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Analysis of Problems with Warship Damage Control Plans and Methods for Preparing Damage Control Plans[1]

Jian Huajun and Zhu Haishi[2]

"Damage control" (*sunhai kongzhi*, or just *sunguan*) refers to measures and actions taken by a warship for the prevention, control, and elimination of damage in order to maintain or recover its vitality (*shengmingli*). If a warship suffers an accident, this could result in major casualties among the crew and cause damage to the ship's equipment; it might also impact the ship's vitality. The crew's

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normal level of damage control training determines the success or failure of damage control. In order to fully leverage the active role of crew members in damage control and fully leverage the effectiveness of damage control, a scientific and rational damage control plan must be prepared. The damage control plan resolves questions related to the deployment and responsibilities of personnel during the damage control process, according to certain principals and requirements. It scientifically and rationally arranges for crew members at their individual combat posts (*zhanwei*) to use corresponding equipment and materials (*qicai*)[3] to implement the correct damage control actions to ensure the vitality of the ship. The ship's commanding officer (CO) should prepare and periodically revise the damage control plan based on the kinds of damage that could occur. The preparing of the damage control plan must focus on the overall situation, highlight the key points, and be rooted in realistic combat situations. The damage control plan has important guiding, learning, training, and risk management functions in warship management, and it can improve warship safety management. But in practical work situations the emergency response plan often suffers from problems such as being incomplete, being disconnected from the scene [of the action], and crew members doing their own things (*gezi weizheng*). To a large extent, this is attributable to irregularities in the preparing of the damage control plan and poor quality control. As a result, the important functions of the damage control plan are not being fully leveraged.

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[1] 翦华军，朱海仕 [Jian Huajun and Zhu Haishi], 舰艇损管预案问题分析与编制方法 ["Analysis of Problems with Warship Damage Control Plans and Methods for Preparing Damage Control Plans"], 安全 [*Safety & Security*], 43, no. 7 (July 2022), pp. 41-46.

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[3] The term *qicai* (器材), often translated as "materials," refers to utensils, tools, parts, and components.

By conducting research into warship damage control plans and summarizing methods for preparing damage control plans and aspects that deserve attention, [this article] provides guidance for warships to effectively conduct damage control actions. [It seeks] to make it easier to organize rapid and orderly damage control operations, enable crew members to coordinate and cooperate from their individual battle stations and [damage control] zones (*quhua*) during the damage control process, employ various types of technologies and means, control the expansion of the damage, successfully implement damage control actions, and reduce damages and losses as much as possible, ultimately achieving a correct and highly efficient damage control effect in order to ensure the ship's vitality.

1. Analysis of the Current Situation with Damage Control Plans

1.1 The Current Situation with Damage Control Plans

In recent years, all warships have revised and improved their respective damage control plans based on requirements from above. During this process of revising and improving plans, it was discovered that the plans widely suffered from problems with damage configurations (*sunhai sheding*), handling [of damage control] on the scene (*xianchang chuzhi*), the dispatching of personnel (*renyuan diaodu*), equipment use, and organization and command. These mainly manifest in the following ways:

(1) There is insufficient emphasis on damage control plans. Due to a low level of professional knowledge, inadequate work experience, and a weak sense of responsibility among the personnel responsible for preparing (*bianzhi*) damage control plans, some warships take plans from other ships, make a few minor modifications, and then adopt them as their own ship's plan in order to cope with inspections from their superiors. Personnel responsible for preparing the plans do not conduct on-site investigation or analysis at combat posts or in ship compartments. Instead, they "divorce themselves from reality" (*bimen zaoche*) in their offices. As a result, the contents of the plan are incongruent with the real circumstances of the ship, and in the case of an accident involving damage the plan cannot serve as the basis for overseeing or handling damage control.

