

Chapter 4:

Delivery Management



4.1 Nomination and readiness of Shipyards

In view of the declining force levels of the Indian Navy, the Defence Acquisition Council (DAC), headed by the Raksha Mantri, in March 2003 considered the Navy's 15-Year Shipbuilding Plan envisaging 'X' number of ships Navy by 2017. The plan includes 'Z' number of ships of the frigate/destroyer¹ category. The DAC also directed that the Navy should ensure that force levels do not fall below 'Y' number of ships. Given the diminishing force levels on account of ageing and decommissioning, Navy was also under pressure to step up its shipbuilding activities during the 10th, 11th and 12th Plan. The ambitious ship construction plans led to Indian Navy sanctioning three major projects for warship constructions (ten war vessels) within a span of six years².

The Indian Navy has a well-established tradition for constructing ships indigenously. Out of the 13 major war vessels, inducted during the last two decades, ten have been constructed at Indian shipyards. The

¹ The two categories, Frigates and Destroyers, have been clubbed together as in contemporary naval doctrine, the difference in the roles of the two categories has virtually lost their distinction

² 1998-2003 P17 (three ships), P15A (three ships) and P28 (four ships)

selection of shipyard is done by Navy in consultation with the Department of Defence Production. As mentioned at Chapter 1, the nomination of shipyards for construction of Frigates, Destroyers and other larger ships is limited to MDL and GRSE as GSL has built only smaller vessels. Consequently, the flexibility of the Ministry / Navy in nominating a shipyard is limited.

Inadequate Infrastructure at MDL

In 1998, MDL was nominated to construct the P17 class of ships. At that point of time, two ships of Project 15 were in the advanced stage of construction at MDL. The construction of P17 ships started late by 17 months in December 2000. Four months later, it was also nominated for the construction of three ships under P15A in April 2001 on the premise that the shipyard has constructed similar ships earlier, thereby, the advantage of operating with a proven design, past experience and trained manpower would lead to faster construction. Nonetheless, such parallel production of four to six major warships³ was unprecedented. The decision was taken despite the inadequate infrastructure with the yard for taking on the load of warship building of two simultaneous major projects.

Poor Track record of GRSE

As regards Garden Reach Shipbuilders and Engineers (GRSE), its poor track record was evident as it had been able to deliver the P16A class of ships only after delays ranging from 51 to 75 months. Thus, its nomination for the P28 class of ships was based not on the shipyard's inherent advantages but because MDL was already over-loaded and GSL did not have adequate infrastructure to construct bigger warships.

At GRSE, construction of the P28 ships commenced after a three year delay from the sanctioning date. The shipyard could not meet prescribed time-lines of construction in the case of any project. The yard also attributed the delay due to more time taken to train its personnel in the welding procedure for the high-tensile steel specified by the Navy impacting its hull fabrication capacity adversely.

At the time of nomination of these shipyards, Ministry was aware of the inadequate facilities / infrastructure at these two shipyards and the fact that in the past, two shipbuilding projects had faced considerable delays. The impact of this became clear when, in both projects (P15A

³ MDL was also awarded a contract in 2004 to construct six Scorpene submarines under Project 75.

and P17), the original delivery dates extended due to inadequate facilities at MDL.

Subsequently, recognizing that modern infrastructure is critical to reducing build periods, the Navy, sanctioned over ₹ 600 crore from 2003 onwards to MDL and GRSE with the aim to arrest time and cost overruns. Shipyard specific findings related to delays in modernisation activities are given below.

Modernisation Programme of the Shipyards

4.1.1 Mazagon Dock Limited

Presently, facilities at MDL include three dry-docks, three slipways and one wet basin. The need for modernisation was felt as early as 1995 by the shipyard and accordingly, a modernisation programme was also developed by MDL. However, no action was taken on this plan. Later, when the LOIs were issued for P17 and P15A shipbuilding projects (1998-2001), MDL emphasized that these facilities needed to be available progressively between 2003 and 2006 to attain the required shipbuilding capacity.



Inordinate delay

The Ministry however decided that the funding for modernisation of the shipyards would be through naval ship-building projects. Accordingly, in December 2001, two Statements of Case were submitted to the Ministry by MDL at a total estimated cost of ₹281 crore. However, there were delays and eventually, the shipyard modernisation plan was approved in March 2006 at a cost of ₹423 crore (₹206 crore under P75⁴ and ₹217 crore under P17). As of November 2010 out of ₹257.23 crore⁵ released, ₹209.96 crore⁶ was expended for modernization project of the shipyard. It was thus evident that the modernization programme of MDL envisaged as early as in 2001 could not be completed in the last ten years and resultantly all warship construction projects have been significantly delayed.

