The Sejong the Great Class DDGs: How ROK Navy Embraced and Trained them

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ABSTRACT

The Aegis combat system has been widely considered as one of the most powerful weapon systems for surface ships due to its high level of war-fighting capability. In 2009, Republic of Korea (ROK) Navy became the fifth country in the world that operates Aegis combat system-equipped ships through the KDX-III program, and a total of three Sejong the Great class DDGs (Destroyers with Guided missile) are currently in fleet operations. These ships have performed an excellent level of war-fighting capabilities such as successful tracking missions for the missile provocations by North Korea and ROKS Sejong the Great's top-gun award-winning at the firing competition during multi-national exercise. These are empirical supports showing outperformance of ROK Navy's DDGs in spite of its relatively short period of operations as less than six years when compared to other countries operating similar Aegis-equipped ships. In this paper, we introduce ROK Navy's strategy, plan and efforts to realize these accomplishments in the KDX-III program, mainly focusing on how ROK Navy accomplished and settled a high level of war-fighting readiness in such a short period from the ship's training and familiarization perspectives. Primarily, ship crew's individual capability and team work as an entire ship force were considered as the fundamental for proper operation and maintenance, which precede the state-of-the-art hardware such as system and weapons.

We introduce ROK Navy's systematic approach applied to training and familiarization as a core factor to maximize ship's performance and readiness in this paper. From the beginning of the KDX-III program, a phased approach for ship crew was applied to develop skills from the basic to advance. Based on the programmatic foundation, we present plans and achievements by ROK Navy Headquarters and fleet operations, which provided various opportunities including on-board familiarization and utilization of the Aegis Operation and Maintenance Center (AOMTC) – ROK Navy's own education and training facility for DDGs. At the end, we conclude with lessons learned and proposals to utilize these efforts for force improvements in the future.

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INTRODUCTION

The acquisition of Sejong the Great class DDG is considered for ROK Navy as a meaningful milestone in terms of the construction of its fleet forces. ROK Navy has strived for a compact but strong force in the East Asia region, which resembles its history achieving surprisingly remarkable development only in several decades after the Korean War. Based on the 'Defense Reform Plan 2020' - a force establishment plan driven by Korean Ministry of National Defense - the Sejong the Great class DDG was acquired in order to enhance ROK Navy's operational capability and to assume the role of flag ship in the 'Task Fleet' so that it can support to realize ROK Navy into the 'Ocean-going' navy, which is the ROK Navy's initiative since 1986. Especially, the Sejong the Great class DDG is equipped with the 'Aegis Combat System' as ship's main combat system, which is one of the up-to-date combat systems and deployed in many advanced countries such as United States and Japan. By the acquisition of the Sejong the Great class DDG, Korea became the fifth country deploying Aegis combat system-equipped destroyers in 2009. It has been expected that the ship can provide ROK Navy with the highest level of capability for detection, command & control and engagement based on this system, and it is also surprisingly enough to see that ROK Navy has deployed these assets without any significant delay or issue as many empirical supports show since the ship is commissioned and deployed for various missions.

It is obvious that successful deployment of this core asset equipped with complex system is not as simple as purchasing an electronic appliance that can be easily used like a 'plug-n-play'. There must have been tremendous efforts for this successful deployment, and we think that it is right time to review and discuss how ROK Navy could successfully embrace this asset as a national strategic asset in a relatively short period of time. Especially, training and educating ship crew is the fundamental for proper operations and maintenance of the ship, which precede the hardware like any system or weapon. Thus, we focus on ROK Navy's approach and methodology for effective training and education to establish ship crew's individual capability and team work as an entire ship, and the primary purpose of this paper is to summarize the lessons learned from the initiation of the program to the deployment of the ship into operations. We discuss in a chronological and phased order from the perspectives of training and education to see what ROK Navy has done from the beginning to this day so that these lessons can be utilized for other forces or nations in the future as a reference point to improve the effectiveness of training and education and to mitigate potential risks when acquiring new assets.