(2) Damage control plan risk analysis is inadequate. Risk assessment done by ship commanders for each compartment and combat post is inadequate, risk identification is unclear, the ability to control risk and handle issues is not comprehensive, and there are no targeted measures for managing risk assessment results. Moreover, analysis of the possible impact scope of the accident and the possible derivative accidents that it might cause is insufficient. As a result, damage control plans are poorly targeted (*zhenduixing bu qiang*). First, risk evaluation is incomplete. The ship CO does not convene the drafting team to study and research identified risks for equipment in each ship compartment and combat post. Instead, they just rely on personal impressions and knowledge to determine scenarios, so scenarios are too simplistic. Second, the scenarios do not match real combat [situations]. Scenarios are not determined based on the extent of weapon damage. If the scenario involves the vessel suffering a missile or torpedo attack, the size and location of the breach are artificially set, and not to the most difficult, most dangerous, and most complex possible [scenarios]. [These assumptions] are unsupported by data, and evaluations of effectiveness lack specificity.

(3) Damage control decision making lacks theoretical basis. There has been no serious research or analysis into the patterns of the occurrence and development of damage, and actions to handle [damage] lack theoretical basis. Damage control commanders do not command and make decisions according to the development of the situation, and actions to handle [the situation] are fairly arbitrary. The emergency response behavior for each combat post, zone, and damage control team is disconnected. There is a lack of content such as analysis and assessment of the characteristics and extent of vessel damage; methods, requirements, and issues deserving special attention when conducting damage control; and damage control effectiveness assessments.

(4) The damage control plan is not focused. First, the assignments and responsibilities of personnel are unclear. The actions for each combat post, zone, damage control team, and all other personnel on the ship are overly simplistic, there is little cooperation between them, and responsibilities are unclear. Second, when multiple different procedures are activated at the same time, there is no clear sequencing order, so there are overlapping procedures or overlapping responsibilities. After a certain part of the ship catches fire, or water enters, or equipment malfunctions, or casualties occur, questions such as who will go and rescue [the injured], should the fire be put out first or should the leak be plugged first, and who does what, are unclear, and cooperation between crew members is poor. Third, organizational structure is unsound. The damage control plan leaves out organizations such a fire fighting groups, groups responsible for preventing the ship from sinking (*kang chen zu*), equipment groups, rescue groups, and assessment groups. Some warships lack a leading group (*daodiao zu*). During the training process there is incomplete control over emergency situations. In every case, they complete training according to procedure, and they do not provide leadership (*daodiao*) for all elements and all systems related to the damage.

(5) Drilling on the damage control plan is incomplete, and revisions are not meticulous. First, damage control plan drills are mere formalities (*liu yu xingshi*), organization is lacking, and comprehensive drills are not conducted. Thus, the results of damage control plan drills are suboptimal (*bujia*). Second, after the damage control plan is developed, it is seldom subject to testing under realistic conditions. Do the actions of personnel from each part of the ship make sense, and are they feasible? Are there any missing actions? Can methods for handling [the situation] eliminate the damage? These questions are never verified. Third, revisions to damage control plans are not meticulous enough. After the vessel develops a damage control plan, the plan must be continuously revised according to changes in the situation. For example, if there are changes to vessel personnel, or if equipment is modified, and as the warship ages, the damage control plan must be revised accordingly.

1.2 Analysis of the Causes of These Problems

(1) The personnel charged with developing the damage control plan have low levels of theoretical understanding. Commanders at each level on the ship lack deep and solid theoretical knowledge of the ship's compartment structure, damage control devices, damage control regulations, and the destructive effects of weapons on ships, and there is an attitude of impulsivity. The approach to learning is not closely connected to reality,

there is a lack of comprehensive understanding, and the aim of studying while engaged in training and training while engaged in study cannot be achieved.

