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Battle Damage Repair for *Arleigh* *Burke*–Class Destroyers

Tabletop Exercise Results

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About This Report

The *Arleigh Burke*-class guided missile destroyer, commonly known as a DDG-51, is the primary surface combatant vessel of the U.S. Navy; as of early 2026, there are more than 70 of these ships in commission, and plans are in place to acquire an additional 50 or more within the next 30 years. These ships—combatant vessels designed to operate in contested environments—are likely to sustain widespread battle damage from diverse attacks should a conflict develop in the Indo-Pacific region. The prevalent nature of this damage would give rise to the greatest demand for ship repair that the Navy has experienced since World War II.

To evaluate requirements for and potential issues with a significant demand for salvaging and repairing battle-damaged destroyers, we conducted a tabletop exercise on August 13–14, 2025, with participants from the United States and allied nations in the Indo-Pacific. This exercise involved four vignettes in which ships were damaged and required repair. The exercise focused on the capabilities required to salvage and repair the ships, the implied command-and-control arrangements, and the partner nations' roles.

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acknowledge the very helpful reviews provided by Stephen Worman and Paul Deluca. We would also like to thank Matthew Fay for his valuable contributions to this research.

Summary

In August 2025, we held a tabletop exercise with defense experts from the United States and allied nations in the Indo-Pacific region. The exercise consisted of four vignettes that focused on the capabilities required for repairing U.S. Navy ships during a conflict between the United States and China. The participants were split into four groups, and each group represented U.S. and allied stakeholders who would be involved in the repairs. The discussions during and after the exercise centered on repair requirements, command-and-control (C2) issues, host-nation facilities, and key organic capabilities that U.S. Navy could deploy and develop. After observing how participants handled the scenarios and facilitating group discussions, we determined that attempting repairs in a hostile Indo-Pacific environment will be significantly more complex than existing plans allow. This complexity creates serious risks to U.S. and allied rapid force regeneration and maritime dominance.

Key Findings

Our specific findings include the following:

- Existing Navy systems for battle-damage repair are burdened by outdated peacetime frameworks and ambiguous C2 structures during conflict.
- Presumptive expectations concerning even close allies' abilities and willingness to support extensive repairs might be unrealistic. Representatives from allied nations were clear in their support of alliance commitments, but they noted that most repair facilities are in significantly vulnerable areas. It is not clear whether the United States could rely on partners without formal alliance ties to support U.S. actions beyond brief stops for voyage repairs.
- Although the Navy has organic repair capabilities, these capabilities are sufficient only for limited repairs to combat systems and repairs that allow ships to transit back to the United States.
- Poor availability of necessary parts might cause significant delays, which could occur even if a host nation has agreed to provide more-substantive repair support.

Recommendations for Organization and Capability Development

We offer a series of recommendations, divided into those focused on the U.S. Navy and those on U.S. allies and partners.

Recommendations for the U.S. Navy

- Institutionalize C2 by clarifying authority, streamlining communications, and defining approval chains during crisis and conflict.
- Expand organic repair capabilities and ensure that all deployed personnel are familiar with rapidly deploying those capabilities.
- Negotiate detailed support agreements with regional partners and exercise repair procedures without access to key ports.
- Reconstitute critical parts inventory and a skilled workforce to prioritize operational flexibility over peacetime efficiency.
- Anchor exercises to strategic objectives, prioritizing assured force regeneration, tactical resilience, and alliance interoperability.

Recommendations for Allies and Partners

- Negotiate pre-event legal and policy frameworks to clarify the support that the Navy can expect at each escalation stage and incorporate the frameworks into operational planning.
- Maintain updated bilateral capabilities assessments, prioritizing information-sharing so both sides have an actionable understanding during a crisis.
- In future wargames, include realistic scenarios and emphasize a mutual understanding of C2, information-sharing, and allied support during high-threat situations.
- Codevelop host-nation resilience and continuity plans that focus on port and repair facilities, distributed repair nodes, and partner-specific continuity-of-operations plans.
- Advance multinational pre-positioning of repair packages with clear protocols for accelerated access during a crisis to avoid diplomatic bottlenecks.

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Battle Damage Repair for *Arleigh Burke*–Class Destroyers: Tabletop Exercise Results

We conducted a tabletop exercise (TTX) on August 13–14, 2025, on the requirements for and issues relating to repairing battle-damaged guided missile destroyers (DDGs), specifically those of the *Arleigh Burke* class (DDG-51).¹ The Office of the Assistant Secretary of War for Sustainment's Product Support office and the Joint Staff sponsored the exercise through the Wargaming Improvement Fund.²

Participants were from the Office of the Secretary of War, the Joint Staff, the Office of the Chief of Naval Operations, the Office of the Commander United States Pacific Fleet, the Naval Sea Systems Command and its Program Executive Office Ships, and Navy research facilities. Representatives from the Japan Maritime Self Defense Force, the Republic of Korea Navy, and the Royal Australian Navy also participated. Discussion during the exercise was held at a classified level, but exercise materials were unclassified.

Background and Objectives

The DDG-51 class is the U.S. Navy's principal surface ship combatant. This class has been in production since 1991 and is now on its third flight (a *flight* is a group of ships significantly upgraded from its predecessors) with 73 ships now in commission. According to the Navy's 2025 shipbuilding plan, the Navy intends to purchase 51 additional DDG-51 Flight III destroyers over the next 30 years (Congressional Budget Office, 2025). These ships are combatants; their purpose is to fight in contested areas at varying threat levels. When ships are operated in such conditions, there is a very high probability that they will be attacked by air, missile, and subsurface forces. These attacks, even if well countered, are still likely to result in significant damage to some of the exposed forces.

The Navy has not faced damage at the level likely to occur in a major war since World War II. The Navy has had to repair ships that have been seriously damaged by collisions, mine strikes, and—in one case—missile strikes, but these incidents were limited to single ships and did not occur in seriously contested environments (Cox, 2019; Department of the Navy, 2017; Lagrone, 2017). There has been no need for the Navy to conduct ship salvage or repair operations while under significant

¹ We include the DDG class designation for various ships we mention throughout this report.

