HARPOON II™

THE OFFICIAL STRATEGY GUIDE

THREE-SIXTY

ED DILLE · TOM BASHAM

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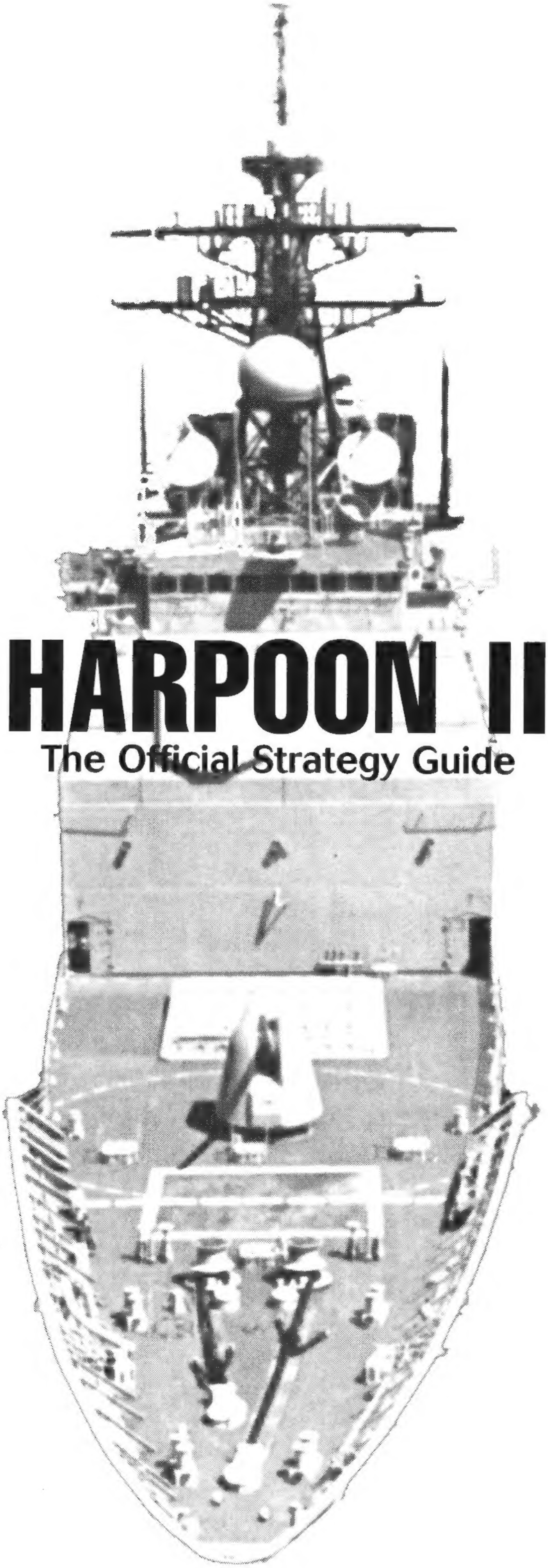

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The Official Strategy Guide

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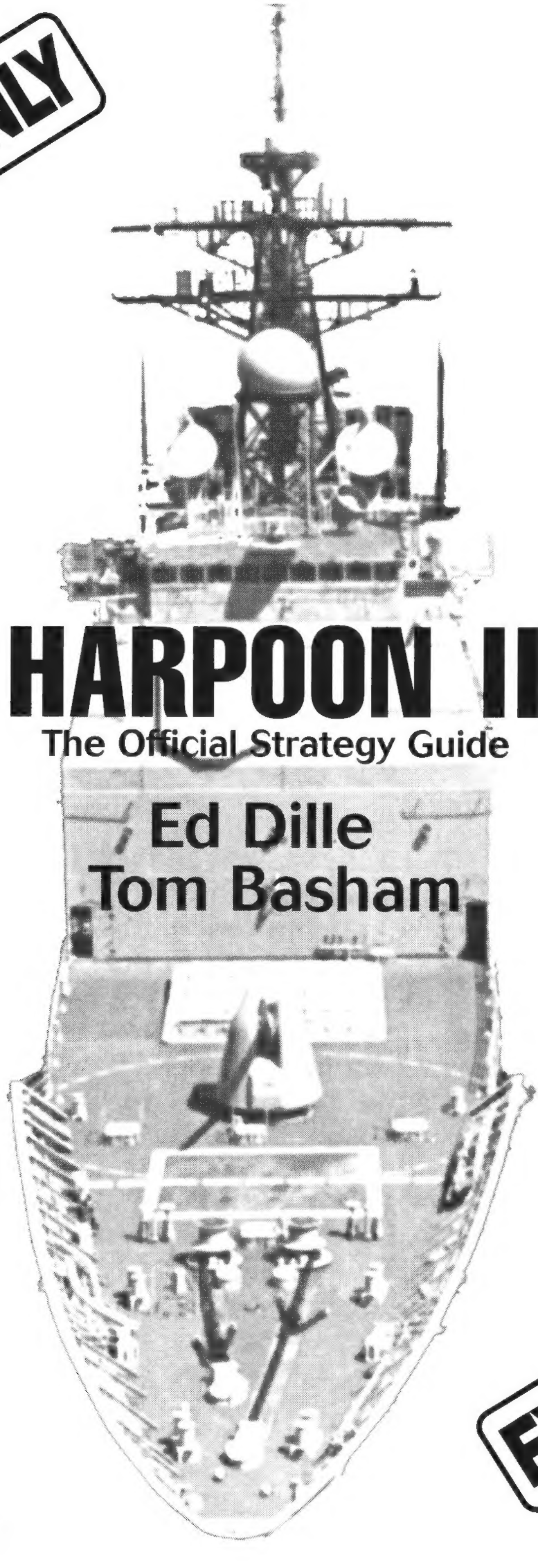

