CHAPTER II

PERFORMANCE AUDITS

PERFORMANCE AUDIT ON CONSTRUCTION AND DELIVERY OF ANTI SUBMARINE WARFARE (ASW) CORVETTES

2.1.1. Introduction

A proposal was submitted (March 2003) by Ministry of Defence (MoD) to Cabinet Committee on Security (CCS) seeking approval for indigenous construction of four Anti-Submarine Warfare (ASW) Corvettes for the Indian Navy (IN). It was stated in the proposal that the Emergency Committee of the Cabinet had accepted (1964) a force level of X Cruisers/Destroyers/Frigates for the Indian Navy against which the force level was X ships. Of the X, three were to be decommissioned by 2006, two ships were under construction at Garden Reach Shipbuilders and Engineers Limited (GRSE) and three ships were being constructed in Russia. At the end of 2007, the force level would have been X. The proposal was to make good the likely depletion in the force levels of the warships.

The role of ASW Corvettes envisaged

(a) Provide ASW capability to Carrier Battle Group (CBG);

(b) Operate and control integral ASW helicopters;

(c) Function as ASW Surveillance Control Platforms;

(d) Provide ASW protection to merchantmen on main shipping routes approaching home ports; and

(e) Search, locate and destroy submarines in designated areas.

The indigenous Weapons and Sensors fit included Hull Mounted Sonar (HUMSA), Active Towed Array Sonar (ATAS), Advanced Torpedo Defence System (ATDS), Under Water Telephone (UWT), Bathy Thermograph (XBT) and ASW Fire Control System. The ship would carry torpedoes, two rocket launchers, hello borne torpedoes and depth launchers. Corvettes were designed to incorporate stealth features to minimise underwater noise, Radar Cross Section and Infra-red emissions. The ship would also have one Advanced Light Helicopter (ALH) and telescopic stowage hanger for accommodating a Seaking Type helicopter.

The planned induction (of four ASW Corvettes during X Plan between 2002-03 and 2006-07 and XI Plan between 2007-08 and 2011-12) was to partially compensate the reduction in ASW capabilities due to decommissioning of three ASW frigates and ten ASW ships.

The estimated cost of construction of four Corvettes as per the CCS Note, was ₹ 2871.27 crore inclusive of Excise Duty and Foreign Exchange (FE) content of ₹ 564.52 crore. The delivery period of the first ship was approximately four years from the date of launch of construction. The construction for the subsequent ships could commence and delivery effected with a gap of 18 months. Thus, the construction was to start in 2004, 2005, 2007 and 2008 and ships were to be delivered in 2008, 2009, 2011 and 2012 respectively.

Government of India, Ministry of Defence conveyed (March 2003) to Integrated Headquarters (Navy) (IHQ (N)) sanction of the President of India for construction of four ASW Corvettes for the Indian Navy at a total project cost of ₹ 3051.27 crore[1] (2001-02 price level). MoD placed a Letter of Intent (LoI) on Garden Reach Shipbuilders and Engineers Limited (GRSE), Kolkata entrusting (March 2003) the construction and delivery of four Anti-Submarine Warfare (ASW) Corvettes. As per the LoI of IHQ (N), the ASW Corvettes were to be built to the design of Directorate of Naval Design (DND). GRSE was to procure material and services from the vendors nominated by IHQ (N). The ASW Corvettes were to be commissioned under the Eastern Naval Command, Vishakhapatnam.

[1]Construction of the ships ₹2700.20 crore, Cost of B & D Spares ₹ 171.07 crore and cost of augmentation of yard facilities₹180.00 crore.

Build Specification and General Arrangement (GA) drawings, the two basic documents for the ship, were to be prepared and issued by DND. DND finalised the Build Specification and GA drawings only in 2006 and GA drawings underwent major modifications till 2008. Based on the Build Specification and GA drawings finalised by DND, GRSE submitted (September 2008) a revised cost estimate of ₹ 10665.55 crore. After CNC meetings (October 2008 and January 2011) the cost was revised to ₹ 7852.39 crore. The increase in project cost was due to 242 *per cent* increase in cost of labour (from ₹ 472.68 crore to ₹ 1615.14 crore), 99 *per cent* increase in cost of materials (from ₹ 1822.00 crore to ₹ 3625.91 crore), 84 *per cent* increase in cost of Modernisation of facilities at GRSE (from ₹ 180.00 crore to ₹ 331.27 crore) and 454 *per cent* increase in cost of Base and Depot (B&D) spares (from ₹ 171.07 crore to ₹ 947.04 crore). GRSE attributed the increase to significant changes in equipment, weapon and sensor fit, indigenisation efforts for various equipments and substantial increase in yard effort due to final specification of the vessel being vastly different from the original concept. CCS sanction was accorded (April 2012) for the revised cost of ₹ 7852.39[2] crore. A contract was signed (June 2012) between MoD and GRSE for construction and delivery of four ships on a fixed price basis.

Audit scope and objectives

This Performance Audit is focussed on design, construction and delivery of four ASW Corvettes by GRSE during the period 2002-03 to 2015-16.

The project was taken up with the objective of inducting indigenous technologically advanced ASW Corvettes. The objectives of the Performance Audit were to examine:

- Whether GRSE was able to develop the capability to build advanced ASW Corvettes
- Whether the Indian Navy was able to induct technologically advanced Indigenous ASW Corvettes as per the induction plan;
- Whether the technical requirements of the Indian Navy were achieved and whether the intended benefits from the ASW Corvettes were realised.

