards. This separation could be achieved by a half fishtail. The drop distance can be factored in the range obtained at (f).

CHAPTER 19

UNREP

1. UNREP is a good test of one's ability to think on one's feet while making an approach. Further, once alongside, it calls for a great deal of concentration. This becomes all the more important whilst topping up for long hours, as the possibility of a break in concentration is higher as compared to a 'shop window' short run. Among other issues, one of the key actions for the navigator, prior commencement of an UNREP run, is to rehearse two essential emergencies with the SSD OOW, viz; Steering gear breakdown and total power failure. This chapter deals with general ship handling tips during UNREP, however, BR 45 (6) and 67 should be referred to for a deeper understanding of the specific evolutions. A note of caution, whilst reading this chapter, is that examples provided are illustrative for a generic Destroyer / large Frigate and are not to be taken as actual solutions for any "class of ship".

Astern Replenishment

2. **Ship-Handling Procedure**. "Checks points" for ship-handling during RAS, for a large frigate / destroyer (at RAS speed 12 kn), are enumerated below:-

(a) **5 Cable Astern - Standby Station**. On execution of standby station, from a position 5 cable astern of the supplying ship, alter course 5 degree outwards in the direction of the stand by station and order shaft revolutions for a speed advantage of 6-8 kn. In most cases, the supply ship closes up flag "Romeo" by this time, whereby the requirement to maintain at the stand by station is bypassed and approach is commenced directly. A good indication that the approach is being at a safe distance is the separation between the wakes of the two ships, there should be at least 5m of blue water between them.

(b) **Standby Station To Alongside**.

(i) At standby station, carry out reciprocal bearing checks (wing pelorus to wing pelorus) with the Guide.

(ii) Warn MCR “approach commenced".

(iii) Monitor build-up of shaft rpm indicator (loosely, but practically, termed as ‘tacho-meter’ or (just ‘tacho’), and the log speed. There may be no SRPM/ log repeater available on the bridge wings, and this would have to be relayed by the SSD OOW.

(iv) Watch the angular separation and distance, and maintain appropriate lateral separation (generally 120 to 140 ft).

(v) At 1 % cables distance (Bridge-Bridge) close up own flag “Romeo".

(vi) At the appropriate distance from the stern of the guide (calculated earlier based on surge and distance to RAS point), order revolutions for the base speed or lower SRPM (as per ship’s characteristics and comfortable practice).

(vii) In case ‘Slow Ahead’ 2Es is ordered, which normally has a fixed srpm, and the base speed would require 2Es at Half Ahead, order "Set revolution __’ (for RAS speed 12 kn). The exact revs would need to be ascertained while stationed astern, prior to commencement of run.

(viii) Monitor rates of fall of tacho-meter and log speed. The log speed usually lags by ~ 2-3 kn from the actual speed through water during this reduction, and the tacho gives a better indication of the deceleration.

(ix) When tacho reads a little below the base rpm (i.e. for ~ 11 kn), order base SRPM (or "Half Ahead 2Es", if SRPM has been earlier 'set'). The actual speed through water at this time would be 14 kn.

(x) The lead time for regaining base SRPM would normally correspond to the speed loss from 14 to 12 kn, allowing the ship to quickly settle into RAS station and speed. This may vary slightly as per the ship and RAS speed.

(c) **<u>Handling in Alongside Station</u>**.

(i) A ship-handler should determine his own "check points" to confirm that the rate of deceleration is correct. Likewise, he should determine references for maintaining the ship in alongside station.

(ii) In normal cases, a slight damping action of a- 4 SRPM (two turns) may be required to settle down. Thereafter, the ship can be comfortably maintained in station with x 2 SRPM (one turn), in calm weather.

(iii) The interaction between the ships increases as the lateral distance between them reduces. This, in turn, leads to an increase in the number of course and speed orders required to maintain alongside station. Hence, it is best to maintain RAS distance just outside the heavier interaction area. This varies as per the ships and weather and should be empirically determined for all cases. Generally, the interaction zone increases with heavier ships and heavier weather.

(iv) After gear has been connected, ships generally have to steer out slightly to maintain distance. In case of fuelling with the tankers, once the span wire is connected and tension is applied, the approach ship (Destroyers / large Frigates) will usually need to steer 1 ½ degrees outwards, which may further increase to 2 degrees once the probe is engaged. At a lesser lateral distance, of ~ 120 ft, the sheer experienced and amount to steer out may be more than for a greater lateral distance of ~140 ft. The exact figures will vary as per the class of ship and conditions.

(d) **Alongside To New Station**.

(i) After the gear has been returned, maintain within ~20 feet of the optimum alongside distance till disengaging. This allows the RAS party to stabilize the amount of line retained, and facilitates the breaking-off.

(ii) The distance line should be the last line to be disengaged, particularly by night, as it can otherwise be disconcerting.

(iii) With the order "Disengage", and throwing of the outboard ends of the RAS distance lines, adjust course in steps of 2-3 degrees outwards for the first ~5-10 degrees and increase speed progressively (2 - 3 kn), to open out on a steady bearing till ~ 100 m clear (stem to stem). Proceed to new station when clear of the supply ship. At all times, monitor that the stern does not swing inwards too much. ***Do not move ahead of the abeam station*** till well clear, i.e minimum one cable, even if next station is ahead sector.

3. **Co-ordination Tips**. In handling of a ship, each command team would establish the practices most comfortable to itself. The

following tips are mentioned towards providing initial co-ordination whilst a command team develops its own most comfortable operating procedure:-

(a) Handle the ship from the bridge wing. Whilst most ships can be successfully conned from within the bridge during RAS, the overall control and appreciation from the wings is generally better.

(b) The NO and Chief Quarter Master must try and use separate cons for the ordering and reporting chains. This would avoid congestion on just one system.

(c) As the ship takes up alongside station, the Captain would normally maintain control over course keeping while leaving speed control to the NO.

(d) The communication with the SSD OOW should be well established on a clear line.

(e) The base SRPM should be checked and established early by the SSD OOW/ NO, preferably in waiting station.

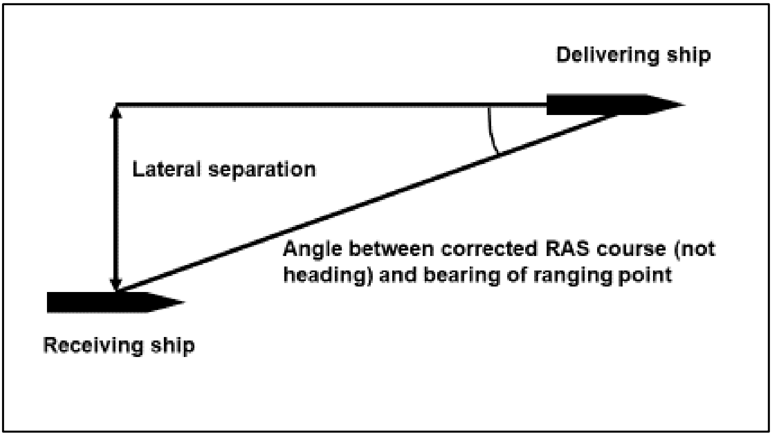
(f) Marking of course and SRPM orders on a RAS board by a sailor nominated for the same is very useful.
The following format is recommended:–

COURSE	**RPM**
~~007~~	~~96~~
006	98

Note:- The previous course/ RPM order is not erased but scored through

(g) Minimise the number of personnel inside the Bridge. The crowding and attendant noise level can be distracting for the Chief Quarter Master/ SSD OOW.

(h) While calculating lateral separation during approach, remember to use the 'R' Corpen as the reference and not the course you may be steering or the ship's head. E.g. If 'R' Cpn is 005 — 12 kn, and you are steering 008 to achieve lateral separation, if you measure the range as 3 cables, and the bearing as 001, then the calculation would be 4x3x10 = 120 ft. Here the angle is 4 degrees i.e. 005 minus 001 = 4. Further in case, there is a difference in the gyro between the two ships, post reciprocal bearing check, then the angle should be measured w.r.t the corrected 'R' Cpn.



(j) It is a good practice to rehearse basic machinery emergencies, particularly, steering gear breakdown and total power failure, prior commencement of the run. This may also include practicing changing over of steering systems[103].

[103] Regs Navy Part I Art 0515; BR 3000 Art 0114 & 0902and MSC 1/CIRC 1398 of 10 Jun 11.

4. **WSR**. Somewhere after the ship commences the run from standby station and before she gets into the abeam position, the ships carryout the **reciprocal bearing check.** At suitable point, the ships exchange the bearing of each other's pelorus (preferably). It has been seen invariably that after the reciprocal bearing is received onboard the ship making run, she compares the difference between the two and thereafter starts applying her own gyro error[104](and the guides if it is available from the morning report!). This only tends to complicate the matter further and by the time anything is sorted out, the ship finds herself abreast. WSR is done basically to ascertain as to what course would keep the ship (theoretically) parallel to the guides course. (**Nothing stops you from doing another WSR when you are in abreast position, as this only reconfirms the course with respect to the guide**). One should avoid getting embroiled in applying and correcting gyro errors**. It is irrelevant, here**. Once this is done, then it also helps you to find the exact lateral separation. For example let's consider the R Corpen to be 120 (with guide reporting in the morning gyro 1 deg high). As you proceed on stbd side(your gyro error 1 ½ low), you carry out a WSR. While steering 120, you observe her bearing 116 (at 2 cables) and she reports your bearing to be 297.

(a) Instead of now applying gyro errors and getting entangled, just equate as to what **your 116 relates to her. It is 117.** So if she is steering 120, when abreast a course 119 steered by you should maintain you parallel.

(b) If you had calculated lateral separation with reference to your actual heading, it would come as 4 degrees at 2 c i.e, 80 feet. If you had applied your gyro error, then it would be 5 ½ deg at 2 cables i.e. 110 feet**. Actually you are with respect to your heading 119 (to keep you parallel), 3 degree separation at 2 cables which is 60 feet!**

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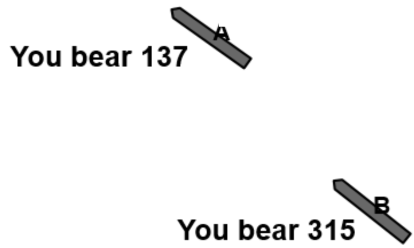
[104] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

EXAMPLE 1

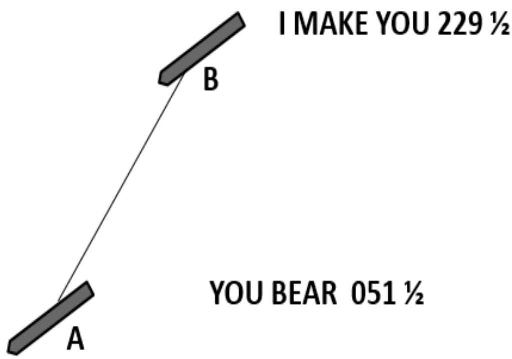
R CPN 315-12
Guide to steer
Gyro course
ordered and not
apply any
correction



- B's gyro is reading 315 for contact from which it bears 137.
- Its gyro is 2 degree low (relatively) from guide.
- Corrected RAS course for approaching ship is 313.
- Calculation of lateral separation wrt the corrected RAS Course.

EXAMPLE 2

R CPN 235-12
Guide to steer
Gyro course
ordered and not
apply any
correction



- B's gyro is reading 229 ½ for contact from which it bears 051 ½ .
- Its gyro is 2 degree low (relatively) from guide.
- Corrected RAS course for approaching ship is 233.
- Calculation of lateral separation wrt the corrected RAS Course.

Astern Replenishment

19. Approach for astern replenishment is normally undertaken with ~3 - 4 kn speed advantage as against the speed for abeam replenishment. Some salient points for the same are summarised below:-

(a) Initial approach speed from station astern should usually be kept at ~ 16 kn (for 12 kn R-Spd). .

(b) The tanker normally streams the hose to ~ 150 - 160m with the tail line etc. adding another 110 m. The marker float is streamed as per the approaching ship.

(c) Speed should be reduced to base speed so as to settle alongside the float.

(d) Initially aim to approach abreast the hose line with lateral distance 15-20 ft. Thereafter, close distance from hose line to 5-10 ft to enable the RAS party to hook the hose line with the grapnel. When the hose line is grappled, the RAS party starts heaving in the hose line."

(e) As the hose line is being heaved-in, go up in speed by about four turns/ 8 srpm (1 kn), to take the weight off the nose line, open out to lateral distance of 30 ft, and maintain a bight of 90-120 degree w.r.t. ship's fore and aft line.

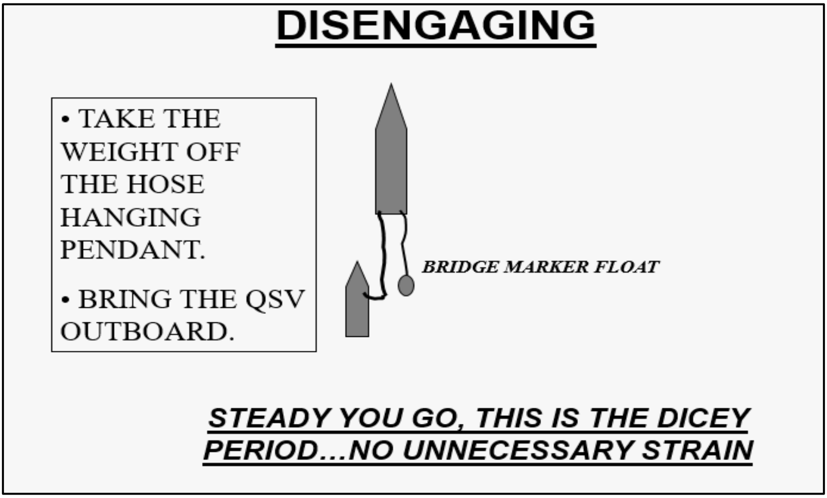
(f) Once the float has been secured on board, increase speed by another two turns to facilitate quick heaving in of the hose line. Adjust this overtake speed with the speed of heaving-in of the hose line by the RAS party.

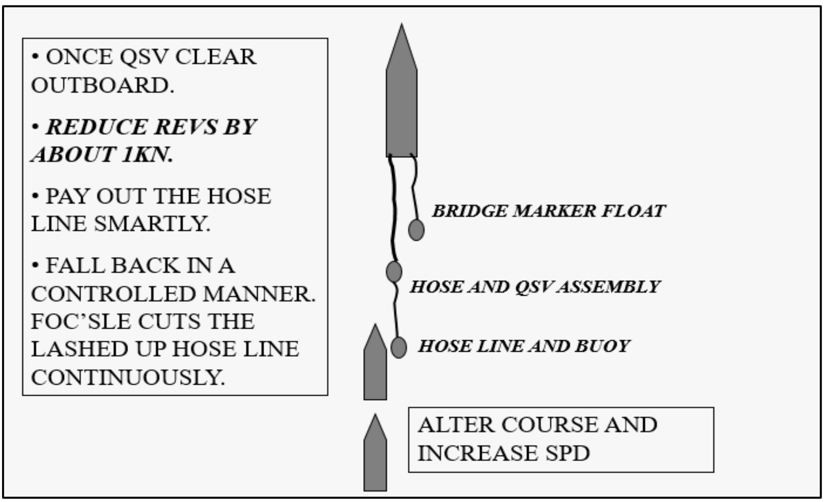
(g) In a well worked up ship, it is possible to compress the steps at (c) to (f) above into a single, continuous step. Herein, the ship reduces to 1 - 1 ½ kn speed advantage even as the grapnel party directly picks up the float and heaves in the hoseline while the ship keeps moving up, without necessarily pausing to settle alongside the float

(h) Reduce to base speed as the hose-end comes clear of the water, and it is brought on board. When the hose is secured and connected up, open lateral distance from hose to ~ 40 ft, and maintain the hose bight at ~ 90 - 120 degree w.r.t ship's fore and aft line.

(j) While disengaging, do not start falling back until the QSV is outboard and in the water. The speed of the ship must be carefully monitored during the time the QSV is in transit from the water to the deck and vice versa. When the hose and the bridle are outboard, reduce ship's speed by ~ 1 - 1 ½ kn and keep the bight at 90 deg when paying out on the hose and hose line. On slipping the hose line float, reduce speed further to bring the float fwd of the bows prior to altering out, and proceeding to the station.

Note: - Remember good timing does not mean that you overshoot the float and reach the hose. The overtake speed on picking up the float must be maintained commensurate with the ability to heave in the hose line.





Beam Approach for Replenishment

5. The beam approach, though not very commonly used, is nevertheless extremely useful, particularly in heavy weather or in the case of a ship not having adequate speed advantage. The approach is made from abeam station and should be made with a ~ 5 -7 degree alteration inwards, with a concurrent increase in

speed by ~ 1- 1 ½ kn. This itself will effect relatively rapid closure for passing lines and due caution needs to be exercised to ease the throw off in time. The following issues bear considerations.

(a) Do not attempt a bold alteration inwards, as you may not be able to take it of rapidly enough while paralleling out to base course. This can result in a close quarter situation as your advance along the throw off course would carry you towards the guide. In any case, a bold alteration would not really result in any significant time gain.

(b) Keep a careful watch on the bearing of the guide. Do gain bearing on the guide, as this can result A in your ship landing up in the suction zone of the guide as you close her.

(c) As the distance closes, you may need to adjust speed slightly to maintain closure at a steady bearing. This is due to the ship moving into waters closer to the guide and therefore into greater attraction / repulsion / interference zones.

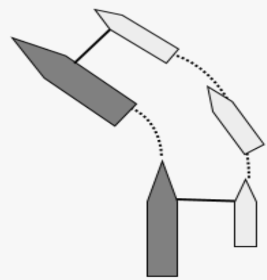
(d) Normally, as the ship moves in from 400 yards on steady bearing, she would need to start easing off the inward course progressively and also adjust speed downward, to ‘slide‘ into station.

(e) An initial alteration of 5-7 deg is mostly adequate to start the manoeuvre, with a 1 - 1% kn speed advantage. By about 200 yards lateral separation, the course should be eased to 3-5 deg inwards and ½ - 1 kn speed advantage; and then from 200 ft to ½ - 1 deg inward at ¼ - ½ kn speed advantage so as to slowly and smoothly slide into station.

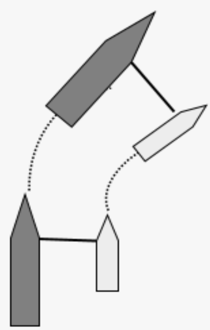
6. **Course Alterations (Corpen N) (Abeam RAS)**. The procedure for altering the RAS Course is by Corpen N**.** When an

alteration of course is ordered while replenishing (Corpen N), ships replenishing report ‘Ready’ to the RAS Control Ship (usually the Delivering Ship) by ‘AF’ when they are ready to alter. The RAS Control Ship orders the first and subsequent steps of the alteration and also sounds relevant sound signal. Steps of 5° or 10° degrees are normally used, although 15° and 20° steps may be ordered, “ Stand by to wheel over Port/ Stbd to course ………”.

- When altering towards Guide
- Receiving ship likely to fall behind
- Increase speed and order wheel
- Monitor heading of Guide being reported
- Monitor lay of Distance line



- When altering away from Guide
- Receiving ship likely to move up
- Decrease speed and order wheel
- Monitor heading of Guide being reported



When executed, Control Ships orders others ships of replenishing units to alter course by 5 deg or 10 deg. Guide signals ‘Wheel Over’ by one (stbd) or two (port) short blasts on the siren. On execution the Guide is to indicate its ships head at every degree change to the ships of her replenishing group. On completion of each step ships are to indicate readiness for next step by ‘AF’.

7. **Altering Course and Speed (Astern RAS).** Altering course during an Astern RAS is carried out by Corpen N in the same way as for an abeam RAS. However, when the Delivering Ship’s bows move to starboard, its stern moves to port (and vice versa). In a large Delivering Ship this effect can be substantial. Thus during an Astern RAS, the following ship (‘Approaching Ship’) has to turn initially in the opposite direction to that ordered by the Corpen N step, to avoid either opening the bight or over-running it (depending on the direction of turn). Having followed the initial movement of the Delivering Ship’s stern, the rudder must be reversed to turn sharply to the ordered course.

CHAPTER 20

TIPS FOR TOWING OPERATIONS

1. All warships must be able to take other damaged warships in Tow and for this reason warship are equipped with a suitable Towing Point and Towing Hawser so that it is capable of Towing a ship of at least similar size to itself. Although warships are powerful, manoeuvrable and well manned, the positioning of the Towing Point aft of the rudders makes their handling characteristics very poor when towing. In a conventional tug, the Towing Point is well forward of the propellers and rudders, allowing a large Turning Moment to be used to turn the tug effectively, even when there is weight on the Tow. By contrast, with weight on a Towing Point aft of the rudders, the available Turning Moment is very small and warships Towing often experience great difficulty in establishing and maintaining courses other than those which are directly into or out of wind, particularly if the Casualty cannot be steered. Thus warships are not suitable for Towing in or near harbour, where tugs should be employed. **It is important that these limitations are understood as they directly affect the methods employed to bring a Casualty to safety under Tow in an emergency.** Thus towing operations place stringent demands on the Command Team in respect of planning and ship handling skills. Various aspects of the same are covered adequately in the Navigation and Seamanship volumes and the same should be referred to, for a deeper understanding of the evolution.

Phases of a Towing Operation

2. **Towing Surface Ships**. With Towing operations, time spent in planning and preparation is never wasted; once the Tow is connected and the Towing Ship is committed to the operation, it is usually too late to address any important issues which have been overlooked (e.g. when Towing a Casualty which has no power, and the Towing Hawser is connected to many shackles of the Casualty's heavy anchor cable, how is the Tow to be

eventually recovered, when no heavy duty winches are fitted aft in warships?). A successful Towing operation can be divided into 5 phases, as follows:

(a) **<u>Assessment Planning and Preparations for Towing</u>.** Whenever contemplating Towing operations, the fullest assessment possible in the prevailing circumstances should be made, backed up by good planning and preparation. The likely weather for the operation and other environmental factors must not be overlooked

(b) **<u>Making the Approach</u>**[105]. The plan of approach must allow for holding the Towing Ship close enough to the Casualty to pass the Tow and starting the Casualty making way in a controlled manner.

(c) **<u>Passing the Tow</u>.** Passing the tow could be undertaken by firing gunline at appropriate distance, or by firing through pneumatic line thrower, or by sea boat, or by streaming the messenger. A nominated person in a suitable position to watch the Towing Hawser during streaming (and recovery) and to show a red flag or bat if the propeller is in imminent danger of fouling the Towing Hawser. It is then for the Command to decide what action to take.

(d) **<u>Starting the Casualty Making Way</u>.** When the Towing Hawser has been secured in the Casualty, the Towing Ship should move slowly ahead directly into-wind/down-wind, or Turn at Rest **(Cast)**, before moving slowly ahead into wind. These manoeuvres are required due to very limited Turning Moment of warships when Towing, warships almost always have to start the Casualty making way either directly into-wind or directly down-wind, only altering to the required course when a good speed has been built up and steering in the Casualty can be effective. Attempts to start the Casualty making way

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[105] BR 45 (6)1/ 2002, Ch 5, Art 0524 (c).

across the wind normally cause control to be lost. In the worst case this can result in the Towing Ship's stern being dragged (up-wind) by the bow of the Casualty flying into wind, so that both ships end up in a bow-to-stern configuration.

(e) **<u>Towing in the Required Direction at the Required Speed</u>.** Once the Casualty is making way at a reasonable speed under Tow, either directly into-wind or directly down-wind, it will usually be necessary to alter course, probably across wind and sea. The safe towing speed of a Tow depends on the tonnage and type of ship under Tow, the power of the Towing Ship and the strength of the Towing Hawser. If a Safety Factor is applied to the strength of the Towing Hawser in use, a Safe Towing Pull can be established which can then be translated into the Towing Speed for the particular ship under Tow.

(f) **<u>Slowing Down and Recovering/Transferring the Tow</u>**. When casualty is towed across the wind it has a tendency to yaw into the wind. This Yaw often causes the Casualty to lie slightly upwind of the Towing Ship's track, even when steering to maintain course. When the Towing Ship slows and pull of the Towing Hawser is reduced, the Casualty will normally yaw into-wind. If the Casualty is being towed at a reasonable speed at this stage, it should be able to counter this Yaw by using its rudders. This is appropriate when slowing down to freshen the nip of the Casualty's anchor cable. However, if speed is reduced further (as in recovering / transferring the Tow), it will become more and more difficult to control the Casualty's heading. As when starting a Tow and in the worst case during slowing down, the Casualty's Yaw into-wind can result in the Towing Ship's stern being dragged (up-wind) by the bow of the Casualty flying into-wind, so that both ships end up in a bow-to-stern configuration. The situation may be avoided by turning the Casualty directly into-wind before slowing down. It may be possible to turn directly down-wind if constrained upwind, but turning downwind and keeping the Casualty heading down-wind when slowing is much more difficult. Once turned into-wind, the Towing Speed should be reduced in small steps so that the steadying pull of the Towing Hawser is not reduced too sharply at any stage. Unless the Casualty is particularly small, it will tend to carry it way for a long time and for this reason plenty of sea-room is required for slowing down. While slowing down, even when heading directly into-wind, the Casualty can take an unpredictable sheer without warning, particularly when almost stopped in the water as it tries to lie beam to the wind. However, at such very low speeds (virtually stopped), it is normally possible for the Towing Ship to maintain Station on the Casualty without too much difficulty. Thus the greatest vigilance is necessary when manoeuvring the Towing Ship during the whole slowing down phase of a Towing operation.

3. **Methods of Approach.** The choice of approach will be dictated by the type of ships involved, the Casualty's aspect to the wind, drift direction / rate, any damage or flooding sustained, the ease with the Towing Ship can hold close enough to the Casualty to pass the Tow and the anticipated ease (or otherwise) of starting the Casualty making way in a controlled manner. The detailed methods of approach are given in BR 45 Vol 6.

4. **Tips on Towing by Frigate/ Destroyer**. While the exact distances and speed/ engine regimes to be used would vary with each class of ship, the general procedure followed by a Destroyer/ large Frigate for APTOW /TOWEX, with a ship of similar size is appended below alongwith the illustration and salient aspects.

(a) The parallel approach is generally used in *IN* for APTOW/ TOWEX. It is normally made from about 7 cables distance, keeping 120 ft separation, with the ship initially approaching at ~ 10 kn. The approach is made on the windward side since the disabled ship would drift at a higher rate than own ship. Of course, prior commencement of the approach one needs to circle around the disabled ship / lay off at a distance, to observe her final aspect and to ascertain any drift. This is particularly required if exercising with steam ships or CPP fitted ships (in case engines are clutched in) with propellers engaged, as they tend to have a definite ahead/astern creep. This creep needs to be clearly established prior commencement of the run.