⁴ P75 – The submarine project- Scorpene

⁵ ₹ 108.78 crore for P17 and ₹148.45 crore for P75

⁶ ₹ 101.46 crore under P17 and ₹ 108.50 crore under P75.

Under the modernization programme, it was envisaged that one new wet basin, extension of slipway - 2 and modular shop as well as Goliath Crane would be constructed. Modernisation Programme also provided for Cradle Assembly Shop, building and ancillary works. Audit noticed that the construction of Wet Basin, Building and ancillary works as well as erection of Goliath crane was beset with repeated delays which had an adverse impact on shipbuilding activities.

Besides the late approval of plans and sanctioning of funds, delays occurred in the modernization programme itself, because of delay by the Ministry in certain contracts on account of security concerns regarding vendors and consequent re-tendering as well as non-availability of clear space for erection of Goliath crane due to on-going construction of ships in slipways.

Impact of delay

The impact of the delay in sanctioning funds and execution of modernisation activities on naval shipbuilding projects was undertaken by MDL in January 2004. As per the analysis, the number of ships which could be built by MDL until 2012 would be less than the requirements of the Acquisition Plan of Navy. As against 11 ships to be delivered in 10 years as per the acquisition plan, only seven ships could be delivered if the modernisation plan was delayed by 12 months and only six ships in case the modernisation was delayed by 24 months. In terms of financial effects, the cost of construction of P15A would increase by approximately ₹ 175 crore for a delay of 24 months.

Audit also noted that due to the delay, the cost of modernisation also increased as the cost estimates were made based on the assumption that the modernisation would be completed by January 2007. As on date, the modernisation cost of MDL is proposed to be escalated from ₹ 423 crore to ₹ 826.11 crore, an increase of 96 *per cent*. This has also led to significant cost increases in these two warship projects, besides commissioning of only one frigate of P 17 till date as against the target of the commissioning of all three Frigates and three Destroyers of both projects.

4.1.2 GRSE Kolkata

GRSE has one dry dock, one wet basin, one building berth and two slipways. The necessity to upgrade the shipyard's facilities was felt while conceiving P28 in 2001-02 itself. With the modernisation expected to cost approximately ₹ 270 crore in 2001-02, it was felt that Navy and GRSE would share the modernisation expenses at ₹ 180 crore and ₹ 90 crore respectively. Against Navy's share of ₹ 180 crore sanctioned in March 2003, ₹ 141.69 crore was paid to GRSE (₹ 34 crore in March 2003 and another ₹ 107.69 crore in March 2007). The shipyard utilised ₹ 137 crore against a total payment of ₹ 141.69 crore made by Navy as of November 2010.



Garden Reach
Shipbuilders and
Engineers



Ship at GRSE

Modernisation plans envisaged a 3000 ton ship lift, apart from goliath crane, one module hall, paint cell and associated facilities as approved by the CCS in March 2003. However, ultimately one dry dock and one inclined berth were finalised in view of doubts about the viability of the shiplift facility due to operation problems and heavy siltation in the river Hoogly. The other facilities such as goliath crane, modular cell paint cell and associated facilities were retained in the plan.

Modernisation of infrastructure at GRSE was to be undertaken in two phases. As on date (June 2010), while Phase I was completed by early 2006-07, the second phase consisting of installation of a Goliath crane, civil works, piping and other allied works is likely to be completed only by 2011. Progress of already contracted works is slow due to technical problems in construction of Corvettes and severe space constraints, etc.

In the meanwhile, in December 2008, GRSE has computed the modernisation cost to be ₹ 605.81 crore⁷ with the revised distribution as ₹ 331.73 crore and ₹ 274.08 crore in respect of Navy and GRSE.

Thus, despite sanctioning ₹ 180 crore for infrastructure development, the yard was unable to put in place the infrastructure required even after seven years of sanction of funds. While the project costs are now estimated at more than double of the original estimate, shipbuilding itself is progressing slowly. Even delivery of the first in class ship has been delayed by four years and none of the Corvettes could be commissioned till date against the target of three Corvettes.