² The Assistant Secretary of War and Secretary of War are designated the Assistant Secretary of Defense and Secretary of Defense, respectively, under Public Law 81-216, National Security Act Amendments of 1949.

threat conditions. Since 2021, the Navy has reassessed its repair capability for battle-damaged ships under such conditions (U.S. Government Accountability Office, 2021).

The TTX that we hosted posited four vignettes in which ships were damaged during a conflict and required repair. The focus of the TTX was on the capabilities required for repairs, the implied command-and-control (C2) arrangements, and partner nations' roles. Although ship-specific damage is important for scoping the problem (i.e., determining the effort required to repair a ship), the exercise was not intended to be a ship-level one. Participants were asked not to focus on ship-level issues; instead, they were encouraged to consider responses at the strategic and operational levels. The following four learning objectives guided the TTX:

- Enhance the understanding of the challenges, decisions, and C2 requirements involved in responding to battle damage to multiple surface vessels.
- Manage the allocation and prioritization of limited resources to reconstitute ships and weapons (including rearming requirements).
- Explore collaboration with allies and regional partners (including issues related to ship maintenance and repair, weapons, and weapon handling).
- Identify gaps and opportunities for improving U.S. maintenance, technical, and repair personnel's access to forward-operating locations during a conflict.

Exercise Execution

The exercise was conducted over a two-day period and featured plenary and breakout sessions so participants could consider how the four learning objectives applied to each vignette as they occurred during a single broader scenario. The vignettes were set at different times in the scenario but were not specifically linked: The guiding assumption was that the force structures and dispositions were not affected by actions taken in earlier turns.

Plenary sessions covered the vignettes and other relevant information and allowed participants to ask clarifying questions before breaking into discussion groups. Four breakout groups, each of which reflected different stakeholder perspectives, convened for one hour to consider the vignette, capabilities, and organizational issues. The groups considered the complete breadth of the repair effort from their assigned perspective.

The four groups' perspectives were as follows:

- **Group 1**—a maritime component commander responsible for management of operational assets
- **Group 2**—a theater logistics and sustainment commander, responsible for husbanding resources and conducting actual repairs
- **Group 3**—partner nation coordination
- **Group 4**—continental United States (CONUS)–based stakeholders: the Office of the Secretary of War, the Joint Staff, the Office of the Chief of Naval Operations, Naval Sea Systems Command, and regional maintenance centers.

Each group had a diverse membership: Participants were from different commands and functions. Some, but not all, participants were placed in a group that was not immediately connected to their actual occupational role. Groups were intentionally diverse to encourage members to generate differing solutions to the issues at hand. The groups' diversity also led to an environment in which individuals could learn from each other to deepen their understanding about capabilities and gaps.

We served as the TTX facilitators; we had been conducting the research for this project and were thus familiar with the scenario and the underlying issues. We guided discussions in accordance with the learning objectives.

During breakout sessions, communication was limited between groups. However, these limitations were consistent with what would happen in real life: Communication could occur, but complete coordination could not.

After the breakout sessions, each group presented its findings to the larger group in a second plenary session, which spurred discussion and adjudication. In some cases, new insights emerged from the breakout sessions that went beyond the original questions. We have documented those insights in this report.

Assumptions

Participants were instructed to accept the following assumptions when considering the vignettes:

- The vignettes are set in 2027–2029 in the Indo-Pacific Command area of responsibility.
- China's People's Liberation Army (PLA) capabilities and force structures are the same as they are in 2025.
- U.S. C2 structures are the same as in 2025.
- U.S. force structure and general capabilities are the same as in 2025.
- Program-of-record repair capabilities are available.
- Plausible capabilities (i.e., expeditionary mobile repair facilities and others) that could be made available may be allowed but will require additional resources.
- Host-nation capabilities can be assumed but the nations' willingness to grant access should not be assumed.
- Vignettes are separate—that is, forces are not tallied from one vignette to the next—but the overall scenario is common.

Baseline Scenario

The TTX's baseline scenario was as follows: While Chinese forces are engaged in a large-scale and highly aggressive exercise near Taiwan, Taiwanese ships and aircraft challenge PLA Air Force and PLA Navy (PLAN) units, sparking a growing crisis between China and Taiwan. The training exercise is the largest exercise the PLA has held to date, and it is accompanied by strong intelligence indications that China is preparing to at least attempt a blockade of Taiwan, but it is more likely that China will invade the island.

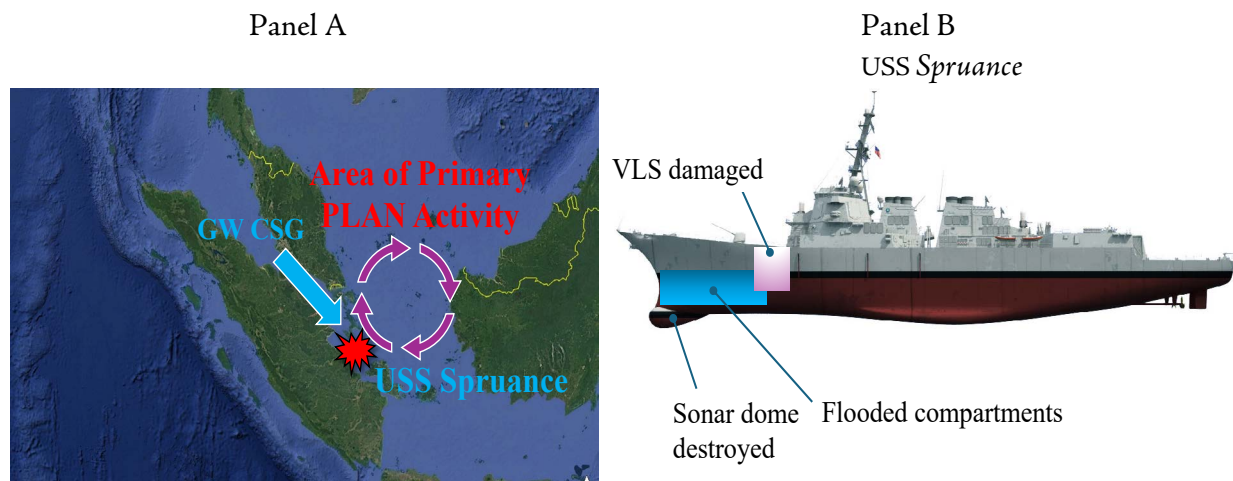
The United States has begun moving additional land, air, and maritime forces into the Western Pacific and a joint task force has been activated. The United States has asked regional allies—Australia, Canada, India, Japan, the Philippines, Singapore, and South Korea—for varying degrees of support, including logistics and maintenance support for U.S. surface combatants.