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(2) There is insufficient understanding of the role of the damage control plan. First, there is inadequate understanding of the importance of damage control plans. Among personnel of all ranks on the ship, there is inadequate emphasis on the aim and function of damage control plans, with misalignment in thinking and understanding. The assessments of ship COs are inadequate with respect to the severe consequences that might be caused by an incident. There exists a luck mentality (*jiaoxing xinli*): they believe that the vessel could do without a damage control plan, so they are unwilling to expend lots of effort on the damage control plan. Second, damage control plans are developed by just a few people, their suitability for real combat situations is poor, and there exists a fairly pronounced problem with other crew members being unfamiliar with the contents of the damage control plan. The majority of vessel damage control plans are developed by the ship's chief mechanical/electrical officer (*jidianzhang*), without participation from commanders from other levels on the ship. As a direct result, the development of damage control plans is regarded as a mere formality. Third, risk assessment, the transfer (*diaoyong*) of damage control equipment for use, and the emergency use of equipment are all regarded as mere formalities. The description of complex risks is not well-focused, and there is no comprehensive scientific analysis of the severity of incidents, scope of impact, or secondary damage.

(3) Development work for damage control plans is weak (*bu zhashi*). The organizer of the drafting of the damage control plan (i.e., the ship captain) does not form a damage control plan drafting group and does not conduct scientific planning or [establish a] division of labor for preparing the damage control plan, much less formulate corresponding work plans. After drafting of the damage control plan is complete, a simulation (*tuiyan*) or review (*shencha*) is not organized, the views or suggestions of commanders at different levels are not widely solicited, and the contents of the damage control plan are not further optimized.

(4) The complexity of damage control training is not fully understood, and there is inadequate recognition of the [the importance of being] brief, flat, and rapid (*duan, ping, kuai*) in damage control plans. First, damage control is imagined in terms that are too simplistic. There is a belief that complex damage control involves a fire starting and water entering at the same time, with the addition of casualties. Crew members train according to assigned responsibilities, each combat post reports up the chain on how they are handling the situation, the commander sends down orders, and the damage is successfully dealt with. This [approach] ignores the complexity of the damage. Second, damage control training is overly simplistic. It is just a simple overlay of damage control skills training. It ignores the fact that the important characteristic of complex damage control is the total factor (*quan yaosu*) [aspect]. It does not conduct damage control training from [the perspectives of] individual crew member actions, combat post coordination, organization and command, and the damage situation. There is fairly little training on escaping from danger (*renyuan taosheng*) under complex conditions,

searching for missing crew members, emergency handling of equipment, and abandoning ship.

(5) The guiding role of headquarters departments (*jiguan yewu bumen*) is not obvious. Headquarters departments do not carefully investigate issues related to the surface fleet's damage control plans. In their work, they have prioritized delegation and under-emphasized implementation (*zhong bushu qing luoshi*). They lack whole-of-process supervision, do not track results, and do not hold people accountable, and they are even less willing to take a hard line on these issues. Education and guidance on newly-emerging (*miaotouxing*) and tendentious (*qingxiangxing*) issues lack depth, and assistance is lacking (*bangdai baguan bu yan*). As a result, warship crews have inadequate understanding of damage control plans, with damage control plan corrections, guidance, and inspection not occurring in a timely manner. When contradictions occur, people just walk around them.

2. Preparing the Damage Control Plan

2.1 Overall Requirements

(1) The basis for preparing the damage control plan. Regarding the basis for preparing the damage control plan, there are mainly four aspects to consider. First, the damage control plan requirements as stipulated in the "Navy Military Training Outline"; second, the configuration of ship damage control equipment and materials and the personnel staffing situation; third, the ship's table of assignments (*bushu biao*); fourth, key parts of the vessel [related to] damage control and the damage that might be suffered.

(2) Being clear about the role of the damage control plan. The ship CO should increase understanding of the importance of the damage control plan and clearly understand the role it plays in emergency response, fundamentally understanding that the damage control plan is used to handle emergencies. [The CO] must strengthen preparation and management of the damage control plan. [The CO] must strengthen the sense of responsibility among officers, must be forward thinking, must consider issues from the elevated perspective of science and development, and delegate responsibility in a reasonable manner. The damage control plan is not for show (*bu shi baishe*), and it is not just a means to cope with inspections. Rather, it should be continuously drilled during damage control training. Only by doing so will the crew not be panicked or perturbed and handle matters in an orderly way when an emergency occurs.