Recommendation

- ✓ *Ministry may revisit its policy of getting its warships built only through DPSUs by including capable shipyards either in public or private sector also.*
- ✓ *Select shipyard that possess adequate capacity and infrastructure keeping in view the features of ships to be built to ensure adherence to timelines and costs.*
- ✓ *Sanctioning of shipyard modernization plans during the construction or even at the time of selection of shipyard should be revisited.*
- ✓ *All shipyards should be modernised and necessary resources be made available to them so as to bring them on par with best shipyards of the World.*

⁷ GRSE justified the increase in cost based on the finalized concept plan drawn up by a consultant wherein ₹ 402.62 crore was estimated, which was escalated up to the year 2009 @ 6 per cent per annum.

4.2 Slippages in Delivery

4.2.1 Time over-run

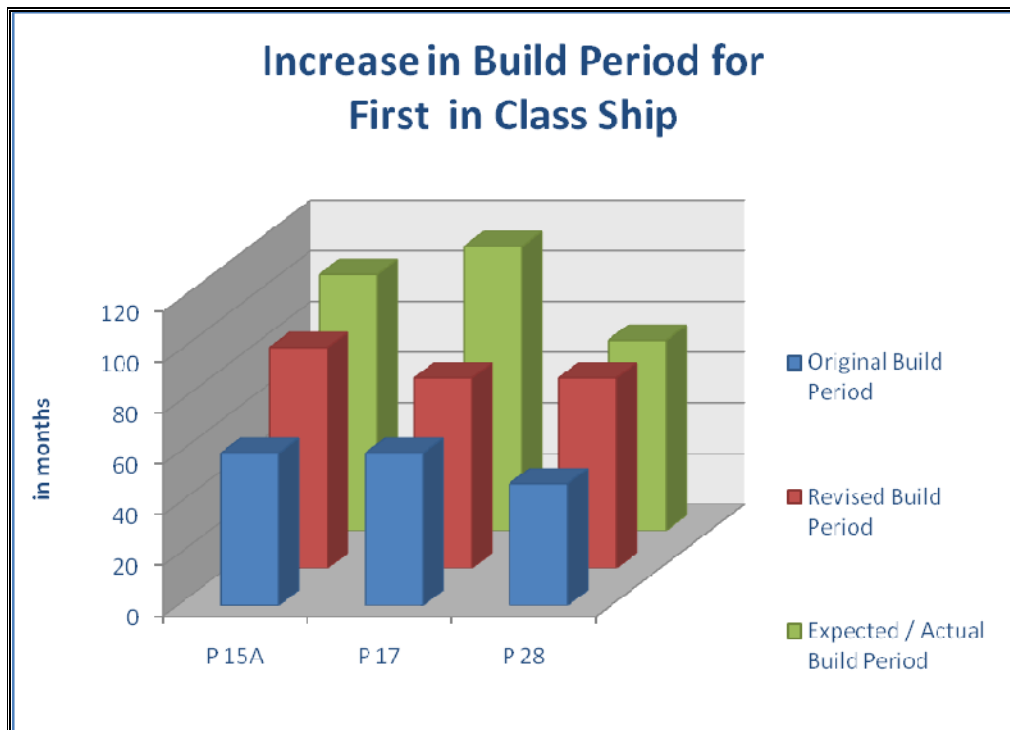
At the time of original sanction of these three projects, delivery period of 78, 86 and 66 months was envisaged in respect of P15A, P17 and P28 respectively. However, as the shipyards were not able to deliver in the specified period, the CFA approved a revised schedule. Even the revised time schedule could not be adhered to as given below.

Project / Date of Original /Revised Sanction	Ship	Original date of delivery of Ships	Revised date of delivery ⁸	Status as of September 2010 in percentage terms	Expected Date of Delivery
P 17 January 1998 March 2006	Ship 1	December 2005	September 2008	100	Delivered in March 2010
	Ship 2	December 2006	May 2009	95.53	January 2011
	Ship 3	December 2007	December 2009	89.18	May 2011
P 15A June 2001 February 2006	Ship 1	2008	May 2010	71.08	March 2012
	Ship 2	2009	May 2011	57.52	March 2013
	Ship 3	2010	May 2012	46.77	March 2014
P 28 March 2003	Ship 1	August 2008	June 2012	47.67*	June 2012
	Ship 2	August 2009	March 2013	27.86*	March 2013
	Ship 3	August 2010	March 2014	11.79*	March 2014
	Ship 4	August 2011	January 2015	5.36*	January 2015

* As of October 2010

⁸ In respect of P28, the revision in dates of delivery has been proposed by shipyard by four years.