This paper is structured as follows; The chapter 'BACKGROUNDS' discusses backgrounds regarding its acquisition and ship's general specification which would be the basis to identify necessary factors in preparation and execution of training strategy and policy, and we present various practices of ship's successful achievements as empirical supports to prove ship's successful deployment. In the chapter 'APPROACHES AND EFFORTS', we introduce ROK Navy's approach and efforts from preparation, building and operation phases to the present to show what contributed in each phase based on the first ship's timeline. We then conclude this paper with conclusion and future works in the chapter 'CONCLUSION'. In addition, we mainly focused on a methodological way and referred to various contents from press releases so that we could avoid discussions on unauthorized or classified topics.

BACKGROUNDS

The Sejong the Great class DDG is acquired under the KDX (Korea Destroyer eXperimental) program, which is a part of the 'Defense Reform Plan 2020' aiming to replace the outdated destroyers transferred from US Navy in 1980s with modernized destroyers. There have already been a dozen of DDH-I/II class ships acquired under KDX-I

and KDX-II programs, and the KDX-III program was the final phase of a series of programs to acquire a total of three 7000-ton class destroyers. The basic design of the ship was developed from 2001 to 2003 by Korean shipbuilding companies, and the 'Aegis Combat System' was selected as ship's main combat system in 2002. The first ship was named as ROK Sejong the Great (DDG-991), and launched in May 2007. Subsequently, all three ships were commissioned and deployed into fleet operations in 2013.

The acquisition of the Sejong the Great class DDG implies for ROK navy that the core asset to realize the 'Ocean-going' navy is finally added to its fleet list. The facts that ROK Navy named the first ship as 'Sejong the Great' - one of the most magnificent kings and the ship's catchphrase was given as the 'Turtle ship in the 21st century' which was inspired by the turtle ship built by Admiral Yi Sun-Shin – a famous Korean navy admiral in the Joseon dynasty in the 15th century who defeated Japanese invasion - show the significance of the acquisition.

Ship's General Specification

The primary objective of acquiring this class of ship for ROK Navy is to have a core asset in preparation for the advancement to the 'Ocean-going' navy, which is the ultimate objective of ROK Navy. The Sejong the Great class ship has essential capabilities to conduct various missions such as theater-level anti-air defense, ground operations support, aircraft control, and tracking normal and ballistic missiles. Thus, these capabilities can largely contribute to the improvement of operational capability for ROK Navy, and this asset can be utilized as the flag ship of ROK Navy's 'Task fleet'. The ship is installed with the Aegis combat system including its remarkable SPY-1D (v) multi-function radar and various other systems such as detection, command and control, and weapon system, manufactured by US-based manufacturers. In addition, various kinds of weapon and sensor systems developed by Korean domestic vendors (i.e., KVLS (Korean Vertical Launching System), surface-to-surface/surface-to-subsurface/surface-to-land cruise missiles, torpedo, electronic warfare system, and navigation radar) are integrated with the Aegis combat system. Due to this unique configuration, the ship is called as the Aegis combat system-equipped destroyer with Korean configuration baseline. When compared to the other Aegis combat system-equipped ships in US or Japan, it is evaluated that it is equivalent or superior to them in terms of the specification and configuration of the ship (Donaldson, 2013). In addition, Korea has competitive shipbuilding industries ranked in top five in global shipbuilding market. Based on this advantage in shipbuilding industry, Korean naval ships have been built by Korean shipbuilding companies since 1980s such as the first Korean frigate, and all three Sejong the Great class destroyers were also built by Korean shipbuilding companies in Korea from the basic design to the final delivery to ROK navy.