[2] Construction of the ships ₹6574.07 crore, Cost of B & D Spares ₹ 947.04 crore and infrastructure development
₹ 331.27 crore.

Audit criteria

The criteria adopted for assessing the construction, delivery and performance of the ships are as follows:-

- CCS approvals
- Statement of Technical Requirements of Navy,
- Build Specificationof Navy/Build strategy documents
- Contract with Navy and sub-contractors
- Defence procurement procedure/ manual and Indigenous shipbuilding procedure
- Ministry records and directives,
- GRSE Board sanctions and approvals; Internal orders and circulars
- Monthly progress reports submitted by GRSE to Indian Navy
- Minutes of Project Review Sub-committee and Apex Committee
- Program Evaluation Review Technique (PERT) and work plans for the ship construction
- Invoices of GRSE and paid bills

Previous Audit coverage

A Performance Audit on 'Indigenous construction of Indian Naval Warships' was conducted by the Comptroller and Auditor General of India and included in the Report No.32 of 2010-11. The report covered the observations for the period from 2005-06 to 2009-10 and covered projects sanctioned from 1986 to 2003. The observations on ASW Corvettes included delay in contract finalisation, selection of GRSE which had no prior expertise in such ship construction, delay in finalising labour hours, changes in hull design and equipment, release of funds before finalisation of contract, abnormal revision of contract costs. All the observations were prior to entering into contract. The report was discussed by the Public Accounts Committee (PAC) and observations/recommendations of the PAC on the Action Taken Note by the Ministry was includedin the PAC's report No. 32 of 2015-16.

Audit methodology

Audit methodology adopted while conducting the audit included

(i) holding of an entry conference on 26 May 2016 with the Management, representatives of Ministry of Defence (contract concluding authority) and Director General of Naval Design (nodal agency for the project),

(ii) scrutiny of records of Naval Dockyard, Eastern Naval Command, Vishakhapatnam, DND, New Delhi and GRSE, Kolkata;

(iii) information and contracts and their execution as also MIS reports;

(iv) issue of preliminary audit observations for eliciting replies and clarifications.

(v) Exit conferences were held with the Management of GRSE and DND on 9 December 2016 and 11 January 2017 respectively to discuss the audit findings and possible recommendations. The views of the Management and DND have been considered while finalising the report.

Audit Findings

2.1.2. Audit Objective 1: Whether GRSE was able to develop capability to build advanced ASW Corvettes

2.1.2.1. Non establishment of modernised infrastructure in time for construction of warship

As per contract entered (June 2012) into with MoD, ₹331.27 crore was sanctioned for augmentation of infrastructure facilities for construction of ASW Corvettes against ₹180.00 crore in March 2003. The yard was to be modernised for construction of corvettes since, as per the CCS Note of March 2003, existing infrastructure was considered to be grossly inadequate. The modernisation was completed in 2013-14 as against the scheduled completion of July 2009 and thus, the work of modernisation of shipyard as well as construction of corvettes were undertaken simultaneously.

2.1.2.2. Lack of proper planning

In terms of the LoI issued in March 2003, GRSE was to forward the proposed construction schedule, procurement schedule, forecast of funds requirement of schedule drawings and build strategy for taking up the project by April 2003.

Based on the experience of construction of other bigger ships, GRSE intimated (2003) build period ranging between 42 and 48 months. The contract could not be finalised immediately after the issue of LoI due to delay in finalisation of Build Specification and lack of clarity regarding the material to be used for construction. GRSE did not prepare/promulgate the PERT for the pre-launch activities of first two ASW Corvettes (3017 and 3018).

The cardinal dates for construction and actual date of delivery of all the four ASW Corvettes as per Controllerate of War Production & Acquisition Project Review Meetings (CPRM) and their achievement is detailed in **Annexure-I**.

It was observed that GRSE could adhere to the stipulated date at only "Start Production" stage. Subsequently, there was delay in achieving the major milestones which led to revisions of cardinal dates in the CPRMs.

Further, the PERT prepared by GRSE had no co-relation to the cardinal dates proposed in the CPRM which led to GRSE frequently updating the PERT chart.

Management agreed with audit observation and added that at the time of LoI only a sketchy specification of the ships was made available and finalisation of system design was yet to be undertaken by DND. Warship grade steel was also under indigenous development and production could start only after receipt of steel. Further there was also change in drawings/specifications based on requirement of customer which led to delays. Consequentially PERT had to be revised from time to time, which was inevitable.

2.1.2.3. Freezing of designs

The LoI of March 2003 indicated that the ASW Corvettes would be built to the design of DND. GRSE was required to furnish the schedule of drawings, specifications and build strategy to DND by April 2003. Upon this, the outline specifications, design drawings and other associated documents would be forwarded by DND to GRSE for construction of the ASW Corvettes within four weeks of their receipt.

Audit observed that at the time of issue of LoI, only a sketchy specification of the ship was made available to GRSE and finalisation of system design as well as specification of equipment, weapon and sensor fit were to be undertaken by DND. DND finalised the same only in the year 2006 and major modifications continued till 2008. This resulted in delays in preparation of General Requirements for Acceptance of Quality (GRAQ).