Audit observed that only the first ship under P17 has been commissioned and that too after a delay of more than four years from the original delivery date and almost two years from the revised delivery date. Thus, even after a decade, shipyard efficiency in terms of the Build Period has not improved. Against 108 months taken for P15 class of ships, MDL is likely to take 129 and 144 months for the P15A and P17 ships respectively. Also, these figures are almost double the originally envisaged Build Periods as shown in the figure below.



* From commencement of construction to delivery

In the case of the P28 ships, although the original build period is over, only 47.67 per cent of the work is complete for the first ship (October 2010).

Although strict comparisons are not possible, nonetheless, a rough bench-marking with shipyards worldwide reveals that the Indian DPSU shipyards have taken much longer periods to build similar war vessels as seen in the table on the next page.

BUILD PERIOD FOR FRIGATE – INTERNATIONAL SHIPYARDS

Shipyards	Award of Contract to Commencement of Construction (months)	Construction Period (months)	Project Time Frame for First of Class (months)
Lockheed Martin (USA)	24	60	84
Bath Iron Works (USA)	43	36	79
Fincantieri (Italy)	28	50	78
DCN (France)	21	57	78
Daewoo (Korea)	38	34	72
Northrop Grumman (USA)	18	48	66
Hyundai (Korea)	36	30	66
Rosoboron Export (Russia)	30	54	84

As against the above timelines ranging from 66-84 months, the indigenous construction of P15 by MDL and P16A by GRSE took 116 and 120 months respectively. Even in the present shipbuilding projects being reviewed by audit, the situation has remained by and large unchanged, if not worsened.

4.2.2 Reasons for delay

While infrastructure issues have already been discussed in the earlier section, the other main drivers for the delays are elaborated below.

4.2.2.1 Design and technology issues

The design of Navy ships is telescopic in nature, i.e. the process of detailed designing runs concurrently with the ship construction. Thus, changes to the preliminary design become inevitable. Additionally, modifications also become necessary to keep pace with technology changes during the build period. Such changes, in turn, lead to delays both at the start of production and during construction, as shipyards are unfamiliar with the new technology.



INS Shivalik (Project 17)

The design of ship is also dependent upon the parameters of on-board equipment. Unless the parameters of equipment are known, designs cannot be frozen which in turn contribute to delay in construction. Delays were also noticed in finalizing weapon package which resulted in late receipt of binding data essential for design. In some cases, changes in design even led to re-work of already completed portions.

Similarly, some of the on-board equipment was also being indigenized. Delays in indigenization resulted in impact on design as design parameters were received late and consequently resulted in delays in actual ship-building.

The shipyards generally agreed that design changes led to delays. However, they could not specify the impact of the same on construction activities. Therefore, it was not possible in audit to quantify the impact of design changes on the cost and time over run.

Project wise details are discussed as under:

P17

Audit noticed that subsequent to the launch of 1st ship in 2003, a total of 738 modifications were made, triggered by the change in design and selection of equipments. Exhaustive modifications to general compartments on board the vessel were introduced between August - October 2005 by IHQ (Navy) which took a heavy toll in terms of rework. These modifications were primarily to layout in the messes, retrieval

and relaying of cables due to equipment relocation, modifications in magazines and Weapon compartments besides extensive structural rework for installation of bridge windows, Barak and Automatic Missile Detection Radar (AMDR).



NS Shivalik at sea

The construction of the first ship of P17 class commenced in December 2000 as against the originally scheduled date of July 1999, since the structural drawings were not frozen due to non-finalisation of propulsion equipment and weapon package. Further, Navy was designing a frigate with a combined diesel or gas (CODOG) main propulsion for the first time. The retuning of this new requirement and its evaluation took 20 months as against the six months anticipated. Even after the design issues were resolved the shipyard was unable to handle the Gas Turbines and had to depend on the OEM experts, i.e. General Electric personnel, who were unavailable from January 2009 to April 2009. Similarly, non availability of Russian specialists for the LADOGA⁹ system for the first ship also hampered progress.