2.2 Issues that Deserve Attention

(1) Clear thought processes. A damage control plan must be prepared with a clear thought process. First, the damage situation must be ascertained, clearly determining primary and secondary [damage], followed by the resolve to handle the situation. Second, the importance of "limiting the spread" must be remembered at all times. [Ship crews] must adopt effective actions to control damage to the maximum extent possible, reduce or eliminate damage, and prevent the expansion or spread of damage to other compartments. Third, [crew members] must consider the impact that damage control actions will have on the equipment in the compartment [where damage occurred], in relevant compartments,

and on the combat post. Negative impacts must be eliminated, the combat power of the equipment must be preserved, and the ship's vitality must be recovered to the maximum extent possible. Fourth, the occurrence of secondary disasters must be prevented in a timely manner while handling the damage. Damage control cannot be treated in a narrow manner as simply preventing the ship from sinking and extinguishing fires. Rather, efforts to prevent sinking and extinguish fires should be closely integrated with the emergency handling of equipment. To the maximum extent possible, the supply of power and electricity to the whole warship should be maintained, the [ability to] use weapons and equipment systems should be ensured, and the ship's ability to maneuver should be ensured.

(2) Emphasize "realistic" (*shizhanhua*) tabletop simulations (*zhuomian tuiyan*). Before preparing the [damage control] plan, the plan drafting group should take relevant scenarios and place them on a tabletop or aboard the ship. They should simulate the circumstances that might be encountered through every step of the process, discussing and determining the most reasonable and feasible measures. During the simulation, they must consider combat posts, zones, damage control teams, and support crew members from adjacent compartments. They must simulate the development of the damage situation, personnel coordination, and equipment use. After the tabletop simulation, they can then prepare the damage control plan.

(3) Damage control data must be quantified. When preparing the damage control plan, relevant damage control data must be accurately calculated for different damage (fire) in each compartment. More calculations and comparisons must be done so that the data can be converted into intuitive phenomena and physical quantities, providing powerful bases for commanders to correctly judge the degree of damage and conduct scientific decision making. Every damage control action—the initial response by crew members at combat posts, initiation of the damage control response for the whole ship, resource allocation, emergency response, elevation of response, and the end of the response—should all be clearly described. For example, when the flow through a breach reaches a certain level the leak should be plugged and water removed first before dealing with the equipment, and when the volume of water entering the ship reaches a certain level the crew should abandon ship. The impact of the damage on the ship's floating stability should also be fully considered, and effective measures must be adopted in a timely manner in order to ensure the ship's vitality.

(4) The setting for conducting drills related to the damage control plan should be realistic. On-the-scene drilling is a true simulation of a damage incident. The aim is to test (*jianyan*) and improve the

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damage control plan and make the plan more targeted. When simulating the accident, the damage control situation and course of events should be as realistic as possible, so that crew members feel that it is not an exercise and that a real ship accident has occurred. Equipment such as smoke generating devices, smoke canisters, and various types of leak-plugging simulation equipment should be used in order to increase the realism of the drill, so that those undergoing training can feel the battlefield and experience actual

combat, thereby strengthening their battlefield perception and real combat awareness. Those participating in training must be personnel assigned to that combat post or zone. The conduct of realistic drills can increase the ability of crew members to handle contingencies without surprise and [improve] their ability to adapt to the dynamic situations that occur during the course of a damage incident.