The table below summarises discipline-wise number of system drawings, approvals by DND, number of revisions and period thereof:

Table 2.1 – Details of number of revisions to System Drawings

Discipline	No. of major systems	Date of DND's approval to drawings	Period of revisions to drawings	Number of revisions in drawings (Minimum to Maximum)	Delay in no. of months from issue of LOI (March 2003)	Delay in no. of months from issue of LOI (March 2003) to last revision period
Hull and superstruc-ture	85	July 2005 to March 2010	December 2005 to October 2013	1 to 10	28 to 84	33 to 127
Hull out fit	56	September 2005 toMay 2015	April 2006 to June 2016	1 to 24	30 to 146	37 to 159
Machinery	31	February 2006 to August 2010	January 2007 to February 2013	1 to 13	35 to 89	46 to 119
Electrical and Weapon	75	June 2006 to July 2015	July 2006 to June 2016	1 to 16	39 to 148	40 to 159

Audit observed that the drawing as indicated in Annexure E of the contract was forwarded by DND to GRSE only between July 2005 and June 2016. Further, as could be seen from the Table supra, the approved designs were amended upto 24 times till as late as June 2016. The frequent amendments resulted in non-freezing of design of the major systems which adversely affected adherence to scheduled completion of Corvettes. As such, considerable time was spent for finalisation of design leading to delay in start as well poor progress of the project.

Thus, DND's failure to freeze the design before issue of LoI and commencement of construction concurrently without appropriate monitoring and target timelines resulted in delay in construction of the Corvettes.

2.1.2.4. Statement of Technical Requirement (SOTR)

SOTR for major equipment is prepared by the professional directorates of IN in consultation with the Productional Directorate of the Project i.e. DND. After preparation, SOTR is handed over to GRSE for passing the same on to vendors before signing of the contract for supplies. The dates of approval, amendments and time gap from LOI to latest amendments are detailed in **Annexure-II**. Audit observed that the time taken to finalise SOTR ranged

from 32 months to 68 months which affected the progress of ASW Corvette construction.

IHQ reply was silent in this regard.

2.1.2.5. Use of composite super structure in shipbuilding

The envisaged weight of the corvettes as per the contract (June 2012) was 3170 tonnes. During construction of first two corvettes (3017 and 3018), DND observed the weight of the Corvettes increased significantly due to adoption of various signature reduction measures. In order to achieve the reduction in weight of the Corvettes, DND suggested (May 2009) that GRSE use composite super structure in lieu of the steel super structure on board three Corvettes out of the four whereby the weight could be reduced by 70 to 80 tonnes. Considering the long lead time for procurement of composite materials from foreign vendors, GRSE decided to use composite material only for the last two Corvettes**.** After inviting tenders from three firms[3] nominated (May 2009) by IHQ (N), the orders were placed on ThyssenKrupp Marine Systems International Pte Limited (TKMSI) in September 2010 for the composite superstructure material and associated works for two Corvettes i.e., 3019 and 3020 at a cost of ₹ 123.65 crore. This additional cost for the composite superstructure was catered to in the contract which was signed in June 2012.

Audit contends that increase in the weights of Corvettes *vis-à-vis* the envisaged weight was owing to absence of a concrete plan for build of ships. A major change in construction plan/methodology in the middle of a major project involving construction of series of ships spoke of inadequate preparation before sanction of project and resulted in non-commitment to sanctioned outlay with involvement of major escalation in construction cost. Further, the decision to go for composite super structure was taken as late as in May 2009 and placement of order in September 2010 with the lead time of 15 to 23 months had a cascading delay on the construction schedule.

Management replied (December 2016) that the use of advanced technology by way of carbon-composite super-structure was decided upon by the customer, considering various aspects including reduction of the overall weight of the ship and adoption of new technology in shipbuilding.

Reply is not convincing and indicated the faulty design specifications of the ships upfront.

[3]M/s Intermarine, Italy, M/s Kockums, Sweden and M/s Kangnam Corp, Korea

2.1.2.6. Nomination of single vendors

GRSE was to place order for various systems on IHQ(N) nominated vendors. The IHQ(N) nominates the vendor after going through procedure of solicitation, enquiry, technical evaluation and short listing. Subsequently, the DND intimates GRSE for initiating procurement action.

Audit observed that IHQ(N) nominated single source vendors in respect of 59 major machinery/equipment/ weapon and sensor systems. The value in respect of 132 purchase orders placed on such single source vendors amounted to ₹ 1992.61 crore which accounted for 57.70 *per cent* of total material cost of ₹ 3453.24 crore. Some of the major single vendors on whom GRSE placed purchase orders were BEL, L&T, BHEL, KOEL, GSF, Wartsilla and York, etc.,

IHQ(N) stated (October 2016) that the vendors for equipment were nominated by the Professional directorates. Identification of suitable vendors was a continuous process and the list was updated periodically based on capacity assessment of vendors.

Management stated (December 2016) that they had no option or little option, as the concerned material/equipment were either proprietary in nature or the manufacturer of the same has been nominated by the user/customer.

Reply of IHQ(N)/GRSE clearly indicates that the materials to be used and the source of procurement were yet to be decided at the time of placement of LoI. Further, the high percentage of single vendor would indicate the process of updation of vendors list needed to be improved in order to ensure availability of alternate vendors in case of failure/delay in supply by the single vendor.