⁹ LADOGA weapon stabilization platform

The P17 design was made primarily to accommodate Russian weapons. Although the Indian side had projected their requirements in September 1995, the Russians submitted their offer belatedly in November 1998. The political reality after the disintegration of USSR contributed to this delay and ultimately the weapon package could be signed only in April 2000. Since the technical specifications of the weapon package and of the Propulsion System Integration (PSI) system were essential for framing up of structural drawings, delays occurred.

There were changes in the selection of the weapons package also. The originally contemplated Point Defence Missile System (PDMS) was the Kashtan Combat Module. Due to sub-optimal performance of the Kashtan system during the delivery acceptance trials of INS Talwar, Navy reviewed the proposal and selected the Barak PDMS for the P17 ships. Audit noticed that though the decision for change in the weapon system was conveyed to the shipyard in June 2004, it took considerable time to conduct price negotiations and the purchase order could be placed only in March 2006 when the shipyard had achieved 66 *per cent* progress on the first ship under P17. By the time the system was received, shipyard had achieved 87 *per cent* progress in the first ship. The shipyard had to invest additional man days for structural drawings and fabrication on account of the new system.

P15A

Though the P15A ships were conceived as follow-on of P15 ships, the project witnessed 2,363 modifications. There were major changes in weapon packages, Sonar Dome, Helo Hanger etc. The decision to include a sonar dome (sensor) was taken after MDL had completed the detailed design, production, assembly and erection of the bow structure without sonar. This had a cascading impact on the schedule. Similarly, the changes in the gun mount were decided by Navy in March 2008 after the first ship was launched. This necessitated re-design of the entire structure in and around the gun mount and barrette. Further, changes in LR SAM in lieu of Kashtan missiles and modification of the helicopter hangar to accommodate the Advanced Light Helicopter were later decisions which resulted in extensive re-work.

P28

There were significant uncertainties associated with the new design being used for these ships. As design and construction were carried on in parallel, GRSE could not assess the associated complexity and delay due to concurrent design. Also, binding data for major engineering equipment like the Gear Box Raft Mounted, was not available. As of November 2010, around 1200 design changes have been made to the P28 design.

4.2.2.2 Material

Material issues are concentrated basically in the timely availability or not of specially fabricated material like fire-proof cabling, high tensile steel etc. However, there is an absence of backward linkages of the shipyards with strong and reliable vendors in India. Not only is availability a problem but dependency upon a few international suppliers resulted in protracted negotiations and consequent delays.

Project 15A: The steel for Project 15A was contracted by MDL from M/s Prometey Russia in June 2003 at a total cost of USD 12.06 million. As per the contract, the rate would remain firm and fixed during the currency of the contract. The delivery of the steel was to be carried out between June 2004 and February 2006. However, after the supply of first lot of steel in May 2004, the firm discontinued supply demanding higher prices because of sharp increase in price of steel in the international market. The firm recommenced the supply of steel only in September 2005. This delayed the commencement of production of second and third ship by 11 months each.

Project 28: The steel (DMR 249A) for Project 28 was developed indigenously by DMRL (a DRDO laboratory) and produced by SAIL. Since the steel was used for the first time, there were teething problems and the supply commenced only in June 2005 as against the original build strategy wherein all steel would have been supplied between December 2004 and May 2005. After further delays due to defects in the steel and grant of extension in delivery period, the shipyard could commence the production of first ship only in May 2006.

4.3 On-board equipment

4.3.1 Nomination of under development/unproven systems

The reason for a new warship is often a new weapon or a new sensor. However, there is a great risk to design and construct a ship, which is to carry a major system that has not been proven.

Audit noticed that in the three projects presently under construction at MDL and GRSE, seven equipments/systems viz; ATAS¹⁰, AISDN¹¹, EON51¹², CAIO¹³, ATDS¹⁴, LR SAM¹⁵ and Revathi; were still under development at the time of nomination.

The performance of these equipments onboard the dedicated ships as well as their successful integration can be evaluated only post commissioning of the ships.

4.3.2 Acceptance of systems with changed/diluted parameters

Naval Staff Qualitative Requirements (NSQRs) express the user's requirements in terms of functional characteristics of a system, equipment etc., while the Statement of Technical Requirements (SOTR) enables standardisation, inter-changeability, inter-operability, system integration etc.