(b) At 5 cables distance, speed is normally reduced to 6 -7 kn.

(c) At 3 cables distance from the disabled ship's bridge, "Stop 2 Engines", with log speed 6 kn. The lateral separation will increase slightly, with the other ship drifting slightly to leeward. The bows may have to be correspondingly brought in to maintain the lateral separation, aiming ahead of the target ship's bows.

(d) At 2 cables to go, check the lateral separation and adjust own- course (always heading forward of the other ship's bows).

(e) At 1 cable to go (as the bows cross the other ship's stern), the log speed would be ~3 kn. Order Slow Astern on outer/ both engines, and start paralleling out slowly, in steps.

(f) As own ship's quarterdeck comes abreast the target's bows, the log speed should be ~1 kn. At this point, pass the gun-line and order both engines astern to check headway.

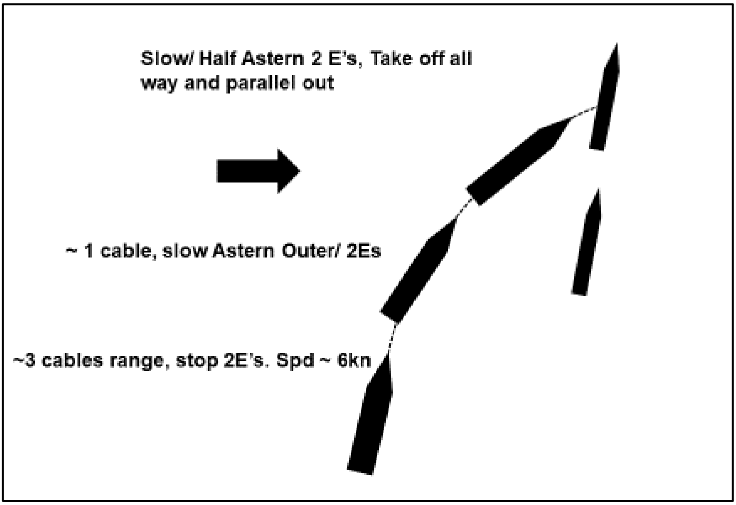
(g) Complete paralleling out as own stern passes the target's stem, and take all way off and stop.

(h) Always have Dutchman's logs handy in adequate numbers, as these would immediately provide an input in respect of headway / sternway. It may also be useful, particularly in Indian waters, to cover these with white paper for ease of observation, as great parts of our waters are brown as would the wooden logs.

(j) Be careful not to develop sternway as it will be difficult to control the stern thereafter as it seeks the wind.

(k) If the approach ends up being too broad / far from the disabled ship's stem, it may be better to go around and repeat the run rather than try to manoeuvre into position by going astern.

5. Due caution needs to be exercised in respect of undertaking TOWEX with smaller ships. The rate of drift generated by one's own ship may be as much as that for a ship which is considerably smaller. In such cases, use of a higher speed in the final stages of the approach may counter your own drift with corresponding use of astern higher power to check headway. However, further care should be exercised to avoid generating sternway. In the case of a ship which is much smaller / greatly dissimilar, the use of a boat to pass the initial lines could be considered, subject to the swell and weather.



<u>Figure 20.1 Towex</u>

Towing Submarines

6. The Towing of submarines is a special case and slightly different procedures are required. Submarines lie low in the water, make little Leeway and do not always lie beam to the wind. Submarines drift with the current / tidal stream.

7. **Methods of Approaching a Submarine.** The Towing Ship should stop on the beam of the submarine's fin. Only part of the submarine's hull is visible and when the Towing Ship is lying close to the submarine, the distance apart must not be assumed to be greater than it really is.

(a) **Converging or Parallel Approach.** A converging approach to windward of the submarine is not suitable because the Towing Ship may drift rapidly down onto it. A converging approach to leeward of the submarine may be possible but the Towing Ship may drift rapidly away from it.

(b) **Downwind Approach.** A down-wind approach across the submarine's bow is suitable in most conditions and allows the Towing Ship to manoeuvre into the correct position and hold with its stern into-wind.

8. **Connecting the Tow.** Connecting a Tow to a submarine is very weather limited. The submarine fires the line, which is taken in hand in the Towing Ship and secured to the Towing Ship's Messenger; the Messenger is hauled to the submarine and secured to the outboard end of the 'emergency rip-out' Towing Pendant. The Towing Ship Heaves in the Messenger, which starts the 'rip-out' of the Towing Pendant / Towing Hawser from its stowage. **The Towing Ship must not be ahead or astern of the submarine's fin by more than 15 degree during the initial phase of the 'rip-out' process.** If weather is suitable, RIB may be lowered to carry the messenger and handover to the submarine.

9. **Towing the Submarine.** Due submarine's very limited windage, very few of the handling problems associated with the

towing of surface ships are factors. Once the tow has been passed, the Towing Ship should be turned to a heading parallel to the submarine and moved to a position ahead of it, while pulling out the rest of the Towing Hawser from its trough stowage. **A submarine under Tow should always be started making way in the direction that it is lying.** Submarines, even on the surface, have a most of their hulls submerged, so it is difficult to alter the submarine's heading under Tow unless it has gathered some way and hydrodynamic forces come into play. Most submarine emergency Towing arrangements are intended to allow the submarine to be held head to wind / sea or Towed at slow speed in calm conditions. When slowing down, the steadying pull of the Towing Hawser should not be reduced too sharply.

10. **Slowing Down and Transferring the Tow.** When the Towing Ship slows down the submarine will carry its way much more than an equivalent sized surface ship.

CHAPTER 21

SHIPHANDLING ALONGSIDE

1. Ship handling alongside would vary slightly based on the hull design (including presence / absence of bow domes, etc.), size of ship, type of propulsion, rudder positioning, etc. However, the basics remain quite similar, particularly for slightly larger ships (Frigates/Destroyers) and planning meticulously for each movement retains paramount importance. The two most common aspects encountered while handling ships in confined waters involve ‘Casting Off’ and ‘Going Alongside’ from/ to the berth. This chapter would bring out the primary factors that merit consideration while handling ships in various conditions, with examples of some possible plans to better understand /appreciate the same. It bears emphasis that the situations discussed below are generic and are in no way complete or prescriptive, and the figures used are merely illustrative in nature and would vary as per class of ship and conditions. It must be borne in mind that no two cast off / going alongside evolutions can be exactly the same and the Command team needs to assess the situation based on the prevailing conditions and inputs available at that time, and adjust the plan/ execution accordingly. The discussion in this chapter is primarily for large Frigates/ Destroyers, while many aspects may be applicable for smaller ships.

2. **Planning and Execution**. The plan for any cast off/going alongside must always be carried out in clear waters. The plotting of LDL and the corresponding clearing bearings must be undertaken carefully for ‘boxing up’ the area where the ship is intended to turn. The reference objects used for monitoring the ship’s position w.r.t to the nearby dangers (or keeping the ship in the centre of the channel) must be conspicuous and therefore, carefully chosen. Homemade transits (using uncharted objects) may be used for quick assessment of head sternway, set and drift and also Ieeway.

Cast Off

3. Any manoeuvre for casting off from a berth can be broken down into two parts, and the decision to cant the head or stern out should be made keeping these in mind:-

(a) Getting off the berth.
(b) Turning around to leave harbour.

4. **Strength of Wind /TS**. As a general guideline, the under mentioned terms for wind / tide at berth may be used:-

Strength of Wind		**Tidal Strength**	
Calm	~ 1-4 kn	Negligible	< ½ kn
Light	~ 5-8 kn	Light	~ ½ -1 kn
Moderate	~ 8-12 kn	Moderate	~ 1- 1 ½ kn
Strong	~ 12-16 kn	Strong	~ 1 ½ - 2 ½ kn
Very Strong	> 16 kn	Very Strong	> 2 ½ kn

5. **Leeway**. While handling the ship alongside, it must be borne in mind that the speed is almost negligible and, therefore the effect of wind (leeway) may be considerable depending on the type of ship involved. While planning the manoeuvre, adequate clearances towards the lee side need to be catered. For assessing the effect of 'leeway', the table given below may be used as a guideline for a large Frigate/Destroyer size ship:-

Beam Wind Speed 10 Kn		
Ship's Speed	**Leeway**	**Ratio**
Stopped	~ 1kn	1:10
5 kn	~ ½ kn	1:20
Ship's Speed	**Leeway**	**Ratio**
10 kn	~ ¼ kn	1:40
20 kn	<0.1kn	1:100

Canting Out

6. **General**. Warships by design are generally highly manoeuvrable even when alongside, and respond with alacrity to engine wheel orders, as compared to Tankers /larger ships. On Frigates / Destroyers canting out of the stern (or stem) can generally be achieved comfortably up to moderate opposing wind/ tide conditions, using only 'Slow Astern/ Slow Ahead' (or as relevant to the individual ship) orders on the shafts, while pivoting on the fwd fender and the No. 2. A cant of ~ 10-12 deg is normally adequate in most conditions of berthing for a clean cast off. However, due to the pronounced bow flare of some warships, it may be preferable not to heave in on the No. 1 for canting out. This may not give the desired result / cant and instead may tend to bring in the bows bodily towards the jetty / ship alongside. A reliable and smooth cant may generally be achieved by first ordering the wheel (as for ahead motion) followed by a Slow Astern (or equivalent) order on the inner shaft and just prior gaining sternway, the outer shaft may be put to Slow Ahead (or equivalent order). Canting the ship, in various conditions, has been discussed in the succeeding paragraphs. These are illustrative for Destroyers /large Frigates, and are neither precise nor prescriptive. The examples must be freshly worked out for the specific ship and conditions, as per records available in the NDB, and not taken as actual solutions for any class of ship.

7. **Calm Wind/ Tide**. Under conditions of wind < ~ 4 kn, and tide < ~ ½ kn, ships generally respond immediately to wheel/ engine orders. E.g. in the case where a ship is casting off from port side to the jetty, with 15 m clearance ahead/ astern (one bollard length), the wheel could be put to Port 35, with all (lines singled up, 05 min before cast-off time (C-5). At C-3 min, No. 1 & 4 could be let go. At C-2 min (depending on the conditions and the amounts of cant desired) the order "Slow Astern Port, Slow Ahead Stbd" (or equivalent order) may be given (if the ahead response is quicker, this sequence is used to preclude early headway). The ship would normally be felt to be turning in, even as the SSD OOW advises "Port/ Stbd responded". The stern cant

of 10-12 deg should be achieved comfortably within 02 min, and the ship then ready to 'Slip'.

Onshore Winds

- Achieving a cant with onshore winds may be difficult. However, engines in conjunction with heaving on No. 1 may be used to get about ~ 10 - 15 deg cant (except on ships with pronounced bow flare/ bow mounted domes).

- Adequate fendering must be provided to prevent the bows scraping the jetty while pulling astern.

- Thereafter as ship pulls astern using Slow/ Half Ast 2Es, use the wheel to keep the stern from swinging uncontrollably in to the wind. The inner engine may have to be used in stop/ ahead mode to check the stern seeking the wind.

- In case of winds stronger than Moderate, it may be prudent to use tugs to haul out of the berth and thereafter use engines to pull astern and turn around.

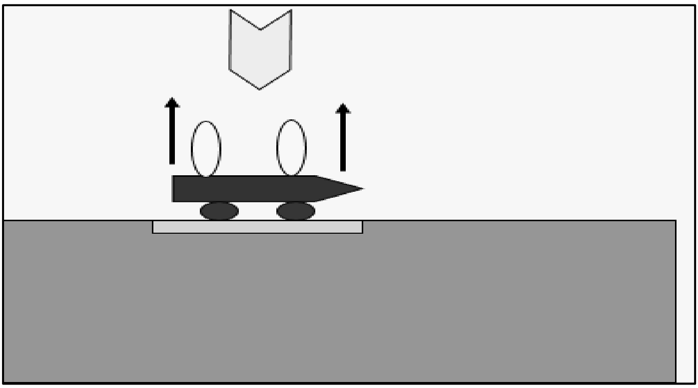
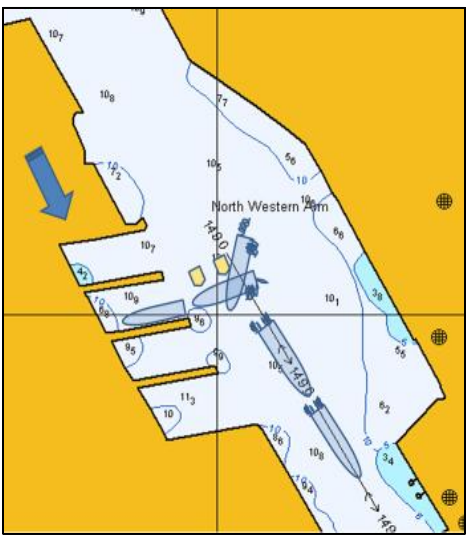


Fig 21.1: Natural Condition - Onshore Winds, Negligible Tide

8. **<u>Light/ Moderate Onshore Winds < 12 kn</u>**. In light and moderate onshore wind condition, the cant may still be obtained with engines alone as above. But, higher winds will mandate a larger cant of ~ 15-17 deg, and consequently will also take a little longer (~ 01 - 02 min more). The turning movement will need to be maintained, and a larger number of engine orders may be required (stop/ ahead/ astern) towards this end and to preclude gathering head/ stern way.

9. **<u>Strong Onshore Winds > 12 kn</u>**. The cant may be difficult to attain in such conditions, unless there is strong tide from astern. Subject to the berthing arrangement, it may be more economical and prudent to employ tugs to pull out the ship, particularly with lesser clearance astern (e.g. if berthed at SBW 6, Mumbai, with three ships astern at SBW 5). In that case, the astern power ordered for the aft tug would normally be one higher than for the fwd tug (e.g. if fwd tug is given 'slow astern', the aft tug may need 'half astern'), to offset the greater opposing moment aft and to get the desired stern cant. However, the cant may still be achieved using engines as in Para 7 above, if required. The point to be borne in mind in this case would be that the ship would need to 'slip' soon after the cant is achieved, as it would not be possible to hold the cant against a strong onshore wind.



<u>Fig 21.2: Visakhapatnam – Finger Jetty (Onshore Wind)</u>

➢ For ships berthed at Finger Jetties, on shore winds may pose difficulty for clearing the berth without scraping the ship's side on the jetty.

➢ Upto moderate wind, a cant of 5 – 10 degrees may be achieved using berthing hawsers. Thereafter, clutching in port shaft (for CPP ships) would assist the stern to swing out.

➢ For strong winds, cant may be difficult to attain and it may be prudent to use the tugs to haul the ship out before putting astern.

➢ Ensure adequate fendering on Port bows.

➢ On attaining the cant whilst pulling astern with 2 Es, the wheel would be required to counter tendency of the stern to swing into the wind till the bows are clear of the jetty edge.

➢ Once bows are clear of the jetty, use can be made of the stern swinging into the wind, with differential engines to turn around to the leaving harbour leg.

Offshore Wind

10. **Light /Moderate/ Strong Offshore Winds > 4 kn**. Under these conditions, merely checking the stem lines alone would usually provide the desired cant, rapidly and without any use of engines. In fact, the stern lines may need to be held on till time of ‘Slip’, to prevent excessive cant. In case the wind is > 8 kn, the head rope should also be held on to till cast - off, otherwise the ship may tend to get blown away from the jetty.

➢ Adequate lateral separation from the berth may be achieved by checking all lines and thereafter, the desired cant by holding on to No. 1 & 2 and checking 3&4. Sequence of letting go of lines would be 4, 3, 1.

➢ Upon attaining the required separation and cant, ship can pull astern using inner engine, let go No. 2 as the ship gathers sternway, and pull astern on 2Es.

➢ Wheel may be required to keep the stem steady as, with strong winds, the tendency of the stern to seek the wind would be greater. At times, leeward ME may need to be at Stop/ Ahead to counter this effect.

➢ Once clear of berth, differential engines in Ahead/ Astern mode can be used to turn around, As far as possible, the turn should be made either with a sternway or headway, keeping the stem /bows turning into the wind. Turning on the spot may be difficult with strong tidal/ wind conditions, as the ship could get wind/ tide locked.

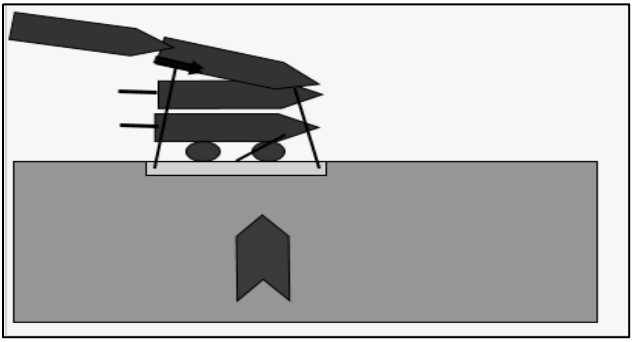
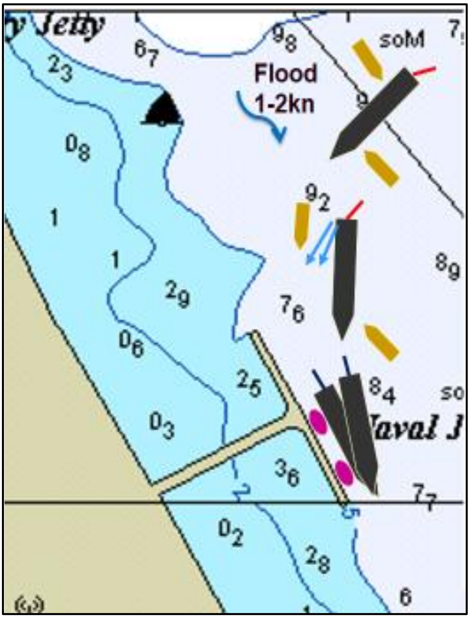


Fig 21 .3: Natural Condition - Offshore Winds, Negligible Tide

Effect of Tide

11. **Stern Tide**. The effect of the tide at the jetty varies with the harbour and the specific berth. In most cases, the full effect of the tide is felt only after casting - off, when the ship clears the berth (Kochi is an exception). This is particularly more in the case of a stern tide, as the ship would not offer an adequate plane till a certain amount of cant has been achieved and the tide starts acting on the inner quarter. Hence, the use of the stern tide for achieving the cant per se may be limited in certain harbours / jetties, where other factors such as wind and berthing space/ jetty constructions may have a greater effect. However in places where the effect of the tide is significant, such as Kochi / SBW outer side at Mumbai, etc., it may be used to good effect for achieving the cant. For canting out the stern, No. 3&4 may be checked to achieve initial cant. This may be followed up by checking all lines, as this would aid the ship gaining lateral separation from the jetty.

Checking of No. 2, however, would depend entirely on the clearances ahead. Subsequently, once the tide is playing on the inner quarter, the No. 1&2 may be held on till the desired cant is achieved. A point of caution, though, would be to resist the temptation to continue with generation of cant beyond what has been planned for. This may lead to undue strain on the lines and, if clearances ahead are low, parting of the No. 2 could have disastrous consequences.



<u>Fig 21.4: Stream From Astern - Kochi Berth S3/S4</u>

- The effort required to cant the stern out would be minimum in this condition. By just holding on to No - 1 & 2 and checking No - 3 & 4 (getting the TS on the inner quarter} any amount of desired cant May be achieved. A cant of 5 – 20 deg would normally be sufficient.

- It must be ensured that at no point should the tide come to bear upon the outer quarter (especially prior to commencement of the manoeuvre).

➢ No 2 would be required to be held and be the last line to let go, as the ship will get pushed forward. The sequence of letting go of lines would mostly be 3, 1 and 4.

➢ Once the desired cant is achieved, ship can pull astern with 2 Es and let go No.2 as sternway develops.

➢ In the centre of the channel, differential engines in ahead/ astern mode can be used to turn around.

➢ Depending on the wind, as far as possible, the turn should be made either with a sternway or headway. Turning on the spot may be difficult with strong tidal/ wind conditions as the ship may get wind/ tide locked.

➢ If required, the tug on port bow can hold the bows as the stern will swing with the TS and align the ship in the required direction.

12. **Stem Tide**. For warships, the effect of stem tide on canting out is usually more than a stern tide. This is because the part of the ship, behind the flare, would offer a large plane for the tidal stream to act upon. When the effect of the tide at the jetty is significant (such as Mumbai SBW outer side) canting out the stern is rendered difficult, particularly if the tidal strength is ~ > 1 kn (moderate/strong). In such cases, the ship may have to use tugs for hauling out while casting off from Mumbai SBW berth 2/3 in a strong flood, the conventional tugs also tend to be less effective against the tide. Here, it is important to use tugs with strong power from the beginning, to develop a strong lateral moment and get the desired lateral distance and cant before the tugs become ineffective. In case of strong stem tides, and adequate room, the option of canting out the stem may be exercised. This would require positioning, the fender aft, abreast No. 3 fair lead. The wheel could be put to outer side, and No. 1 & 2 checked to get the tide on inner bow and cant out. No. 3 &4 can also be checked to get some lateral separation. In this case, sequence of letting go would normally be No. 2, No. 4, No. 1 and as head way is gathered, No. 2. Cautioned is required that Excess strain on No. 3

could cause it to part. Also, if the lateral separation is not taken/ feasible, the ship's stern may ride on the fender/ jetty and can sustain some damage.

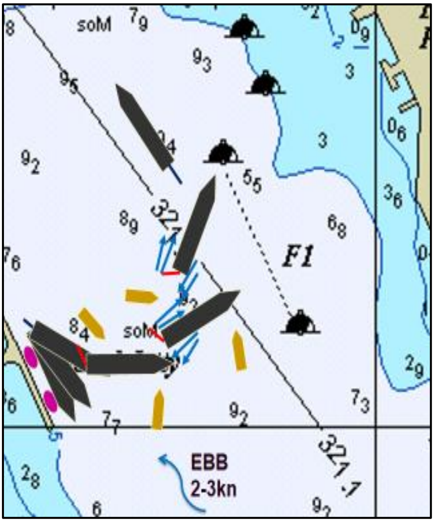


Fig 21.5: Strong Stem Tide - Kochi Berth S3/S4

- For strong TS, it may be easier to cant the bows out. Ships with proud propellers/ alongside another ship need to be careful while doing this, and should gain adequate lateral separation before moving ahead.

- Advance planning needs to be done if the decision to cant the bows out is taken. The aft catamaran / fender should be positioned when favourable wind/ tidal conditions exist (even a day prior}.

- The brow should be removed early to commence the movement by checking No.1, Port 30 and holding on to No 3. An adequate lateral separation from the jetty can be achieved by maintaining an inclined aspect to the TS and checking the lines in sequence 1,2,4,3.

➢ Once bodily clear of the catamaran, No. 3 would need to be held and the last line to be let go as the ship will got pushed astern. The sequence of letting go of lines would usually be 2, 1, 4 and 3.

➢ Upon achieving at least ~ 30 – 40 deg cant, ship can go ahead on 2 Es and let go No. 3 as ship gains headway. As the ships clear jetty, ahead power can be increased with full port rudder, followed by stop/ astern PME.

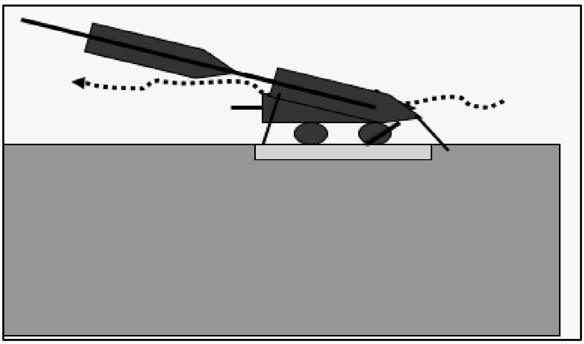


Fig 21.6: Light / Moderate Stem Tide

➢ In the centre of the channel, differential engines in Ahead/ Astern mode can be used to turn around. As far as possible, the turn should be made with headway. Turning on the spot may be difficult with strong tidal conditions as the ship is likely to get tide locked.

➢ If required, the tug on port quarter and another on stbd bow can be used to push, to assist the turn, especially if the ship gets tide locked.

➢ For light/ moderate TS, the canting of stem can be attempted with the use of MEs. A cant of ~ 15 deg can be achieved by using MEs in differential mode (Ahd/ Ast).This can be done by holding No.2, checking 3 and 4, full inner rudder and kicks of Ahead on outer with Astern on inner MEs

➢ Once a 15 deg cant is achieved, ship can pull out astern with 2 Es and clear the berth before the TS pushes the ship back on to it.

➢ Wheel can be used to keep the bows steady. Depending on the direction of the wind, as far as possible, the turning around should be made either with a sternway or headway. Turning on the spot may be difficult with strong tidal/ wind conditions as the ship may get wind/ tide locked.

➢ In case there are ships berthed close astern, or there is lesser sea room astern, then it may be prudent to use tugs to haul out the ship bodily and then pull astern with MEs.

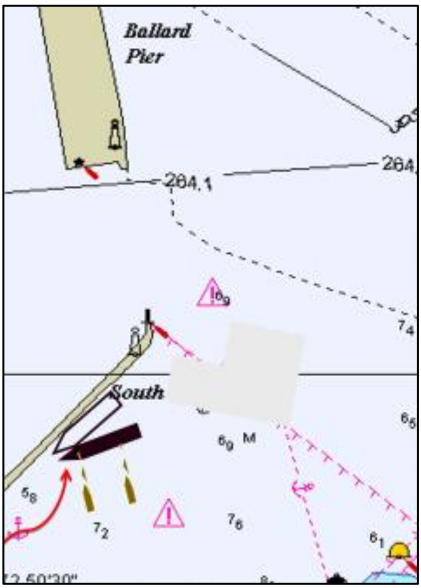


Fig 21.7: Mumbai – SBW Outer (Flood Stream)

➢ The flood stream would set the ship towards the berth astern; therefore sufficient clearance astern (2~3 Bollards) is essential for casting off on engines during a strong flood tide.

➢ The canting out of the stern would be difficult if the TS is strong (> 1 ½ kn). Tugs may have to be used for hauling out in such cases.

➢ Once the cant is achieved, ship can pull astern using slow/Half Ast 2 Es to clear the berth quickly.

Effect of Combined Wind and Tide

13. **Tide/ Wind in Opposition**. The equation of 1:10 for tide/ wind is generally relevant for frigates / destroyers when manoeuvring alongside. However, since in most cases the tide may not be

acting directly against the ship's side while canting out, the wind may have a greater effect at the berth. For instance, when berthed stbd side to at Mumbai SBW outer side, in a flood and offshore wind, a ship may achieve its cant using the offshore wind in conjunction with engines and be able to cast off comfortably. After casting off, however, the effect of tide is felt strongly, and the standard ratio of 1:20 would be valid.

➢ A cant of ~ 10 deg would usually be sufficient before the ship begins to pull astern. A large cant can become counter productive, especially in case of strong onshore wind and ebb tide.