Vignette 1—Collision in the Straits of Malacca

China imposes a quarantine on Taiwan. The U.S. Navy is ordered to conduct patrols off Taiwan's east coast ports. To support this effort, the *George Washington* Carrier Strike Group (GW CSG) is recalled from the U.S. Central Command area of responsibility. A mixed group of PLAN, China Coast Guard, and Chinese merchant ships encounter the GW CSG ships while in transit through the Straits of Malacca.

There is poor visibility and, while maneuvering to avoid collision with a PLAN frigate in the Straits of Malacca, the *USS Spruance* (DDG-111) collides with a Chinese-owned bulk carrier. The *Spruance* is struck on the port bow, and several forward compartments are flooded before damage control parties can secure the hull breach (Figure 1, Panel B). The ship's forward sonar dome is destroyed, sensors in the forward vertical launch system (VLS) register a severe shock, and damage limits the ship to a speed of six to ten kts.

Figure 1. Vignette 1 Geography and Damage Profile



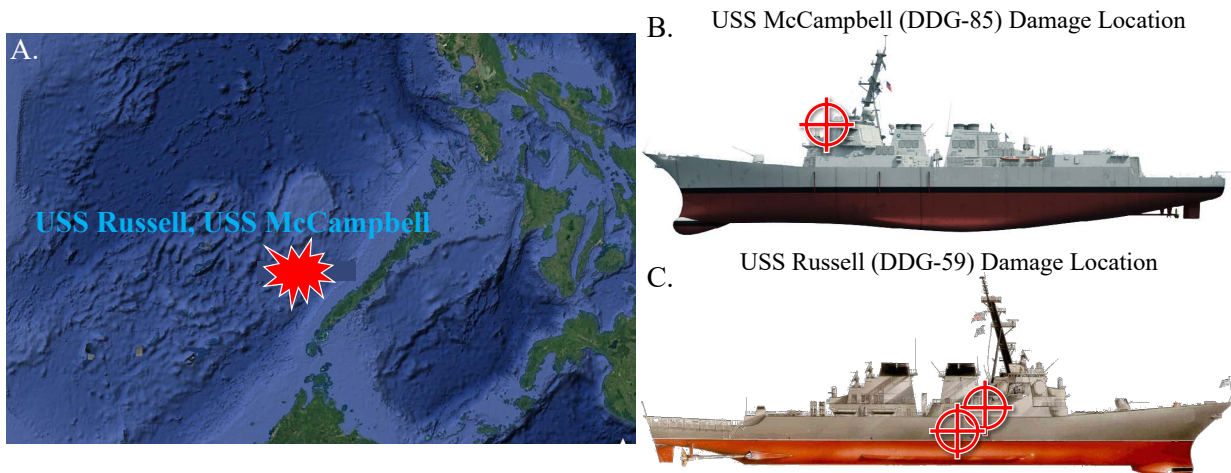
SOURCES: Map data: Google. Ship image: U.S. Navy.

Vignette 2—Gunfire Exchange in the South China Sea

The PLA intensifies patrols in the South China Sea, and its ships and aircraft begin intruding into Philippine territorial airspace and waters. China prevents Philippine ships from resupplying an outpost on Second Thomas Shoal (Figure 2, Panel A). Manila requests a U.S. escort for another resupply attempt. The *USS Russell* (DDG-59) and the *USS McCampbell* (DDG-85) are tasked with escorting the resupply ships to the Philippine garrison. The DDGs are intercepted by a Chinese group, including two coast guard patrol ships and three PLAN surface combatants.

When the Philippine resupply ships refuse Chinese orders to turn back, they are engaged from the frigate *Huangshan* (pennant 570). An embarked Chinese Z-9 helicopter strafes the supply ships with gunfire and rocket fire. The *McCampbell* engages the Z-9 with two RIM-162 Evolved SeaSparrow Missiles, shooting it down. Chinese forces respond with gunfire from several ships aimed at both the *McCampbell* and *Russell*. Both the *McCampbell* and *Russell* return fire, damaging a PLAN frigate and both coast guard vessels. The Chinese ships withdraw. The *McCampbell* suffers hits to the bridge, causing casualties, and one surface ship, radar, surveillance, and control (SPY) array is damaged (Figure 2, Panel B). The *Russell* incurs damage to its electrical distribution and machinery control systems (Figure 2, Panel C). The primary propulsion system is also damaged, causing the maximum speed to be no more than 20 kts. There are multiple small fires on the *Russell*.

Figure 2. Vignette 2 Geography and Damage Profile



SOURCES: Map data: Google. Ship images: U.S. Navy.

NOTE: The target sights in Panels B and C indicate damage from gunfire.

Vignette 3—Large-Scale Missile Attacks

Major conflict has begun. Two DDGs, the USS *Fitzgerald* (DDG-62) and USS *Peterson* (DDG-121), are stationed to provide air and missile defense to Manila (Figure 3, Panel A). These ships are struck with an antiship cruise missile barrage. The *Fitzgerald* suffers severe damage to the forward superstructure (Figure 3, Panel B). This prompts a “pulse” strike by the GW CSG, which results in a large-scale attack on missile sites and PLA forces in Taiwan.