2.3 Drafting Process

The main work in the process of preparing the damage control plan includes the creation of a drafting group, research and collation of damage control materials, the drafting of a risk assessment report, analysis of damage control data, the drafting of the plan, revision and improvement [of the plan], and audit [of the plan]. The preparation of the damage control plan must prioritize the strengthening of realistic damage control capabilities under complex conditions, emphasize innovation in damage control training methods, deepen research on important and difficult points related to damage control, ensure the safety of the ship, and improve crew members' real damage control combat capabilities.

(1) Establish a damage control drafting group. The damage control plan is an action plan implemented after personnel casualties, equipment damage, and fire and water damage occur. It involves each department and combat post on the ship. Drafting a damage control plan requires full cooperation from each department. A damage control plan drafting group should be formed with the ship captain as the group leader and participation from the executive officer and department heads. Moreover, the damage control team leaders, zone managers, compartment section leaders (team leaders), and rigging zone team leaders and combat post leaders and team leaders closely related to damage control should be included, with the group leader in charge of the whole drafting process.

(2) Research and collate damage control materials. Damage control plan drafting must be created on a foundation of research on warships and damage. First, familiarity must be gained on the ship's overall performance, hull structure, the distribution of compartments and passageways, and the arrangement of systems, as this benefits the rapid analysis and judgment of a specific plan for the part of the ship that has suffered damaged (or is on fire). Determine the compartments and passageways fore and aft, port and starboard, and above and below [the damaged part of the ship]; what technical equipment is in the protection zone (*fanghu qu*); and how to safely enter the scene of the damage and what protective measures should be adopted by personnel. Second, information about the type, quantity, performance, function, distribution, and methods of use of the vessel's damage control equipment must be collated, and this information must be converted into a table indicating for each compartment what can be used and what damage control resources are available for support, such as firefighting checklist (*miehuoka*) and a checklist with items on the prevention of sinking (*kangchenka*). This is done so that when damage does occur personnel can rapidly know where damage control equipment is located, which parts of the ship to operate them, what equipment should be used and how much to use.

(3) Draft a risk assessment report. First, before preparing the damage control plan the number and type of ship plans should be determined. [It must be determined] whether the plan is based on equipment (*zhuangbelei*) or based on common subject class (*gongtong*

kemu lei), whether it is comprehensive (*zonghelei*) or specialized (*zhuanxianglei*), and whether it is for the combat post, zone, or for the whole ship. The ship's plan for preventing sinking should take the ship's main watertight compartments as the smallest unit, and the type and number should cover all compartments below and across the waterline. The ship's firefighting plan should include main compartments such as the engine room, ammunition storage, the bridge, and the operations control room (*zuozhan zhihui shi*). Other compartments should prepare a combined plan encompassing the same watertight compartment and same deck. Second, risk analysis should be highlighted and the key parts of the plan and important sources of danger should be clarified. The primary task of the drafting group is to go deep into the combat posts and compartments to identify sources of hazard, summarize all of the danger points for each source of hazard, and propose control measures. On the foundation of comprehensive risk assessment, [the group] should analyze the possible types of hazards and the scope of impact posed to ship crew members and equipment. [They should] clarify matters such as the key parts [of the ship] for damage control, emergency response methods, supportive actions by crew members in nearby compartments, and matters that deserve special attention, forming a risk assessment report that can provide a basis for preparing the damage control plan.

(4) Scientifically demonstrate and rationally allocate damage control forces. Ship damage control data analysis and accumulation should be strengthened. Accurate and detailed damage control data is an important basis for command decision making. This mainly entails blast effects of weapons on ships and data on resistance to sinking and fire extinguishing.

First, the blast effect of weapons on ships. Blast effects refer to the crushing and tearing effects of explosives and shock waves on a ship. The size of the effect is an extremely complex topic. It not only depends on factors such as the amount, type, packing density, packing methods of explosive material, and proximity to the explosion, it is also largely determined by ship structure, relative position, and hull strength. The damage radius of underwater weapons such as torpedoes, mines, and depth charges are generally no smaller than five meters. Guided missiles are generally composed of the seeker section, the forward section (*qianshe beicang*), the warhead section, the engine section, and the rear section (*houbei shecang*). Their damage radius against ships is typically no less than two meters.