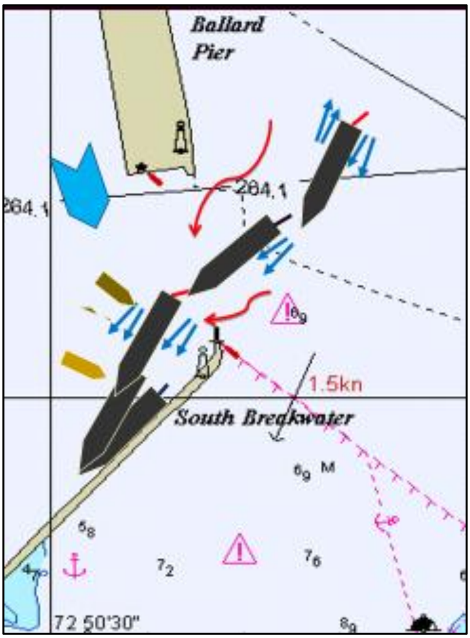


Fig 21.8: Mumbai - SBW Inner (Ebb Stream & Onshore Wind)

➢ The sequence of letting go of lines would usually be 4, 3 and 1.

➢ Upon achieving the cant, ship can pull astern using slow/ Half Ast 2 Es and let go No2 as the ship gains sternway. The tendency of the stern seeking the wind may need to be checked using wheel and, if the winds are strong, port ME may need to be stopped and even ordered Ahead to prevent the bows swinging towards the SBW knuckle.

➢ Once the stern is clear of the knuckle, Port ME can be stopped and the ship pulled further astern on stbd before using differential engine orders to turn abeam of Ballard Pier/ PSS to align for leaving harbour leg.

➢ The considerations mentioned earlier for onshore winds must be kept in mind. The ebb stream tends to push the stern towards middle ground.

➢ Strong astern power may be needed to pull the ship astern, while guarding against the stern swinging uncontrollably into the wind, again towards Middle ground.

➢ As the stern seeks the wind and the ship lies with the wind astern, the turning rate would tend to reduce and the ship may get wind locked.

➢ During spring tides, when the ebb stream rates are higher, it may be difficult to keep the stern pointed in the right direction only by the use of wheel orders and therefore, inner shaft may need to be stopped or even put ahead with full counter rudder to hold the stern steady against the swing.

➢ *Tugs must be standby and used well in time, as at times, during strong ebb stream they may also become ineffective*.

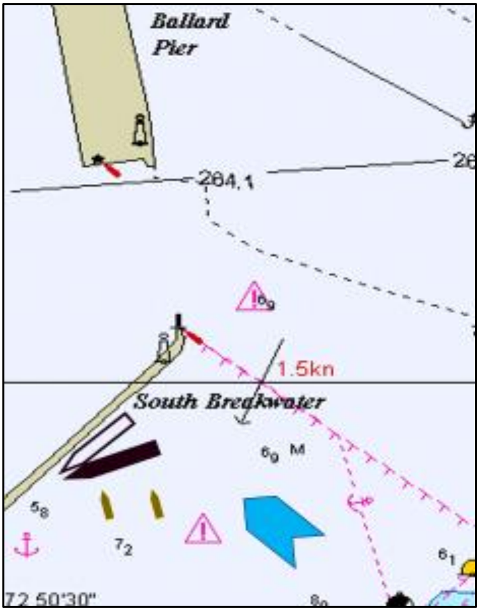


Fig 21.9: Mumbai - SBW Outer (Ebb Stream & Onshore Wind)

Casting Off/ Turning Around

14. **General**. After the ship has achieved the required cant and cast off, she has to clear the berth and turn around to the leaving

harbour course. In this period, the ship experiences the full force of the elements. The ship is vulnerable to the forces of wind and tide, and it is essential to watch closely for set/drift and provide an early counter with wheel/engines. Once the effect of the wind/tide has developed fully, it can become difficult to counter and may lead to an embarrassing position.

15. **Wind**. The stern of a warship normally seeks the wind strongly, which may be pronounced as the ship gathers more stern way. In most cases, this corresponds to a position ~ ½ - 1 ship length away from the berth. So, it is normally comfortable to pull astern with "SIow Astern 2Es", followed by "Half Astern 2Es" (or equivalent orders), to first clear the berth, then watch the stern and apply counter rudder as soon as the stern starts to swing. In a strong wind (e" 12 kn), the leeward shaft may have to be stopped (and sometimes put to "SIow Ahead") along with full counter rudder in order to hold the stern. It is essential that the navigator goes through the motions of casting off and turning around in his mind thoroughly prior execution - ordering. "Stop" on the wrong engine could-be embarrassing to say the least. E.g. while pulling astern from SBW 6 in Mumbai, if the stem develops a swing towards Ballard Pier, a wrong engine order could accentuate the swing rapidly, with minimal sea room available.

16. **Tide**. A ship would normally set in proportion to the tide and her own speed. The tide will usually set the ship in towards the berth ahead / astern. Consequently, sufficient clearance is essential for casting off on engines during a strong tide. Strong ahead / astern power will be required, in most cases, to pull clear of the berth comfortably.

17. **Less Sea Room**. In some harbours/ berths (such as Vizag and Chennai), the ship may not have adequate sea rooms or time for turning around. Here, tugs may be used to facilitate the turn, especially if there is wind/ tide impeding the turning around.

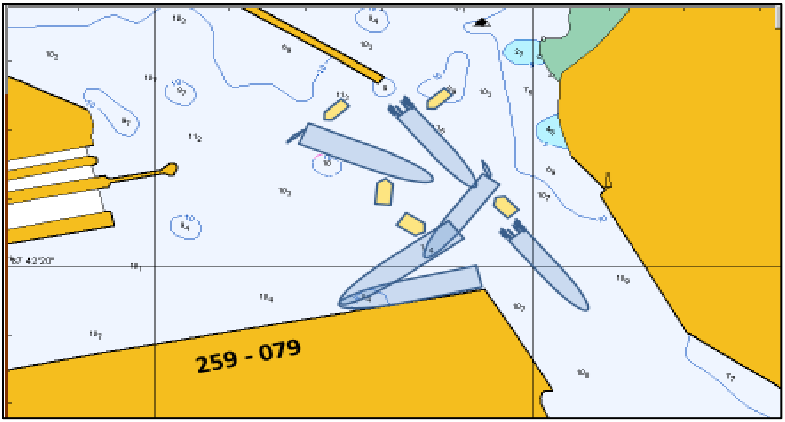


Fig 21.10: Visakhapatnam – Berth 17

Berth N17 is a very tight berth to cast off from, when berthed port side to. The cant required is more than 60 deg, which often requires the use of tugs, especially with onshore winds. One tug can be ordered to pull the stern out while the other tug pulls the bows very slowly, aim being to swing almost on the spot keeping the bows clear of the jetty.

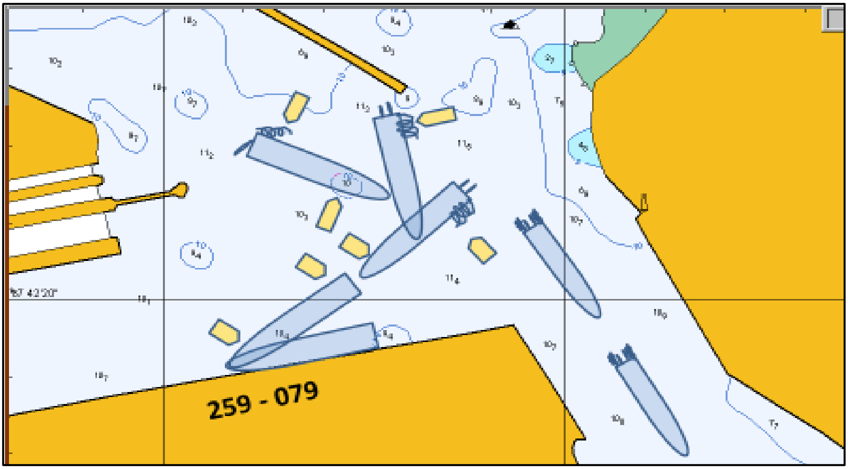


Fig 21.11: Visakhapatnam - Berth 18

➢ The ship can cast off from berth N 18 under own power under favourable wind conditions {calm/ light offshore). Herein, a cant of ~ 30 deg is required, which may be achieved with engines going DS Ahead Stbd and DS Astern Port, with Port 30 deg wheel in conjunction with heaving on to No. 1, Additional fendering must be available for the bows and the yokohoma should be placed forward. No. 3 & 4 are usually let go as canting out commences.

➢ Ship can than pull astern on Port ME and No. 1 & 2 let go on gaining sternway. As the bows swing clear of the jetty Stbd 35 deg wheel, with Port going Slow Astern and Stbd stopped, can be used, followed by using differential engines to turn around for leaving harbour. Tugs can be used on opposite bow/ qtr to facilitate the turn.

➢ Sternway of more than >~2 kn should not be gained. Rudder/ engines should be used to ensure that stern swings clear, west of the ammunitioning berth.

GOING ALONGSIDE

18. **General**. Warships, particularly steam ships and Destroyers, demand an early assessment and response to the set and/ or drift while proceeding alongside. A loss of momentum on a ship would be akin to loss of initiative and may, in some cases, even render the ship totally vulnerable to the elements. A longer approach to berth, with a broader angle, will cater to - most conditions and allow maximum flexibility to the ship handler. A terminal deceleration rate of ~ 100 yards/ kn is usually valid for Frigates/ Destroyers, and normally requires only a small kick astern (or ahead) for finer adjustments for brow position, in calm condition and a clear final approach path.

19. **Calm Wind/ Tide**. In calm wind (< ~4 kn) and tide (< ~ ½ kn) conditions, with a clear approach to berth, an approach angle of ~ 15 deg is generally suitable and would permit maximum flexibility till the final stages. The approach path should be aimed for a point ~ Ml ship-length from the stem (i.e. between the stem and forward fender positions, on the bollard receiving the No. 2). A

steady 'run' of about 3 cables on the final approach path is considered optimum. The approach is usually commenced at about 6 kn. As the ship turns on to the final approach path, the speed would normally drop slightly, due to the turn. The speed is thereafter adjusted as per the class of ship to reach the berth with minimal headway, and paralleling out being achieved using the rudder and engines in conjunction to checker headway and turn outwards.

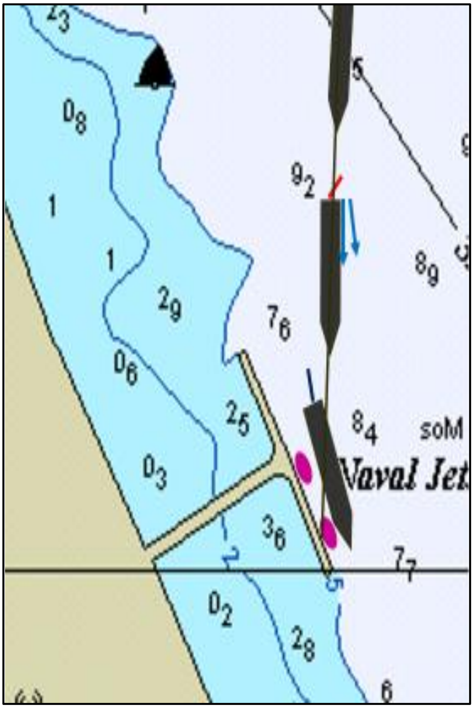


Fig 21.12: Kochi S3/S4 – Calm Conditions

- Aim for the Bridge Position on the berth (~8 – 10 deg).

- Start swing away before ordering offshore engine astern to parallel out and arrest headway.

- Rough guideline for reduction in speed over ground is as follows:-
10 c – ~10 kn
5c – ~5-6 kn
2c –~3-4 kn
1c – ~2 kn
1 ship length – 1- 1½ kn
½ ship length – ½ -1 kn

Reduce speed @ ½ kn per ~50 yd, in terminal stages.

Effect of Wind

20. **General**. The sail area of a ship is the key factor that can let the wind take total control of the situation, if not catered for in the approach and final stages of going alongside. Its effect on the approach for onshore and offshore winds is discussed here under.

21. **Onshore Wind**. It must be remembered that, commensurate with the sail area of a ship, the approach in a strong on-shore wind must be carefully controlled. The endeavor should be to bring the ship in bodily precisely at berth (or as close as possible). If the ship remains narrow in the final stages (as would happen if the initial approach is narrow or if the way is taken off early), the ship is likely to find herself alongside whilst still short of her berth. Similarly, if the ship is broad when she reaches abreast her berth, she is likely to develop a strong leeway and move into the berth with a high, undesirable momentum, which could even damage the ship's side. For destroyers / frigates, in a strong on-shore wind, it may be useful to give an off-set to the approach and aim for a position outwards from berth by about one ship-breadth (i.e. 3rd ship position when going alongside as the 2nd ship). The standard 15 deg approach angle on this offset position, with a slightly higher speed may be used. The initial drift may be slight and will slowly increase with the drop in speed. A rapid leeward movement may be expected from the point when the engines are put astern and when headway drops d" 1 kn (more on ships with larger sail area). So, in a strong on-shore wind, it may be preferable to maintain more headway than for light condition. In this case, whilst approach speed can be same, the stopping and astern orders can be slightly delayed to offset the drift. A strong/ longer astern order may then be required to stop at/ abreast the berth. At ~ ½ ship-length to go, the ship would have drifted in ~ half the initial off-set given, and the bows may need to pointed in by
a couple of degrees in the final stages. The astern order should be adjusted so as to take all way off when abreast the berth, as further use of engines would be curtailed by a strong onshore wind.

- Point ahead of the Bridge position (2m for every knot of wind)

- ~ 8 - 15 deg approach, as per strength of wind.

- In case of higher leeway, the approach speed needs to be increased accordingly,

➢ Paralleling out and stopping ship about 10 m abreast of the berth, Will allow wind to set the ship smoothly on to the berth.

➢ In case of strong onshore winds (greater than 12 kn), use of tugs may be prudent.

➢ Keeping a line passed to the tug from the bows can help prevent the bows from blowing on to the berth.

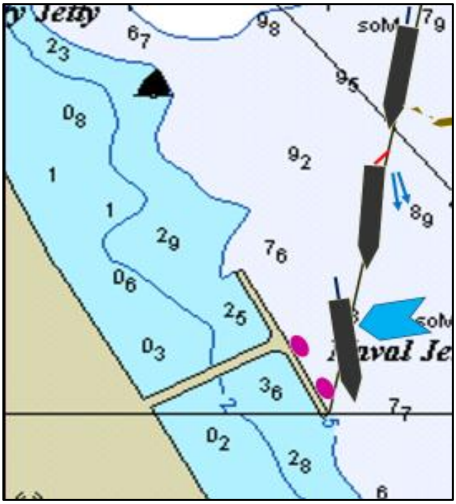


Fig 21.13: Kochi- Berth S3, Onshore Winds, Negligible Tide

22. **Off-shore Wind**. In a strong off-shore wind, also, a precise manoeuvre is warranted. It would be best to bring the ship right alongside her berth, and then hold on to the breast ropes, else the ship will drift rapidly away from her berth. A useful approach in an off-shore wind may be a broader approach angle (~ 20-25 degrees), aiming a little short at the fwd fender position, keeping the speed of approach and stopping points the same as for a light wind. Thereafter, from ~ ¾ ship-length from berth, use engines and wheel to turn outwards and parallel out, while continuing to take off all way. In most cases, this may be achieved by increasing the astern power on the outer shaft with full outer wheel. This could be coupled with occasional ahead 'kicks' on the inner shaft to increase the turning moment. Smart action with the breast rope will complete the manoeuvre. In a strong off-shore wind, it is cumbersome to adjust position once the way has been lost. Hence, the use of initial momentum remains very important. At times, it may be necessary to use tugs to hold/ push the ship in even after passing the lines till properly secured. Hence, in strong off—shore wind in the final stages, it may be useful to keep the tugs closer abreast.

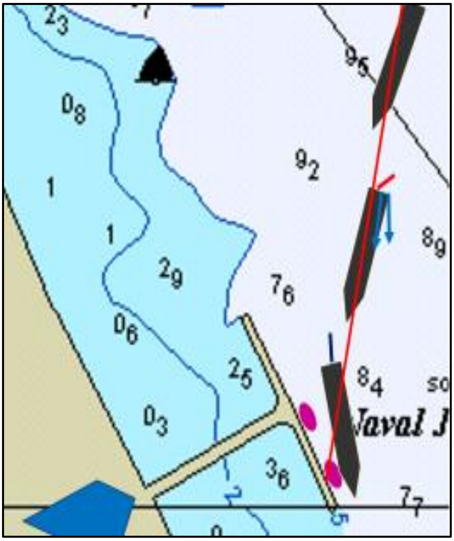


Fig 21.14: Berth S3/S4 Offshore – Beam Winds, Negligible Tide

- A narrow approach can be attempted with higher speed, provided there is sea room available (i.e. no ships astern), aiming short of the final position.

- Broad approach is otherwise valid (add 1 deg for every knot of wind in addition to the normal approach angle), again aiming short of the final position.

- At ~1 ship length to go, adjust heading to point at Bridge/ Fender.

- Parallel out when close to the berth. The ship's advance will bring the stern in, otherwise use MEs to get the stern in.

- Secure all lines quickly.

- Tugs may be required to hold the stern

- The wind sheer will swing the bows away from the jetty once stern order is given.

- A broad approach in this case would give a beam aspect to the wind and thus greater leeway will be experienced.

- A narrow approach (less than 10 deg) is preferable.

- There is lesser room for any error of judgement

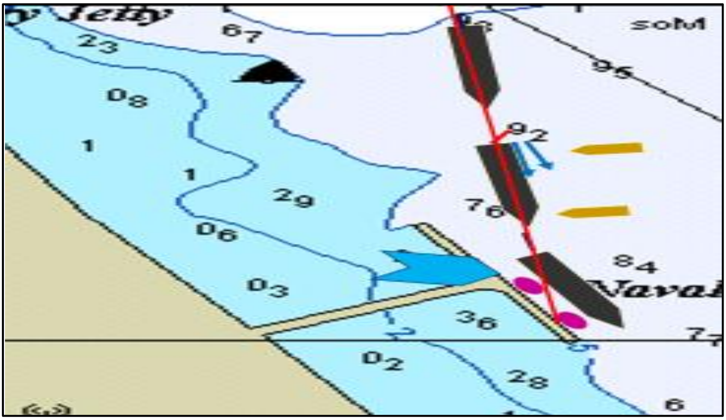


Fig 21.15: Kochi-Berth S3/S4;
Offshore-Winds from Qtr, Negligible Tide

➢ Initially, point short of the Bridge position (Mid/ Stern)

➢ Adjust heading to bridge / Fender, when ½ - 1 ship length short.

➢ Pass lines quickly and use MEs to bring in the stern.

➢ Caution for wind sheer, which will swing the bows towards the jetty once astern order is given to check headway.

Effect of Tidal Stream

23. **General**. A normal approach (~10 deg) can be attempted with light tidal streams of up to ~ 01 kn, as warships have enough power to counter the effects. However, the tidal flow pattern needs to be studied carefully. In many harbours and berths, the flow is not linear and catering for it can becomes difficult. The Pilots, Port Orders and Nav Data Books would generally provide the requisite information in most cases, and should be supplemented by discussions with experienced COs/ NOS, as feasible.

24. **Stem Tide - Linear Flow**. A tidal flow from ahead/ bow is generally the easiest to handle, especially when the flow is linear

along the final approach path. This allows the ship to steady up on a longer approach of 5C or more, and adjust for the set. However, caution needs to be exercised for reverse flow/ eddies at the berth. Examples of stem tide with linear flow are Kochi during ebb (especially North jetty) and Mumbai SBW outer side (especially berth 2/3).

25. **Stem Tide - Cross Flow**. This is a tidal flow across the approach path, with the major component from ahead/ broad on the bows. It is difficult to cater for, as it can cause the ship to sheer. However, the cross-flow is normally in a restricted area due to the land! breakwater contours, and once crossed (carefully), its effect reduces considerably. Normally, a slightly higher approach speed and throw-off upstream would be required. Examples include entering Mumbai Tidal Basin during strong ebb or flood streams. Accordingly, an approach to Barrack/ Cruiser Wharf is easier during ebb, and to SBW inner side is easier during flood stream.

26. **Stern Tide-Cross Flow**. This is a tidal flow across the approach path wherein the major component is aft of the beam/broad on the quarters. It is more difficult to cater for, as it can cause the ship to broach. Depending on the strength and angle of tidal flow, the approach can be made with due throw-off and readiness to use strong bursts of power to break past the sheer, and also to take all way off thereafter, as the tide may be pushing the ship forward. Examples include approach to berth 5/6 SBW inner side at Mumbai in ebb, and onto Cruiser/ Barrack Wharf at Mumbai in flood. In both cases, just as the ship clears the Knuckle/ Bollard Pier successfully, the tidal flow tends to push the ship broad of/ beyond its approach path to berth.

27. **Stern Tide-Linear Flow**. A tidal flow from astern/ quarters (especially inner quarter) is not only very difficult to handle, but can become dangerous as it is very likely to make the ship broach, even if tidal strength is ~ ½ kn (negligible/ light). In such cases, a narrow approach with tugs standing by close to keep the stern in can be executed by a bold, able ship handler. But, it would remain tricky and is preferably avoidable. Such situations may

occur with earlier than expected turn-around of tidal flow, at Kochi N/S jetties with onset of flood and at Mumbai SBW outer side with onset of ebb. A judgment would need to be made at the time whether the manoeuvre is ‘do-able’ and safe. If the T.S. is > ½ kn, it may be prudent to button up strong tugs off the berth and then get pushed in. In case of moderate or stronger T.S. (> 1 kn) from the stern, the ship can turn around in the channel (using MEs and anchor! tugs) and make an approach by stemming the tide.

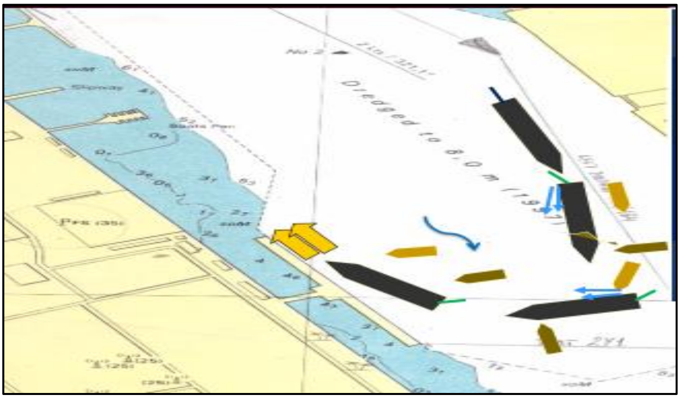


Fig 21.16: Kochi - Berth S3/S4

- Commence the turn well short of the berth depending on the strength of the TS.

- Use hard wheel and differential engines to commence the turn with slight headway.

- Chances of getting tide locked in strong TS is greater, therefore, have one tug positioned on port bow.
- In case required, tug on port bow to hold the bow while me stern swings with the TS.
- Once turned to desired heading make a normal approach or crab on to the berth.

- Ship can also be turned short around an anchor (other than for ships with bow / forward fixed sonar mounts).

CHAPTER 22

SHIP HANDLING ASPECTS OF SUBMARINES

1. Modern submarines are unique in their construction and vary significantly from warships both in the underwater hull form as well as in the placement of underwater appendages with respect to the propeller (usually a single screw, with the exception of some large SSBNs such as Typhoon class, which are twin screw). The uniqueness of these platforms must be clearly understood for better appreciation of their ship handling aspects. The features that have a bearing on the ship handling aspects of submarines can be summarised as follows:-

(a) Position of propeller. Any underwater appendages forward or aft of propeller.

(b) Position of rudder with respect to propeller. For the conventional submarines in *IN*, rudder is placed ahead of the propeller. When propelling ahead from rest, there is no propeller wash that impinges upon the rudder. However, when propelling astern the propeller wash falls directly onto the rudder.

(c) The underwater hull form is smooth and is shaped like a hydrofoil. This results in water flow sans any significant eddies.

(d) The size of propeller is relatively small compared to the size of the vessel and has a high speed of rotation with RPM/kn value of 40.

(e) In addition to the rudder, the submarine also has large stabilizers in horizontal plane, positioned in line and ahead of the propeller.

2. **Pronounced Effects whilst Propelling Astern**. In case of submarines, the effect of sideways forces is far more

pronounced when it moves astern from rest. This can be attributed primarily to following factors:-

(a) The underwater appendages are all located ahead of propeller and therefore play a greater role in generating the sideways forces in astern propulsion.

(b) In astern propulsion, the propeller wash falls directly on the rudder, making it relatively more effective.

3. **<u>Sideways Forces</u>**. In order to understand all the sideways forces as mentioned in Crenshaw as well as in Admiralty Manual of Navigation Vol 6, lets take a closer look at all the forces individually and try to understand their corresponding effects in a submarine. These are as follows:-

(a) **<u>Following Wake</u>**. The water carried by the hull owing to skin friction passes the prop at an angle of attack and with differing velocity. The frictional wake velocity is zero at the bows and increases as it reaches stern, therefore, in effect, the propeller advances through a section of water that is moving at a slower relative speed. Speed of water at Propeller = Speed of submarine through water – Frictional wake speed. As a result, in a right handed screw ship, the stern moves to port when going ahead. Therefore, a left handed prop when going ahead would experience a turn to port. This is the reason why submarines carry wheel to stbd when propelling ahead on surface. The effect increases with increase in speed. In respect of submarine, the following issues are important to remember:-

(i) This effect has negligible impact when propelling astern because the movement is in the direction of the propellers and therefore the speed of frictional wake is zero.

(ii) The impact is negligible when manoeuvring alongside as the speed through water is near zero and therefore again the speed of frictional wake is zero.

(b) **Inclination Effect**. The axis of propeller is inclined to the axis of water flow because of the inward and upward moment of water past the stern. The inward movement is identical on both sides (port and stbd) and therefore cancel each other. The upward movement imparts addition thrust to the vessel and net effect turns the ship's head to port when propelling ahead and to stbd in astern movement (Right handed). Therefore, with left handed screw, a submarine turns to port when going astern.

(c) **Helical Discharge**. This effect is caused because of the helical discharge from prop impinging upon the rudder. Therefore, in submarines, the effect is negligible when propelling ahead as the prop is placed forward of the propeller. In astern motion it aids in head swinging to port.

(d) **Shallow Submergence**. If part of prop breaks surface or is very to surface in the upper arc, the difference in depth of top and bottom tend to move the stern to stbd & head to the left. Therefore, the submarine turns to port (Bows) when going astern. The effect is not very pronounced as the propeller diameter is small and therefore the difference between the top and bottom part in not very pronounced. Further, owing to the placement of propeller, the complete propeller is well immersed all times.