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Tom Basham

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Dedication

To my parents, Tom and Nancy.

Acknowledgments

I would like to thank Carl Norman at 360 Pacific, who pulled me into this project. Without him, I would never have been involved. On the downside, he did introduce me to Ed Dille. As they say, "nobody is perfect." Many others at 360 also supported this project in various capacities, most notably Darrel Dearing, Scott Witte, and Mike Steele. Mike in particular spent considerable time answering my phone calls, emails, and tracking down answers to my odd and obscure questions.

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Very special thanks to my new wife, Sara, who endured me staying in the computer room for hours on end, coming to bed as the sun came up, and "borrowing" her computer chair which is significantly more comfortable than my own.

Tom Basham

Dedication

To my lovely wife Tami, who supported my Naval career through good times and bad with a steady hand and giving heart. I would be nowhere without her.

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Finally, to Tom Frisina and Carl Norman of Three-Sixty, who epitomize the arduous search for quality in a sea of mixed mediocrity and adversity. Both of you exemplify the meaning of the word "professional" and I am proud to include you among the finest people I have known in this industry. Endeavor to Persevere!

Ed Dille
Huntington, WV
July 26, 1994

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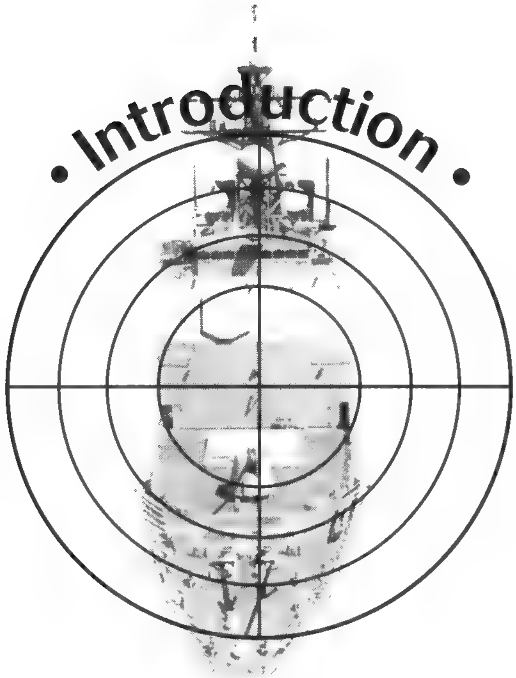
Introduction



Welcome to *Harpoon II: The Official Strategy Guide.* This book is a little different from other game books you've seen. Most game books step you through the game in question and point out answers and solutions. This book is not like that. The authors do not tell you secret code words or ultimate maneuvers that allow you to defeat your enemy every time. Instead, we teach you (regardless of your political alliance) how to command a naval task force. *Harpoon II* emphasizes realism; this book does likewise.

Rather than teach you how to beat the game, this book teaches you how real-world naval officers utilize the assets at hand in real-world situations and then how to apply real-world doctrine and tactics in the world of *Harpoon II.* When you have completed this book, you will know more than how to win a typical *Harpoon II* engagement; you will understand the concepts of naval warfare.