- **Size (meter):** 165 m x 21 m x 6 m
- **Tonnage:** 7,700 ton
- **Weapons:**
  - Aegis weapon system with SPY-1D(V) R/D
  - 5"/62 Gun, Missiles (Surface to air/surface/sub), Torpedo, Close-in weapon system
- **Ship Crew:** Approx. 300 officers and the enlisted
- **Three Sejong the Great class DDGs commissioned in 2008, 2010 and 2012 respectively.**

Figure 1. Specification of Sejong the Great Class DDG
(Photo: Courtesy of Republic of Korea Navy)

The Sejong the Great class DDGs in Action

There have been various accomplishments of the Sejong the Great class DDGs since the ships were commissioned. As this paper is motivated by the fact that the ship has been adopted into ROK Navy and accomplished given missions successfully, we thus aim to review the steps taken for these accomplishments and to identify lessons learned from them. Therefore, we first present empirical evidences to support this assertion. There are a number of

quantitative methods to measure a level of accomplishment such as measurement of effectiveness. However, we present various practices in a qualitative way to evaluate how the ship could be successfully deployed in this section. As we previously described the purpose of the acquisition of the ship, the ship is acquired as a core asset of the ROK Navy Task Fleet to accomplish various essential tasks such as theater-level air defense, ground operations support, aircraft control, ballistic missile tracking, etc. There are three main accomplishments for these tasks, and we present them in a timely order. First, the ships successfully countered multiple provocations with ballistic missile threats by North Korea. The ships participated in missions in vicinity of Korean peninsula both in the East and West Sea, and successfully tracked their long-range rockets in 2009 and 2012 respectively (I.H. Shin, 2009). Second, each ship successfully completed the CSSQT (Combat System Ship Qualification Trial), which is a comprehensive evaluation of ship's overall readiness both for ship crew and combat system, and all ships have been certified for their combat readiness (Ratan, 2014). Third, all ships have actively participated in various kinds of combined exercises such as RIMPAC (Rim of the Pacific) exercise, Foal Eagle exercise, and other exercises to project their deterring capabilities based on the combined interoperability. Especially, during the RIMPAC exercise in 2010 when the first DDG - ROKS Sejong the Great - participated in as her 'maiden' combined exercise, the ship was awarded as the top-gun ship among 19 ships from various nations for the excellence in the surface gunnery exercise (Lee, 2010). Even we presented only some remarkable practices in this paper, these facts sufficiently support that the ships are successfully deployed with no significant issues since their procurement, and they have accomplished every given mission successfully to assume their role as strategic assets for Republic of Korea armed forces. Thus, it becomes clear that we need to find out how the ship crew are trained and educated to fulfill ship's combat readiness.

Considerations

Based on the background of the acquisition and specification of the ship we discussed above, ROK Navy initially conducted a SWOT analysis at the beginning of the program in order to identify the factors required to be considered to prepare and set effective ways of training and education for ship crew. The SWOT analysis method was selected since it is a good way to analyze an organization's current status (Helms and Nixon, 2010). The summarized result of the analysis is shown on Fig. 2. The major factors that were identified for consideration for training and education are as follows. First, the ship is equipped with one of the most complex and challenging system in operation and maintenance even though the Aegis combat system can provide ROK Navy with the most powerful capabilities. Especially, a close coordination between ROK and US governments is considered as an essential factor to build and maintain ship crew's proficiency and readiness throughout the planning and execution of the program since the system is procured from foreign manufacturer through FMS (Foreign Military Sales) case between two governments. Second, a basic level of knowledge for combat system operation and maintenance is required for the prospective ship crew. In addition, the ship crew's language barrier also needs to be overcome since the system is procured from foreign country and they need to learn from foreign manufactures at first. Thus, it is