2.1.2.7. Inordinate delay in supplies by indigenous vendors

GRSE placed orders on the IHQ(N) nominated indigenous vendors for procurement of major equipment and systems between 2005-06 and 2012-13 with staggered deliveries. On a review of 132 POs valued ₹1992.61 crore placed on single source vendors, Audit observed that vendors did not adhere to the stipulated delivery dates and delivery schedule was extended up to 7 ½ years through amendments (ranging from 2 to 13) as detailed in **Annexure-III**. The reasons attributed by the indigenous vendors were delay in development and manufacture, delay in sourcing/getting the raw materials, dependency on foreign vendors due to high import content, changes in components, list of deliverables etc.

IHQ(N) had neither assessed the preparedness of the indigenous vendors including Central Public Sector Undertakings to take up development of systems before nominating them as single vendor nor developed alternate vendors for development of systems. As a consequence, supplies did not dovetail with the shipbuilding time lines as indicated in the CCS note.

Management replied (December 2016) that it was taken as a developmental project with the objective of indigenisation of warship-building. As and when SOTRs were finalised, orders were placed by GRSE on the nominated vendors. Vendors took long time to develop the systems. However, considering the long term advantages of future production of these equipment in India, loss due to delays would be far outweighed by benefits derived.

Reply is not convincing as the single vendors on whom GRSE placed orders delayed the supplies.The delay had a significant impact on the Anti-submarine warfare capabilities of the Indian Navy. Though the ASW capability of the Indian Navy was severely depleted considering decommissioning of Petya class ASW Corvettes by 2003 and decommissioning of Leander/Nilgiri class Frigates with ASW capabilities by 2012, the first ASW Corvette was delivered only in July 2014 without major Defence and Offence capabilities.

2.1.2.8. Procurement of steel

IHQ(N) suggested (March 2004) for procurement of DMR 249A steel from Steel Authority of India Limited (SAIL) which was under development at Defence Metallurgical Research Laboratory, Hyderabad. In the CPRM (July 2004), IHQ(N) directed GRSE to go in for procurement of D40S for the first Corvette steel from M/s Rosoboronexport, Russia (ROE) till DMR 249A Steel from indigenous source was developed to avoid the delay in procurement of steel which was being produced for the first time by SAIL. While negotiations with ROE was underway, GRSE placed two purchase orders (August 2004) on SAIL for procurement of steel for the second and third Corvettes. SAIL developed (September 2004) steel based on the technical specification provided by DMRL. However, it could not adhere to the delivery schedule due to problems faced in rolling out and time extension was granted up to June 2008. As procurement from ROE also did not materialise due to high prices, the purchase orders for the requirement of steel for the balance two ships were also placed (June 2007) on SAIL. Thus, the delay in supply of steel from SAIL impacted the construction of the Corvette

IHQ(N) stated (October 2016) that construction of P-28 Ships was originally envisaged using D40S high tensile steel imported from Russia. Subsequently, at construction stage, a proposal for use of DMR 249A steel was approved and order on SAIL was placed in August 2004.

Management replied (December 2016) that indigenous production of DMR249A steel plates and sections by M/s SAIL and other private industries took a long time to stabilise. Also, availability of special electrodes (indigenous) for this steel took some time. GRSE prepared detailed procedure for qualification of welders and carried out welder's training for GRSE in-house welders as well as welders from subcontractors. Although this indigenisation process delayed the construction schedule of ASWC, it established the use of indigenously developed steel material for construction of naval ships which was a giant step towards indigenisation and self-reliance

The delay was crucial considering the Corvettes in operation in 2003 and decommissioning plan of the corvettes by 2007. The supplyof indigenous DMR249A steel commenced only in 2008 and first Corvette was delivered only in July 2014 which severely limited the anti-submarine capabilities of the Indian Navy for seven years as the Navy was left with only limited Ships with Anti-submarine capability.

2.1.2.9. Procurement of Magazine Fire Fighting System (MFFS)

Magazine Fire Fighting System (MFFS) provides automatic switching of the firefighting systems in magazine spaces, gun barbettes and helicopter hangar spaces. GRSE invited (April 2009) global tenders for procurement of MFFS. However, IHQ(N) intimated (January 2010) that MFFS was to be procured from ROE since MFFS for majority of the indigenously designed and built warships were sourced from Russia through Inter Governmental Agreement. An order was placed (May 2011) on ROE for four sets of MFFS at a cost of ₹111.03 crore after a lapse of more than one year from the date of nomination of the vendor by IHQ(N). MFFS were received by GRSE after a delay of more than two years.

Management while agreeing with the audit observations replied (December 2016) that finalization of detailed specification from IHQ(N), conclusion of Tender Negotiation Committee (TNC) and final receipt of IHQ(N) directive to initiate procurement of MFFS took considerable time.

The reply confirms the audit observation that delay in placement of order of MFFS impacted the build schedule of the first ship.

Thus, delay in finalisation of materials required and also nomination of single vendors had an adverse impact on the availability of equipment for building of ASW Corvettes by GRSE.

Conclusion

DND did not finalise the Build Specification and freeze the design before issue of LoI and commencement of construction. IHQ(N) also failed to nominate the vendors in time and assess the preparedness of Indian vendors to take up indigenous development.