Second, data on resistance to sinking. The flooding time of a damaged compartment is calculated according to formula (1) to obtain the time required for compartment flooding without any dewatering measures taken.

Formula 1:

$$t = \frac{klbz}{\mu s \sqrt{2gH}}$$

k – permeability coefficient;

l – vessel aft engine room length in meters;

b – vessel aft engine room width in meters;

z – vessel aft engine room depth in meters;

μ – flow coefficient;

s – vessel aft engine room breach area in square meters;

g – gravitational acceleration in meters per second;

H – depth of aft engine room breach below water surface in meters.

For example, a ship's aft engine room has a length of l = 16 meters, a width of b = 8.8 meters, a depth of z = 3 meters, a permeability coefficient of k = 0.85, and there is an underwater breach of H = 3 meters. See Table 1 for the depth required for compartment flooding to reach one meter.

It can be seen from Table 1 that quickly plugging the breach can greatly prolong the time that important equipment is submerged. If timely dewatering measures are taken, the time that the equipment is submerged can be delayed and the initiative to plug the leak can be obtained. When flooding and fires occur simultaneously in compartments below the waterline of the ship, the commander, based on damage control data, must first make decisions on which type of damage control to carry out.

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Table 1: Breach Diameter and Flooding Time

Breach diameter in centimeters	200	60	50	40	30	20	10
Breach area in square meters	3.14	0.283	0.196	0.126	0.07	0.03	0.008
Time in seconds	43	473	684	1063	1914	4467	16750

Third, fire extinguishing data. This mainly includes the capabilities, spray time, and working distance of various types of fire extinguishers, the burning time of each compartment after being sealed off, and the ventilation time of burned compartments after fires have been extinguished. This data provides the basis for commanders to organize command, study and make decisions, allocate damage control forces, and assess damage.

(5) Determine the key points of damage control actions according to the flow chart (Figure 1). For the same type of damage in the same compartment, the least impact and the worst impact of damage should be considered comprehensively based on the most complex and difficult situation with all factors included. This compartment's damage control data can then be factored in to carry out corresponding emergency measures according to the specific situation. This allows various kinds of damage to be covered.

First, determine a flow chart for preparing the damage control plan. First determine the damage control scenario and explain the events taking place, their locations, nature, and extent. Scenarios should be closely related to actual combat so that the entire exercise is carried out in the context of actual combat. Then analyze the various elements involved in the scenario and prepare the damage control plan according to the results of this analysis. Finally, conduct an analysis and verification of the plan [to ensure] it is reasonable. If it is reasonable, further study the achievable objectives of the damage control plan, otherwise, modify the plan and verify it again. The process of damage control plan preparation is shown in Figure 1.

Second, clarify the division of labor and carry out deployment. When preparing the plan, it is necessary to