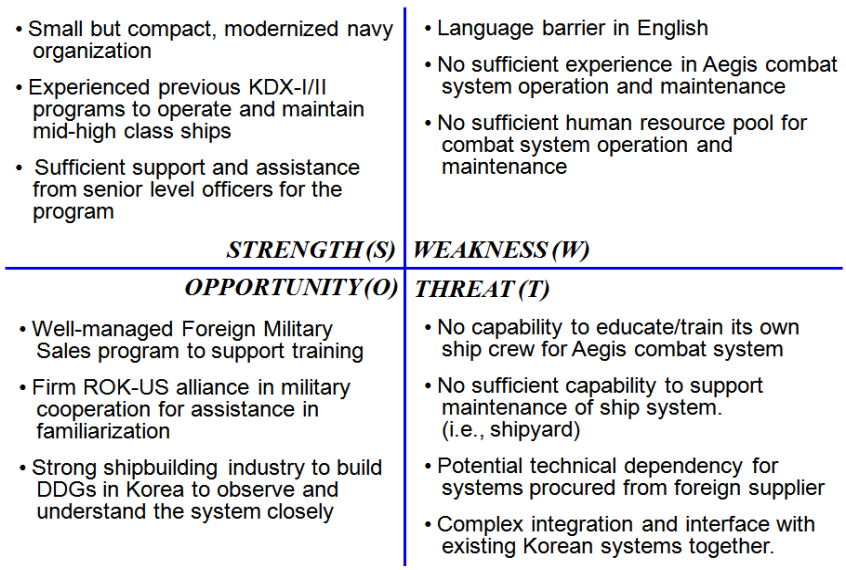

Figure 2. Summary of SWOT Analysis for ROK Navy's Status in Preparation for Deployment of DDG

necessary to verify that the ship crews have the basic language skills in advance before those manufacturers provide initial training and education for the system. Third, it is required to understand the interface of Korean domestic sensors and weapons integrated with the Aegis combat system since it is the basis of the overall mechanism and interface of the ship to operate and maintain the ship's capability properly. The factors mentioned above are identified as key factors for ROK Navy in order to prepare for the initiation of the program. Lastly, there has been no sufficient supporting information for operation and maintenance of the system such as publications, logistic supports and capability to train and educate the ship crew by itself.

APPROACH AND EFFORTS

In this chapter, we present ROK Navy's approach and efforts from the initiation of the program to the current operations of the ship in a phased order based on the timeline of ship #1. We discuss how the accomplishments mentioned above could be achieved in terms of the factors in each phase. The successful operations of this ship could have been realized by not only the detailed preparation and planning but also intensive efforts during last decade. We divided into three phases, which are preparation, building and operation phase.

Preparation Phase

This preparation phase includes the period from the initiation of the program after the conclusion of the contract for acquisition of the ship to the launching ceremony of the ship, which is a milestone considered as a birth for the ship. This phase is considered as a starting point of the entire program. First, ROK Navy headquarters organized a task force named 'KDX-III Task Force for DDG deployment' in 2007 to establish fundamentals for ship's deployment. The goal of the task force is to identify tasks necessary to be prepared by various entities of ROK Navy and to oversee the progress of each category throughout the entire program. The task force was lead by a flag officer and identified various tasks including developing publications, preparing for CSSQT (Combat System Ship Qualification Trial), and developing integrated logistic support plan, which are shown on Table 1. Especially, the subgroup for training, education and familiarization identified essential tasks such as an integrated management of ship crew as a human resource pool, establishment of ROK Naval Combat System School, etc.

Category	No. of Tasks	Major Tasks
Fleet Operations	8	✓ To develop the Master Plans for DDG operations, training and education ✓ To publish ROK Navy's combat system doctrine and operational manuals ✓ To translate English version manuals into Korean ✓ To conduct acceptance trials for DDGs, etc.
Training, Education and Familiarization	5	✓ To manage human resource for Aegis weapon system trained officers and the enlisted. ✓ To establish the Naval Combat System School ✓ To develop a plan to conduct CSSQT ✓ To develop a plan to train initial ship crew, etc.
Combat System Maintenance and Support	4	✓ To develop a plan for Aegis weapon system maintenance ✓ To establish a life-time support maintenance system ✓ To develop a plan for Integrated Logistic Support, etc.