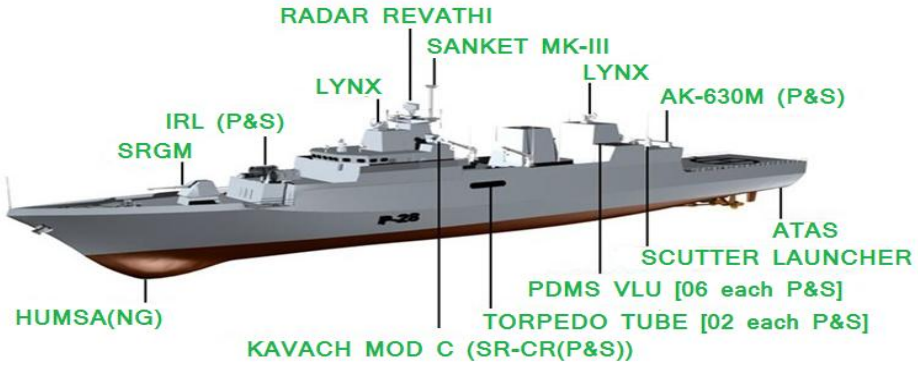
Recommendations

- ***MoD may ensure that required infrastructure is established in time.***
- ***A clear roadmap needs to be drawn for equipment under development stage till their final development so as to synchronise with completion of construction of warships.***
- ***IHQ(N) needs to develop alternative vendors and update its vendor base to minimise the impact of delay in nomination and failure to supply by the nominated vendors.***
- ***IHQ may also consider relying on the expertise of ship builder to identify vendors and make the builder accountable for timely delivery of ships.***

2.1.3. Audit Objective 2: Whether the Indian Navy was able to induct technologically advanced Indigenous ASW Corvettes as per the induction plan

2.1.3.1. Introduction

The four ASW Corvettes were to be built by GRSE according to the design of DND based on the outline specifications, design drawings and other associated documents. IHQ(N) was responsible for nomination of vendors, monitoring the development of weapons & sensor systems and promote indigenisation. While GRSE had constructed and delivered two ASW Corvettes - INS Kamorta (3017) in July 2014 and INS Kadmatt (3018) in November 2015 respectively to the Indian Navy (IN), the remaining two were under construction (January 2017).



Audit observed that ASW Corvettes delivered were not fully compliant with the anti-submarine capability as specified in the Contract. The factors which affected construction/capabilities of the ASW Corvettes were as below:

2.1.3.2. Delayed construction of ASW Corvettes

The time taken at various stages, ship-wise, is furnished below:

Table 2.2 – Details of Ship-wise Time taken

Sl. No	Activity	Percentage of work of total ship building activity	Time taken for completion (in months')		Time taken till December 2016 for completion (in months')	
			3017	3018	3019	3020
	Start Date		March 2006	March 2007	March 2008	September 2009
	Completion Date		June 2014	November 2015	In Progress	In Progress
	Percentage of Completion				85.96	48.96
1	Hull	22.5	63	60	102	87
2	Hull Out Fit (HOF)	17	81	95	78	60
3	Plumbing	13.5	81	95	87	72
4	Machinery	12	78	77	66	45
5	Electrical	12	69	71	60	42
6	Air Conditioning Ventilation and Refrigeration (ACVR) System	3.5	48	68	60	39
7	Weapon	6	48	56	45	18
8	Compartment out fitting	5	45	53	54	36
9	Services	8.5	54	65	45	24
	TOTAL	**100**	**99**	**104**	**105**	**87**

As could be seen from the above, GRSE completed the first ASW Corvette in 99 months and the second in 104 months. Though 105 months and 87 months were consumed in respect of the balance two ships upto December 2016, the percentage of completion was only 86 and 49 respectively.

On a comparison of the activity wise time consumed for construction of the second corvette (3018) with the first corvette (3017), Audit observed that the time consumed in respect of 3018 exceeded the time consumed by 3017 in six (items 2, 3, 5, 6, 7 and 8 of the Table above) out of the nine activities which ranged between 2 to 20 months. The time taken activity-wise in respect of the other two ships also were likely to exceed the time taken for the first ship. This was contrary to MoD prescribed benchmarks for performance parameters such as labour productivity, outsourcing, outfitting, procurement, etc. which assumed improvements over period from ship to ship. Thus, GRSE failed to derive the benefits of learning curve.

It is pertinent to mention that GRSE, in reply to MoD on comments of Ministry of Finance regarding revision of cost of the corvettes, stated (January 2012) that GRSE had adequate technical capability for construction and delivery of ASW class of ships. It further stated that based on the concept design, GRSE successfully developed system as well as detailed designs and it was the only defence shipyard having proven expertise of using DMR 249A steel.

2.1.3.3. Recovery of Liquidated Damages for Delayed Delivery of ASW Corvette

The first two corvettes were delivered during July 2014 and November 2015 as against the contracted delivery by October 2012 and July 2013. The construction of 3rd and 4th Corvettes was in progress though they should have been delivered in July 2014 and April 2015.

KAMORTA

KADMATT

Due to delay in delivery of first two corvettes, MoD withheld ₹ 103.25 crore (₹ 33.60 crore for 3017 and ₹ 69.65 crore for 3018) towards Liquidated Damages (LD). Further, as the contractual delivery dates had already expired for the balance two corvettes, GRSE was liable to pay ₹ 147.31 crore towards LD (₹ 72.89 crore towards 3019 and ₹ 74.42 crore towards 3020 at 5 *per cent* of ships basic cost) as per the terms of the contract.