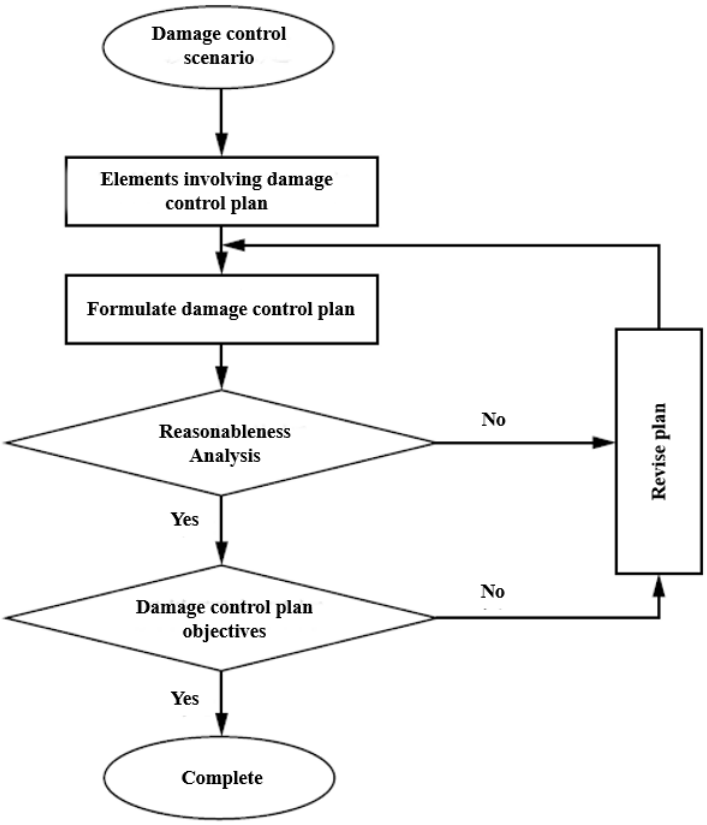

Figure 1: A flow chart for preparing the damage control plan.

pay attention to the characteristics of handling complex events (*fuhe shijian*). The plan should contain interfaces (*jiekou*) to clarify the conditions for plan activation and response mechanisms to ensure the coordination of key tasks and links such as command authorities, materials dispatch, and team support. Organization of the command organization should be specified. Command methods (direct command or delegated command), who is in command, and various teams set up, such as the fire extinguishing teams, hole plugging teams, dewatering teams, shoring teams (*zhicheng jiagu zu*), evacuation teams, communication teams, safety support teams, rescue teams, fire search teams (*huoqing zhenchazu*), direction and coordination teams, and evaluation teams, should be specified. Deployment duties should be clarified, such as the corresponding responsibilities of personnel and their mutually coordinating actions in damage control at combat posts, zones, and the entire ship. Highlight relevant content in command organization, fire searches, personnel rescue, smoke prevention, smoke control, firefighting tactics, and preventing and stopping the [vessel] from sinking (*fangchen kangchen*). Command authorities should be transferrable. When the senior commander arrives on scene, the lower-level on-site commander will proactively report the damage situation and relinquish authority to the senior commander. When damage control personnel are supporting damage control, authority rests with the damage control team leader.

Third, strengthen work towards the "four goals" (*si hua*) in the damage control plan. For the damage control plan to work, it must not only be comprehensive and detailed, but also needs to be further optimized on the technical levels of its preparation. Augmenting "four goals" work in the damage control plan means it should be simple (*jianhua*), realistic (*shihua*), streamlined (*liuchenghua*), and illustrated (*tujiehua*). "Simple" refers to reduced descriptive content in the damage control plan and a focus on damage to important nodes. "Realistic" refers to putting the focus of plan preparation on the assigned responsibilities and tasks of ship personnel and the handling of damage control procedures. This highlights description of risk identification, risk analysis, evaluation of effects, and response measures. "Streamlined" means to standardize crew damage control response such as in activation timing, damage control response procedures, damage reporting, damage status analysis, and damage information plotting. It also means the process for handling damage control must be clear. "Illustrated" refers to the presentation of important combat posts and equipment, dangerous elements, response procedures, handling methods, and equipment changeout in the form of tables and flowcharts. Effort towards the "four goals" will make damage control plans understandable, digestible, and applicable, and will improve their operability, [allowing] for plans to play a real role [in damage control].

Fourth, pay attention to effective risk assessment. In accordance with the characteristics of different damage, [the plan should] identify existing hazard factors, analyze possible direct consequences and secondary and derivative consequences, evaluate the degree of harm and the scope of its impact, and put forward preventive and control measures to create a risk assessment report. This will provide a basis for the preparation of the plan. Linked to the tactical context, risk assessment should be conducted continuously and consider ship damage control in peacetime and wartime and the features of damage in actual combat environments. Risk assessment mainly applies qualitative and quantitative methods to conduct comprehensive analysis and conducts item by item assessment on identified damage risk results to determine the degree of risk tolerance and levels of risk. Targeted measures in the areas of safety technology and management can then be proposed according to the risk assessment results, thereby improving overall damage control capabilities and ensuring ship safety.