Table 1. Summary of ROK Navy's Tasks for Training and Education of DDG ship crew

Second, ROK Navy headquarters developed a master plan that serves as a basis for implementing training and education. When developing the master plan, the programmatic support by the FMS case was considered as a backbone of the plan. That is mainly because the training and educating package for ship crew was also included in the contract when the Aegis combat system was procured through the FMS case between ROK and US as shown on Fig. 3. It consisted of four main stages of training and education for the ship crew from the basic training in US-based training center to the advanced training for enhancing combat readiness. ROK Navy adopted this concept of US-provided training and education since it can be considered a role model, and established the master plan adding

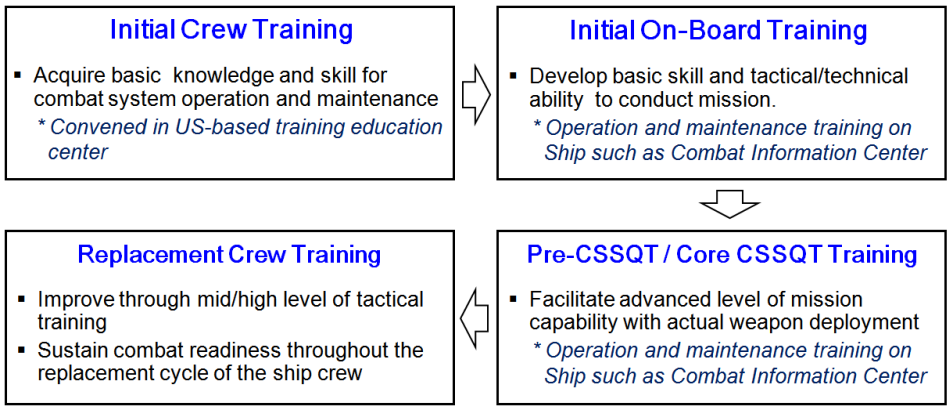

Figure 3. The Concept of Training and Education by Programmatic Supports

more opportunities that can contribute to training and education of the ship crew as shown on Fig. 4. Since there has been no background regarding operation and maintenance of the system, a step-by-step approach was applied in order to build the capability from the basic to advanced level. According to the master plan on Fig. 4, the step one corresponds to the preparation phase, the step 2 to the building phase, and step 3 and 4 correspond to the operation phase.

Third, ROK Navy headquarters selected the prospective ship crew. The ship crews were selected by qualification tests for basic knowledge of combat systems and English language skills. Based on the programmatic support of the FMS case, all the initial ship crews are supposed to be detached to US-based training centers for initial crew training to acquire basic level of knowledge and skills. Thus, it was required for ROK Navy to select the officers and enlisted who are qualified to complete these courses. The members were then gathered together for several months to have intensive preparatory training and education for basic knowledge of combat system and English language skill by ROK Navy Training and Education Command. After the preparatory period, they were detached to various training centers in US to acquire basic concept of the system according to each assignment. Since it was limited to facilitate the ship crew with basic knowledge and skills in Korea and also by ROK Navy, the initial ship crew is required to be detached to US-based training and education centers to achieve this objective. It was fully acknowledged by ROK