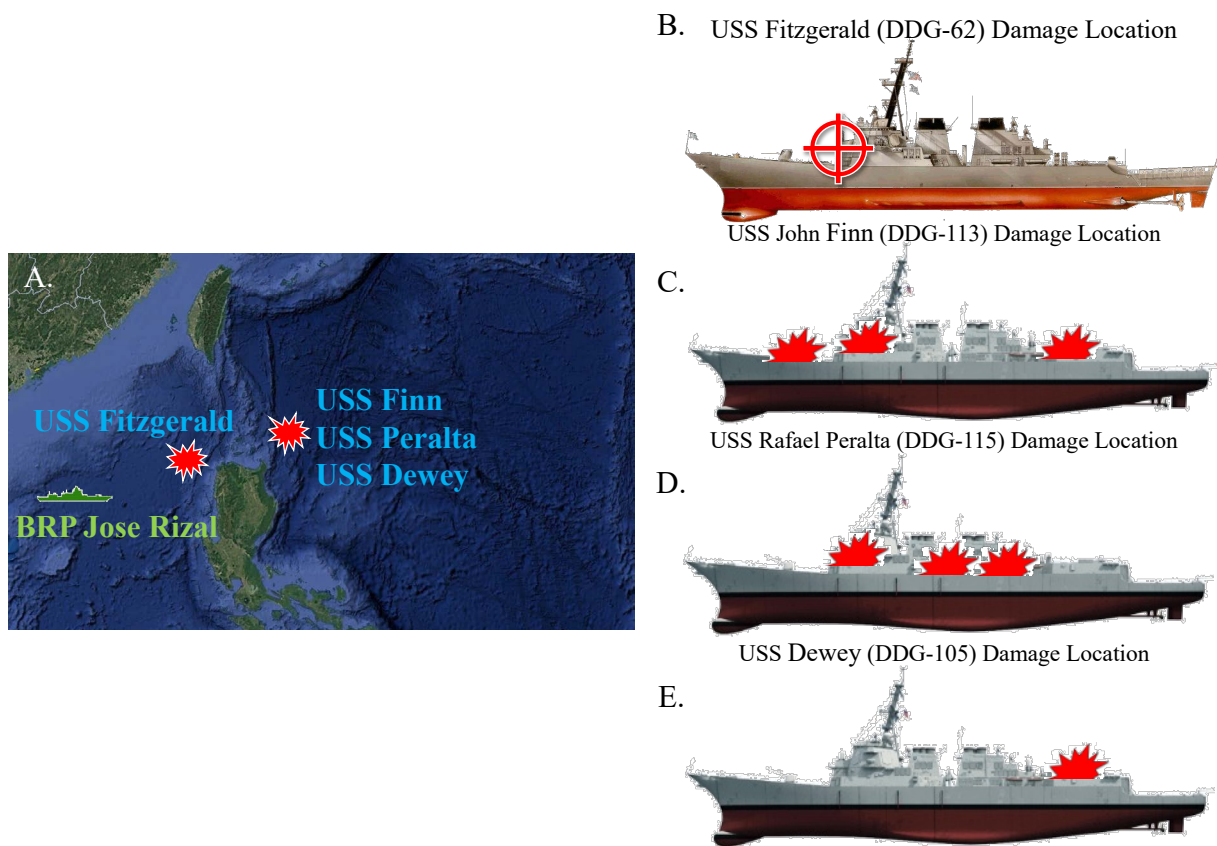
Half of the missiles fired at the GW CSG are intercepted and destroyed by the carrier strike group’s defenses. However, the flight deck of the nuclear-powered aircraft carrier is struck and penetrated by multiple submunition warheads, causing many secondary explosions in the hangar deck and rendering the carrier unable to conduct flight operations.

The USS *Fitzgerald* suffers significant damage. The SPY radar is inoperable. The forward satellite communication terminals and AN/SPG-62 fire-control radar are destroyed. The AN/SLQ-32 electronic warfare system, MK-38 gun, and forward close-in weapon system (CIWS) are destroyed.

The forward VLS registers severe shock. The Philippine Navy's guided missile frigate (FF) BRP *Jose Rizal* (FF-150) is in the vicinity and can escort the *Fitzgerald* to Subic Bay.

The three escorting DDGs—the USS *John Finn* (DDG-113), the USS *Rafael Peralta* (DDG-115), and the USS *Dewey* (DDG-105)—are also damaged. Both VLS installations on the *John Finn* are inoperable (Figure 3, Panel C). The forward SPY radar is damaged by submunition strikes, and both CIWSs are destroyed. The USS *Rafael Peralta* suffers hits to the bridge area and amidships (Figure 3, Panel D). The SPY radar is inoperable. There is fire damage to the amidships superstructure. There is also damage to the exhaust manifolds, limiting speeds to three to five kts. Meanwhile, on the *Dewey*, the helicopter hanger is damaged (Figure 3, Panel E). One MH-60 and the aft CIWS are destroyed. The aft SPY arrays suffer shrapnel damage. There are more than 100 casualties on the four damaged ships.

Figure 3. Vignette 3 Geography and Damage Profile



SOURCES: Map data: Google. Ship images: U.S. Navy.

NOTE: The target sight in Panel B indicates damage from gunfire. The explosions in Panels C through E indicate missile hits.

Vignette 4—Prolonged War

Ground war on Taiwan moves into its second month, and Taiwanese forces are being pushed out toward Taipei as Chinese forces expand their lodgment. Both the United States and China have

suffered significant attrition to their forces and have begun exhausting munition inventories. For the U.S. Navy, damaged combatants have, when possible, been withdrawn to locations where weapons can be offloaded, tested, and prepared for redeployment. This process has been slowed, however, by extensive damage to port facilities in the Marianas, Japan, and Singapore. These ports have been subjected to heavy Chinese attacks. U.S. ships in Korean ports have been targeted.

Attrition of Australian and U.S. P-8 aircraft limits the availability of aerial antisubmarine warfare and surface surveillance. Dockyards on the west coasts of the United States and Canada are nearing capacity. Modern munitions and critical spares (especially for SPY and associated fire-control systems) are running short. To increase economic pressure on China, the United States and Australia are conducting “distant blockade” operations in and around the Malacca Strait (Figure 4, Panel A).

A U.S. surface action group, consisting of two DDGs and two littoral combat ships (LCSs), is deploying to the Malacca Strait to interdict illicit shipping bound for Chinese ports. As the group passes through the South China Sea en route to the strait, it is ambushed by two Chinese diesel-electric submarines. One, an advanced Type 039 with VLS tubes, fires a volley of 12 antiship cruise missiles while the other seeks to penetrate to torpedo range.