(e) **Paddle Wheel Effect**. Paddle wheel is significant when turning at rest. It is a force of interaction between flow of water generated by the propeller and the hull structure in vicinity. The direction of rotation is of importance irrespective of CPP or FPP. A right handed prop when going ahead the stern to starboard. Therefore, in certain submarines, because of the location of appendage well forward to the propeller & absence of any appendage aft of prop, the effect when going ahead is negligible. However when going astern, the resultant force tends to push the stern to stbd and head to port.

(f) **Pressure & Suction**. The phenomenon is predominant only in twin screw ship owing to development of pressure on one side and suction on other. No significance for submarines, except when using reserve motors in tandem. The effect of reserve motors is pronounced only at rest or very slow speeds. At speeds greater that 3-4kn, the effect of reserve motors is negligible and rudder is more effective at these speeds.

(g) **Lateral Wash**. The magnitude of this force is a function of wash thrown by prop on hull and therefore highly effective in CPP. The direction of flow of water determines the direction of 'stern kicking'. In submarines, the force results in stern getting kicked to port and head swings to starboard. The flow of water is less owing to the small size of propeller, however, to some extent it is made up for by the higher RPM. The absence of appendages in the vicinity of propeller tends to reduce the effect of this force.

4. **Effect of Wind and Tide**. Submarines lie low in the water, make little *Leeway* and do not always lie beam to the wind. Submarines drift with the *Current / Tidal Stream*.

CHAPTER 23

USE OF TUGS IN SHIPHANDLING

1. References:-

(a) BR 45 Volume 6.

(b) Port Orders of Various Naval Harbours.

2. **Naval Tugs – Capabilities and Limitations**. The tugs in Indian Naval ports are controlled by the boat pool. As on Oct 2019, the various tugs available in Indian Naval ports as per port orders with their capabilities are tabulated below:-

Ser	**Naval Port**	**Naval Tugs Available**	**HP/BP**	**Remarks**
(i)	Visakhap-atnam	B C Dutt Sambhu Singh Avataar Baldev Angad	1250/25T 1250/25T 600/12T 372/06T 372/06T	Two tugs are manned round the clock except between 0600-0730h and 1930-2200h and on Sunday and holidays. However one tug is manned round the clock.
(ii)	Port Blair	Nakul Abhilash Ananta	25T 10T 10T	
(iii)	Kochi	Balshil Sarthi Aja Atal	25T 25T 10T 06T	Normally, not more than two tugs for

				capital ships and one tug for smaller ships will be provided.
(iv)	Karwar	Sahas Himmat Dheeraj Kushal Umang Tej	50T 50T 50T 25T 25T 25T	
(v)	Mumbai	Arjun Bhim Tarafdar Madan Singh Bajrang Bahadur Anup Athak Anjan	25T 25T 25T 25T 20T 10T 10T 10T 10T	Tugs are generally not available 0630-0830, 1200-1330 and 1830-2030.

Note:- However firm timing and availability of tugs need to be confirmed from respective boat pool/ COY. The names of the tugs are subject to change on the basis if operational availability and basing of tugs.

3. **Methods of Operating Tugs**. Tugs can operate in one of these methods: by being secured with a hawser so that they can *Tow* (the *Towing* and *Indirect Towing method)*, by being secured with the bows close to the ship's side (the *Push-Pull* method), or by pushing without being secured.

4. **Positioning and Usage of Tugs (Including Cold Moves)**

(a) **Planning Factors**. Planning of a tug assisted movement should include consideration of the following factors:-

(i) Pilotage Plan (route into/ out of harbour and to/ from berth).

(ii) Physical layout of the berth and the method of fendering used.

(iii) Presence of nearby ships and scheduled movements of other shipping.

(iv) Wind and Tidal Stream.

(v) Whether ship's engines and rudders are available to assist, and if so how.

(vi) Number, size, type, power and effectiveness of tugs available.

(vii) Day or Night, and whether the sun will cause dazzle affecting the movement.

(viii) Local knowledge and whether a Pilot is to be embarked or not.

(ix) Whether tug is a Naval Tug or commercial tug.

(x) Experience of tug master.

(xi) Speed of the ship.

(b) **Planning Process**. The planning process should result in up to 5 outputs, which are considered in more detail below:-

(i) Whether or not to use tug(s).

(ii) How to position the tug(s).

(iii) How to secure and operate the tug(s).

(iv) How to communicate with and brief the tug(s).

(v) How to exercise control of the tug(s).

(c) **<u>Whether or Not to Use Tug(s)</u>**. This decision will depend on all the circumstances of the individual case. However, the CO who elects to secure two tugs and makes a perfect alongside will rarely excite any comment, where as the **CO who chooses to make a 'heroic' alongside without tugs in less than perfect conditions and hits the jetty causing millions of rupees of damage to the *Bow Dome,* becomes the focus of a vast amount of unwanted interest.**

(d) **<u>How to Position the Tug(s)</u>**. This decision will largely depend on the conditions of wind and stream, the complexity of the manoeuvre and the number/ type/ power of the available tugs. When the ship's engines and rudders are available (*Hot Move),* the bow will generally be less easy to control than the stern. Therefore, as a general principle, a single tug should normally be positioned on the bow, and if two tugs are available the more effective tug (a function of manoeuvrability and power) should be forward.

(e) **<u>How to Secure and Operate the Tug(s)</u>**. The choices are limited to *Towing* on a hawser, and *Push-Pull / Push-On*.

(f) **<u>How to Communicate, Brief and Exercise Control of the Tug(s)</u>**. The method chosen will depend on whether a Tug is a Naval Tug or a civil tug and also on whether a pilot is embarked or not. *Always remember that order given to tug (i.e. Forward, Astern, Port or Starboard) are with respect to the ship and not with respect to the tugs.*

(i) **No Pilot Embarked**. In Indian Naval Base Ports, the usual method of tug briefing and control is by VHF. The NO/XO should brief the tugs personally, in plenty of time.

(ii) **Local Pilot Embarked**. If a local pilot is present, it is normally best to control the tugs through the Pilot, particularly in foreign ports where there may be language or terminology problems with the local tugs. The local Pilot should also brief the tugs. If briefing and control of tugs is deputed to the local Pilot, it is essential that the Pilot's instructions to the tugs comply with the CO's requirements, and that the tugs' execution of them (or not), are monitored by an experienced officer who is also aware of what has actually been ordered by the local Pilot. It should be remembered that tugs in commercial ports may be used to handling only large merchant ships and thus unused to the special requirements of thin-skinned warships with vulnerable underwater structures and fittings; as a result, it is not unusual for such tugs to manoeuvre very robustly with the possibility of damage to the warship.

(g) **Cold Moves**. *Cold Moves* are generally conducted by berthing master using naval tugs on the authority of COY/ASD of the port. If berthing master is not embarked during the cold move, proper briefing needs to be carried out and responsibility of controlling tugs needs to be clearly defined.

5. **Girding of Tugs**. While handling tugs, caution for girding to be exercised. If a tug is *girded*, it will almost always sink with strong possibility of loss of life. Girding is generally caused when tug is not able to maintain station, even at full power, and goes out of its station. Girding takes place when the angle of the Tow grows towards tug beam i.e. more than R/G 135 from astern. Girding can be avoided by arresting ship's speed.**The possibility of *Girding* a**

tug may be judged by: (a) monitoring the angle at which the hawser is growing from the tug, relative to its centre-line, (b) whether it is having difficulty maintaining *Station*. The hawser should ideally be parallel to the tug's *Centre Line* but should never be allowed to grow further forward than Red 135° or Green 135°.

6. **Methods of Controlling Tugs**

(a) **VHF**. In Indian Naval Base Ports, the following standard VHF orders are normally used for controlling tugs. Prefix all VHF orders with the **tug's name,** pass the **minimum number of instructions** necessary and say **what to do, not how to do it.**

Category	**Orders Used**
Securing:	
To *Tow*	'Secure your hawser to my port/ starboard bow/ quarter or to my bullring/stern' or Take hawser from my foxle and secure(in case ship is passing rope)
Push-Pull	'Secure your bow/ stern to my port/ starboard bow/ quarter or abreast turret/ bridge etc'
Control Orders:	
General	'Push' / 'Pull' / 'Stop'
Alongside as an engine tug:	'Ahead' / 'Astern' / 'Stop'
Power Orders	'Dead Slow' / 'Slow' / 'Half' / 'Full'
Direction Orders	'Take my bow to port/ starboard' 'Take my stern to port/ starboard'

	'Take me ahead/ astern'
'Letting Go' (Routine)	'Stand by to let go, let me know when you are ready' *Tug*: '*Ready for letting go'* *'Let Go'* *Tug: 'Letting go now/ All gone and clear'*
Finishing with Tugs	'Finished with movement, thank you' (as a signal for dismissal)
'Slipping' a tug on a hawser (Emergency)	'Stand by to ***Slip',*** let me know when you are ready' *Tug: 'Ready to **Slip'*** ***'Slip'*** *Tug: '**Slipping** now'* *Tug: (When appropriate) 'All gone and clear'*
(Note: '*Slip*' is an emergency order)	

7. **Methods of Securing Tugs**. Naval tugs generally provide their ropes for the movement but some tugs may not be in possesion of suitable ropes/ hawsers. Therefore, the ship should always be ready to pass the rope/ hawser. In addition, civil/commercial tugs will always ask ropes/ hawsers from the ship. Ship should secure tug lines by the following methods so that they can be handled secured and slipped quickly (see also BR 67). Whenever tugs are being employed, the Command, Pilot and tug Masters must know exactly how hawsers have been secured.

(a) **Securing the Hawser of a Tug**. All conventional tugs have arrangements for slipping hawsers from their end. When using tugs for *Towing*, ships should have axes ready on deck to cut the hawsers in an emergency. Some tugs have an eye on the outboard end of their hawsers. These hawsers should be led through a fairlead and the eye put directly onto the bollard or bits. However some tugs may require to use ship's hawsers, or if the tugs provide their own, these hawsers may not be fitted with an eye and should be turned up round bollards and racked.

(b) **Securing a Tug Positioned for Push-Pull**. A tug that is positioned for the *Push-Pull* method will normally pass one or more *Headropes* to the ship to help maintain its position against the effect of stream or the ship moving ahead or astern. These lines need not be secured to slips, but they must be let go quickly when required.

(c) '**Let Go the Tug' and 'Slip the Tug'**. The order '*Let go the (aft/ fwd) tug'* should be the normal usage for releasing tugs. '***Slip the Tug*' is an emergency order which may require the very dangerous procedure of releasing the hawser under tension.** If cutting a hawser with an axe in an emergency, requisite safety precautions need to be kept in mind.

8. **Securing Tug Hawsers at Long and Short Stay**

(a) **Consideration of Tug Hawser's Stay**. When securing a tug on a hawser consideration needs to be given to the length of stay to be used.

(b) **Choice of Short or Long Stay**. The advantages and disadvantages of using hawsers at short and long stays are listed below. It can be seen that a hawser at long stay is usually more effective unless there are constraints of space which limit its use.

(i) **Short Stay**.

(aa) The tug can pull in confined spaces (eg narrow entrances and corners etc).

(ab) In high freeboard ships, the lead of the hawser can be sharply downwards, tending to lift the tug's stern and restrict its pulling power.

(ac) Propeller wash from the tug may reach the ship being towed and reduce the effectiveness of the pull.

(ad) It is more difficult for the tug to position itself accurately.

(ii) **<u>Long Stay</u>**.

(aa) The tug may not have enough room in confined spaces (eg narrow entrances and corners etc) to pull and may be forced to stop pulling or even let go and recover the hawser.

(ab) In high freeboard ships, the lead of the hawser is nearer to the horizontal and the tug can pull more effectively.

(ac) Propeller wash from the tug from the tug is unlikely to reach the ship being towed and so the effectiveness of the pull will not be reduced.

(ad) It is easier for the tug to position itself accurately.

9. **<u>Other Factors</u>**. Few other factors which must be kept in mind while employing tugs are:-

(a) **<u>Likely Tug Power Against Likely Power Requirement</u>**. When planning the use of tugs it is important to assess their likely pull against the likely power required.

(b) **<u>Practical Effect of Ship’s Headway on Tug Performance and Safety</u>**. Due to the diversion of some tug power to maintain station on a moving ship, the choice of ship's speed while tugs are connected is a major consideration.

(i) **<u>Connecting and lead Tug Speed – Rule of Thumb</u>**. As a rule of thumb, when connecting tugs or using a bow tug to lead a ship, the ships speed should not exceed two-thirds of tug's maximum free running speed and ideally it should be less.

(ii) **<u>Running Connected – Not Towing</u>**. If it is essential to run with a tug secured at higher speeds than two-thirds of the tugs maximum, the tug will not be able to pull and may have difficulty in keeping Station. **It is thus essential to pass all course and speed alterations to the tug before applying wheel, to assist it in maintaining Station.**

SECTION VIII

FORMATS OF BOOKS MAINTAINED BY THE NO

CHAPTER 24

FORMAT FOR NAVIGATING OFFICER'S WORK BOOK

1. **Introduction**. The Navigating Officer's work book is a mandatory requirement for any officer carrying out duties of Navigating Officer on any ship in the Indian Navy. A well maintained work book has often been the hallmark of a professional and dedicated navigator. It has also been a prized possession invoking a deep sense of pride within the navigator. Certain guidelines on the maintenance of a NO's workbook are incorporated in BR 45(1) / 1987, as well as BR 45(4) / 1995 (not mentioned in new BR 45 (1) and BR 45 (4) 2008 edition). However, these publications do not lay down a specific format for the book. A recommended format is described below.

2. **Section I - Ship's Particulars**. This section should contain ship's data that is relevant to navigational planning, viz. lengths, beam, draughts, blind arcs on the bridge, shadow distances, etc. (except manoeuvring and fuel consumption data). On moving to a new ship the data in respect of the new ship, may be added on in continuation.

3. **Section II - Manoeuvring Data**. This section should contain relevant extracts from the NDB in terms of turning data, acceleration/ deceleration data. Calculations/ observations in respect of important manoeuvres, giving insight into shiphandling characteristics may be inserted here for subsequent transcription into the NDB.

4. **Section III - Underway Replenishment**. This section should contain a scaled diagram of the ship indicating replenishment points along with linear measurement data of the same. This should be followed by a record of calculations for RAS/ SKBDL with various classes of ships. Important observations of runs that bear analysis can be done here for subsequent transcription in the NDB. This section could also have a table of

visual reference, photographs in alongside station for different classes of ships, e.g. Bridge-top forward whip aerials in transit. A record of throw off given while fuelling with oilers, to cater for auto tensioning under different conditions may also be tabulated for ready reference.

5. **Section IV - Towing Operations**. This section should contain brief details of towing arrangement onboard including a schematic diagram for ready appreciation. Relevant calculations / plan for generic and special runs should be recorded in this section. Additionally, important observations made during towing runs undertaken can be recorded in this section for future analyses and transcription into the NDB.

6. **Section V - Pilotage Plans**. This section should contain relevant references / extracts from port orders / pilots in respect of home port and ports frequently visited. Further, general entering / leaving harbour pilotage plans for all harbours should be included. Anchoring plans for each harbour should also be included in this section for standard naval anchorages, under both flood and ebb conditions. This section should also contain details and calculation in respect of pilotage plans, viz. LDL, tidal/ astro data, berthing data, ETA/ETD, etc. The plans should be reviewed and updated for relevant/ required aspects, for each occasion of pilotage.

7. **Section VI - Ship-handling Alongside**. This section should contain schematic diagrams of berths in the home port and other frequently visited ports, apart from fender/ brow positioning at different berths and alongside various classes of ships. Alongside / cast off plans should be recorded in this section, along with a schematic diagram including ‘boxing up' of the plan. Additionally, observations / lessons learnt, it any, should be recorded in this section and subsequently transcribed into the NDB.

8. **Section VII- Passage Plans**. This section should contain fuel consumption data of the ship. Passage planning for individual passages should be done by creating a new sub section within this section for each passage. The section should contain relevant

references / extracts from publications used, astro / tidal data, SOA and fuel calculations, passage graphs, etc.

9. **Inspection**. The work book should be kept updated at all times, and used for all navigational, pilotage and ship handling/ planning by the Navigating Officer. It should be scrutinized by the Commanding Officer as required, to familiarize himself with/ check the NO's plans. Separately, it is recommended that the work book be inspected and signed by the Commanding Officer every month. Additionally, the book should be put -up for the Fleet Navigating Officer's perusal during Annual inspection and all fleet embarkations.

10. **Multiple Workbooks**. BR 45(4) / 1995 suggests that the NO may, if necessary, maintain two separate workbooks, one dealing with Planning and other dealing with Execution. 'While the first could be used for recording data/ calculations, the, latter could be used for recording navigational observations such as weather, current, speed made good, shipping conditions, etc. The decision to use one or multiple Workbooks would depend on ship's programme and frequency of making passages. In case only one Workbook is maintained, the observations (under Execution) should be recorded after the calculations in the respective sections.

11. **The Book**. The work book could be in the form of a hard bound register or it could be maintained in the form of a tight bound folder (such as with screw and nuts, as used for Standing Orders, Form 'R', etc., or even comb bound), in which pages may be added in relevant sections as required. However, a loose bound folder should be avoided, due to propensity of work sheets tearing off. The entries in the work book may be written by hand, or inserted as computer print outs. In either case, all pages must be serially numbered, as a composite whole or as per section.

12. The above suggested format does not, in any way, preclude insertion of additional calculations, data or information considered relevant / useful.

CHAPTER 25

FORMAT FOR NAVIGATING OFFICER'S NOTE BOOK

1. **Introduction**. BR 45(1) / 1987 and BR 45(4) / 1995 (not mentioned in the new edition of BR 45 volume 1 or 4) summarise the conceptual requirement of the Navigating Officer's Note Book and provide generic guidelines regarding It. The NO's Notebook essentially empowers the navigator to conduct pilotage from the pelorus without recourse to the charts or publications. The note book should contain the navigator's pilotage and ship handling plan in brief, but covering all aspects therein, including a harbour sketch. It should contain all the information that the NO needs for conduct of pilotage. However, no specific format is laid down for the note book in the Navigation Volumes, and a recommended format is described in this chapter.

2. **Filling up**. It is recommended that the NO's Notebook be filled in hand by the NO. In case, a computer printout is being used, the NO should personally ensure the correctness of all data, updated for the current movement.

3. **General Data**. General data for the ship may be inserted in the inner cover such as Anchors, dimensions and tonnage, advance and transfer for normal pilotage speed, etc.

4. **Additional Data**. Additional data, e.g. change of flow of tidal stream in different parts of the harbour, Gyro checks on each leg, etc, may also be mentioned in the note book. Some Navigating Officers also like to append basic ship data/home port data in the initial pages of the Notebook for quick reference.

5. **Met, Tide, ASTRO and Berthing Data**. This should be entered prior to recording the pilotage data, and should include:-

(a) ETA ·

(b) Berth

(c) Lay of the berth

(d) Clearances ahead/ astern

(e) Wind

(f) HW/ LW timing and HOT, Flooding/ Ebbing

(g) Draught and LDL as per calculations

(h) Astro Data

(j) Communication (MMB/ Motorola Channels)

6. **Format**. The following format is recommended for recording the pilotage data and also recommended by FOST.

ENTERING/ LEAVING HARBOUR

DATE	: ____________	DAY	: _____
BERTH	: ____________	LAY	: _____
ETA/ ETD	: ____________		
TIDAL DATA	:		
HIGH WATER	:	LOW WATER	:
HOT AT ( )	:		
TIDAL STREAM	:	EBBING/ FLOODING (SPRING/ NEAP)	

LDL :	DRAUGHT	:	MTRS
	+SQUAT	:	MTRS
	+SAFETY MARGIN	:	MTRS
	- HEIGHT OF TIDE	:	MTRS
LDL	:	MTRS	

ASTRO DATA

S/R	:	S/S	:
M/R	:	M/S	:
M/P	:	%	

WEATHER	:	______________	
WINDS	:	______________	
VISIBILITY	:	______________	
SEA STATE	:	**IN HARBOUR** :	______________
		AT SEA :	______________
CLOUDS	:	______________	
STORM WARNING	:	______________	
MISCELLANEOUS:-			
POINT OF NO RETURN	:	______________	
COMMUNICATION	:	______________	
TUGS	:	______________	
PORT CONTROL	:	______________	
ADDITIONAL	:	______________	
CEREMONIAL	:	______________	
SPECIAL LTS/ FLAGS	:	______________	
CHANGE OF CON AT	:	______________	
CAST OFF/ ALONG SIDE PLAN (WITH SKETCH)			

7. **Harbour Sketch**. In addition to the above, a sketch of the harbour/ relevant portion of the chart may be etched in the notebook for ready reference. The same should depict the major landmarks and the legs for entering harbour. A radar PPI sketch of the blind pilotage plan should be incorporated in the note book, for each leg, to enable easy orientation on the radar.

8. **Inspection**. The note book should be put up for the Fleet Navigating Officer's perusal during inspection.

9. **The Book**. The size of the note book should ideally be such that one should be able to refer it with one hand while using other hand for taking bearing. Additionally, weather proofing of the note book is recommended, particularly onboard ships with open bridges.

<table>
<tr><td rowspan="2">TRACK</td><td rowspan="2"></td><td colspan="2">HEAD/ STERN MARK</td><td></td><td>DAY CHARACTERISTCS</td><td></td></tr>
<tr><td colspan="2">DISTANCE TO HEAD/ STERN
MARK</td><td></td><td>NIGHT CHARACTERISTCS</td><td></td></tr>
<tr><td>COURSE/
SPEED</td><td>DIST TO
W/O</td><td colspan="3">VISUAL MARKS</td><td>HAZARDS/
NAV MARKS/
GYRO CHECK</td><td>REMARKS</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td rowspan="10">EXPECTED SET AND DRIFT
DTR : MIN DEPTH : M

CLEARING BEARING
OBJ:
NLT: NMT:
CROSS INDEX RANGE
CIR (P) :
NMT: NLT:
CIR (S) :
NMT: NLT:
W/O CIR
OBJECT:
W/O CIR:</td></tr>
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<tr><td colspan="5">NEXT TRACK : COURSE : SPD: KN
DTR: C
HEAD/ STERN MARK:</td><td>MIN SAFE WATER
P
S</td></tr>
</table>

CHAPTER 26

FORMAT FOR NAVIGATIONAL DATA BOOK (NDB)

1. BR 45, Volume 1, 2008 edition, suggests a format for the Navigational Data Book. The format entails a single book, for maintaining a record of the ship's performance under varying conditions to be passed on from commission to commission. A similar format is in use onboard most ***IN*** ships, albeit with minor variations / modifications. The recommended format for use in the ***IN*** is enumerated in the succeeding paragraphs.

2. In maintaining a comprehensive record of the ship's performance certain sections of the NDB bear frequent additions, while others remain largely the same, except for changes that may occur during major refits / change in the weapon / equipment / sensor fit of the ship. Accordingly, it is recommended that the NDB be maintained in two parts. The first part could be made up of sections that remain largely unchanged for long periods, while the second part could incorporate the sections that bear frequent additions. The NDB should be a hard bound or, preferably, tight bound folder of appropriate size and qualify.

3. **Part I**. The following sections could comprise Part I of the NDB:-

(a) **Section I - Dimensions and Tonnage**. This section may contain the following:-

(i) Lengths, breadths, heights and draught.

(ii) Relevant distances - stem to standard, stem to ECP, standard to wing peloruses, stem to RAS points, stem to radar, etc.

(iii) Standard and full load displacement: Net Gross, etc.

(iv) Diagram / photograph of end elevation, from the stern indicating propeller positions. In case of ships with bow/ forward sonar domes, the diagram / photograph from the stem indicating dome position along with the relative position of the anchors (when lowered).

(v) Stability data, Tons per Centimeter Immersion (TPC).

(vi) Visibility diagram for the bridge, particularity on carriers, etc., and for ship's with large blind arcs on the bridge. Shadow distances and corresponding visual references from bridge, wings and bridge top.

(vii) Position of underwater fittings, with corresponding above water references, e.g. echo sounder transducer - frame no. 22 V2 , below port wing gyro repeater, etc.

(viii) Details of underwater fittings that may be proud of the ship’s side, e.g. stabilisers, propellers, etc.

(b) **Section II - Anchor and Cables**. This section may contain the following:-

(i) Make, type, weight, holding power, age of the anchors.

(ii) Details of tests undertaken on the anchors and cables.

(iii) Diagram/ photograph of the anchor deck.

(iv) Photograph of the cable clench securing the inboard end of the cable, including details of locking mechanisms for the same.

(v) Details / certificate of sighting the inboard end of the cable, as mandated by Regs *IN*.

(vi) Diagram of the cable, indicating the position of each shackle therein.

(vii) Capstan capacity, speeds available, etc.

(c) **Section III - Propulsion / Power Generation and Auxiliary Machinery**. This section could be in two parts as follows:-

(i) **Part I - Propulsion Systems**. This part may contain the following:-

(aa) Make, power, rating of engines.

(ab) Schematic diagram / photograph of the engines.

(ac) Detaiis of shafting, including, no. of plummer blocks, etc., and description of shaft engaging / disengaging, etc.

(ad) Modes and regimes of operations. Capabilities / limitations of each, e.g. max speed for trailing shaft, locked shaft, single engine / shaft motoring, link shaft mechanism (where present).

(ae) Details of exploitation restrictions, viz. prohibited / critical regimes, restrictions on wheel, etc.

(af) Brief description of the propulsion chain, reversing mechanism, clutching-in mechanism, etc.

(ag) Safety features, with specific details of automatic tripping, etc.

(ah) Major break down drills, soot blowing drills, etc.

(aj) Notice to motoring. ·

(ii) **Part II — Power Generation & Distribution and Auxiliary Machinery**. This part may contain the following:-

(aa) Make, rating, capacity of PGD equipment.

(ab) Schematic diagram of PGD chain, including options available for redundancy / back up.

(ac) Load management chart.

(ad) Details of auto change over switches, with positions and photographs.

(ae) Details of power supply arrangement for major navigational equipment.

(af) Details of emergency supplies, with specific emphasis on navigational equipment.

(ag) Details of relevant auxiliary machinery.

(d) **Section IV - Revolution Tables & Full Power Trials**. This section may contain the following:-

(i) Speed Vs SRPM tables and graph.

(ii) Acceleration / deceleration tables and graphs, including stopping distance.

(iii) Revolutions for various engine regimes.

(iv) Calculations for surge, across different speed ranges, Calculation of terminal deceleration.

(v) Details of Full Power Trials, including speeds / rpm achieved, position, depth, weather conditions during trials, etc.

(vi) Effect' of stabilisers, retractable sonar domes, towed arrays, etc., on speed/ srpm.

(vii) Limitations on speed/ srpm, during evolutions such as towing, etc.