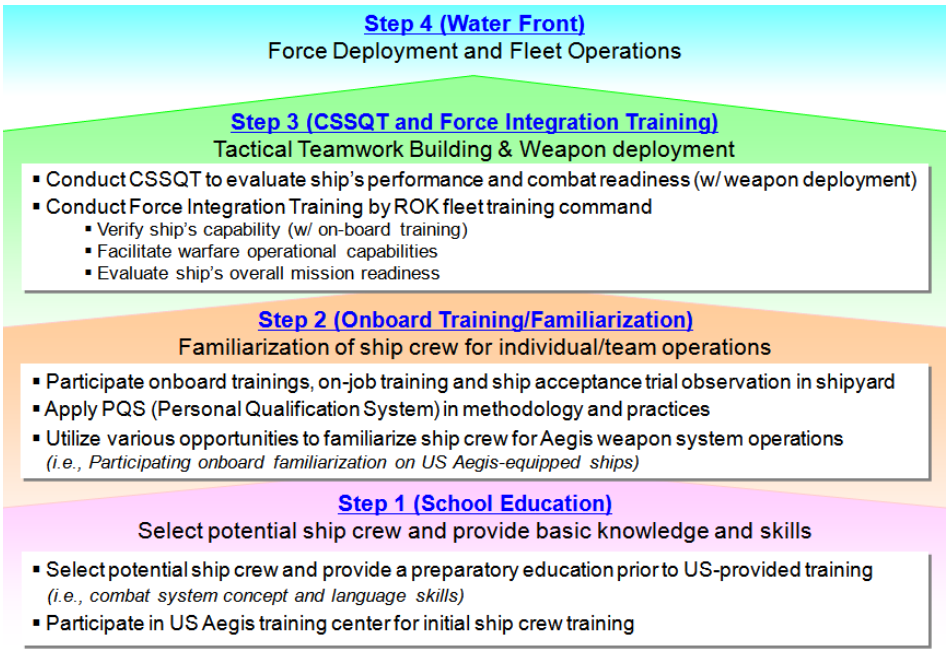

Figure 4. The Summary of the Master Plan for Training and Education of the Ship Crew

Navy that these detachments are not the ultimate solution for further ship crew replacement, and the requirement to establish organization and facility for training and education was also identified as one of main tasks of ROK Navy. In fact, the construction of ROK Navy's own training center for the Aegis combat system was also included in the FMS case so that ROK Navy can have its own facility to train and educate subsequent ship crews, which would be a part of facilities for ROKN Combat System School. (This facility will be discussed in detail later in the operation phase.)

As we discussed, during the preparation phase, the task force was organized as a control tower, tasks were identified, and the master plan was established by ROK Navy headquarters along with the programmatic support by the FMS case. These fundamentals are utilized as a basic direction in implementing training and education for the ship crew. At the same time, the prospective ship crews were selected, gathered for the preparatory training and education, and finally detached to US-based training and educating centers. In addition, the ship was designed and constructed in Korea by Korean shipbuilding company combined with US manufacturers. Various equipments of combat system were transported from original countries to Korea, installed on-board the ship, and integrated with other systems such as Korean domestic furnished equipments.

Building Phase

This phase begins with the launching ceremony of the ship and finishes when the ship is commissioned and attached to ROK Fleet Operations Command. The ship crew normally known as pre-commissioning unit arrived at the shipyard after they completed the basic training courses and came back from US. They then assumed the role as an initial ship crew detached to the shipyard. The primary objective in this phase is to enhance ship crew's skill and capability to operate and maintain the system along with ship building. Various kinds of opportunities were utilized to improve ship crew's operation and maintenance capability, and we present five main factors in this phase. First, the ship crew participated in various shipbuilding activities during the time they were detached to the shipyard. As mentioned above, the ship was built in Korean shipbuilding company, and this provided the ship crew with valuable opportunities to observe installation, test and acceptance trials closely and to be familiarized with ship's system. In addition, there were on-job trainings provided by manufacturers to have instructions for the systems installed during ship building period. Even though there are separate ROK Navy organizations to evaluate shipbuilding progress and trials, it acted as a good chance for the ship crew to observe and experience ship's system in person for the first time.

Second, the initial on-board training under the FMS case was commenced. It was the second stage of the training cycle under the FMS case as mentioned above on Fig. 3. This training mainly focuses on the development of basic level of skill and tactical/technical ability for ship crew. Based on the knowledge acquired in US training centers, the ship crew could obtain tactical and technical skills for individual assignment and build team work through combat information center training course as shown on Fig. 5 (upper left). In addition to the regular training courses, ROK

Figure 5. Main activities to enhance ship crew's skill and capability during the building phase
(Photo: Courtesy of various sources, see reference)

Navy headquarters and Operations Command utilized close relations with allied nations. Among these nations, US Navy was considered as a benchmark for ROK Navy for its long history and advancement in training and familiarization. There have been numerous symposiums and Navy-to-Navy talks between senior leaderships from two navies to support ROK Navy to be familiarized through mutual cooperation. There have been regular combined exercises between ROK and US such as Key Resolve/Foal Eagle exercise, and these exercises were also utilized to send the initial ship crews to US ships for on-board familiarization not only to assume exchange officer assignments but also to be familiarized and learn US Navy's know-how in Aegis system operation and maintenance as shown on Fig. 5 (lower left). The familiarization gave the ship crew insights to operate, maintain and conduct on-board ship training. For example, the ship crew learned the training methodology during the on-board training to organize training teams by ship crew to train the other ship crew by themselves such as on-board integrated training team or combat system training team, which is a new training methodology for ROK Navy. They could observe in person on US ships how actual trainings are conducted with these concept and methodology. In addition, they could observe how the PQS (Personal Qualification System) works for each assignment for CIC (Combat Information Center) watch standers on Aegis ships. These experiences were valuable and have been utilized when the ship crew developed publications for DDG training and education such as 'Ship training manual for the Sejong the Great class DDG' and other manuals.