Audit noticed that certain equipments/systems were approved for use in the ships under Project 15A, Project 17 and Project 28 despite their non-compliance with NSQR/SOTR formulated. Details are tabulated below:

¹⁰ Advance Towed Array Sonar
¹¹ ATM based Integrated Ship Board Data Network
¹² Electro Optical Network
¹³ Combat Action Information Organisation
¹⁴ Anti Torpedo Defence System
¹⁵ Long Range Surface to Air Missile

Sl. No.	Project	Name of System/ Equipment	Remarks
1.	P15A	Asynchronous Transfer Switches	ATM Switches with lesser capacity
2.	P15A/ P28	Ship Weapon Interlock System	The system will not transfer data at the rate prescribed in SOTR
3.	P28	Diesel Alternator	The noise and vibration levels are higher than those stipulated in SOTR.
4.	P28	Main Propulsion Change	Navy accepted engines beyond the specified N&V levels

4.3.3 Commissioning of ship with concession

As against the scheduled delivery date of December 2005, the first ship under P17 (INS Shivalik) was delivered in March 2010. Out of a total of 149 D-448¹⁶ liabilities, 59 liabilities were completed as of May 2010. At the time of commissioning, the integration of CAIO system for the effective command and control decision support system for a comprehensive and effective exploitation of all weapon and sensors onboard is not yet complete.

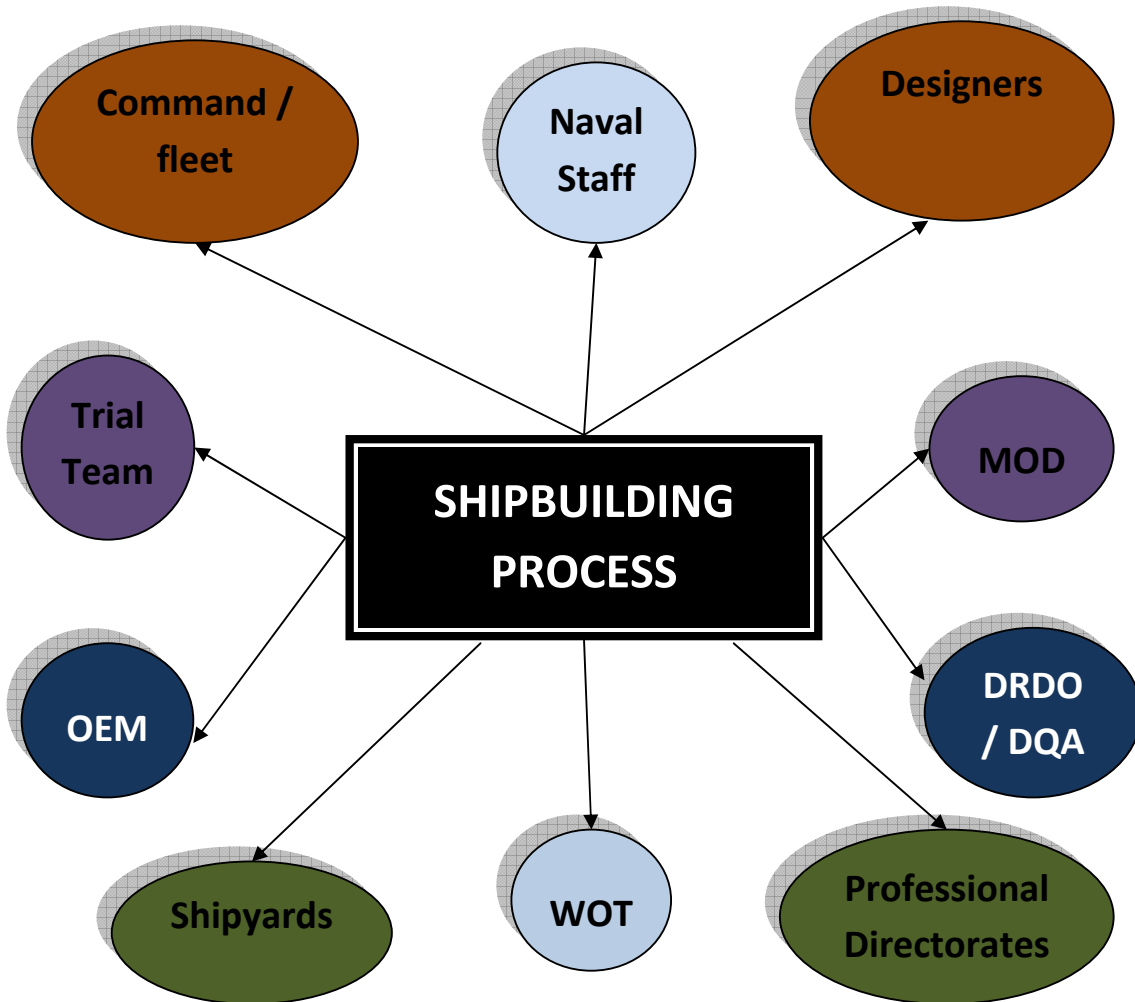
Apart from the above, ATAS required for the detection of low frequency targets is already de-linked as the same was not supplied by M/s BEL thereby restricting the operational capability of the ship. Thus, the delay in taking a decision on the installation of the critical weapon system diluted the role of the ship at the time of its commissioning.