(e) **Section V - Fuel Oil Capacity & Consumption Data**. This section may contain the following:-

(i) Theoretical and practical full fuel and POL carrying capacity.

(ii) Details of quality of fuel to be used and; minimum criteria for fuel, viz. sulphur content, etc.

(iii) Fuel consumption tables and graphs under. various engine regimes and under varying conditions of temperature, weather, etc.

(iv) Range Vs speed graph.

(iv) Economical speed / regime, with endurance in terms of distance.

(f) **<u>Section VI - Turning Trials</u>**. This section may contain the following:-

(i) Tabular and graphical record of turning characteristics of the ship, at various combinations of speed and wheel (generally, from the trials carried out by the first of the class of ships).

(ii) Endeavour to include Distance to New Course for all angles of turn used. If the data is not available, a blank column may be left in the table to fill in the data, as and when calculated.

(iii) Tactical diameter for various speeds. Tactical rudder angle for the tactical diameter in use in the Fleet.

(iv) Turning at rest, time taken, creep observed if any.

(v) Calculation of fish tail manoeuvres for losing ground for all standard manoeuvres. .

(vi) Drop distance for 360 deg turn at various speeds.

(vii) Diagram for taking up station from the bows.

(g) **<u>Section VII – Ship Handling Characteristics</u>**. This section may contain:-

(i) Responses while turning into / away from the wind.

(ii) Details of leeway experienced for different angles of wind and different speeds.

(iii) Effect of tidal streams experienced.

(iv) Response to wheel with headway / sternway, at various speeds.

(v) Limitations of bridge blind zones, pelorus positioning, etc. _

(vi) Recommended positions for ship handling during various evolutions, viz. alongside, cast off, UNREP, Towex, etc.

(vii) Specific responses under various engine regimes, e.g. single engine, shaft locked / trailing, etc.

(viii) Recommended stages of speed reduction and engine usage for anchoring, etc.

(ix) Recommended approach for Towex, including speed management.

(h) **Section VIII - Berthing Information**. This section may contain the following:-

(i) Schematic diagram of the upper decks, indicating position of bollards.

(ii) Diagrams / record of berthing alongside jetties and other ships.

(iii) Recommended brow length and positions.

(iv) Position for catamarans / fenders.

(v) Recommended placement of fenders/ catamarans for various conditions and requirements of cant.

(vi) Details of cautions w.r.t fittings proud of the ship's side.

(j) **<u>Section IX - Replenishment</u>**. This section may contain the following:-

(i) Schematic diagram indicating position of replenishment positions.

(ii) Recommended approach speed, validation of surge calculated.

(iii) Speed reduction procedure.

(iv) Ship handling procedure for approach and recommended distances to be maintained.

(v) Engine regimes.

(vii) Visual references for various ships, for speed reduction as well as when alongside.

(viii) Interaction effects experienced and corrective action recommended.

(k) **<u>Section X - Navigational and AIO Communication and Conning Positions</u>**. This section may contain the following:-

(i) Schematic diagram / photographs of conning arrangements .and conning positions. Details of voice pipes, intercoms, telephones, etc. that may serve as alternatives.

(ii) Details of positions connected via the various modes of communication and redundancy available.

(iii) Limitations, in terms of ship handling positions, imposed by the conning arrangement.

(iv) Details of internal communication facilities, specifically for navigation and operations (AIO).

(l) **<u>Section XI - Steering Gear and Stabilising Equipment</u>**. This section may contain the following:-

(i) Block diagram of steering gear.

(ii) Steering positions and master / slave relationship therein.

(iii) Description of the steering system chain and functioning, including various modes available.

(iv) Power supply and redundancy available.

(v) Limitations imposed by various modes in use, e.g. no. of turns required on the manual hand wheel for turning the rudder by one degree. Limitations imposed by supporting equipment, e.g. position of gyro repeater, etc.

(vi) Details of the auto pilot (if available) including description of settings.

(vii) Steering gear break down drill, and drill for connecting up various modes, with photographs of relevant valves, etc;

(viii) Details of stabilisers, including operating regimes, limitations during deployment/ retraction (if relevant).

(ix) Diagram and photograph of stabilisers, indicating the amount they may be proud of the ship's side.

(x) Speed restrictions due to use of stabilisers.

(xi) Max operating limits of the stabilisers.

(xii) Details of simulator/ test mode of stabilizers and the cautions to be borne in mind therein.

(m) **Section XII - Compasses**. This section may be divided into three separate parts as follows:-

(i) **Part I - Magnetic Compass**. This may include details of the magnetic compass, including limitations imposed by its position, deviation table and graph, record of full magnetic swing and check swings, including corrections undertaken therein. Details of swinging procedure, including communication procedures during the same and manning requirements.

(ii) **Part II - Gyro Compasses**. This part may include details of gyro compasses fitted, redundancy available, settling time (including emergency), settings required, position of auto change over switch. Record of major overhaul / change of supporting liquid, etc. Record of the general trend in the gyro error[106]. Drill for gyro failure.

(iii) **Part III - Repeaters**. This part may contain details of magnetic and gyro compass repeaters available, including any limitations that may accrue due to the positioning or lack thereof of repeaters.

[106] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

(n) **<u>Section XIII - Echo Sounder</u>**. This section may contain the following:-

(i) Make, type and scales available.

(ii) Modes of operation, particularly if different frequencies are available for different depth scales.

(iii) Mode of recording and position of echo sounder repeaters.

(iv) Equipment to which the echo sounder provides input.

(v) Record of calibration.

(p) **<u>Section XIV - Log and Auto Plotter</u>**. This section may contain the following:-

(i) Make and type of log.

(ii) Position of log repeaters and limitations imposed by the same, if any.

(iii) Equipment to which log feed is provided and consequences of failure of feed.

(iv) Record of calibration and details of procedure used, location in which the calibration was undertaken with prevalent weather data.

(v) Details of auto plotter fitted.

(vi) Limitations and capabilities of the auto plotter.

(vii) Description of procedure for setting up and operating the auto plotter.

(viii) Sensor feeds available to the auto plotter (e.g. log, gyro, etc.) and limitations and redundancy for the same. Consequences of failure of any or all feeds.

(ix) Record of- drift experienced.

(q) **Section XV - Degaussing Equipment**. This section may contain details of the degaussing equipment fitted, including a diagram of the placement of coils, position of operating and indication panels. A record of noise ranging, de-perming, wiping, etc. should also be maintained, including the navigational and technical procedure followed for the same.

(r) **Section XVI - Navigational Lights**. This section may contain the following:-

(i) Number and location of navigational lights fitted.

(ii) Limits of visibility of each light.

(iii) Power supply arrangements, including emergency lights and switching on positions.

(iv) Details of dimmer facilities, if provided.

(v) Record of Nav light arc checks.

(s) **Section XVII - Radars and Radio Aids**. This section may contain the following:-

(i) Details of type, make, frequency bands, beam width, range scales, displays, display functions, ARPA facilities (mapping, etc.), antenna location, etc., in respect of navigational radars.

(ii) Blind arcs and limitations imposed thereby.

(iii) Operating limits of the radars.

(iv) Power supply arrangements and redundancy.

(v) Equipment providing feed to the radars and consequences of failure of one or all of the same on radar performance.

(vi) Details of radar calibration, including method used and index error obtained.

(vii) Details of other radio aids available, including DGPS / GPS, MMB sets, NAVTEX receivers, etc. Positioning of antennae for the same may also be included with photographs.

(t) **Section XVIII - Special Sea Dutymen**. This section may contain details of personnel required to man key posts during important navigational evolutions, e.g. entering / leaving harbour, seamanship evolution, etc. It may also contain the organisation and positions for blind pilotage, anti collision reporting, etc., and reports and sequence of the same during pilotage, etc.

4. **Part II**. This part of the NDB could be maintained as a separate book / folder and may include sections that require frequent additions. The sections that may be included in Part II are as follows:-

(a) **Section I - Steaming Table**. This may be a table with a record of all ship's movements. A recommended format is placed below:-

Sr.	Date/ Time (DTG) from	Date/ Time (DTG) to	Total hours Underway	Distance Steamed	Cumulative Distance steamed	Total Days at Sea	Cumulative Days at Sea

(b) **Section II - Deployment Summary**. This section may contain a summary of each deployment in a tabular manner. A recommended format for the same is placed below;-

Ser.	**Date From**	**Date To**	**Mission**	**Remarks**
1.	12 May 18	18 May 18	WEFDEP 08/18	➢ Fleet Commander embarked ➢ Astern UNREP with ADT ➢ MFSTAR tracking runs ➢ ASU 6 NGFS on 16m Rock (Netrani Island)

(c) **Section III - Record of Dry Docking**. This section may contain a record of dry docking along with the period and version of docking.

(d) **Section IV - Captains Impressions**. This section may contain the experiences, impressions of successive Commanding Officers, and can generally be written by the Captain prior handing over Command.

(e) **Section V - Harbours**. This section may be split into two parts as follows:-

(i) **Part I - Indian Harbours**. Pilotage plans and details of Indian ports.

(ii) **Part II - Foreign Harbgurs**. Piiotage plans and details of foreign ports.

(f) **Section VI - Ship Handling Alongside and Analyses**. This section may contain a record of ship handling alongside and analyses of the movements, which may merit mention and need to be recorded for posterity. and future reference. This could include a **diagrammatic sketch (or ECDIS cut out)** indicating the alongside / cast off plan, including depiction of weather conditions. **The plan** could be mentioned alongside the cut out / diagram, followed by the **analysis/ observations** and **lessons learnt** from the manoeuvre. Preferably, the record should have an index, for port, berth, wind and tide conditions. The serial number of the movement should be entered in this index, to facilitate quick reference as per port, berth and wind/ tide conditions.

(g) **<u>Section VII - Passage Analyses</u>**. This section may contain a record of passages undertaken along with an analysis of each.

5. Navigating officers must pen in their comments on equipment performance / defects observed, in the relevant section of the NDB. This helps immensely in better understanding of equipment performance.

CHAPTER 27

PREPARATION OF PILOTAGE CLAIMS

1. **Authority**. Following documents will serve as reference towards eligibility, pilotage rates and preparation for pilotage claim:-

(a) Regs Navy Regulations1301,1302, 1345,1355.

(b) Navy Order 02/2018.

(c) Govt. of India/State Gazette Notifications issued time to time towards pilotage rate for a specific port.

2. **Eligibility**. The Commanding Officer and Navigating Officer of a ship is eligible for pilotage claim which is admissible only for piloting in/ out of ports and channels where local pilotage has been established. Where no qualified navigating Officer is borne, the commanding officer can appoint another officer, under his command to perform the duties of navigating Officer, who then will also be entitled for pilotage fees. During tenure as Commanding officer or Navigating Officer onboard each ship, the claim is admissible for six in/ out (total twelve including anchoring within port limits) for any stipulated port. The pilotage cannot be claimed if the ship has embarked a pilot for the movement.

3. **Pilotage Rate**. The pilotage rate for a specific port is promulgated periodically by IHQ MoD (Navy)/ DNO as when it is received through Govt. of India/ State Gazette Notification. The rates are generally based on the tonnage of a vessel. The Govt Notification will also amplify if a specific port is authorised for night pilotage rates. These rates may also be revised time to time. The time for night pilotage is considered from evening nautical twilight to morning nautical twilight.

4. **Ports for Pilotage Claim**. Following ports are admissible for pilotage claims iaw NO 02/2018:-

Kandla	New Mangalore	Paradip
Vadinar	Kochi	Mayabander
Bhavnagar	Tuticorin	Rangat Bay
Sikka	Noncowry	Port Blair
Porbander	Kakinada	Diglipur
Okha	Chennai	Campbell Bay
Marmagao	Vizag	Mangdala

5. **Procedure for Pilotage Claim**. While preparing pilotage claim, following are to be kept in mind:-

(a) The claims are not prepared port wise however it is prepared for a specific time period. The claims can be prepared and submitted monthly or quarterly as comfortable. The pilotage claim is prepared on form called IN21 (Revised).

(b) A monthly/ quarterly claim should include all the movements for all the ports entered/ left (provided not crossed six in/ out limit for a specific port and for a specific officer) during that particular month/ quarter. Events in the claim are to be arranged in chronological orders.

(c) Separate claim is to be prepared for Commanding Officer (CO) and Navigating Officer (NO) on Form IN 21 (Revised). Accordingly the supporting documents will also need to be arranged and checked separately for both Commanding Officer and Navigating Officer. The claims are to be prepared in Quadruplicate for both CO and NO. One copy remains onboard as Office Copy. Four copies are submitted to the Operational Authority (e.g Fleet Office/ FNO). After scrutiny of the claim, Operational Authority forwards three copies to the Administrative authority. Admin authority forwards two copies of scrutinized claim to NHQ for rating and the approval.

(d) Commanding Officer is to certify that the amount claimed are in accordance with latest pilotage port rules

(e) Claims are to be serially numbered, commanding Officer from 01 Jan each year. For CO –C01/18, for NO 01/18. These numbers will not change even if the new Commanding Officer/ Navigating officer has joined the ship.

6. **<u>Supporting Documents</u>**. Along with the Form IN21 (Revised), following supporting documents are required to be submitted:-

(a) **<u>Restricted Certificate</u>**. A certificate that the named officer has not completed six in/ out for a specific port is to be prepared and signed by the Commanding Officer. The certificate is to be prepared separately for CO and NO and for the ports mentioned in IN 21.

(b) **<u>Work Sheet for Each Port</u>**. Based on the day/ night rate (given with respect to displacement) for a specific port, a calculation needs to be worked out for your ships displacement for all the ports mentioned in IN 21.

(c) **<u>Log Extract</u>**. An extract from Ship Log Book/ OOW note book is to be prepared for each movement (separately for in and out movements). This extract can be typed in a word file, encompassing all activities starting from closing up of SSD, Visual fixes, connecting up tugs, securing alongside and securing of SSD.

(d) **<u>Admissibility Certificate</u>**. A certificate stating that the movement undertaken by the ship was in best interest of the navy and is signed by the Command Operation Officer (COO)/ Staff Operations Officer (SOO) as applicable. This also includes the DTG of the completion of the movement and authority for the movement.

(e) **<u>Night Pilotage Certificate</u>**. A certificate signed by COO/ SOO, stating that the movement was conducted during night time and was conducted due to operational requirement.

(f) **<u>Signals</u>**. A copy of following signals will required to be enclosed:-

(i) Sailing Order
(ii) Permission to enter harbour
(iii) Permission to leave harbour
(iv) Motoring signal (if in company)
(v) Any signal/ fax which concerns to the change in already promulgated Deployment Programme.

(g) **<u>Copy of Deployment Programme</u>**. A copy of deployment programme which has mention of the entry/ leaving of the ports mention in IN 21.

(h) **<u>Appointment Letter</u>**. Appointment letter of CO and NO is to be submitted in their respective claims.

(j) **<u>Captains Temporary Memorandum (CTM)</u>**. A CTM for the duties of officer, stating the officers for whom the claim is being submitted are carrying out the duties of Commanding Officer / Navigating Officer.

7. **<u>Preparing Pilotage Claim</u>**. Following points may be helpful in timely preparation and submission of pilotage claim:-

(a) Have four different files for pilotage claim. The first file should have the copy of latest Navy Order on Pilotage Claim and all Govt Gazette notification on pilotage rate for the ports eligible for pilotage claim.

(b) The second and third file should have all the filed claims for the CO and NO respectively.

(c) The fourth file should be a working file, wherein you can keep all the supportive documents required for the preparation of next pilotage claim. Sufficient copies of Appointment letters for both CO and NO, copy of CTM and Ships Tonnage Certificate (Certificate issued by IRS and is available in Ship Data Book) should be readily available in the file.

(d) The NAVYEO should be instructed to keep one copy of signed Deployment Programme in the working file as soon as it gets signed. Also he should get in liaison with MCPO/ CPO YEOMAN and get one copy each of all the signals mentioned at para 6(g) above. A cross check by you after the end of deployment (soon after securing alongside) will streamline the process.

(e) Getting the admissibility / Night certificate causes the maximum delay in submission of pilotage claim. Therefore, on entering a port (other than base port) for which you have to submit the pilotage claim, send your NAVYEO (or a suitable sailor) to COO/ SOO office with required copies of Admissibility/ Night Pilotage certificate (with one row blank for the movement you will be undertaking while leaving harbour) for getting it signed. Don't forget to get a round stamp put on it. Additionally, you can also send the draft admissibility certificate by SECEM to the concerned COO/SOO soon after you leave harbour with request to send desired no of signed hard copies back by normal post.

8. **Pilotage Claim for Foreign Harbours**. Pilotage for entry/ leaving from a foreign port can also be claimed, if there was no pilot embark for the movement and movement was undertaken within port limits. All such claims are to be supported by relevant

extracts of pilotage rates obtained from the local port authorities and duly certified by the Indian Mission/ Embassy. In addition, the commanding officer of the ship needs to certify that that the pilotage is not compulsory in that particular port and that the pilot from local port authority was not embarked for the movement.

9. **Pilotage Claim for Newly Constructed non-Commissioned Ships**. This aspect is not mentioned in NO 02/18, and therefore pilotage claim in respect of non-commissioned ships are not being entertained by DNO. However, one needs to check the contract with shipbuilder, whether navy has agreed to provide master and pilot during the Contractor Sea Trials phase. If yes, then no pilotage fees can be claimed. If it has not been mentioned in the contact, then the shipbuilder is supposed to provide the pilotage fees to the master and pilot (CO Desig and NO Desig) if no civil pilot embarked for the movement.

SECTION IX

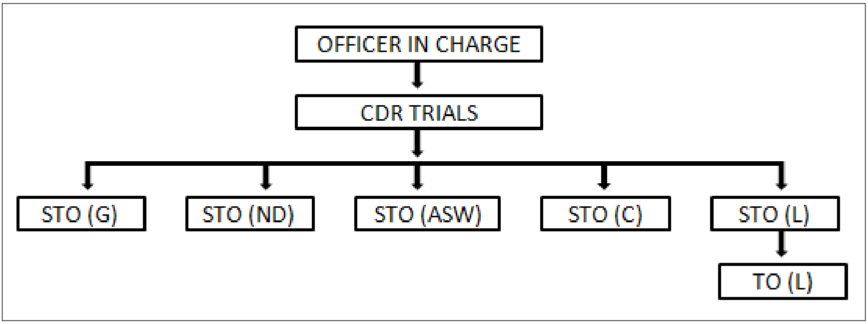
MISCELLANEOUS

CHAPTER 28

HATs/SATs OF NAVIGATION EQUIPMENT

1. The optimal exploitation of weapon and sensor equipment is critical in ensuring successful engagement. This can be achieved by addressing two issues. Firstly, by correct testing and tuning which can be achieved by HATs and SATs of the equipment. Secondly, by systematic conduct of operator training on equipment. Timely conduct of HATs and SATs of an equipment goes a long way in ensuring OP availability of weapons and sensors during prolonged deployments.

2. Weapon Acceptance Trials Team (WATT) is the nodal trial agency, tasked with carrying out trials of Weapons and Sensors of the *IN* ships and submarines. The WATT is directly responsible to IHQ MoD (N) for trials of *IN* afloat units which includes ASW, Gunnery, Radars, AIO, Navaids, Communication and EW equipment. It also recommends in respect to policy and procedural matters concerning inspections and trials. The WATT organisation is shown below:-



3. **<u>Occasions</u>**. Occasions for inspection by WATT reps related to navigation aids are mentioned below:-

(a) During Pre-Refit Trials (PRT) of all ships prior to Normal, Medium and Long refits.

(b) On completion of Normal, Medium and Long refits

(c) Installation Inspections, HATs and SATs of weapons and sensors of new construction ships.

(d) After major A's & A's or retro fitment as directed by NHQ / CDHQ.

(e) Trials that are necessary for improved performance of weapon/sensor systems at sea.

(f) As and when directed by NHQ/AAs.

4. The navigational equipment which are to be offered for Ops checks/HATs/SATs are as follows:-

(a) Navigational radars
(b) Surveillance radars
(c) Gyro
(d) Log
(e) Plotting Table
(f) Wind Instruments
(g) CMS
(h) OVNTS
(j) IFF/RRB
(k) Magnetic Compass
(l) Bridge Management System
(m) Echo Sounder
(n) ECDIS
(p) MDA
(q) AIS
(r) GPS
(s) CTD
(t) Integrated Bridge System (*IBS*)

5. **<u>Harbour Acceptance Trials (HATs)</u>**. The maintainer is accountable for HATs of the system/equipment. Though the maintainer is directly responsible for timely coordination with WATT and dockyard for undertaking trials, the operator should also be aware on the progress of HATs and note the observation given by WATT on completion of trials. This will ensure the operator in understanding the equipment limitations and accordingly shape the trial directives for the consort for SATs.

6. **<u>Action before Offering Equipment for SATs</u>**. An approved HATs/ SATs schedule (GRAQ in case of ships under yard production) is to be obtained and adhered to prior conduct of SATs. This may also form a guideline for conducting in-house trials/ pre-SATs of system/equipment whenever possible. The relevant procedures for calibration of some equipment has been mentioned in chapter 8. The occasions for conduct of SATs/ OP checks and associated consort requirements for *IN* platforms is given in **CNO 07/10** which is to be used to prepare trial directives. It is recommended that observation sheets from WATT for various equipment may be kept onboard for reference and undertaking trials.

7. **<u>Proposed Deployment of Fighter Aircraft during Trials as Consort</u>**. Op checks/SATs requires dedicated planning prior sailing as it necessitates effective utilisation and employment of Fighter/MR aircrafts, helo and ships which are used as consorts. The basic requisites for trials are mentioned in ***CNO 07/10***. However, the detailed specifications are to be elaborated in trials directives by the ship to the trial agency and units being tasked as consorts. One of the issues, meriting immediate attention during the trials, is employment of fighter aircraft mainly due to prolonged duration of trials and poor R/T at long ranges. This can be managed in two ways. Firstly, by having two fighter aircraft available for the trials and keeping one overhead while the other aircraft is employed for range trials. Whenever the radar lock breaks, the aircraft overhead may relay the same to the other aircraft. The aircraft while turning towards the ship, should change height and start closing in for maximum and minimum ranges. Secondly, by employing these two aircraft in such a way that at

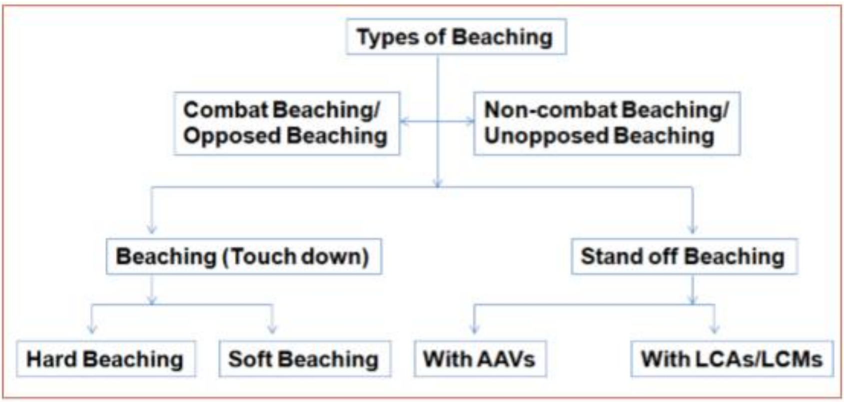
any point of time when one aircraft is closing the ship the other one should be on opening heading, so that R/T at long ranges can be ensured from ship to the aircraft via other aircraft as relay number. Each aircraft may change height as required for trials whenever they are inbound for tracking unit.

CHAPTER 29

BEACHING OPERATIONS

1. Beaching Operations define the physical movement of personnel and/ or cargo to shore. Even during peace time, these are fairly complex in nature, need precise planning and their success hinges on several factors. These include the expertise and work up level of the crew, material limitations and reliability of the ship's critical equipment as well as prevailing conditions of weather and surf.

2. Classification of Beaching Operations. Beaching Operations may be classified as depicted below:-



Hard Beaching by Amphibious Ships

3. The procedure of Hard / Combat beaching mostly involves the same activities except that in hard beaching the ship uses its stern anchor for holding its stern steady on the beach and in combat beaching there is no use of stern anchor. The entire procedure of hard beaching entails four critical phases of operations as mentioned below:-

(a) **<u>Preparation Prior Undertaking Beaching</u>**. The ship is required to be closed up at beaching stations prior to proceeding for beaching as per the manning of the beaching post. The following preparations are to be carried out prior to the beaching operation: -

(b) **<u>Composition of Beach Survey Team (BST</u>**). The composition of beach survey team depends on type of the ship. However, for example, following is the minimum personnel recommended to be available as part of the beach survey team for LST(L):-

(a) NO and Diving Officer/ WKO.

(b) Beach master.

(c) PO RP I/ LS RP I.

(d) Navigator's Yeoman

(e) Four divers (good swimmers trained in operating Gemini in lieu, if divers not available).

(f) One LRO/RO.

(g) Two LEMP/ EMP (If only day beaching is planned, two sailors of any trade are suitable, however, for training purpose LEMP/ EMP may be deployed if feasible even during day beaching).

(h) One Medical Assistant

(j) Five additional Seamen

(c) **<u>Beach Survey</u>**. A thorough beach survey of the beach is to be carried out prior to undertaking beaching. Met data, especially wind data is also to be available. In case of a beach survey done by a previous unit in the recent past the data is to be validated by carrying out a check survey.

(d) **Lay of the Beach**. The lay of the beach is to be determined prior to undertaking beaching either through the large scale chart of the area or whilst carrying out beach survey. This would assist in determining the approach leg while proceeding for beaching.

(e) **Draught**. Establishing correct draught of the ship is very critical prior to beaching as it determines the amount of clearance available under the propeller when the ship beaches on the beach depending on the beach gradient. It also determines the depth of water at the ramp at the touch down point which is critical for the disembarkation of vehicles and troops subsequently. The trim should be achieved accordingly so as to keep adequate under water propeller clearance when beached. A trim aft by about 2 mtrs (optimal trim 3 mtrs) is suitable for a beach gradient of 1:30.

(f) **Centralised Briefing**[107]. Centralised briefing is to be conducted for all key personnel involved in beaching.

(g) **Reporting Procedure**. A comprehensive, crisp and short reporting procedure is to be adopted and the personnel concerned be adequately trained in such reporting so as to reduce the additional clutter on the intercoms as well as increase the inputs required by bridge for carrying out the evolution effectively.

(h) **Check List**. The check list for undertaking hard beaching should be followed in detailed.

(j) **Time-Line for Beaching**. Timeline to be followed should be discussed with Command and same is to be told in the centralized briefing. Maintaining timelines as planned will ensure smooth transformations of plans into on ground actions.

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[107] Art 1312(u)-(w) p 13-16, BR 45(1)(2) ed 2008.