Lastly, ROK Navy opened a training and education facility - AOMTC (Aegis Operation and Maintenance Training Center) under ROK Naval Combat System School in 2009 as shown on Fig. 5 (upper right). The facility was constructed as a part of the KDX-III program, and it has electronic classrooms, an emulated CIC with consoles equivalent to the consoles on the ship. It is evaluated as the second training facility of its kind in the world after the ATRC (Aegis Training and Readiness Center) in US Navy (Jung, 2009). With the AOMTC, ROK Navy could have an infrastructure to train and educate officers and the enlisted with its own facility. The classroom lectures provided basic knowledge on Aegis combat system for individuals, and the tactical team trainings on the emulated CIC enhanced the CIC watch standers' team work with simulated consoles. The AOMTC also worked closely with US partners through mutual summits and reciprocal visits in order to exchange ideas for effective training and education as shown on Fig. 5 (lower right).

Operation Phase

This phase begins when the ship is commissioned and attached to ROK Navy Operations Command as an active combatant. Through the training and education conducted during the building phase, it is recognized that the ship crew has an adequate level of knowledge and skill to conduct their missions. However, dynamic tactical situation in vicinity of Korea requires the ship to have a higher capability so that the ship can operate as not only a single ship but also an entity of a combat group combined with other forces or nations. In addition, it is also necessary to consider how well the level of skill and knowledge for the ship crew can be maintained consistently even though a significant number of initial ship crews are replaced annually or biennially. In this sense, we could identify four main events conducted during the operation phase. First, the CSSQT was conducted in order to certify ship's overall combat readiness. It was conducted not only to certify the performance of combat system including actual deployment of weapons such as surface-to-air missiles and guns but also to certify the ship crew's skill, proficiency and team work to properly operate and maintain the system. The CSSQT was a new concept for ROK Navy in terms of test and evaluation for newly built ships even though there has been a similar training event, which is the force integration training. It was considered as a great opportunity to certify overall combat readiness of the ship. There was also a pre-CSSQT training in preparation for CSSQT. The focus of the training is to verify ship crew's capability to deploy ship's weapon. The procedure to master proficient operation of the system was developed by the ship crew, and it was repeatedly performed with weapon simulators.

Second, the replacement crew training was conducted to provide training and education for newly replaced ship crew and to refresh the existing ship crew. In addition, ROK Naval Combat System School also supported training and education for projective ship crews before they are assigned to the ship. In addition, the initial ship crews were transferred to the assignments highly related to the operation and maintenance of the Aegis combat system after they finish their assignment on the ship. Some of them became instructors to train and educate at the ROK Naval Combat System School, and others were transferred to the program office or logistic command to support the ship's operation and maintenance. Likewise, officers and the enlisted from Aegis-related organizations were utilized as replacing ship crew. This pooling of the human resources for DDG is considered as an effective way to maintain the level of overall ship's readiness in a limited situation.

Lastly, ROK Navy Operations Command utilized various opportunities to enhance the interoperability for ship's operations. For example, additional capability mainly required for the ship crew by Operations Command was the air-control capability since the ship should assume a central role to control aircraft for air defense mission. Therefore, training AIC (Aircraft Interceptor Controller) is identified as additional training requirement. The AIC courses in US Navy aviation school and training/maintenance courses in ROK Air Force were identified and utilized for the ship crew to add more capability for air controlling mission. ROK Navy Operations Command has continued to seek opportunities to enhance interoperability with other nations or forces.