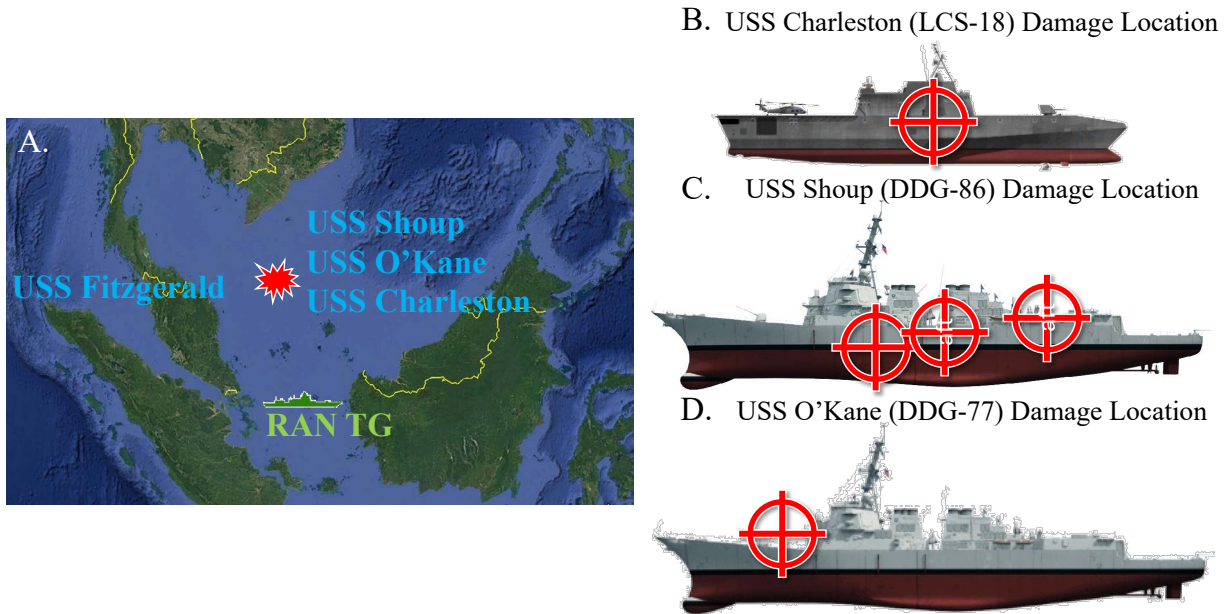
The DDGs have only partially full VLS magazines, and the fire-control system of the USS *Shoup* (DDG-86) fails. Six of the 12 antiship cruise missiles are intercepted, and one misses any target. Five leakers strike the three U.S. ships. The nearest friendly ships are a Royal Australian Navy surface action group on interdiction duty nearly 500 nm to the southeast.

The USS *Charleston* (LCS-18) is struck amidships, damaging the mission bay and hangar and causing a fire. The fire is burning out of control, the crew has abandoned ship, and many crewmembers are wounded. The ship is lost, but there are survivors to rescue (Figure 4, Panel B).

Missiles have struck the *Shoup*, damaging the superstructure and hull near the waterline. The helicopter hangar is destroyed, and the engine uptakes are badly damaged. The primary propulsion system is inoperable. There is flooding amidships, the aft SPY is damaged, and the VLS is destroyed. Severe fires have damaged the ship’s aft, but the fires are mostly controlled. The *Shoup* is temporarily dead in the water (Figure 4, Panel C).

Missiles have also struck the USS *O’Kane* (DDG-77) near the 5-inch gun mount. The gun and adjacent VLS are destroyed (Figure 4, Panel D). Shrapnel has shredded the forward SPY array, killing and wounding personnel on the bridge, which is also badly damaged.

Figure 4. Vignette 4 Geography and Damage Profile



SOURCES: Map data: Google. Ship images: U.S. Navy.

NOTE: The target sights in Panels B through D indicate damage from gunfire.

Vignette Discussion Topics and Dilemmas

We developed a set of topics designed to engage participants in discussing strategic- and operational-level issues. The vantage points that each group was responsible for considering are as follows:

- **Mission effectiveness**—Does the ship retain the ability to operate in one or more warfare domains that would justify repairs within the theater for a swift return to in-theater operations (potentially leaving the ship only partially mission capable)?
- **Voyage repairs**—Are temporary repairs required to get the damaged ship to a facility that is capable of more-permanent repair?
- **Repair location**—Is there a determination of an optimal in-theater port to conduct temporary or permanent repairs (depending on the severity of the damage and the operational situation)? A determination could be that no such repair in theater is feasible.
- **Towing and salvage**—What decisions should be made to tow, scuttle, or salvage a ship or ships (depending on the damage and operational situation)?
- **Weapons recovery**—What decisions should be made surrounding the offloading, recovery, and recertification of vital, limited-availability assets (e.g., VLS-launched missiles, such as Tomahawk missiles, and standard missiles in particular)?
- **Critical equipment**—Would cannibalizing ships to remove critical materiel from damaged ships to reconstitute and maintain other forward-deployed forces be warranted?

The breakout teams addressed these issues in their deliberations and provided the plenary session with their answers. In some cases, the breakout team simply noted that it had little insight into or authority over some of the topics that the vignettes raised.

Exercise Results

In the following sections, we discuss our conclusions drawn from the breakout and plenary sessions across all vignettes. These conclusions fall into four main categories: identifying and defining **repair requirements**, establishing appropriate **C2** for repair during phases of conflict, identifying capabilities and shortfalls in **host-nation facilities**, and identifying **key organic capabilities** that the U.S. Navy could deploy and develop. The observations came from a variety of participants; we do not identify participants by their name, organization, or position. However, we note particular points about which there was strong consensus.

Identifying and Defining Repair Requirements

When ships experience damage, the response depends on what equipment is affected and to what extent. Some repairs might be conducted on the ship by the ship's company. Some might be completed while the ship is underway and with outside assistance. Some would likely require major industrial facilities with specialized equipment. The degree and nature of damage might not always be obvious. The ship's company will be dealing with the damage, but the immediate priority for the ship will be containing damage and caring for survivors. Moreover, the ship's crewmembers might know the ship's equipment but not necessarily possess detailed knowledge on how to repair it.

Accordingly, to make an effective repair assessment, some method must be applied to allow an evaluation of repair requirements shortly after the damage has taken place. Methods could include flyaway assessment teams, virtual transmission of images showing the damaged area, or possibly stationing repair specialists on afloat staffs who can rapidly travel to a damaged ship.

Establishing the scope of and resources needed for repairs are essential for the rest of the process to continue. Exercise participants indicated that the mechanisms for such an assessment are not in place in existing U.S. Navy protocols.