(k) **Proceeding for Beaching**. Whilst undertaking the beaching run the following issues are to be borne in mind: -

(i) **Approach Course**. The approach course for the beaching run should be perpendicular to the lay of the beach.

(ii) **Exploitation of Engines / Speed**. In LST (L) Class of ships it is difficult to wash off the ahead speed as the ahead power is considerably higher when compared to the astern power. It is therefore recommended that the approach be made at lower speeds in the final stages of the run so as to cater for the inadequacy in generating instant high astern power. The ideal approach speeds were found to be 8 kn at 10 cables to let go stern anchor, about 5 kn at 6 cables to let go, and 2- 3 kn of speed after let go.

(iii) **Winds and Drift**. It is important to determine the general wind and surface drift conditions in the area in order to plan the beaching run. The higher the wind speed greater will be the drift of the ship owing to its large sail area when compared to draught under water. It is recommended that the Ship remain sufficiently off track towards the windward side of the track whilst making approach so as to cater for the drift generated at low speeds at the final stages of the run. It is also recommended to carry out a dummy run at low speed till about 4c from the beach before undertaking hard beaching, so as to determine the direction and strength of the drift.

(iv) **Speed at Touch Down**. The speed at touchdown should be sufficient enough to beach about 1/3rd of the ship on the beach. This would assist the in ship being firmly seated on the beach for the duration of disembarkation of troops and vehicles. In general for a beach having a mixture of lose sand and mud, speeds between 2.0 to 2.5 kn have been found to be sufficient for achieving a firm beaching.

(v) **<u>Ship’s Head</u>**. In the final stages of the run maintaining ship’s head perpendicular to the surf is very critical as it would keep the stern at right angles to the surf. Once the stern anchor is let go the endeavour should be to be perpendicular to the surf and not to regain transit if found off track.

(l) **<u>When Beached</u>**. The most critical part of the beaching operations is to stay on the beach. When beached the following considerations are to be borne in mind: -

(i) **<u>Maintaining Ship’s Head</u>**. It is very important to maintain the ship’s head steady on the beach for the following reasons: -

(aa) It prevents the ship’s stern in swinging towards the beach thereby avoiding the chances of broaching.

(ab) It prevents the unnecessary movement of the bow and ramp door thereby providing safety for the ramp when lowered as well as to the vehicles being disembarked.

(ii) **<u>Use of Bower Anchor</u>**. Use of windward bower anchor underfoot has been found to assist in maintaining Ship’s head steady when beached. This procedure is of particular importance during higher wind speeds and when the ship has not beached firmly on the beach. The weight of the anchor and the cable prevents the ship’s bows from bobbing due to waves hitting the beach near to the bows and also prevents the bow from shifting towards the lee.

(iii) **<u>Exploitation of Engines and Rudder</u>**. Once firmly beached, keeping both main engines clutched in between 0.5-1.0 Ahead and use of the rudder towards the opposite side of the ship's head swing is effective in arresting the ship's head from swinging more than 1-2 degrees either side. At times more ahead power needs to be given to keep the ship firmly beached, especially when the ship has not achieved a firm beaching.

(iv) **Use of Stern Anchor**. On touchdown, announcement is to be made on main broadcast to this effect. The quarter deck is to immediately connect up the aft windlass and take in the slack on the stern anchor wire rope and report to bridge. This ensures that the stern wire is taught and this prevents the stern from swinging on either side. Care should be taken so as not to heave in the stern wire rope too much such that the ship un-beaches because of the astern pull by the wire rope. It is pertinent to mention that the main role of the use of stern anchor during hard beaching is to keep the stern steady when beached.

(v) **Soundings**. Foxle, quarterdeck and midships should at frequent intervals (not more than 10 min) check sounding at their positions by hand-lead and line and report to bridge. A record of the same is to be maintained in the bridge so as to determine the following, from time to time: -

(aa) The depth of water at the ramp is safe for disembarkation of vehicles and troops. Vehicles can be disembarked safely up to depths of 1.4 m near the ramp. However, disembarkation of personnel require less than 1.2 m of depth.

(ab) The amount of water available under the propellers.

(ac) Gradual increase in the depths reported by foxle, midships and quarterdeck, indicates that the

Ship has un-beached. This is also supported by slackening of stern anchor wire rope subsequently.

(vi) **Beam Bearings**. Reporting of beam bearings frequently is also very important as it indicates whether the ship is steady on the beach or has started un-beaching so that necessary ahead power can be given to keep the ship firmly beached.

(m) **Un-Beaching**. During the process of un-beaching on completion of disembarkation of troops and vehicles, the following considerations should be borne in mind:-

(i) **Use of Stern Anchor**. Unlike in the LST (M) Class of ships, in LST (L) Class, the stern anchor is not to be used for un-beaching the ship. The ship is required to use its main engines astern for pulling out from the beach. The purpose of stern anchor is only to hold the stern of the ship steady when beached. As the weight of the anchor and holding capacity is much lesser than the overall tonnage of the ship, unnecessary heaving on the stern anchor may instead of un-beaching, result in either parting of the stern wire rope or anchor coming home.

(ii) **Use of Main Engines**. Once the decision to un-beach has been made, putting engines 2.5-3 astern will result in un-beaching safely. Once the ship has started un-beaching, the ship gains astern movement quickly, therefore, the engines should be used ahead accordingly to restrict astern speed over ground to 0.4-0.8 kn. Higher astern speeds would result in too much slack on the wire rope and may result in the wire rope fowling with the propellers.

(iii) **Maintaining Ship's Head**. It is very important to maintain the ship's head as steady as possible so as to avoid the ship swinging rapidly away from the wind and becoming parallel to the beach. As the ship un-beaches and starts falling astern the ship swings towards the lee pivoting on the stern anchor because of the winds. Use of engines in differential mode and application of counter wheel needs to be resorted to for arresting the rapid swinging of the ship head towards the lee.

(iv) **Heaving of Stern Anchor Wire Rope**. Once the ship unbeaches, the quarterdeck is to take in only the slack of the rope continuously and should frequently report the slack (short stay / long stay / up and down) on cable, angle in which the cable is leading and the amount of cable heaved on deck to bridge. This facilitates the bridge in maintaining safe astern speed. Under no circumstance should the stern anchor wire rope be used for pulling the ship astern.

(v) **Safe Distance to Turn Around**. Safe distance from the beach, depending upon the sea room available, proximity of navigational dangers and available depth, should be decided prior to attempting beaching. Once the stern anchor is weighed, the ship should continue falling astern to this safe distance and thereafter turn around to reciprocal course for opening out from the beach.

(vi) **Indications of Un-beaching**. The following are the indicators of the ship having un-beached: -

(aa) Change in beam bearing.

(ab) Hand-lead and line at foxle leading forward.

(ac) The foxle starts bobbing.

(ad) The sounding at foxle, Q'deck and midships start increasing gradually.

(ae) The GPS shows increase in astern speed component.

(af) Quarterdeck reports continuous slack on the stern wire rope.

Formation Beaching

4. **Formation Hard Beaching**. Formation hard beaching is a process of two or more LST (L) Class of ships undertaking hard beaching simultaneously. It does not necessarily mean that all the ships in the formation are to execute touch down at the same time. A sequential touch down can also be carried out. The following additional issues are to be borne in mind before undertaking a formation hard beaching:-

(a) **Size of the Formation**. The size / number of ships in the formation would depend upon the extent of the beach available for carrying out safe hard beaching, proximity of navigational dangers, and the amount of sea room available in manoeuvreing the ships.

(b) **Order of Beaching / Retraction**. As mentioned in BR 45(4), the windward ship should beach first and retract last. This allows enough clearance between ships whilst beaching / retracting from the immediate windward ship as the drift experienced would be towards the lee, away from the other ship.

(c) **Distance between the Ships**. The distance to be maintained between the ships beaching in sequence should be such that, it caters for the following issues:-

(i) Allow the lead ship to ride up to the beach, achieve a firm touch down and settle comfortably before the second ship commences approach.

(ii) Allows for the second ship to safely abort the run in case of any emergencies / contingency and clear the beach without endangering the beached ship.

(iii) A separation of about 3 cables between two ships undertaking beaching sequentially is ideal in catering for the above mentioned issues.

(d) **Separation between Approach Lanes**. The lateral separation between the approach lanes of ships undertaking formation beaching should be not less than 200 metres in case of sequential touchdown and 350 meters in case of simultaneous touchdown. However, a distance equal to the Length of Ship + Length of Stern Wire rope paid out + safety margin of 50 m is an ideal separation between two consecutive approach lanes if beach space permits.

Stand Off Beaching

5. The concept of 'Standoff Beaching' (SOB) provides marginally greater flexibility than conventional beaching. The essential requirement of SOB is to stop the bows of the ship short of beach, the distance varying with the gradient of the beach and thereafter discharge the amphibious vehicles capable of swimming out to the beach. As is evident, during SOB, at no time the bows touch the beach (unlike conventional beaching operations, where the bow firmly rests on the beach) thereby making the ship positionally unsteady. This is a critical factor and must be catered for while planning.

6. **Under Keel Clearances**. The ship would have greater under keel clearances during SOB operations as it is operating further seawards from the beach. However, if the area is unsurveyed, there is always a possibility of isolated rocks or shallow patches, which may jeopardize the entire operation.

7. **Amphibious Vehicles**. BMPs are capable of swimming out to the beach but are severely restricted in their manoeuvrability in water and particularly in even slightly rough

seas. The capabilities and limitation of these vehicles must be taken into account while determining the limiting conditions for SOB operations.

8. **Procedure for Standoff Beaching**. In order to streamline drills involving the disembarkation of troops, vessels and equipment on to the beach without the ships having to beach, the following Standard Operating Procedure for Stand Off Beaching are to be followed: -

(a) **Beach Survey**. An accurate beach survey is critical for the success of any beaching operation. The beach survey team for 'Standoff Beaching' is similar to that for conventional beaching and no additional gear is required to be carried by the beach survey team.

(b) **Limiting Transits and Beam Mark**. BMPs are likely to get drifted down stream while transiting to the beach. The amount of drift would depend on the existing conditions and the distance at which the amphibian vehicles are discharged into the water. The limiting transits for LST (L) s are required to be placed at a minimum distance of 50 m from the center transit during beaching operations in accordance with current orders. However, this limit would have to be suitably increased to cater for the drift of BMPs during transit to the beach and the time required for beach survey would also correspondingly increase. During standoff beaching the ship would stay farther from the beach, therefore, the base line for rigging up the 'beam mark' needs to be correspondingly increased to provide appreciable change of bearing during the ship's approach. The distance for rigging up the beam mark shall be selected taking following into consideration: -

(i) The beam mark should be so located to be as near as possible to the beam of the ship at the time of stopping.

(ii) The mark shall remain visual and identifiable during the complete run.

(c) **Position for Standoff Beaching**. The first and foremost requirement is to determine the distance at which the BMPs are to be discharged into the water. It would depend on following: -

(i) The depths available in the area.

(ii) Mission requirement.

(iii) The distance at which surfs breaks from HW mark.

(iv) Weather conditions including wind, current and surf and swell.

(v) Navigational dangers.

(d) Standoff beaching is always carried out well seaward of the surf as the ship is more vulnerable to the action of waves, swell, surf and cross current/wind conditions. BMPs have slow speed of advance and are also extremely vulnerable in water. Therefore, the ship would invariably be required to close the beach. However, the ship must close the beach only to the extent required for successful conduct of the mission and must cater for adequate sea room for retraction and emergencies.

(e) The navigationally safe distance to determine the position of the standoff beaching is between 500 m to 1500 m from the mean low water line (the maximum distance for BMP induction is 1500 m). This distance may be reduced depending on the workup of the BMPs and the depth in the area.

(f) **Approach Course**. The approach course should usually be perpendicular to the lay of the beach and a one mile of run is preferable. The BMPs have almost negligible manoeuvrability at the moment of entry into the water. If the waves break at the bow door, then in rough seas the BMPs might get swamped by them and nose-dive into the water.

Therefore, it must be ensured that there are no sideways components of the waves at the ramp door.

(g) **<u>Stopping the Ship in the Planned Position</u>**. The touch down point is planned during conventional beaching based on various factors and the speed is accordingly reduced to effect the touch down at predetermined speed. It is imperative that the ahead momentum is checked well in time during standoff beaching, as unlike conventional beaching, the beach does not assist in arresting the ahead momentum. Adequate throw off would be required to cater for the current and wind conditions. The stern anchor wire rope goes slack at the time of touch down during conventional beaching.However, the same may not be readily apparent in the case of standoff beaching. Therefore, the quarterdeck crew should be accordingly briefed and the brake must be put on after paying out the planned amount of stern anchor wire rope. The distance to go to be in the position for standoff beaching can be calculated similar to the distance to touch down during conventional beaching.

(h) **<u>Maintaining Position during StandOff Beaching</u>**. Maintaining position is a critical aspect of ‘standoff beaching operations’. It must be ensured that the ship stays perpendicular to the surf and at the same time does not move ahead. The ship may use her engines, bow anchor and stern anchor as required to achieve this. A constant use of engines in astern mode would generally be required to prevent the movement ahead due to the waves if the stern anchor is not holding properly. It should be borne in mind that the dropping of bow anchors underfoot would provide considerable stability to the ship.

(j) **<u>Letting Go Stern Anchor</u>**. A stern anchor is almost invariably used for beaching operations. It is used to keep the stern steady and for retraction from the beach. However, if the amount of stern anchor wire rope paid out is inadequate it may not provide the required holding pull and may lead to dragging of the stern anchor. During standoff beaching, taking into account the position of the ship and corresponding depth available at that position, paying out 30 to 40 m of stern wire rope after the stern anchor is let go should meet the requirement of keeping the ship in position. There being no requirement of retracting the ship as in beaching paying out more than 50 m is neither needed nor advisable.

(k) **Use of Bow Anchor**. Dropping of the bow anchor underfoot can be resorted to for reducing the drift to leeward and to hold the bows in position. As a standard procedure, the windward anchor is to be dropped under foot.

(l) **Tidal Conditions**. Though the standoff beaching may be carried out during rising or falling tide, higher height of tides would provide greater under keel clearance during the approach of the ship.

(m) **Currents**. The effect of current would be similar to the conventional beaching. However, strong cross currents would make the task of maintaining perpendicular aspect to the surf extremely difficult.

(n) **Wind Conditions**. Strong cross wind conditions would be hazardous for standoff beaching as it should not only hamper maintaining the correct aspect but also make the retraction difficult. Greater control of the ship using engines, stern anchor and bow anchor would have to be exercised to overcome the strong wind condition.

(p) **Surf Conditions**. Standoff Beaching should always be carried out well to seaward of the surf. If the circumstances warrant Stand Off Beaching to be conducted close to the surf line, it must be borne in mind that the ship and BMPs would be vulnerable to the action of the waves and adequate precautions should accordingly be taken and position of the ship for Stand Off Beaching be decided as enumerated in the preceding paragraphs.

(q) **<u>Sea State and Surf</u>**. Sea state more than 1 to 2 and surf height greater than 1 m are not recommended for BMP and LCA operations.

(r) **<u>Trim Conditions</u>**. The ability to beach is governed by the trim conditions and the beach gradient. However, Standoff Beaching can even be undertaken on the beaches where the gradients are unsuitable. The trim conditions are to be kept in accordance with the current directives for conventional beaching to prevent any damage to the ship in the event the ship beaches for reasons beyond her control. If the beach gradient is unsuitable for conventional beaching operations, the trim should be adjusted to provide maximum possible clearances aft without adversely affecting the ship handling characteristics.

(s) **<u>Retraction</u>**. Retraction requires as much planning and attention as beaching and essentially the procedure is similar to conventional beaching. The only exception being that there would not be any requirement to raise the bows by de-ballasting. Constant monitoring of the stern anchor wire rope is to be ensured during retraction to obviate any possibility of fouling of the propellers. Smooth and efficient coordination between heaving in the stern anchor and the bow anchor would be required to clear from the beach.

9. All laid down directives for conventional beaching are equally applicable to SOB and must be observed in both letter and spirit to ensure safe execution of the operations.

10. **<u>Machinery Issues</u>**. Both main engines are prone to heavy under loading during beaching operations therefore, exhaust clearance of the engines is to be carried out at every possible opportunity as follows:-

(a) After leaving harbour.

(b) Before commencing beaching run.

(c) Post Completion of beaching run.

(d) Between two beaching runs.

(e) Before entering harbour.

CHAPTER 30

PREPARATION FOR WEFDEP/EFDEP

1. It is an often heard refrain that WEFDEP and EFDEPs (Fleet exercise programmes/ FXPs) are complicated for a first timer NO and he has to prepare thoroughly with every input just to take the ship to the right place at the right time. It is not just about navigation anymore and involves planning for own ship's operational role and timeline activity chart, while being completely in sync with what the Fleet Commander on Flag ship is trying to achieve at Sea. Hence Situational awareness is a must and network centricity along with continuous watch at signal communications is an essential stepping stone to enable presenting a comprehensive tactical picture.

2. Few guidelines towards preparation are as follows:

(a) Prior to WEFDEP/ EFDEP requirements of consorts, tracking/ firing runs, trial regimes and SHOPs requirements should be forwarded to FNO in time for factoring in the deployment programme.

(b) Always obtain the WEFDEP/ EFDEP programme in time (in Soft and Hard) to have a briefing or at least a sit-down of specialists with PWO and Command for a brief walkthrough of the entire sequence of serials planned.

(c) Plan to cast off in short time to allow for any changes in sequence by having Sea and action/ Briefing earlier by 30 min. While the sequence and stationing may commence from leaving tidal basin emphasize on individual actions for Navigational safety in pilotage waters.

(d) Keep a track of Flag ship and all units leaving harbour / joining the formation or carrying out independent trials off the WEFDEP/ EFDEP area. Having a manoeuvring board and fleet disposition board is a must even though MDA and Radar are available.

(e) In case of breakdown or emergency have a mental picture which side to haul out and inform Flag and ships in Coy well in time.

(f) While it is prudent to arrive at RV position 15 min early, MDA should also be used to infer where the other unit is and should you close it for RV and if the stationing is not promulgated then alter parallel to formation course and maintain 3-5 nm clear.

3. A brief Timeline in tabular format is as mentioned below:-

Ser. No	**Timeline**	**Activity**
(a)	D – 1 (or earlier)	Collect FXP copy from fleet office usually finalized post presentation brief to all CO's of fleet. (If its weekend then the WEFDEP Presentation to CO's will be on Friday). Collect the Presentation as well and make hard copies of FXP for bridge/ ops room and OOW and Captains exercise folder in bridge.
(b)	D – 1 (or earlier)	FXP to be plotted on the small-scale chart, with remarks highlighting S/M exercise areas, time of R/V. Remember the Navtrack promulgated is of the Flag Ship so anticipate where your ship is going to be.
(c)	D – 1 (or earlier)	All R/V positions to be plotted on Chart, MDA and ECDIS. (If in PMF serial ensure all stations of different ships / aircrafts have been plotted).

(d)	D – 1 (or earlier)	Prepare FXP file containing FXP, COMPLAN, Signals / Orders for various exercises in sequential order.
(e)	D – 1 (or earlier)	(i) Carryout briefing for HODs Officers and Regulators/COTs a day prior. (ii) Highlight the orders required to be promulgated by own ship with specific Officer designated for action. Demand other orders to be collected by respective departments from concerned units and submit a copy for Bridge/ Ops room. (eg, PMF/ ASU8 orders from FGO, TFX / CASEX orders from FASWO or SOO COMCOS etc.)
(f)	D – 1	Undertake Comprehensive Sea and Action checks and update Ops status.
(g)	D Day Prior Cast off	(i) Bridge and Ops room check off list readily available (ii) All books are readily available in ops room. (iii) JSCP II and Navaids operator's manual readily available. (iv) Bridge and ops room checks off list readily available. (v) Report any defects to NO /NO II after sea and action. (vi) Collect tactical call-signs and Helo call-signs. (vii) Ensure all state boards / totes

		filled up.
(h)	D Day	(i) Carry out Sea and action checks and Briefing for leaving harbor in advance by 30 min of regular timings to cater for any change in leaving harbour sequence. (ii) Keep a visual watch on FLAG ship and ensure TP manned 30 min before First ship in sequence casts off from harbor. Address Flag in all signals viz, ‘Have slipped’ reporting of defects or Gyro error on leaving harbor.

CHAPTER 32

READY RECKONER ON PILOTAGE

Pilotage Planning – Visual

1. **Know Your Job**. The start point of effective and efficient pilotage is knowing your job. Each man in the team needs to be aware of his roles and responsibilities. Ensure regular PQS of the pilotage team. Conduct it regularly and sincerely! We all know that piloting an aircraft is an exercise in precision and exactitude. Why should piloting a ship be any different?

2. **Initial Preparations**.

(a) Keep your pilotage planning checklist handy at the start, lest you forget some key facet! {***Ref****: Art 1310 of BR 45(1)(2) for detailed checklist}.*

(b) Consult all Books, Publications, Notices and Orders before you decide on key facets of Pilotage. {***Ref****: Art 1311(a) of BR 45(1)(2) for the list of books to be consulted}.*

Distinguishing a Well Surveyed Chart
(Ref para 0626(b) of BR 45 (1))

A reliable chart shall have:-

- *Reasonable modern survey.*
- *Credible survey authority.*
- *Adequate survey scale.*
- *Close depth contours and continuous soundings.*
- *Good topographical detaiis.*

No suspicious inconsistencies of any sort (eg. errors in latitude and longitude for geographical position should be carefully assessed).

3. **<u>Preliminary Chart Work</u>**. {***Ref***: *Para 1311 of BR45(1)(2)}*

(a) Select the largest scale chart suitable for pilotage.

(b) Ensure that the charts are of latest edition and are corrected to the latest NTM/NAVAREA.

(c) Identify the recommended navigational channel and the system of buoyage in use.

(d) Highlight all dangers and insert brief description/obtain photographs of conspicuous objects, if required.

(e) Check the datum of chart and datum shift required

4. **<u>Track Selection on Chart</u>**. **{*Ref***: *Para 1312 (b) of BR 45(1)(2)}*

(a) **<u>ETA/ETD</u>**. Determine the ETA/ETD depending on relevant factors and local considerations, such as tidal streams, HOT, shipping, operational factors, local meteorological effects, availability of tugs, port orders/ regulations etc.

(b) **<u>Underkeel Clearance</u>**. Determine the minimum underkeel clearance and its effect on shallow water interaction.

(c) **<u>LDL</u>**. Determine and plot LDL to ascertain the length and width of navigable track. *{**Ref**: Para 1311 (d) of BR45(1)(2)}*

<u>Shallow Water Effect (SWE) – Onset Depths</u>

{Ref: Para 1220 (d) of Br 45 (1)(2)}

- *The Onset Depth of SWE depends on the ship's spped over displacement.*

➢ *The formula indicates the Onset Depth at which SWE is likely to start to occur (for a single ship in open water) and is referred to as "100% Onset Depth".*

100% Onset Depth (meters) = Vel (knots) x 0.17 x (Displacement in Tonnes)$^{1/3}$

➢ *Depths less than 100% Onset Depth calculated by formula may be referred as their percentage of Onset Depth (eg 50% Onset Depth).*

(d) **Plotting the Track**. Plot track on chart keeping in view availability of headmarks/ transits, local port regulations as also requirements of IRPCS. Rule 9 of the IRPCS states that in narrow channels, vessels should keep to the starboard side as far as 'safe and practicable.' However, depending on the circumstances (eg one way routes/ depth of water/ *interaction effects* etc) it may be necessary to plan to use the centreline, while being prepared to move to the starboard if required.

(e) **Plot the Wheel Over**. Plot wheel over positions using Advance & Transfer/DNC data from NDB.

(f) **Proximity to Dangers.** Track must not pass unduly close to dangers.

(g) **Minimum Speed**. Ascertain the minimum expected depth for each leg.

(h) **Course to Steer**. Adjust planned track for tidal stream and leeway.

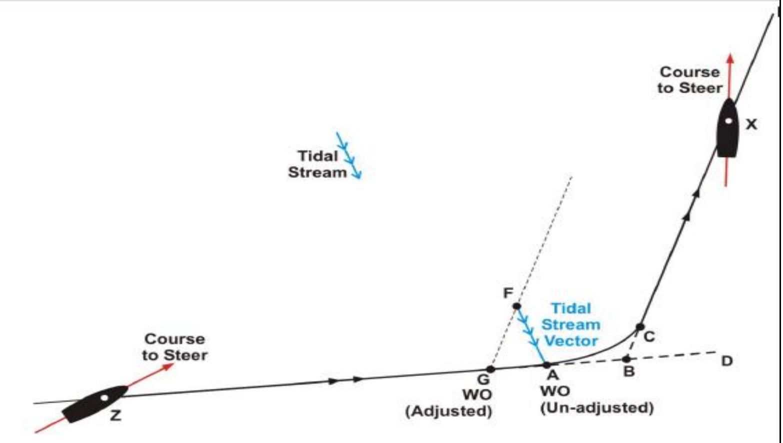
Plotting the Wheel Over in a Tidal Stream

{Ref: Para 1314 (h) of BR 45(1)(2)}

➢ *Plot the Initial (unadjusted) Wheel Over position.*

➢ *Plot AF (in reverse direction) i.e vector distance that the Tidal Stream will carry the vessel during the time of the turn.*

> ➢ *Plot transferred position line GF back to the original Ground Track ZB where it cuts ZB at G.*
>
> ➢ *Position G is the point at which the transferred line cuts Ground Track ZB and is the 'Adjusted' Wheel-Over position which allows for the Tidal Stream.*



(j) **<u>Clearing Lines</u>**. Plot clearing Bearings and Clearing Ranges. Once the LDL has been created and the tracks selected, clearing lines should be plotted to 'box in' the safe navigable water completely.

<u>Clearing Lines</u>

{<u>Ref</u>: Para 1315 of BR 45(1)(2)

A clearing line (i.e Clearing Bearing/Clearing Range) is a line over which the bridge (or the Crossing Position) of a vessel MUST NOT CROSS

(k) **<u>Fixing Marks</u>**. Select fixing objects for each leg and order of taking bearings - ahead/astern first and abeam later. Bear in mind that some marks may be wooded at certain times.

(l) **Track Check**. Running along a 'made to scale' cut-out of the ship on the track to build a mental picture of the sea room available on each leg is strongly recommended.

(m) **PNR**. Ascertain Point of No-Return.

> **Note**
>
> *Few ships designate a PNR when Leaving Harbour. Through the BR 45(1)(2) {Para 1312 (k)} does not forbid this specifically, it does state that the PNR may be well to seaward for a ship, implying that same is applicable when entering harbour alone. As such, the custom has been to only set up PNR when entering harbour.*

(n) **Distance to Run.** Distances to run should be shown on the chart. In the last 10 miles they should be shown every mile and in the last mile every cable.