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(6) Continuously verify and improve through simulation exercises. Ship damage control exercises are a fundamental task to test the plan and train the crew. The ship commander should organize the heads and relevant cadres of each department to discuss, analyze, and test the plan, so as to judge the soundness of the plan. Through exercises, problems are revealed and constant improvements and modifications made to the plan, thereby "guiding exercises with the plan and improving the plan through exercises." The plan can be continuously improved in accordance with the closed-loop management [process] of "planning – drilling – revising the plan – drilling." During exercises, commanders at all levels are expected to commit to their command positions and roles and convert the [damage control] plan into an exercise plan for damage control training. Attention should be paid to tactical coordination, close cooperation, and precise actions with a focus on complex disaster patterns and command training in damage control under actual combat conditions to strengthen teamwork in damage control teams. Damage control tasks should

be seamlessly used to lead operations, damage control training, and equipment use and management. Training should be organized closely around the damage control plan, constantly testing and improving the plan and enhancing its operability and practicability. Only by maintaining and making timely updates to the plan can it be continually improved and truly play a role when emergencies happen.

(7) Review and solicit feedback. After the damage control plan is complete, it should be reviewed by the preparation team, focusing on whether there are omissions in risk assessment, improper calculation methods, and wrong calculation results. After the review is approved, opinions should be solicited from ship personnel at all levels, which should then be used by plan preparation team members to make necessary revisions. Linking problems arising from step-by-step training and comprehensive exercises, [the preparation team] should earnestly summarize and tackle key problems, learn from advanced experience and knowledge, and promptly apply findings to the improvement of the plan. Daily advancement and regular practice and updating will improve the scientific character of the plan. Headquarters departments review the hierarchy, content description, organization and command, countermeasures, and effects assessment of the damage control plan. With actual combat requirements as the evaluation standards, they will review the damage control plan's focus, practicability, objectivity (*kexuexing*), and operability and put forward relevant opinions.

3. Combat Effectiveness

The damage control plan of a particular class of ship was revised and improved. After revisions, the damage control plan was accepted through inspection, evaluation, and assessment of damage control capabilities. It was found that the objectivity and practicability of the damage control plan improved by 80 percent, the plan's focus increased by 85 percent, and the scores of commanders at all levels on damage control theory were all above 95 points. Damage control drills became closer to actual combat, with standardized damage control actions. Combat posts, zones, and ship personnel at all levels were closely coordinating, and the command abilities of commanders at all levels reached 90 points or more. The overall damage control capability of the ship had risen to a higher level.

4. Conclusion

Preparation of damage control plans is an important part of a ship's preparatory work for damage control training. It is a powerful tool for improving damage control capabilities. Taking a deep look at the characteristics of ship damage, this article expounds on the current status of damage control plans while also proposing specific methods and focus requirements for damage control plan preparation, so as to provide a basis for damage control command decision making.

Preparation of damage control plans must focus on the overall situation, highlight key points, and be based on the most difficult and complex damage situations. [Plan preparation should be] linked to specific compartments and specific equipment to convert abstract theory (*yuanli*) and doctrine (*yuanze*) into concrete measures and essential actions for ship personnel. In daily work, [we should] strengthen study of professional theoretical knowledge and place emphasis on the accumulation of damage control knowledge. Damage control skills and command capabilities should be improved, and plan maintenance, management, and updating should be strengthened.

Advanced technologies should be absorbed and drills carried out based on actual conditions. Continuous summary, revisions, and improvement will improve the objectivity, focus, and operability of damage control plan preparation, so that damage control plans can effectively serve the needs of damage control in actual combat.