Establishing Appropriate Command and Control for Repair During Phases of Conflict

Before we started the TTX, stakeholders emphasized the importance of C2 when responding to battle damage, particularly how C2 issues could cause frictions and delays. The TTX results supported this concern to a degree, although some C2 issues centered less on planning for arrangements required for repairs and more on a general lack of awareness concerning these arrangements. In some cases, the breakout groups seemed largely unaware of what the other breakout groups would be attempting to do. Ship repairs already occur in peacetime with well-established C2. However, the TTX demonstrated that C2 relationships might be less clear during transitions to

conflicts and during conflicts. The C2 awareness challenges emerged even with the assumption that communications systems were largely unaffected by the conflict.

In the first vignette, which is set in peacetime prior to the hostilities, C2 relationships were largely clear, and participants noted examples of similar kinds of ship damage from the other vignettes. The participants said they had little doubt that in-theater commands would ensure that the damaged ship would be taken to a suitable port for evaluation and receive at least enough repairs for seaworthiness. Prior to hostilities, there would be no issues of escorting or offering other protection for the damaged ship, and the Navy theater logistics commander could take care of such details as arranging for towing the vessel, coordinating with host nations for access to port facilities, arranging for voyage repairs, and coordinating with support commands in the United States for technical assistance. The combatant and fleet commanders would have an interest in the event, but there would likely not be any questions as to the ship's reporting relationships or of who would be responsible for the ship's repair.

In the remaining vignettes, the C2 relationships were less clear. The second vignette occurs before war has begun but during a period of heightened tension in which an armed exchange takes place resulting in damage to ships on both sides. The third and fourth vignettes occur in the context of a major war. Several shortfalls in C2 emerged as the exercise moved through the conflict's phases, which we discuss in the next several sections. These issues are related to C2 but are less about matters of poor organization and more about a lack of awareness of what the participating organizations are expected to do. Stove-piped communication and a lack of attention to organizational requirements persisted during all the vignettes.

Assumptions About Commonality Between Peacetime and Wartime Processes and Regulations

Participants in the breakout groups assumed that regulations and standards for repair and maintenance would remain the same in a wartime environment as they are during peacetime. Consequently, the participants tried to coordinate large and extensive repairs in contested areas as if they were occurring in a normal environment. The authorities or command structures that would apply were not considered. Time was lost considering how information might be transmitted or action might be taken within peacetime channels. Teams also proceeded on assumptions about what actions would be acceptable without considering how the threat or operational environment might have evolved during the conflict. What might have been a wholly normal peacetime response for reaching repair facilities might prove impractical in wartime.

Lack of Communication Within the Theater About Operational Constraints

The group that represented the in-theater logistics and maintenance team at times took actions, specifically those related to in-theater repair options, that the theater operational commander had already rejected because of operational constraints. For example, and as discussed during the TTX, if the theater commander has determined that fixed sites within an adversary's weapon engagement zone are off-limits, that information should be made clear to the commands carrying out repairs.

Lack of Communication and Requests from In-Theater Groups Back to U.S.-Based Support Commands

In-theater groups were slow to request support—or indeed communicate their statuses—back to U.S.-based support commands. Coordination that could have taken place to move technical support or expedite capabilities did not occur; instead, the CONUS-based commands sometimes had to specifically offer support that the groups should have requested. This lack of communication left the support commands without important information about in-theater responses to the vignettes’ scenarios.

It was unclear whether this lack of communication occurred because the groups representing in-theater commands were unaware that they needed to request certain actions or resources or because they were focused more on the problem within their immediate vicinity. However, the problem persisted even into later vignettes, despite members of CONUS-based support commands communicating the need for in-theater commands to (1) initiate processes that would move key materiel or personnel or (2) to authorize particular technical approaches to a repair problem.

Reluctance to Identify Shortfalls in Support or Coordination

Relatedly, when the breakout group participants came together after each round (i.e., each vignette), CONUS-based stakeholders were reluctant to “call out” the in-theater groups about the consequences of their failure to make requests—particularly the possible limitations on the recommended courses of action that might have resulted if the CONUS-based stakeholders had not intervened. If we had not specifically pointed out these shortcomings, they might never have been recognized, and the same mistakes might have been repeated. There appears to be a gap in understanding about the processes that organizations must follow if they are to both respond to the immediate problem and ensure a workable longer-term solution.

Identifying Capabilities and Shortfalls in Host-Nation Facilities

The geography and operational environment of the Western Pacific make reliance on partner nations inevitable. Every vignette required a consideration of the capabilities and cooperative intentions of regional partners. Partner nations—Australia, Japan, or the Republic of Korea—were represented in all breakout groups, which provided valuable insight. Several key insights emerged from discussions.

Unfamiliarity with Partner Nations’ Overall Capabilities

Japan, Korea, and Australia all bring significant industrial capabilities and expertise into potential repair scenarios, and, in the exercise, the nation’s representatives indicated a willingness to support repair efforts. However, some kinds of operations—such as ordnance handling or a lengthy repair—would bring complications, and there was a particular awareness that the partner nations would be directly vulnerable to attack were they to host U.S. ships for extended periods. There could also be competition with domestic ship construction and repair needs. We found that there were major gaps in planner (i.e., the Navy and joint force) awareness of what host nations could provide. For example,

U.S. participants demonstrated knowledge gaps about the locations of host nations' ports, not to mention host nations' capabilities or access requirements. Examples of such knowledge gaps are as follows:

- Although the presence of host-nation representatives facilitated an informed discussion, the first response of in-theater teams was to discuss appropriate ports despite not knowing whether any decisions to reach those ports were even practical.
- VLS offloading might be particularly contentious depending on the severity of a conflict because offloading requires the removal, movement, and stowage of ordnance. Participants indicated that Singapore might be willing to allow VLS offloading and dry docking of a damaged DDG during a limited conflict, but the nation might be less willing in the event of a full-scale war in the region. Specifying such distinctions before a conflict could save time and energy when faced with repairs to damaged ships during a conflict.
- Participants noted that assistance in dealing with personnel casualties through direct care or the facilitation of medical evacuation would likely be feasible, even for nations that might otherwise be reluctant to become involved in assisting with battle damage response.
- The typhoon season in the Western Pacific lasts from June through August, which means that a ship's transit from the South China Sea to Japan during those months could take an extra three weeks—even if the ship can maintain a normal transit speed.