(p) **Speed, Bubble Times and Arrival Gates.** Accurate speed assessments may be made by establishing fixed positions at which it is intended the ship should pass at specific '*Bubble Times'; 'Arrival Gates' should also be established for* key positions.

(q) **Use of Echo Sounders**[108]. Work out soundings expected along the route to enable correlation with ship's track.

> **Let's be sound about 'Soundings'!!**
>
> *There is a considerable misunderstanding on ships regarding the correct usage of terms related to Soundings during pilotage. The following terms are to be used:-*

[108] Art 0923 p 9-10, 0924 (c)p 9-12, BR 45 (1)(1) and Art 1312 p 13-13, BR 45 (1)(2) ed 2008.

Minimum Underkeel Clearance*. {Ref: Para 1213 of BR 45 (1)(2)}. The term 'Minimum Underkeel Clearance' is the depth required at the deepest part of a vessel during any passage. It is decided by the Commanding Officer, who should be advised by the NO. In benign conditions, a minimum unerkeel clearance of 2 metres at the lowest HOT is normally considered adequate. Though BR 45 does not specifically identify the term ' Alert Sounding' used in the IN, the warning system given out at the Alert Sounding set on the Echo Sounders in IN ships effectively ensures that there is the requisite 'Minimum Underkeel Clearance' below the deepest part of the ship at any point, failing which, a warning would be given out.*

Minimum Expected Depth*. {Ref: Para 1312 (0) of BR 45(1)(2) and Para 0924d of BR 45(1)(2)}. The calculation of minimum expected depth on each leg allows the sounding observed to be correlated to the Nav Plan. The 'Minimum Expected Depth' should be calculated for each leg of the Pilotage track, taking the HOT and whether the Echo Sounder is set to read from the transducer or the waterline into consideration and should be briefed to the Echo Sounder operator.*

Correlating Echo Sounder Reports with Fix on Chart {Ref Para 1312 (0) of BR 45(1)(2)}. When fixing in pilotage waters, the echo sounder reading will not match with the charted depth indicated on chart. To enable a ready comparison with the Echo Sounder report, the fixing team must calculate a particular value (which is a constant for the particular passage) that must be added or subtracted from the Echo Sounder report to compare it with the chart.

Note*:- IN Ships echo sounders have depth settings that may indicate depth below waterline though most are configured to display depth below keel. This must be factored when determining coloumn of water*

available below the keel. The standard practice however, is to set the Echo Sounder to display the depth below the lowest portion of the ship.

(r) **Approval of Nav Plan**. The Pilotage *Nav Plan* must be submitted to the CO for 'Command Approval'. The NO's workbook should be available for scrutiny and full supporting information should be available if required.

(s) **Briefings**[109]. The Pilotage/ Blind Pilotage teams should be carefully briefed on the *NavPlan* in good time before closing up. In addition, an entering/leaving harbour briefing must be conducted.

(t) **Change of Navigation, Execution and Charge of Ship**. Determine positions where NO should take over the charge and con from the SSD OOW. In case the alongside approach is to be done from a different position (bridge top/ wings), decision as to when/ where would CO/NO shift to that position).

Pilotage Planning Blind/ ECDIS.

Blind Pilotage Plan *{Ref Para 1316 of BR 45(1)(2)}.*
➢ *Blind Pilotage plan stems from pilotage plan and is not prepared independent of the pilotage plan.* ➢ *Prepare and paste Radar Indentification Matrix next to Radar Display.* ➢ *Ascertain radar conspicuous objects.* ➢ *Mark clearing ranges corresponding to clearing bearings.* ➢ *Mark the wheel over CIR position for each leg.* ➢ *Mark Cross Index Range foe each leg with NLT, NMT limits keeping clearing bearing in mind.*

[109] Art 1312(u)-(w) p 13-16, BR 45(1)(2) ed 2008.

Note:- ➢ *BSO/ BPO must be proficient in using Radar controls and features.* ➢ *DO not use Map feature using GPS for conducting pilotage from Radar – that is not Blind Pilotage.*
ECDIS ➢ *Ensure ECDIS, including own ship setup, is configured correctly.* ➢ *ECDIS time is to be synchronised with GPS time (if time feed from GPS not directly available).* ➢ *Check all inputs (GPS, Log, Gyro, Echo Sounder, Nav Radar, AIS, etc) are functioning properly. Check on error tote for any input errors.* ➢ *Check electronic charts corrected to latest NTMs.* ➢ *Plot NAVAREA warnings.* ➢ *Transfer paln to ECDIS, ensure datum shift is applied.* ➢ *Plot additional informational like promulgated anchor berths etc.* ➢ *Highlight all navigational dangers (preferably red shaded circles).* ➢ *Check XTE and wheel over correctly entered.* ➢ *Check plot interval settings are at minimum.* ➢ *ECDIS operator to be briefed regarding proper sequence of reporting.* ➢ *Navigating Officer and RP rates must be proficient in ECDIS exploitation.* *Read the Manual thoroughly! There is no easy way out!* *Alarms are NOT to be muted blindly without understanding their signifance*

Pilotage Planning - Cast Off/Coming Alongside

5. **Preparation**:-

(a) **Study of Equipment and Systems**. A thorough knowledge of ship systems, equipment and berth peculiarities is a must prior handling ship. These would include but not limit to:-

(i) Capabilities and limitations of propulsion systems.

(ii) Capabilities and limitations of steering systems[110].

(iii) Layout and functionality of Bridge instruments/equipment/ communications and procedures for use.

(iv) Ship structural and environmental data, e.g. heights of eye, shadow areas, hull form, wind/water ratio, leeway, catamaran's positions, tug securing points, anchor facilities, etc.

(b) **Conning Positions**. {***Ref****: Para 0305 of BR45(6)}.* The choice of *Conning* positions and the timing of any move between them (eg moving from centre line to Bridge Wing) is of utmost importance and should be addressed at the *Planning* stage, as follows:-

(c) **During Berthing**. Changeover of Conning Positions prior settling on final approach leg to berth.

(d) **During Unberthing**. When the ship is pointing into safe water at a steady speed well clear of the berth.

(e) For the final approach to a jetty, the CO may decide to give wheel orders rather than ordering courses to steer. This is to avoid the risk of the helmsman using large amounts of wheel and a swing in the wrong direction being created by accident, close to a jetty.

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[110] Regs Navy Part I Art 0515; BR 3000 Art 0114 & 0902and MSC 1/CIRC 1398 of 10 Jun 11.

(f) **<u>Usage of Tugs</u>**. {***Ref****: Para 0352 of BR45(6)}.* Tugs can operate in one of four methods:-

(i) **<u>Towing Method</u>**. When the *Towing method is used, the tug can pull on a taut* hawser to exert thrust in the required direction and can pivot about the hawser to change the direction of thrust. When *Towing over the stern on* a hawser, the risk of *Girding the tug must always be considered carefully.*

(ii) **<u>Indirect Towing Method</u>**. With *Indirect Towing, instead of* pulling directly down the line of the hawser, the tug drives 'into the hawser' at about 90 deg to the line of the hawser, provided the ship has 3-6 knots head/stern way. The tug's pull acts on the ship at the maximum distance from the *Pivot Point and has maximum turning* effect. ***Indirect Towing is used when manoeuvring large ships*** and is particularly effective when controlling the bow of a ship during a *Sternboard* .

(g) **<u>Push Pull Method</u>**.

(i) **<u>Pull-Off / Push-On</u>.** The more usual variant of the ***Push-Pull method*** *is for* the tug to work around to the 90°position from where it can *Push-On or Pull off* as required.

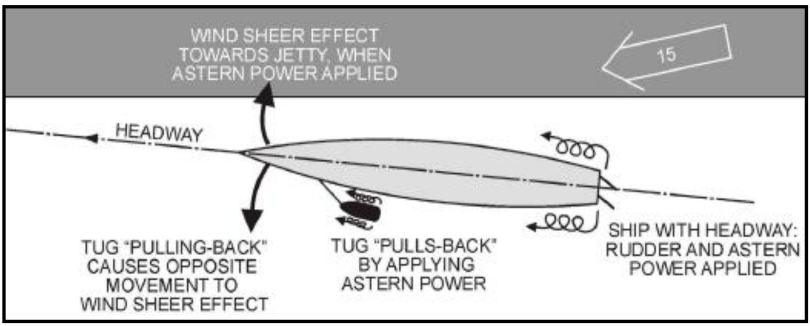
<u>Warning</u>

- ***<u>Girding</u>****.* *Girding a tug will normally cause it to sink and may result in loss of life.*

- ***<u>Avoidance</u>****.* *Avoidance of girding a tug is primarily the responsibility of the ship being assisted.*

(ii) **Pull Back from Aft**. A line from a tug into the *Centre Line* aft, can also be used as an additional method of stopping a ship.

(iii) **Pull Back from Alongside**. A conventional propeller tug can be used with great effect to *Pull-back* from the *Push-Pull* alongside position, provided the ship has headway. By applying astern power from the laying-alongside position, the tug acts as an 'outward forward engine', which pulls the ship's bows away from the jetty and also slows the ship. This option is very useful if berthing in conditions when *Wind Sheer* might cause a sharp turn towards the jetty in final stages.



(iv) **Push-On Method**. A tug may *Push-On* to a ship and is widely used by commercial tugs. The ship must be absolutely stopped in water for it to be effective.

(v) A checklist for factors to be considered is provided at Para 0353 of BR 45(6).

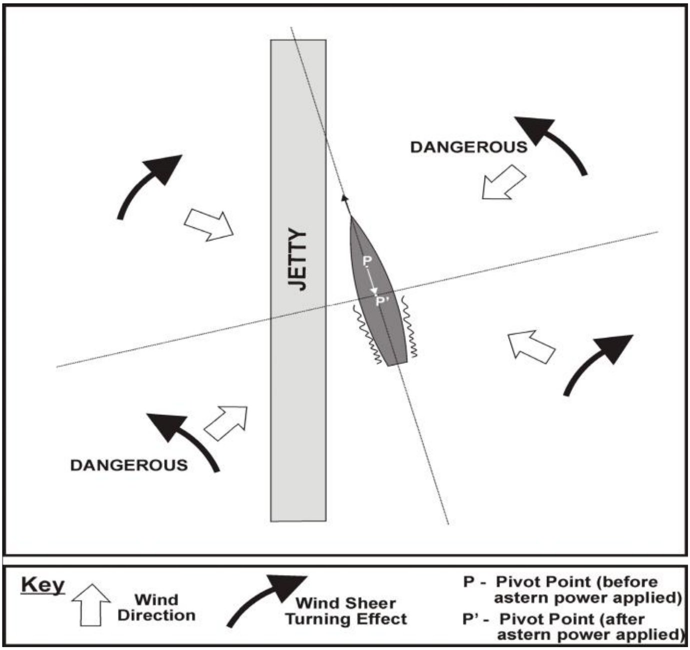
6. **Pilotage Planning - Cast Off/Coming Alongside**.

(a) **Bow Dome Ships**. Unless Berthing catamarans are placed to protect the *Bow Dome*, ships with Bow

Domes fitted usually use shallow approach angles of around 8 degrees with a maximum of about 11 degrees, although this depends on the flair of the bow, the height of the jetty and the ship's draught forward.

(b) **Wind Sheer**.

(i) The rapid aft movement of the Pivot Point while the ship still has headway as a result of applying astern power (eg in the final stages of a manouevre) can have significant effect on how the wind affects the ship. This phenomenon gives rise to the term '**Wind Sheer**'.



(ii) A wind on the inboard quarter or on outboard bow is by far the most dangerous as it constitutes a *Wind Sheer* turning effect towards the jetty. In these circumstances, the best action is to apply the outward helm (ie to starboard in above figure) and start a gentle swing away from the jetty, ***Before*** applying astern power.

(c) **<u>Approach in Calm Weather</u>**. *{**Ref**: Para 0326 (a) of BR 45(6)}*

(i) In calm conditions, approach angles will vary between 8-15 degrees depending on the class of ship.

(ii) The Bridge marker flag/light usually makes a convenient aiming point but if stemming the *tide*, ship's head will need to be aimed up the *Tidal Stream* to achieve a steady bearing on the marker flag.

(iii) A well planned line of approach is the key. Ensure you catch the bearing early. Once on the desired track, never let the bearing slip.

(iv) Avoid rounding out too early to avoid difficulty in passing heaving lines.

(d) **<u>Onshore Winds</u>**. *{**Ref**: Para 0327 of BR 45 (6)}*

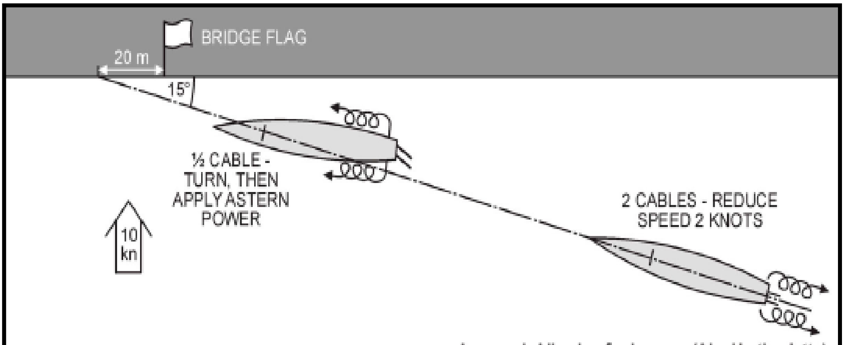
(i) Stop ship parallel to the jetty about 10 metres off the catamaran, close enough to prevent gathering Leeway and berthing heavily, and far enough to provide a margin of safety.

(ii) **<u>Approach in Moderate Winds (upto 15 kn)</u>**.

(aa) An 8-15 degree approach angle should be used.

(ab) The aiming point should be moved along the jetty by 2 metres forward of the Bridge marker flag/light for every knot of wind.

(ac) Higher approach speed may be used to reduce the effect of Leeway while closing the jetty.



Approach Allowing for Leeway (Aim Up the Jetty)

(ad) Consider securing a tug on a 'lazy' hawser; this precaution may be invaluable to hold or pull the bow away from the jetty, if the approach does not work out as planned.

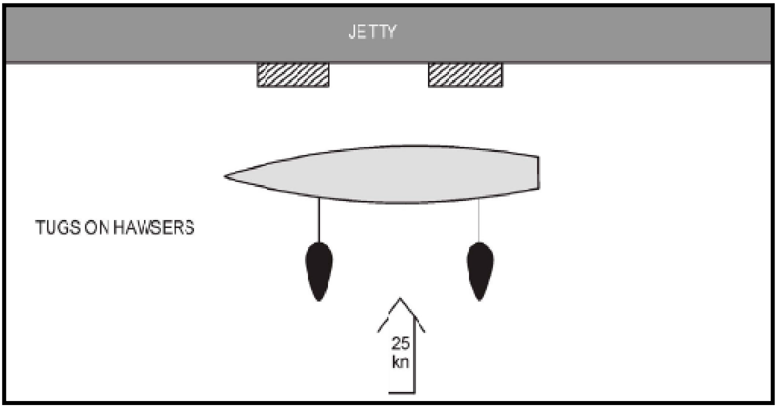
(e) **<u>Approach in Strong Onshore Winds (above 15-18 kn) with Tugs</u>**.

(i) Berthing without tugs would not be prudent, unless an anchor is used to hold the bow.

(ii) If tugs are to be used, they should be secured early (ideally about 7-8 cables from the berth) with speed reduced to 6 knots.

(iii) If only one tug is available, it should be secured on the bow, with the propellers/rudders being used to control the stern.

(iv) Aim to stop the ship parallel to the berth, far enough to give time for the tugs to take position to windward and let the ship gently down on to the berth.



(f) **<u>Approach in Strong Onshore Winds (above 15-18 kn) using Anchor</u>**. An alternative is to stop upwind of the jetty and parallel to it, and let go an anchor *{Refer Para 0345 of BR 45 (6) for further details}.*

<u>Offshore Winds</u>. *{**Ref**: Para 0328 of BR 45 (6)}*

(g) **<u>Approach in Moderate Winds (Without Tugs)</u>**.

(i) Steepen the line of approach, aiming at the Bridge marker flag; add upto 1 degree to the standard angle of approach for every knot of wind.

(ii) Standard approach speed may be used, but higher engine power may be needed to counter the effect of wind.

When the bow is close to the jetty, manoeuvre boldly to swing the bow away while heaving lines are passed.

(iii) Pass the Fore Spring first (rigged from a fairlead well aft towards the Centre of Gravity), so that it may be used to hold the ship bodily up to the jetty while the Head and Stern ropes are passed.

(iv) An alternative is to pass the Head Rope first, and as soon as it has been brought to the Capstan, use the engines to work the stern in towards the jetty, veering on the Head Rope to allow the ship to turn.

(h) **Approach in Moderate Winds (Tugs Available)**.

(i) Steeper approach angle is not so important.

(ii) Connect up both tugs with lazy lines; at about half cable to berth, the tugs can position in Push mode.

(iii) Closer to jetty, tugs push on as lines are passed.

(j) **Winds from Quarters**. With a wind on the inboard quarter, if at all possible, secure and use tugs and approach at a standard or a shallow angle. If tugs are not available, a shallow angle will minimise the risks of Wind Sheer and being blown outwards off the berth, but leaves little room for error on the approach.

7. **Pilotage Execution - D Day Management**

D Minus 1

(a) **Sea and Action**. Conduct Sea and Action. Update Ops Status. Special emphasis on Steering Gear.

(b) **<u>Lubber Line Alignment</u>**. Check Lubber line alignment. It is important that your repeaters indicate correct bearing.

(c) **<u>SSD</u>**. Check for any critical shortfall/change in SSD manning which may affect the conduct of pilotage. Update SSD CTM.

(d) **<u>Winds</u>**. Monitor winds at the same time of cast off.

(e) **<u>Tidal Stream</u>**. Assess tidal conditions at similar time interval from HW/LW. Use Dutchman's Log as required.

(f) **<u>Rope Handling/Yokohama</u>**. Adjust the Yokohoma and shift ropes as required for cast off. Use suitable winds (offshore!) and tide to adjust the position of Yokohama/fenders.

(g) **<u>Administration</u>**. Get the Sailing Order Book signed; discuss routine for next day, including briefings with Executive Officer and promulgate in Daily Orders. Announce the ship's programme.

(h) **<u>Room for Manoeuver</u>**. Plot the ship's position at berth using 'cut out' on the chart. Also plot other ships in the vicinity of own berth. Now, check the **room available** for the manoeuver. Cater movements planned in vicinity up to time of own ship's cast off. Cant/approach planned should also cater for employment of tug(s).

<u>D-Day</u>

(a) Conduct Pilotage Briefing prior commencement of Sea and action.

(b) Conduct thorough ***Sea and Action***. Thoroughness of Sea and Action is vital for safe conduct of pilotage.

<u>Note</u>:- Do not let administrative activities overshadow critical operational requirement of Sea and Action.

(c) Re-ascertain wind and tidal conditions at berth.

(d) Check if the berth is clear. Confirm ahead/astern/abeam clearances.

(e) Check Berthing party is available and Yokohama/fenders are in desired positions.

<u>Amount of Cant</u>

➢ *The amount of cant that can be achieved with ropes would depend upon the position of the catamaran/ yoykohoma that is used for canting. The clearance achieved of the stern from the jetty can be calculated by:-*

Separation of stern from jetty (in feet) = Distance from Pivot point to stern (in cables) X Number of degrees of cant X 10

➢ *"Pivot point in this is the point at which the ship rests and pivots about the Yokohoma/ Catamaran.*

➢ *This calculation is a useful aid in determining the clearance that can be achieved by cant from ships astern.*

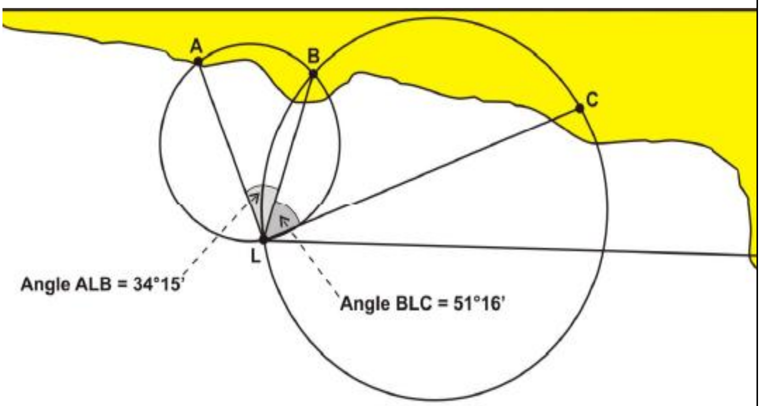
➢ *Cant can be further increased by giving ahead on outboard engine momentarily. Engines can also be used in cockscrew fashion taking care that inboard propeller is well clear of jetty.*

8. **Pilotage Execution**.

(a) **Gyro**. Ensure gyro switching on ordered in time. Ascertain **Gyro Error** [111]**at berth** *{**Ref**: Para 0811 (b) of BR 45(1)(1)}*

Method to Establish Gyro Error

➢ *There are various methods to find gyro error. However, when the ship is berthed alongside or at anchorage, the best method is fixing the ship using HSA fix.*



In the HSA fix method, three fixing objects are identified and the two angle subtended by each is noted down with the help of sextant (or difference of bearings on pelorus, since error on each of the bearings would be the same).

➢ *The ship's position is plotted using a Douglas Protractor or a station pointer.*

Bearing of a distant object is compared with true bearing to arrive at the gyro error

[111] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

(b) Check repeater's alignment with master gyro and recheck lubber line alignment.

(c) Ensure that all positions are manned as per the SSD CTM. Please note that all personnel must be adequately trained prior being designated as **Special Sea Duty Men**.

(d) Adhere to timeline activity chart.

(e) Rehearse (in mind) possible emergencies and actions required.

(f) NO to shift and settle on Bridge Top/Bridge Wing well in time prior cast off and re-check communication with critical posts.

(g) **Maintaining Track**. *{**Ref** : Art 1322 of BR 45 (6)}*

(i) **Basic Axioms**.

(aa) Headmark High – Steer High; Headmark Low – Steer Low (and vice versa).

(ab) Identify objects positively. Never presume! Don't press on in hope when there is uncertainty about the position. Stop instead.

(ac) Cater for gyro error. Make allowance for wind and tide when making good a pre-determined track.

Note: Use of Radian Rule

1 degree subtends 35.35 yards/ 106.05 feet at 1 nm. For mental arithmetic, the approximation of '100 feet' may be used, but this will induce a small 6% under estmation of the distance

(ii) **Manoeuvre to Regain Track**.

(aa) When 'Off Track', it is normally ineffective to merely steer for the mark.

(ab) Steer boldly back towards the track, at an angle 2 or 3 times of the difference of planned bearing and observed bearing.

(ac) Provided that the angle off the planned bearing is small and the range of the Headmark/Sternmark is known, the distance 'Off Track' may be calculated by the Radian Rule. Similarly, the safe water remaining may also be calculated by the Radian Rule

(iii) When a vessel is substantially 'Off Track', provided the range of the Headmark/Sternmark is known, the Radian Rule may be used as follows: -

(aa) **15 deg Offset**. Since Sin 15 = 0.25882 (which can be approximated to ¼), if the distance 'Off Track' is 'x', and the vessel alters 15^{o} from the planned heading, it will need to run a distance of '4x' (down the hypotenuse of the triangle) to regain track.

(ab) **30 deg Offset**. Similarly if sea room permits alteration of course by 30^{o}, the distance required to be run would reduce to twice the distance offset from track. The distance to be run may be calculated with a stopwatch and run accordingly.

(h) **<u>Execution and Monitoring of Turn</u>**. *{**Ref**:* Para 1314 of BR 45(1)(2)}

(i) Look in the direction you intend to turn, prior to giving wheel orders (you should do this immediately prior reaching wheel over point, else your turn will get delayed).

(ii) **<u>Countdown to Wheelover</u>**. When approaching Wheel-Over, it can be helpful for the NO to provide a countdown of the no of cables to run. *{**Ref**: Art 1322 (n) of BR 45 (6)}.*

(iii) Monitoring of turns is important for early corrective action. *Use the fundamentals of quartering bearings.*

(iv) Do not forget opposite quarter when turning.

(v) Be alive to shipping situation at all times.

(vi) When in company, keep the ship(s) astern informed of your movements.

(vii) Allow for adequate clearance when passing buoys and ships at anchor. Pass downstream if possible.

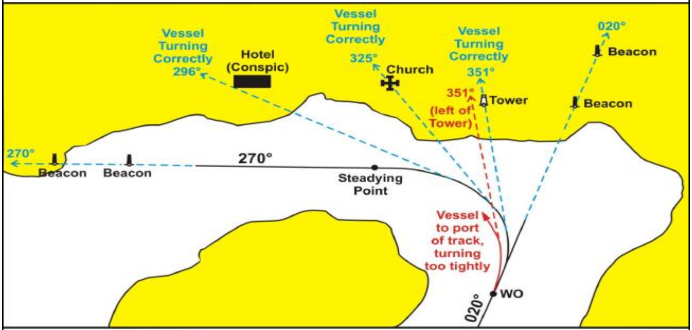
(viii) Pay particular attention to soundings.

(ix) Keep your ship’s stern away from danger. If propellers and rudders are damaged, you are crippled. If the stern is free, the ship can pull herself free.

(x) Do not be an 'Eyeball Navigator' but never disregard visual appreciation of the situation

__Monitoring the Turn__

➢ *To monitor the turn, the curved ground track between wheel over and steadying point should be plotted accurately at intermediate headings.*



➢ *A series of tangential bearings are used to check the turn from the intermediate headings of the curved ground track.*

With ship's head passing 351, the charted tower should be directly ahead. If the ship's head on 351 is left of tower, the vessel is port of track.

(j) __Conning the Ship__.

(i) Always be loud and clear. Your voice must exude authority, but never panic.

(ii) Always physically sight the rudder angle indicator to make sure that the rudder is put in the correct direction.

(iii) Use EOT/ROT for engine orders; Orders given on conning intercom are also to be followed on EOT/ROT.

(iv) Provide QM with hands-free *Conning Intercom*; it will increase his efficiency.

(v) Determine and mark desired position on the volume control dials of all speakers to optimise functional efficiency and manage noise levels.

The Rule of 30

The sum of rudder and speed should not normally exceed 30, unless you are willing to make the ship heel over hard

(k) **Use of Echo Sounder**. *{**Ref**: Para 1322 (d) of BR 45 (6) and Para 0924 of BR 45 (1) (1)}*

(i) Intelligent use of the Echo Sounder is essential to the safe conduct of Pilotage/Blind Pilotage.

(ii) If the reported soundings are different from those predicted, the reasons must be considered and the appropriate action taken, particularly if the soundings are close to the limiting depth.