Management, while agreeing (December 2016) with the audit observation, stated that delays were not wholly attributable to GRSE. After detailed analysis of the reasons for delays, the case for delivery date extension was taken up with customer. It was anticipated that the case for LD waiver (which was submitted to MoD with all justifications) would be viewed favourably. For the remaining two corvettes (i.e. 3019 and 3020) similar approach would be adopted.

Though GRSE submitted request for waiver of LD, MoD is yet to take a decision (January 2017). Due to delayed delivery, Indian Navy could not achieve induction of ASW Corvettes between 2002-03 and 2011-12 as envisaged

2.1.3.4. Non-installation of all the weapons and sensor systems.

Against the 18 weapons and sensors to be installed on ASW Corvettes, Audit observed that the two ASW Corvettes delivered were not fitted with X weapon and sensor systems viz. Equipment 'A' which included Equipment 'B' and Equipment 'C' to make the ASW Corvette perform to its full potential as envisaged. The issues are discussed below:

a. **Equipment 'A'*:***

Equipment 'A' provided detecting, locating, tracking and classifying all types of sub-surface targets like torpedoes, mines, submarines, etc. to the corvettes. Equipment 'B', which was a part of Equipment 'A', protected the corvette from torpedo attack by diverting the incoming torpedo towards the false target created by the Expendable Decoy Launcher. Equipment 'C' is a launcher employed to decoy the torpedo away from the ship.

As per the Statement of Requirements (SOR) formulated by GRSE, the Equipment 'A' was to detect

- dived conventional submarines and on motors up to a certain range in active detection range;
- dived conventional submarines and on motors up to a certain range in passive mode and

- torpedoes at certain range.

The induction of Equipment 'A' was planned (June 1998) under project Nagan which was to be designed and developed by Naval Physical and Oceanographic Laboratory (NPOL), Cochin with M/s Bharat Electronics Limited (BEL) as the production agency. The Research and Development (R&D) model productionised by BEL was installed on INS Sharada for conducting User Evaluation Trials (UET). However, the Equipment 'A' did not meet the requirement of Naval Staff Qualitative Requirements (NSQR). In view of this, the project Nagan was shelved in July 2010. In the meanwhile, IN conducted trials (2008) with L-3OS system which was successful. The trials conducted in 2010 and 2011 by BEL with L-3OS systems were successful. IN carried out trials with ATLAS system during 2011 and based on the trials, invited bids for Advanced Equipment 'A' (Equipment 'A'-ADV) in which ATLAS was L1 and BEL was L2. During the joint ship survey by BEL and ATLAS on the corvette during February and November 2014, it was found that the fitment of Equipment 'A'of ATLAS needed major structural modification to the ship. Considering the cost implication of ATLAS Equipment 'A'-ADV, BEL submitted (August 2015) its statement of case to IN for signing MoU with L-3OS. IHQ gave concurrence (November 2015) to go ahead with L-3OS and to process the case with Department of Defence Production (DDP). Case was under process with DDP (January 2017).

Development of Equipment 'B' was taken up by DRDO and as the user trials did not meet the NSQR, the same was not installed on the corvette.

Equipment 'C' was deleted from the scope of IAC MOD-C since it failed in user trials.

DND stated (January 2017) that MoU between BEL and ToT partner was required to ensure installation of the Equipment 'A' system and the same was awaited from BEL. It further stated that Equipment 'B' was envisaged to be integrated with Equipment 'A' and Equipment 'C' was part of Equipment 'B' which was under trials and hence, not supplied.

Thus, due to IN's failure to decide on suitable Equipment 'A' system despite successful completion of trials, Equipment 'A', Equipment 'B' and Equipment 'C' were not installed on the corvettes delivered and hence, the ability of ASW Corvettes for submarine and torpedo detection was hampered.

b. **Equipment 'D'**

Equipment 'D' is the corvette's self defence system against missile attack. Equipment 'D' provides double layered defence along with augmented

capability to defend against salvo attack (multiple missile attack). X Equipment 'D' were envisaged on board of each Corvette for accommodating certain Equipment 'D' missiles on board. Equipment 'D' was Buyer Furnished Equipment i.e., IHQ(N) had to supply this to GRSE as per the delivery required by GRSE. Procurement and installation of the system on board was not included in the shipbuilding contract. GRSE had to cater only for space for installation of Equipment 'D' missiles on board.

Equipment 'D' was to be developed by Defence Research and Development Organisation (DRDO), Hyderabad and manufactured by M/s Bharat Dynamics Limited. As DRDO could not develop Equipment 'D' in time, the fitment of Equipment 'D' was delinked from the project.

In accordance with IHQ(N) Memo of November 2006, Development systems and equipment were to be included for ships being designed by the Indian Navy and in case the development was not successful or did not comply with the time schedule indicated, alternate proven equipment was to be nominated to ensure procurement and integration within the shipbuilding time frame. Non fitment of the weapon systems was in violation of the IN's instructions.

DND stated (January 2017) that despite the best efforts, it was not possible to develop the Equipment 'D' and a draft Request for Indent (RFI) for progressing the case was formulated and forwarded for comments of external agencies. Further, certain close in weapon systems were fitted to provide the Corvettes with Point Defence against anti-ship missiles.