Guidelines and Regulations

U.S. law normally precludes any activity other than voyage repairs of U.S. military vessels, which might mean that in-theater repair opportunities could be severely limited. Although it is likely that such restrictions would be waived in wartime, other factors in "right to repair" legislation could complicate foreign repair activities. These complications and activities could include (1) the willingness to allow foreign nationals who are not citizens of the host country—and who are commonly employed in overseas shipyards—access to U.S. Navy ships and (2) the transfer of parts (those required to complete repairs) to foreign nationals.

Observations of Host Nations' Capabilities in Key Locations

Singapore: The full group agreed that Singapore would play a critical role if a conflict were to erupt in the Indo-Pacific. However, participants with deep knowledge of operations and trends in Singapore expressed doubt about its continued commitment to assist the United States with regard to escalating tensions with China. To support this claim, the attendees emphasized that the United States operated at Changi Air Base only on a continuously renewed 30-day lease, and a significant proportion (roughly 70 percent) of Singapore's population is ethnically Chinese. The attendees maintained that the United States should not simply *assume* that Singapore assistance will be the natural solution to battle-damaged ships in the Pacific. Additionally, these attendees discussed that most of the dry docks in Singapore are commercially operated, and these operators would likely resist giving up booked time on their docks.

South Korea: The Koreans that were part of our group expressed a significant commitment to assisting the United States in all vignettes. This included such services as humanitarian assistance,

repairs, and towing. The commitment extended to supporting the United States in situations, such as escorts, in which Korean ships could conceivably become combatants. The entire group expressed surprise at the Koreans' willingness to provide such substantial support, but the group also acknowledged that such a discussion of support would have to be held by those with levels outranking any TTX attendees.

Japan: Attendees agreed that Japan offers superior facilities and capabilities compared with many other locations in the Pacific theater. However, getting damaged ships to the U.S. Navy base in Yokosuka could be a complicated undertaking, depending on where the ships were damaged and concerns from Japan about getting involved in the conflict as tensions escalate. Discussions sometimes turned to how capabilities housed at Yokosuka could possibly be moved elsewhere. For example, participants discussed whether the barge used to offload ordinance at Yokosuka could be moved to Australia or Singapore to perform the task in those locations instead. Japan's fleet of US-2 seaplanes also provides a unique capability for at-sea support.

Philippines: The Philippines would play a key role in any conflict in the Indo-Pacific, largely because of its key geographic location and its adversarial relations with China. However, the group discussed multiple uncertainties regarding the Philippines' actual usefulness in the presented situations. First, the Philippines' willingness to assist the United States should not be assumed as a given, especially depending on the level of escalation and the possibility of drawing a Chinese attack. Additionally, participants expressed concerns about capabilities and repair expertise in the Philippines. They also discussed the difficulties associated with getting personnel or equipment into the Philippines to perform their jobs, even if a ship were able to dock there.

Australia: Australia's representatives expressed strong support for the United States, particularly in the situation described in Vignette 4 (prolonged war), which presupposed the presence of Australian forces in the vicinity of the attack. One key bottleneck in depending on Australia would be the location of their ports with advanced repair capabilities. For example, very little could be accomplished at Darwin, which would be the closest port to the locations described in the vignettes. Additionally, the group agreed that transporting a damaged ship to a more capable port, such as Adelaide or Sydney, would require first offloading ordinance, which creates an additional step.

Although there were significant knowledge gaps at the outset of the exercise, once ally members explained their capabilities, collaboration was mostly seamless. U.S. participants were willing to receive support and curious about seeking it. Allied participants were open to supporting the United States with careful thought and consideration of the consequences. Allied participants were open in their discussions about capabilities and limitations, as well as about political and diplomatic challenges.

Identifying Key Organic Capabilities That the U.S. Navy Should Develop and Deploy

Host nations can provide significant capabilities, but these might not be available in every circumstance and might not be helpful at all until damage can be assessed. Consequently, some level of an organic capability for the U.S. Navy to assess battle damage, tow and transport ships, conduct depot-level repairs, and provision parts would be essential. Host-nation support cannot be assumed.

Numerous factors might make the use of partner nation facilities impractical. We explore those factors in the following sections.

Assessing Battle Damage

As noted previously, other than immediately controlling damage on the ship, assessing the extent of damage precedes every other repair activity. Assessment usually involves more than what the ship's company can provide; for example, it can also include underwater hull inspections. Ideally, many of these assessments would be performed before theater commanders must make decisions on the repair location.

Participants indicated that there are flyaway assessment teams and, as noted, it is possible to virtually assess damage. There is, additionally, Explosive Ordnance Disposal Mobile Unit 10 (EODMU-10), which absorbed the responsibilities of the de-established mobile diving and salvage units in 2025. This unit is organic to the U.S. Navy and conducts underwater damage assessments (among other activities), even when a ship is not in port (Carey, 2025). Several of the TTX participants were unfamiliar with this capability. Using this capability would depend, in part, on the overall threat environment. The EODMU-10 team and equipment must be transported to a ship, and, if active threats to the ship are still in play, the ship would have to be outside the range of antiship weapons. But these units appear to be an option that current planners are not considering.

Conduct of Repairs and Workforce Capability

Although many host-nation ports possess world-class capabilities to repair ships, it became clear through the exercise that it might be unwise to assume that these ports will be available. The ability to repair ships to some level of operability in undeveloped ports—including anchorages—might be a key capability.

To that end, the Navy has developed Expeditionary Mobile Repair Facilities, which are deployable into minimally developed facilities and scalable to different levels of repair (short of dry docking) (U.S. Government Accountability Office, 2021). Therefore, access to host nations' capabilities would still be required, but access to areas with well-developed infrastructure might not be strictly necessary. For the TTX, we stipulated that ten mobile facilities would be available in theater, but relatively little discussion went toward how these mobile facilities might be used. Most discussion focused on the use of overseas ship-repair facilities, although it was clear that this option might not be available.