¹⁶ D - 448 liability - the details of uncompleted items of work to be undertaken by the shipyard after commissioning of the ship as per the contract.

4.4 Monitoring mechanism

Warship building is a complex task with a number of agencies involved, as seen in the Interaction Matrix below.

INTERACTION MATRIX OF VARIOUS AGENCIES



Such interaction requires close co-ordination and constant monitoring. Audit was unable to identify a single agency responsible for ensuring timely completion of the projects. For instance, while CWP&A is responsible for monitoring and execution of warship construction projects, decisions on various aspects such as selection of equipment/system, nomination of vendor(s), method of procurement are vested with the professional directorates. The production

directorate under CWP&A, i.e. DND, monitors the projects and advises the shipyards on technical aspects, drawing and design issues. As such, this is a situation where there is wide dispersal of accountability.

Shipbuilding projects are monitored at different levels. At the shipyard, a Naval Warship Overseeing Team is stationed for technical scrutiny of bills, resolve technical issues, etc. Naval Headquarters also monitors shipbuilding progress through CWP&A (Controller of Warship Production and Acquisition) Progress Review Meetings (CPRM) on a quarterly basis chaired by the CWP&A with representation from officers of Director General, Naval Design (DGND), representatives from WOT, and concerned shipyards. Finally, at the Ministry level, an Apex Steering Committee under the chairmanship of Secretary (Defence Production) with Joint Secretary rank officers (MoD), Financial Adviser, and representative from IHQ MoD (Navy) and respective shipyards is held every six months to review ongoing projects.

Ineffective monitoring

In case of P17, though the production of the first yard commenced in July 1999, the first apex committee meeting was held only in December 2003. Hence there was no monitoring of the project by the Apex Committee for the first four and a half years. However, in respect of other two projects i.e. P15A and P28 though the CPRM and Apex Committee meeting were held at regular intervals, there was no significant contribution towards arresting the probable delay faced by these project as is evident from the minutes of these meetings.

A perusal of the minutes of the few apex meeting revealed that though the committee took stock of the situation at the shipyard with regard to delays, no concrete steps were proposed or taken to arrest the time over run and cost overrun in the projects.

As discussed in Paragraph 3.2.2 there is an absence of contractually agreed timelines for major milestones during shipbuilding between Navy and the shipyard. Concurrent design, changes in on-board equipments further aggravate the situation wherein there was absence of a definite plan against which actual progress in ship building could be objectively monitored. Against this backdrop:

- Audit observed that CWP&A meetings are more review meetings exercises in coordination and do not enforce adherence to schedules.
- Further, as per CWP&A memo dated 5th February 1998, the production directorate (DND) is to ensure that each delay is to be analyzed and approved by the CWP&A regularly and the effect of the delay on the project cost should be explicitly stated. However, the perusal of Apex and CPRM meetings held for the projects have not revealed any such analysis.



Recommendation

- ✓ **A single point accountability for the ship building project should be fixed taking care of all the aspects related to the ship building**
- ✓ **Equipment, weapons and sensors under development should be replaced with proven systems in case the development process does not synchronise with the timelines for ship construction.**
- ✓ **In keeping with modern thinking that the ship is built around weapons and sensors, primacy should be accorded to timely selection and finalization of weapons and sensors.**
- ✓ **A ship building project should be seen as a plan with definite timelines and milestones with cut off dates for all stake holders including Professional Directorates of Indian Navy for fulfilling their obligations. In the case of non performance, this should be escalated to higher levels to ensure performance. Accountability should be fixed for delays and suitable action taken by the Ministry.**
- ✓ **Responsibility should be fixed for delays.**