Due to non availability of Equipment 'D', ASW Corvettes did not have double layered defence along with augmented capability to defend against salvo attack.

2.1.3.5. Harbour Acceptance Trials (HATs)

Article 1.4 of the Contract envisaged that GRSE would carry out the Harbour Acceptance Trials (HATs)[4] and Contractor Sea Trials (CST) before delivery of the vessel to Indian Navy in seaworthy state after first reading[5] of Acceptance Document D-448[6].

[4]HATs are conducted when the ship is stationery and includes Diesel Generator trials and Basin trials of the Ship.

[5] First reading of the acceptance document is the date on which the D-448 liabilities are listed out. Second reading is done on the expiry of warranty period (1 year)

[6] D-448 - The contract provided for conduct of successful Harbour Trials and Contractor's Sea Trials (CST) and delivery of the vessels to the buyer in seaworthy state after first reading of Acceptance Document D-448

Audit observed that HAT in respect of FCS IAC (MOD-C) was still pending (December 2016) in respect of the second ASW Corvette (3018) for over a year.

Management replied (December 2016) that HATs of FCS-IAC (MOD) with respect to Yard 3018 was not completed due to non-resolution of interface-issues. DND stated (January 2017) that generally HATs are largely completed before delivery. In case of certain equipment/systems where HATs prior delivery was not completed/prolonged due to various challenges particularly with reference to developmental systems, the same was included in D-448 liabilities.

Reply is not convincing as FCS IAC (MOD-C) was the integrated combat suite for computation of ASW Fire Control Solution and firing of all ship-borne ASW weapons. Non-completion of HAT for this system resulted in not demonstrating the effective computation of ASW fire control solutions.

2.1.3.6. D-448 liabilities

As per Article 7.4.2 Protocol of Delivery and Acceptance, the outstanding liabilities, if any, shall be exhaustively listed and annexed to the protocol of acceptance and delivery (Form D-448). D-448 liabilities were to be liquidated within 12 months of the delivery of the vessel. However, liabilities pending at the time of second reading of D-448 would be valued jointly by buyer and seller and the joint agreed cost deducted from final stage payment. The status of D-448 of the two delivered Corvettes as at the date of delivery and as on December 2016 is brought out in the table below:

Table 2.3 – Status of D-448 Liabilities

(in nos.)

Responsibility	**INS Kamorta (3017)**		**INS Kadmatt (3018)**	
	Status as of July 2014	**Status as on December 2016**	**Status as of November 2015**	**Status as on December 2016**
GRSE	8	2	8	3
Navy	3	2	2	2
Navy/GRSE	30	5	27	17
TOTAL	**41**	**9**	**37**	**22**

From the above table, it could be seen that even after more than two years of delivery of ASWC 3017 and one year after delivery (December 2016) of ASWC 3018, GRSE/Navy were yet to resolve liabilities.

The second reading of liabilities of 3017 (INS Kamorta) and 3018 (INS Kadmatt) should have taken place immediately after July 2015 and November 2016 i.e., on completion of the warranty period by which time all the liabilities should have been liquidated. However, even after a lapse of more than one year the second reading of liabilities was yet to take place (December 2016).

Management replied (December 2016) that efforts are on to liquidate all pending liabilities as mentioned in D-448.

Non-liquidation of the liabilities indicate that defects/concessions continued.

2.1.3.7. Guarantee Defects

Clause 1.4 of the Contract stipulated that GRSE would liquidate Guarantee Defects (GD), Guarantee dry docking and other outstanding liabilities listed in D-448. As per Article 16 of the Contract, the items supplied were under warranty and GRSE was responsible to rectify the defects in equipment or material for a period of twelve months from the time of taking over of the Corvette. Further, in cases which would require extension of warranty by OEMs on account of delay by GRSE, liability would be borne by GRSE. The table below brings out the GDs pending and resolved as at December 2016.

Table 2.4 –Guarantee Defects pending

(in nos)

Particulars	3017 (Kamorta)	3018 (Kadmatt)
Number of GDs	515	1223
Non-GD	57	240
GDs accepted by GRSE	458	983
GDs resolved by GRSE	435	572
GDs pending	23	411

Audit observed that the nos., of GD accepted by GRSE in comparison with the total GDs raised on both the Corvettes speaks of the sub optimal performance endurance of the equipment fitted on the Corvettes.

Conclusion

GRSE could not adhere to the time schedule prescribed in the contract for delivery of corvettes though it had stated that it was the only defence shipyard having proven expertise of using DMR 249A steel. The delay was on account of failure of indigenous vendors to adhere to scheduled timelines and change in material for superstructure. This led to withholding ₹ 103.25 crore towards liquidated damages by MoD. ASWC 3018 was delivered to the IN without successful completion of HATs on one of the weapons and sensor system. GRSE failed to liquidate D-448 liabilities within one year after delivery of

ASWC which resulted in failure to conduct second reading of the ASWC. Further, guarantee defects on the equipment/system indicated sub optimal performance endurance of the equipment fitted on the Corvettes and GRSE failed to liquidate the same.