(iii) If in any doubt about the vessel's immediate safety, it should be turned into safe water or stopped using astern power (as appropriate) until the uncertainty about its position is resolved.

9. **<u>Handling Ship Alongside</u>**.

(a) **<u>General Aspects</u>**.

(i) Maintain Steerageway for as long as practicable.

(ii) The faster the ship is moving through water, the better control you will have. Rudder force and the hull stability depend on speed. Wind and current are felt little by a ship moving at a good speed. {***Ref***: General Ship Handling Tips; Chapter 20; Naval Ship Handling by Crenshaw}.

(iii) Choose visual references (as transits) to determine headway/sternway when turning.

(iv) When collision is imminent and a safe course of action is not apparent, reverse immediately and turn toward danger. Reversing will delay collision and reduce impact. The turn toward danger will reduce the target presented, and the ship can withstand the impact better forward. Head-on collision crumples the bow, but the ship can be cut in two when hit from the beam. {***Ref***: General Ship Handling Tips; Chapter 20; Naval Ship Handling by Crenshaw}.

(v) Avoid passing starboard-to-starboard. The other ship may evaluate the situation as being nearly head-on and cause a collision situation by altering her course for a port-to-port passing. It is safer to alter course to starboard at an early stage and pass port-to-port. {***Ref***: General Ship Handling Tips; Chapter 20; Naval Ship Handling by Crenshaw}.

(vi) Never forget your anchor. Use it as required to conduct the manoeuvre.

(vii) Never hesitate to use tugs.

(viii) Avoid extreme rudder orders towards the terminal stage of manoeuver.

(ix) Do not attempt precise manoeuvres when going astern.

(x) When adjusting position alongside with the lines over, don't wait for the ship to begin moving before stopping engines. The time lag is too long for this. {***Ref***: General Ship Handling Tips; Chapter 20; Naval Ship Handling by Crenshaw}

(xi) Keep the Jack Staff up when maneuvering in port. It is a valuable aid in verifying the ships head with respect to ships and landmarks, and to judge the rate of swing of the bow in a turn {***Ref***: General Ship Handling Tips; Chapter 20; Naval Ship Handling by Crenshaw}

(b) **Ropework**.

(i) Be careful that ropes do not foul the propellers.

(ii) In a tight place where even a small movement in the wrong direction spells trouble, leave a spring line secured to check a faulty movement until the ship is actually moving in the right direction. {***Ref***: General Ship Handling Tips; Chapter 20; Naval Ship Handling by Crenshaw}.

(iii) **Choice of Fairlead for Ropes**. *{**Ref**: Para 0324 of BR 45 (6)}.*

(aa) **Springing the Stern Out.** To achieve maximum leverage to spring the stern out, rig the *Fore Spring* as far forward as possible, ensuring it has reasonably long lead on jetty and **runs as nearly parallel to the line of the jetty as possible**.

(ab) **<u>Springing the Stern In or Out</u>.** A fairlead on the ship's shoulder allows the *Fore Spring* to work either to spring the stern in or out depending on the use of the engines and rudder.

(ac) **<u>Springing the Stern In</u>.** If berthing on a short jetty, where the ship overhangs the jetty and takes *Head* and *Stern Ropes* from dolphins, it may only be possible to pass a Fore Spring in the initial stages of berthing. Rig the Fore Spring as far aft towards the Centre of Gravity as possible. Use of gentle engine power against such Fore Spring will bring the ship bodily sideways to the jetty. Great care is needed to avoid to over-straining the Fore Spring.

(iv) **<u>Tidal Stream/Winds</u>**. {***Ref***: Art 1323 (g) of BR 45 (6)}

(aa) Tidal Streams experienced may not always agree with those predicted.

(ab) Actual time of change of direction may be as much as 1 to 2 hours different from that predicted.

(ac) Allowance for Tidal Stream and wind should always be made by calculating a 'Course to Steer'; it is difficult to recover track if once set downstream

<u>Direction and Strength of the Tidal Stream</u>

- *The direction of the stream could be assessed by:*
- *Heading/ lay of ships at anchorage.*
- *Overboard discharge from ships alongside/ at anchor.*
- *Wash of tidal stream past a buoy.*

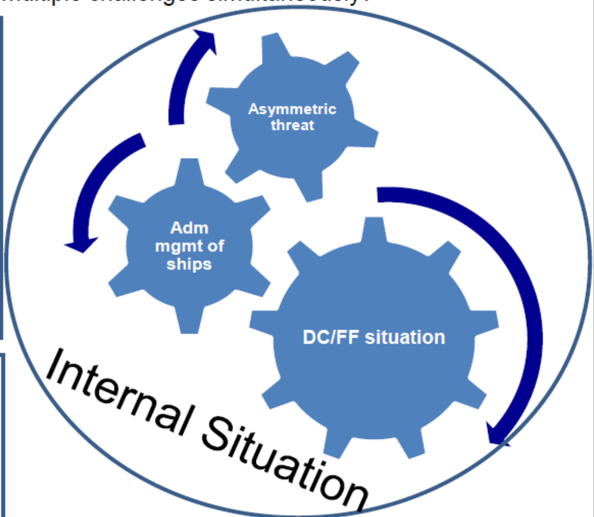
Note: Often, the eye tends to deceive; the actual strength of the tidal stream in knots is not always as great as it appears to be.

SPARE A THOUGHT – ARE WE ORGANISATIONALLY READY?

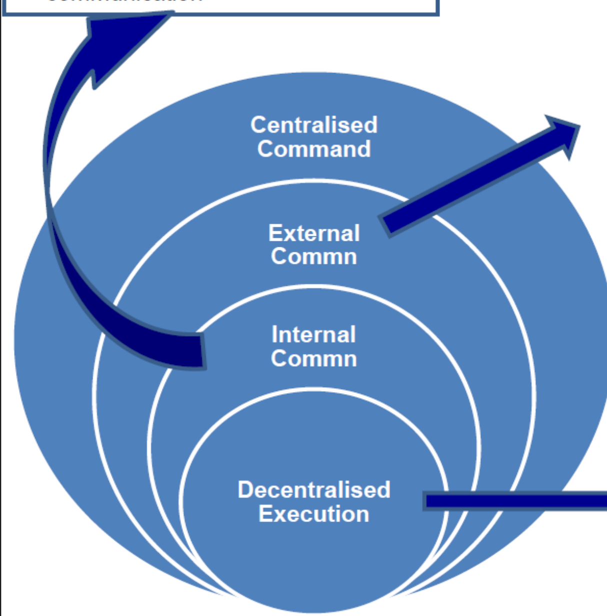
❖ A ship in pilotage waters has to contend with multiple challenges – keeping the ship in safe waters, passing at safe distance from other ships, ensuring onboard safety and countering ever present asymmetric threats. Whilst advancement in technology has made navigation and monitoring of shipping easier, the increase in traffic, higher speeds and challenges from non-state actors has added newer dimensions. Thus on board we need to ask ourselves,"**Are We Organisationally Ready"** to meet these multiple challenges simultaneously?

❖ Organisational Matrix and Measures to ensure flow of Information will vary from ship to ship. Key determinants to be factored

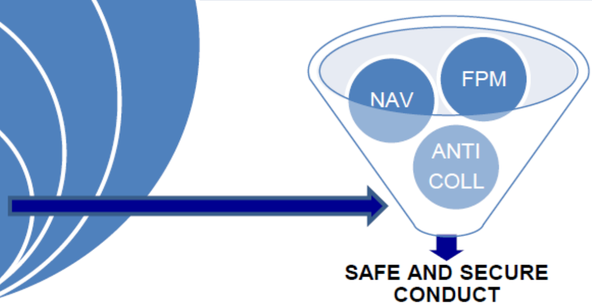
- Decentralise execution with clearly defined responsibilities:-
  - SSD CTM
  - FPM XTM
- Centralised Control of movement of ship.
- Appropriate Engagement Matrix.



- Optimise Internal Communication: through judicious mix of Telling Lines and flow of requisite information to concerned personnel
- Avoid use of V/UHF for internal communication



❖All external communication requirements (and there is a diverse need – merchant shipping, port control, tugs, Navy Control etc)- needs to be rationalised and thought through to ensure all important information is immediately available to Command, without cluttering it with operator natter.



10. **Pilotage Do's And Dont's**

Do's

(i) **Do ensure detailed planning data is cross-checked,** particularly the *Underkeel Clearance, LDL, tracks, Parallel Index Lines, Wheel-Over and Clearing Lines.*

(ii) **Do allow adequate clearances between the *Clearing Lines* and the *LDL.***

(iii) **Do obtain local knowledge if the charts and publications do not appear to be a sufficient guide,** but always treat such knowledge with a proper degree of caution.

(iv) **Do ensure that the Bridge Recorder (or equivalent) has been started** and that a recorded time-check has been made.

(v) **Do ensure that the navigation team and equipment are fully ready** (eg *Echo Sounder, ECDIS, charts, radar, lookouts, anticol, etc).*

(vi) **Do pay attention to the shipping situation, particularly in crowded harbours.**

(vii) **Do treat old surveys with a great deal of caution, particularly in Coral regions;** depths could be much less than charted.

(viii) **Do maintain the DR/EP from the Fix up to the next Wheel-Over;** always know the predicted Wheel-Over time as well as the Wheel-Over bearing(s).

(ix) **Do pay attention to the echo sounder inputs and relate them to the expected depths.**

(x) **Do identify all visual and radar marks.**

(xi) **Do appreciate correctly which side of track the ship is positioned** and which correction must be made.

(xii) **Do allow sufficient correction for Tidal Stream and wind,** particularly during large turns.

(xiii) **Do regain track boldly** (avoid nibbling at corrective action).

(xiv) **Do apply the *Gyro error*** [112] **correctly.**

(xv) **Do monitor large turns carefully** throughout the turn, particularly in big ships.

(xvi) **Do allow plenty of room when rounding points or shoals; cutting corners** can be dangerous (but avoid taking a 'battleship sweep' at them, unless navigating a similarly large vessel).

(xvii) **Do remember the possibility of *Shallow Water Interaction.***

<u>'DONTs'</u>

(i) **Don't neglect the visual situation.**

(ii) **Don't request or order a new course without first making a visual/chart/ radar check** for navigational safety and shipping on the new heading.

(iii) **Don't request or order a new course without first making a visual check** for shipping on the quarter.

(iv) **Don't press on 'in hope' when there is uncertainty** about the vessel's position.

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[112] Art 0121 & 0811 BR 45 Vol (1) (Part I) and Art 1312 (m) & 1323 (h) BR 45 Vol (1) (part II) both ed 2008

(v) **Don’t pass too close upwind or upstream of dangers, anchored ships, buoys** or other obstructions.

(vi) **Don’t attempt to ‘cut in’ ahead of other ships** when approaching the harbour entrance.

(vii) **Don’t forget that the weakest point in most modern *Gyro Compasses* is the transmission system**.

SECTION X

APPENDICES

APPENDIX A
(Refers to Para 1 of Chapter 1)

LIST OF FREQUENTLY REFERRED REGULATIONS, INSTRUCTIONS, ORDERS AND REFERENCES
LIST OF NAVY ORDERS FOR REFERENCE

Ser	Topic	Navy Order
1.	Rendition of Data for Analysis Sensor Performance	*03/08
2.	International Law - Territorial Water, Continental Shelf, EEZ and Other Maritime Zone	31/07
3.	Precaution to be taken while Carrying Out Basin Trials or when Turning Propellers	*20/16
4.	Trials of Equipment after Repair	*08/07
5.	Damage to IN Ships and Crafts - Rendering of Reports	*01/08
6.	Meteorological Charts and Publications – Supply and Accounting Instructions	20/17
7.	Weather Forecast in Indian Ocean	42/13
8.	Disposal of Ships and Submarines Dec Log Books	*05/09
9.	Form and returns Relating to the Magnetic Compass	*06/09
10.	Annual Inspection and Operation of Readiness Inspection of Combat Units	*4/09
11.	Visit of Naval Ships to Foreign Port	*03/11
12.	Sailing Order and Movements of IN Ships	02/10
13.	Survey of Anchor and Chain Cable & Accessories	07/11
14.	SLOC Monitoring and Presence Mission	*04/16
15.	Collection and Rendition of / Oceanographic/ Bathythermograph and sound Velocity Data by Naval Platform during Oversea Deployment	*29/02 and *36/02
16.	Fuel Consumption Trials - IN Ships	*02/14
17.	Maintenance of Inflatable Life Rafts and	20/13 and

	History Card	17/16
18.	Piiotage - Submission and Settlement of Pilotage Claims	02/18
19.	Promulgation of Cyclone/ Storm Warning Signal	44/13
20.	Authorised Scales for Demand and Supply of Navigational Chart and publication for Ship and Shore Authorities	*02/18
21.	Combined Operation with Coast Guard	*10/03
22.	IFF Fitment Policy	*16/03
23.	Echo Sounder Fitment Policy	*17/03
24.	Log Fitment Policy	*18/03
25.	Data link fitment Policy	*21/03
26.	Search and Rescue Organization and Assistance to Ships in Distress, Aircraft Ditched at Sea	06/17
27.	Reporting of Navigational Danger and Change for Updating of Navigational Chart, ENC and Publications	10/12
28.	Ship borne and Air borne Helicopter Controller Course and Classification	17/14
29.	Aid to Civil Power - Disaster Relief by Ships	13/17
30.	General Preparation for UNREP	34/04, 11/11 and 36/13
31.	Promulgation of Navarea Warning	22/12
32.	War Sight/ Aircraft Reports	*08/14
33.	Noise Ranging of Ships and Submarines	*01/06
34.	Ships Weather Observations – Reports and Excellence Awards	03/16
35.	Letter of Proceeding from Ships and Naval Authorities	01/07
36.	Officer of the Executive Branch – Watch Keeping Certificate/ Certificate of competence	11/07
37.	Initial training and award of seniority For officers during ab-initio training	21/15
38.	Conduct of Sea Training Phase and Sub Lt Afloat Training Phase for Executive Branch	08/15

	Officers	
39.	Meteorological Chart and Publication Supply and Accounting Instructions	20/17
40.	Comparison and Calibration and servicing of Meteorological Instruction	46/13
41.	Collection & Rendition of Upper Air Meteorological Data by Units	*06/13
42.	Reporting of Incidents at Sea and Assistance provided	*02/15
43.	Award of Unit Citation	31/13
44.	Allocation of Pennant Number/ Squadron Number & Type Indicating Letters to Ships	*04/08
45.	Naval File List	*04/10

LIST OF BRs/ INBRs

Ser	Name of BR	BR No.
1.	Admiralty Manual of Navigation Vol 0	BR 45(0)
2.	Admiralty Manual of Navigation Vol I	BR 45(1)
3.	Admiralty Manual of Navigation Vol II	BR 45(2)
4.	Admiralty Manual of Navigation Vol III	BR 45(3)
5.	Admiralty Manual of Navigation Vol IV	BR 45(4)
6.	Admiralty Manual of Navigation Vol V	BR 45(5)
7.	Admiralty Manual of Navigation Vol VI	BR 45(6)
8.	Admiralty Manual of Navigation Vol VII	BR 45(7)
9.	Admiralty Manual of Navigation Vol VIII	BR 45(8)
10.	Admiralty Manual of Seamanship	BR 67
11.	Basic Naval Manoeuvering and Signaling Instructions	BR 99/56
12.	ND training manual	INBR 1900/61
13.	Tide additional prediction	INBR 1915/90
14.	Guide to Naval Law	INBR 162/90
15.	Training Aids	INBR 1910
16.	Aircraft direction	INBR 1918
17.	AIO manual 1985	INBR 1625
18.	True wind and flying course computation table	INBR 1924
19.	Scouting operations	INBR 1918 A

20.	Maritime Domain awareness manual	INBR 60
21.	Network centric operations	INBR 61
22.	Basic Naval Manoeuvring and signaling instructions	INBR 1525
23.	Collision and Grounding	INBR 1613
24.	Action Information Organisation	INBR 1982

OTHER REFERENCE MATERIAL

Ser	Topic	Reference
1.	Steering gear checks	Safety Alert 03/14 dated 07 Mar 14
2.	Steering Gear Breakdown	(Safety Acquaint) SAQ/ND-01/03 dated 03 Jul 13
3.	Lookout duties	SAQ/GUN-01/14 dated 01 May 14
4.	Securing of liferafts	SAQ/SS-02/13 dated 20 Feb 13
5.	Duties of ACS/HCS/SRRCS/ARRCS	- INMI - BR 1982A
6.	Aircraft Operations	- INBR 1909 - WHB 0902-WHB on Ship borne Helo Ops
7.	Testing of AVCAT	IHQ MoD(N) letter EG/6321/POL dated 23 May 11
8.	OOW Handing /Taking Over Watch	- BR 45(6) - BR 67(3) - Br 45(8) - Reg Navy Part III, Art 0234 - Post from FOST – May 2007
9.	Passage Planning	- BR 45(1) - Post from FOST – Feb 2004, Vol 8,Issue 1 - Post from FOST – Oct 2010, Vol 14 Issue 3

10.	SAR/ Ready Duty Ship/ Sailing at Short Notice	- Reg Navy Part I - WENCO/ENCO Ops - NO 02/10 - INAP 2 - WEFSO/ EFSO relevant chapter
11.	Manoeuvers	- Post from FOST – May 07 - INMI
12.	Plane Guard Duties	- INMI - INAP 2 - WENCO Ops
13.	Vertrep	WHB 0902-WHB on Ship borne Helo Ops
14.	Precautions during Rough Weather	INWT safety Bulletin 01/14 dated 28 May 14
15.	Handling Ship in Pilotage Waters	Post from FOST – Dec 18 Vol 20, Issue 4
16.	Navigation and Safety	Post from FOST – Jul 2013- Vol 17, Issue 1
17.	Fitment of combiner unit for navigation radars.	IHQ MoD (N)/DSR letter WP/0204 dated 18 Jan 11.
18.	Automatic Identification System.	IHQ MoD (N) WP/0246/A dated 20 Dec 12.
19.	Hand held Laser Range Finder (LRF).	IHQ MoD (N) WP/0617 dated 01 Aug 12.
20.	Night Vision binoculars.	IHQ MoD (N) EE/04/1606/L-47/Nav-06 dated 20 Aug 07.
21.	Policy on migration to ECDIS as primary means of navigation.	IHQ letter OP/OPD/4471/ECDIS Dated 07 Jun 12.
22.	Enhancing Bridgemanship Standards.	IHQ MoD (N) letter TR/0886/ND/P dated 06 Jun 14.
23.	Award of Watchkeeping Certficate (WKC) for Executive Officers.	IHQ MoD (N) letter NA/0101/Policy dated 24 Feb 14.

24.	Helo deck markings.	IHQ MoD (N) letter AO/1337/MARKING dated 12 Feb 10.
25.	Helo deck and flight deck.	IHQ letter NC/0528 dated 12 Jun 02.

APPENDIX B
(Refers to Para 4 of Chapter 14)

FORMAT – PILOTAGE BRIEFING

(TIME – AS REQUIRED TO COVER IN DETAIL)

GENERAL	
GEOGRAPHICAL POSITION	
ETA/ ETD	
BERTH/JETTY	
SHIPS IN COY	
LIKELY STATIONING / SEQUENCE	
SSD ORGANISATION	
SSD POSTS / SPECIFIC NOMINATION	
DISENGAGED SIDE SAFETY	
ANY SPECIAL POINTS / CAUTIONS	
CHARTS	
CHARTS TO BE USED	
INSTRUCTIONS / POSITIONS FOR CHANGING CHARTS/LIMITATIONS ON FIXING OBJECTS AS A RESULT OF CHART CHANGE	
MET AND ASTRO	
WEATHER FORECAST/ WARNINGS	
TIDAL DATA	
SOLAR DATA	
LUNAR DATA (IF APPLICABLE)	
WIND CONDITIONS AND EFFECT AT BERTH/ DURING PILOTAGE	
CLOUD COVER	
SEA STATE	
VISIBILITY	
OVERVIEW	
GEOGRAPHICAL OVERVIEW OF HARBOUR	
NATURE AND DENSITY OF TRAFFIC INCLUDING	

TRAFFIC IN CHANNEL	
CLEARANCE FROM NAVY/PORT CONTROL	
FREQUENCY OF FIXING	
HEIGHT OF TIDE	
LDL CALCULATION	
MIN EXPECTED DEPTH FOR EACH LEG	
AVAILABLE DEPTH / WIDTH OF NAVIGABLE CHANNEL ON EACH LEG	
NAVIGATIONAL DANGERS IN HARBOUR AND PROXIMITY ON EACH LEG	
BUOYAGE SYSTEM	
DETAILS OF NUMBER/ PHYSICAL ATTRIBUTES OF BUOYS	
SEQUENCE OF REPORTING	
PLANNED SHIFT IN CHARGE/CON	
POINT OF NO RETURN	
PILOTAGE PLAN (LEG WISE)	
CLEARING BEARINGS FOR EACH LEG	
WHEEL OVER BEARINGS	
CLEARING RANGES FOR EACH LEG	
SAFE WATERS ON PORT/ STBD	
CIRS/ WHEEL OVER CIRS/ DR	
BLIND PILOTAGE PLAN	
BERTHING	
BERTHS AVAILABLE	
LAY AND LENGTH OF BERTHS	
AVAILABILITY OF BOLLARDS/ DOLPHINS	
FENDERING AVAILABLE	
ANCHORAGES AVAILABLE	
ALLOTTED BERTH	
DEPTHS	
AMOUNT OF CABLE	
EXPECTED SET AND DRIFT OFF/ AT BERTH	
PILOTAGE PHASE	
PILOTAGE COURSES	
PLANNED SPEEDS/ ENGINE REGIMES	

LIKELY SET / DRIFT AND COUNTER ACTIONS	
VISUAL FIXING MARKS TO BE USED ON EACH LEG	
RADAR CONSPICUOUS MARKS TO BE USED ON EACH LEG	
TRANSITS AVAILABLE	
HEADMARKS TO BE USED FOR EACH LEG IF APPLICABLE	
ALTERNATE BERTH / PLAN	
TUGS	
NUMBER / NAME OF TUGS	
CAPABILITIES OF TUGS	
COMMUNICATION FREQUENCIES / CHANNELS	
TUG CONTROL ORGANISATION	
PART OF SHIP ACTIONS	
BOATS	
PILOT EMBARKATION	
ANCHORS	
AMOUNT OF CABLE REQUIRED IN EMERGENCY	
PLAN FOR BERTHING HAWSERS	
REQUIREMENT OF ADDITIONAL LINES	
REQUIREMENT / POSITIONING OF FENDERS	
STEM BOLLARD AND BROW POSITIONING	
PORT ORDERS IN RESPECT OF CEREMONIALS	
SHIPHANDLING	
BRIEF DESCRIPTION OF ALONGSIDE PLAN	
PLANNED SHIFT IN CHARGE / CON (NO – CO)	
ADDITIONAL INSTRUCTIONS TO PILOTAGE TEAM	
SSD OOW	
VISUAL FIXING TEAM	
ANTI-COLLISION REPORTER	
0Ps ROOM TEAM	
BLIND SAFETY OFFICER	
CHIEF QM	

ECHO SOUNDER REPORTER	
ECDIS UTILISATION	
ANY OTHER INSTRUCTIONS	
MISCELLANEOUS	
OTHER RELEVANT ISSUES SPECIFIC TO THE PORT/ PLAN	

APPENDIX C
(Refers to Para 4 of Chapter 15)

FORMAT - ENTERING/ LEAVING HARBOUR BRIEFING (IDEALLY AROUND 10 MIN)

CONTENT	REMARKS
HARBOUR	SAME SLIDE
DATE/ TIME OF ETD/ ETA	
TIME CHECK	FROM GPS
GENERAL	
PURPOSE	
SHIPS IN COMPANY	
SEQ OF SHIPS ALONG WITH BERTH	
PERMISSION TO LEAVE HARBOUR	
TRAFFIC OBTAINED FROM VTMS	
MET & ASTRO	
WIND, VISIBILITY, WEATHER, SEA STATE	
WEATHER WARNING IF ANY	
SATELLITE PICTURE (WEATHER)	FOR THE AREA OF OPERATION
S/R, S/S, M/R, M/S AND MOON PHASE AS RELEVANT	SPRING OR NEAP TIDE
TIDAL DATA	
H/W, L/W TIMINGS FOR THE DAY AND HOT OF ETA/ ETD	
LDL	
COMMUNICATION AND CEREMONIALS	
INTERNAL COMMUNICATION (MANNING BY NO, CH QM, SSD OOW, MCR)	
EXTERNAL COMMUNICATION	
CEREMONIALS INCLUDING NAME OF PIPING PARTY	PIPING/ DIPPING OF ENSIGN
PILOTAGE	

CONTENT	**REMARKS**
SSD ORGANISATION (FLASH ALL KEY PERSONNEL)	CTM SIGNED ON DATE?
E/L HARBOUR LEGS WITH LENGTHS AND PLANNED SPEED AND TIME ON EACH LEG	MAY BE CLUBBED IN SAME SLIDE
MINIMUM EXPECTED DEPTH FOR EACH LEG	
VISUAL OBJECTS FOR EACH LEG	
RADAR OBJECTS FOR EACH LEG	
GYRO CHECK	
POINT OF NO RETURN	
DANGERS ON EACH LEG	
SEQUENCE OF REPORTING	
PLANNED SHIFT IN CON/ CHARGE	
SHIP HANDLING ASPECTS	
BERTH	
LAY OF BERTH	
CLEARANCE AHEAD AND ASTERN	
STEM/ STERN BOLLARD BOLLARD	
EFFECT OF ***WIND*** DURING FINAL APPROACH AND WHEN STOPPED ABEAM BERTH	ALL THIS MAY BE SHOWN IN ONE SLIDE WITH ANIMATION
EFFECT OF ***TIDE*** DURING FINAL APPROACH AND WHEN STOPPED ABEAM BERTH	
TUGS/ POSITIONING/ UTILISATION/	
PLAN	
TURNING BOX	
ROPE HANDLING	
ALTERNATE PLAN	
ANCHOR PREPARATION AND LETTING GO IN EMERGENCY	
MISCELLANEOUS ISSUES	
LATEST NAVAREA	
NAVAREA AFFECTING HARBOUR	

CONTENT	REMARKS
DEFECTS LIMITATIONS DURING SEA AND ACTION	
OPERATIONAL RISK MANAGEMENT	
EXERCISE SCHEDULED FOR THE DAY	OVERVIEW
LOWERING/ HOISTING OF BOATS IF PLANNED DURING PILOTAGE	
POSITION OF GANGWAY	DURING E/H
INPUTS REQUIRED FROM ALONGSIDE SHIP (YOKOHOMA POSITION, LIKELY WIND AND TIDE)	DURING E/H
ROR FOR THE DAY	
EMERGENCY FOR THE DAY	