Continuing causes of concern are the declining numbers within and capability of the maintenance and repair workforce. If the Navy is to conduct organic repair, people with knowledge and experience must be available. The participants assessed that U.S. workforce trends are not favorable in this regard. Exercise attendees stated that the workforce that might have carried out such maintenance and repair in earlier eras is largely gone. Repair technicians are in short supply, and the shortage of SPY radar repair technicians, who would be indispensable in any of the vignettes, is critical.

Critical Parts Shortages

Repairing a damaged ship will likely require the provision of specialized spare parts. There are multiple challenges for spare parts provision.

The U.S. Navy no longer has a budget line for war reserve materiel. Parts are ordered through the Defense Logistics Agency under a working capital fund arrangement, which does not address issues of low demand for critical components. Many critical parts would not routinely be replaced in peacetime, so it might be unlikely that the parts would be in stock in wartime because no demand would have been established for them during normal peacetime use.

Most U.S. Navy ships—including DDGs—have been in service for a decade or more, and a substantial number are near or past 30 years of service (Congressional Research Service, 2025; U.S. Navy, 2024). These ships were equipped with systems that might have been widely used in the commercial sector at the time the ships were built. However, many of these systems were not replaced or upgraded, the result of which is that parts support is no longer readily available. This is most applicable in auxiliary machinery and control systems, and manufacturers might have closed production lines for these parts as consumers began using different systems.

Even ships within the same class can be significantly different from one another. Some critical parts or systems from one ship might not translate to another ship. This limitation is prevalent among the Aegis combat systems. Repairing an Aegis system can be difficult because there are multiple baseline systems, which generally do not share parts. Indeed, even within common baselines, each ship's Aegis system is configured slightly differently. One participant said, "Every Aegis is like a snowflake. No two are the same." Besides making it difficult to stock the correct spare parts, cannibalization would be difficult because no two ships are alike. The lack of commonality means that, even in the complete absence of other impediments, repairs might be delayed simply because specialized parts are not available.

Assuming that repair personnel can correctly identify parts, critical items could be pre-positioned in theater. However, there are challenges with this. Pre-positioning requires host-nation agreements for access and transportation. It is not clear whether the United States has the necessary agreements with host nations in place to create a hub-and-spoke system.

Relying on host nations to fabricate parts is also problematic because agreements on intellectual property would have to be made. Fabrication with additive manufacturing might be possible, but, similarly, there would need to be agreements in place that allow organizations—other than the original equipment manufacturer—to produce the parts.

Conclusions and Recommendations

Participants' insights during this exercise revealed that existing Navy systems for battle-damage repair are burdened by a variety of inefficiencies that hinder the Navy's capacity for responding to widespread battle damage. These inefficiencies include outdated peacetime frameworks, ambiguous C2 structures during conflict, insufficient organic repair capabilities, and presumptive expectations regarding partner nations' contributions. Operating in a hostile Indo-Pacific environment will be significantly more complex than existing plans allow for, creating serious risks to rapid force regeneration and the Navy's ability to command the seas if these gaps are not urgently addressed.

Recommendations for the U.S. Navy

- **Institutionalize warfighting C2:** Update doctrine to establish clear C2 authority, streamlined communications, and defined approval chains for repairs during a crisis or conflict. Peacetime processes must not be assumed to be valid in wartime, and commands need regular rehearsals of new protocols.
- **Expand and resource organic repair capabilities:** Prioritize funding and expanding deployable repair teams, flyaway assessment units, and scalable Expeditionary Mobile Repair Facilities. Ensure that all deployed personnel are familiar with the rapid employment of these capabilities, including EODMU-10.
- **Clarify and exercise partner-support agreements:** Proactively negotiate scenario-specific agreements with regional partners, explicitly outlining permissions for repairs, salvage operations, and ordnance handling under different conflict levels. Routinely exercise restoration without access to key ports or in the event of a partner's refusal, which would build realistic expectations for all parties involved.
- **Reconstitute critical parts and a skilled workforce:** Restore and maintain war-reserve stocks for unique, high-value systems (such as Aegis or SPY radars), and address the lack of advanced repair staffing through recruitment, training, and surge retention, prioritizing operational flexibility over peacetime efficiency.
- **Anchor exercises to strategic objectives:** Future wargames must be evaluated against assured force regeneration, tactical resilience, and alliance interoperability, not just process improvements. After-action reports should measure advancement toward these strategic aims.

Recommendations for Allies and Partners

- **Negotiate pre-event legal and policy frameworks:** In advance, create agreements that specify what levels and types of support—including making repairs, handling ordnance, transferring technology, and granting access to facilities—can be expected at each escalation stage, and incorporate these agreements into alliance operational planning.
- **Maintain updated bilateral capabilities assessments:** Codevelop shared databases or partner port capabilities, repair expertise, ordnance-handling restrictions, surge capacities, and access procedures so allies and partners and the United States have an actionable understanding during a crisis.
- **Deepen wargaming and real-world rehearsals:** Expand joint and multilateral exercises to include realistic battle damage, repair, salvage, and medical evacuation scenarios. Emphasize a mutual understanding of C2, information-sharing, and the realities of support during high-threat situations.
- **Codevelop host-nation resilience and continuity plans:** Work with the United States and its partners to harden port and repair facilities, build geographically distributed repair nodes, and create continuity-of-operations plans to withstand adversary pressure.
- **Advance multinational pre-positioning repair packages:** Where politically feasible, establish regional caches of repair parts, tooling, and mobile modules, and do so with clear

multinational protocols for accelerated access and use during a crisis to avoid diplomatic bottlenecks.

Implementing these reforms will provide the Navy and its partners with a more credible and resilient foundation for sustaining maritime power and deterrence, even in the most challenging scenarios. Collectively, these steps are essential for assuring continued U.S. and allied operational dominance in a rapidly evolving Indo-Pacific security environment.

Abbreviations

C2	command and control
CIWS	close-in weapon system
CONUS	continental United States
DDG	guided missile destroyer
DDG-51	<i>Arleigh Burke</i> –class guided missile destroyer
EODMU-10	Explosive Ordnance Disposal Mobile Unit 10
GW CSG	<i>George Washington</i> Carrier Strike Group
LCS	littoral combat ship
PLA	People’s Liberation Army
PLAN	People’s Liberation Army Navy
SPY	surface ship, radar, surveillance, and control
VLS	vertical launch system
TTX	tabletop exercise

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