Recommendations

- ***GRSE needs to effectively monitor project activities from construction to delivery by dedicated Project Review Committees and through PERTs.***
- ***Care needs to be taken to ensure installation of critical weapons/sensors as per envisaged time schedule.***
- ***GRSE needs to synchronise all activities to adhere to the timelines fixed.***
- ***GRSE needs to ensure that all D-448 liabilities and GDs are liquidated within the time stipulated in the contract.***

2.1.4. Audit Objective 3: Whether the technical requirements of the Indian Navy were achieved and the intended benefits from the ASW Corvettes realised.

2.1.4.1. Corvettes Fleet Level

MoD intended to overcome the depletion in the force level especially in the field of Anti-Submarine Warfare (ASW) considering the Nation's security environment and threat perception.

Considering that India did not possess Advanced Anti-Submarine Warfare Corvettes, MoD envisaged that about X ASW ships in each battle group were required. MoD placed an order for construction and delivery of four indigenous ASW Corvettes on GRSE which were to be delivered between 2008 and 2012. However, GRSE delivered only two Corvettes in July 2014 and November 2015. Further, even the ASW Corvettes delivered to the Indian Navy were not fully equipped with some of the major missiles systems and launchers, impacting the capability to effectively counter the underwater threat in the Indian Oceans.

Hence, the role of ASW Corvettes i.e. capacity to provide Anti-Submarine Warfare support to Carrier Battle Group; operate and control integral ASW helicopters, provide ASW Surveillance Control Platforms; provide ASW protection to merchantmen on main shipping routes approaching home ports and to search, locate and destroy submarines in designated areas could not be achieved.

DND stated (January 2017) that though the project was delayed for various reasons, Navy maintained adequate multi-purpose frigates, destroyers and coastal ASW Ships and ASW capable Aircraft to maintain the desired ASW readiness and capabilities.

Thus, the specific role of ASW Corvette i.e. providing a comprehensive platform consisting of Surveillance, advanced defence and offence capability could not be ensured to the Defence forces.

2.1.4.2. Increase in weight and decrease in speed levels

The Build Specification of ASW Corvette released in July 2003 specified a displacement of 2500 tonnes and achievement of maximum speed of 25 knots[7] and cruising speed of 18 knots at ambient temperature of 40^0C.

Further during the Controllerate Project Review Meeting (CPRM) held in September 2005, GRSE was informed to put an effective weight control mechanism in place so that the displacement does not exceed 2500 Tonnes. However, GRSE clarified (November 2005) that it was not in a position to ensure stipulated weight through design as the construction of the ASW Corvettes were as per the Navy approved SOTRs[8]. At the time of signing of the contract in June 2012, MoD increased the requirement of displacement to 3170 tonnes.

Audit observed that the actual displacement of the first two Corvettes (3017 and 3018) delivered was 3384 and 3490 tonnes which exceeded even the enhanced displacement by 214 and 329 tonnes respectively. Further, the maximum speed and cruising speed achieved was 23.9 knots on the first ASW Corvette (3017) and 22.8 knots on the second ASW Corvette (3018) respectively. The drop in the achievement of the specified speed was mainly on account of increase in weight of the ASW Corvette by over 800 tonnes from initial envisaged 2500 tonnes.

Management agreed (December 2016) that the reduction in speed was due to increase in displacement of the ship and stated that maximum speed attained was itself an achievement considering the increased weight of the ships. Management also stated that ASW Corvette was built as per the specifications, design and requirement of DND and first of its kind in the IN with the objective of indigenous development and construction of warship. During the course of construction additional items/requirements came in as per customer's requirement which resulted in increase in weight/displacement.

[7] One knot = 1.15 miles per hour
[8] Statement of Technical Requirements

DND stated (January 2017) that during performance trials of the Main Propulsion System at full power, a speed of 24.7 knots (by GPS) and 23.9 knots (by log) was recorded which was very close to the design speed and was a result of efficient hydrodynamic design of the ship.

2.1.4.3. Delay in conducting Sea Acceptance Tests

Sea Acceptance Test (SAT) is conducted to test vessel's speed, manoeuvrability, equipment and safety features. SAT would be the joint responsibility of Navy and GRSE after delivery of the ship i.e., when the ship was on sail.

Audit observed that in respect of ASW Corvette 3017, SAT on FCS IAC (MOD-C), IRL, ITTL, AK 630, HUMSA NG and CMS started in March 2015 and were pending satisfactory completion. In respect of ASW Corvette 3018, SAT on all the weapons and sensors are pending satisfactory completion.

Thus, the effectiveness of the main feature of anti-submarine warfare was yet to be fully proved.

DND reply (January 2017) was silent on this issue.

Conclusion

The envisaged role of ASW Corvettes to provide Anti-Submarine Warfare support could not be achieved on account of non installation of critical sensors/ weapons as well as delays. The effectiveness of the main feature of anti-submarine warfare is yet to be fully proved as SATs in respect of six weapon sensor systems on the first corvettes and all the weapons and sensors in respect of the second corvette are pending satisfactory completion.

Recommendations

- ***IN may ensure that adequate fleet level is maintained.***
- ***IN may ensure that Designs are finalised in such a way that the envisaged parameters regarding weight and speed are achieved.***
- ***Sea Acceptance Test needs to be conducted on priority to address defects in the system. Timelines should be fixed and effectively monitored for successful completion of SATs.***

The matter was reported to Ministry (October 2016); their replies were awaited (March 2017).