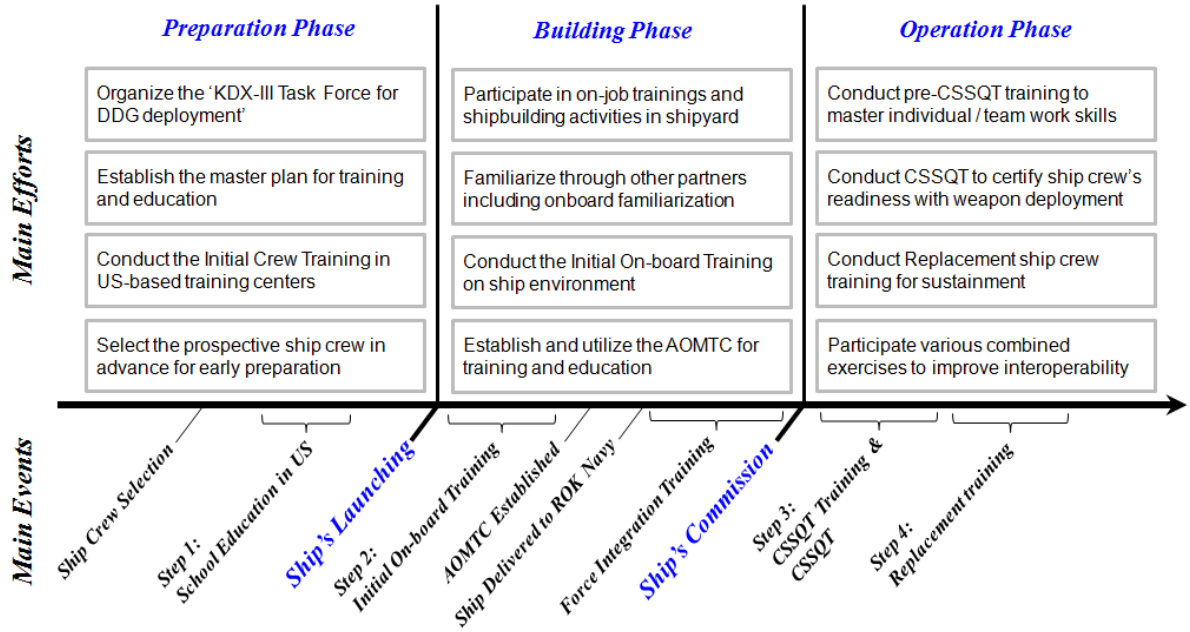

Figure 6. The Overview of ROK Navy's Approach to Training and Education of DDG Ship Crew

CONCLUSION

The acquisition of the Sejong the Great class is a remarkable milestone for ROK Navy in achieving its continuous advancement for the 'Ocean-going' navy. The Sejong the Great class DDG is considered as 'the second turtle ship' to assume a role of flag ship in the 'Task Fleet'. The successful deployment of this asset was a challenge for ROK Navy since it has been considered as a first-ever acquisition of a high-value unit with complex systems. ROK Navy has worked aggressively to accomplish this objective beginning with organizing a dedicated task force, and developed basic policy and plans to have its ship crew trained and educated along with the programmatic supports. Based on the factors that we discussed, we presented ROK Navy's approach with main efforts from the preparation phase to the operation phase as shown on Fig. 6. As a result of this systematic approach, the ships could have been deployed and accomplished given missions actively and successfully as strategic assets for national security.

Recently, ROK Navy announced that it has determined to have three more destroyers in the near future. Even it is certainly good news for ROK Navy to have additional high-end assets for its fleet, it also comes as another challenge to accomplish successful deployment of the asset as the last three ships. In this sense, this paper discussed various aspects of the prior experiences focusing on a phased approach of ROK Navy for the deployment of the Sejong the Great class DDG in training and education, and drew a structural framework for preparing, building and deploying an asset into forces. We also evaluate that this paper can contribute to the next voyage for the assets in the future. In addition, when other forces or navy in other country considers acquiring new kinds of assets or systems, the lessons learned identified in this paper can be effectively utilized for successful deployment of those assets.

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