A HANDS-ON APPROACH

This book isn't a dull, monotonous textbook that endlessly cites philosophy and theory and that is filled with algebraic expressions representing relative motion between two combatants. Instead, this book uses a "hands-on" approach; it's designed to be used in front of your computer while you play *Harpoon II.* Using the missions supplied with *Harpoon II,* we walk you through the lessons and problems presented in the text. We don't quote long theories we can't prove; we take you step-by-step through *Harpoon II* missions and show you the right way, and the wrong way, to fight a naval battle.

Why did we choose this approach? Certainly it would have been easier just to list the order of battle for each mission, what surprises waited, and what to do to "win." This type of an approach, however, usually fails to impress on the reader the concepts behind successful strategies. Later, when additional missions are available (from add-on battlesets or user-made missions by way of a scenario editor), this book would have little practical value.

Therefore, we decided early on to teach naval strategies rather than "how to beat the game." *Harpoon II* tries to model the real world as closely as possible; it stands to reason, therefore, that the player should be able to emerge victorious by also using real-world strategies. Furthermore, after those strategies are learned, they can be applied to future scenarios and simulations that didn't exist when this book was written.

Additionally, this approach sometimes sheds light on current events. For example, after playing a few *Harpoon* scenarios loaded with friendly, enemy, and neutral aircraft, it becomes easier to understand how an incident like the USS *Vincennes* downing of an Iranian passenger liner occurs.

THE MORALITY OF WAR?

Like it or not, war has been around almost as long as mankind itself. Perceptions toward war, however, are continually changing. Across history, war has varied from a legitimate method of improving wealth to honorable retaliation after an insult to a horrendous deed that should be avoided at all costs. The attitude toward war often changes quickly — sometimes overnight.

This book does not address any such issues; for the purposes of this text, war *has* begun and must either be fought or lost. The moral or political correctness of the event is not debated.

THE CHANGING FACE OF WAR?

Naval combat tactics have changed greatly over the centuries. From flaming pitch to cannons to guns to missiles and torpedoes, the destructive power of a combat ship continues to increase. Tactical mindsets, based on the available weapons, armor, and platforms of the day, rise and fall like fashion trends. Ships of the line gave way to columns, and columns likewise gave way to formations. Flaming pitch gave way to cannons, which gave way to guns, which gave way to missiles and aircraft. Radar-guided missile attacks over the horizon have replaced broadside bombardments. The advent of ship-based aircraft allow opposing fleets to fight furious battles without the ships ever seeing each other. Silent, stalking submarines and waves of approaching, missile-armed aircraft require friendly forces to position escort vessels on patrol between the main convoy and the expected threat.

According to Captain Wayne P. Hughes, Jr. USN (Ret.) in *Fleet Tactics: Theory and Practice*, more wooden ships were captured than were sunk during an engagement. Modern naval combat, however, tends to be fast-paced, furious, and devastating. There's no room for mistakes when the balloon goes up. *Harpoon II* illustrates the lethality of modern naval warfare as well as can be illustrated on a computer, and this book teaches the skills necessary to survive therein.

FINDING YOUR WAY THROUGH THIS BOOK

Section 1, "Getting a Commission," brings you into the naval warfare world, by discussing effective methods of maneuvering through the user interface and the platforms, weapons, and sensors used on today's seas.

Section 2, "Taking Command," looks at battle preparations: building and deploying a formation, planning a mission, and operating within the prescribed rules of engagement (ROE). New users should begin their studies with Chapter 1, and those more familiar with the Harpoon gaming system may prefer to jump directly to Chapter 2.

Section 3, "Going Into Harm's Way," explores the three classic types of naval warfare: Sea Denial, Sea Control, and Power Projection. Every naval-combat mission includes one or more of these classic types. Sea Denial means preventing the enemy from using the sea. Sea Control means holding the sea open to your uses despite enemy efforts at Sea Denial. Power Projection refers to a more general application of force, such as the U.S. raids on Libya (using carrier-based airpower) and Iran (using surface ships).

Regardless of the specific details of the engagement, every mission you undertake includes elements of Sea Denial, Sea Control, or Power Projection. For example, one side may be assigned a Power Projection mission to destroy enemy land-based installations, and the defending side may take the Sea Denial role and attempt to prevent the raid.

Successful combat requires a clear understanding of the goals and how to achieve them. Recognizing the combat situation and knowing how to react is half the battle. Therefore, the combat lessons in Chapters 7-9 examine the three classic naval combat types and illustrate the objectives and difficulties associated with each one.

In summary, although the creation of *Harpoon II* spawned this text, we have tried to approach the topic as a typical naval tactician would. The principles and guidelines we present are as valid for other naval simulations as they are for *Harpoon II* because they're taken directly from the real world. We have gone to great lengths to present accurate, viable tactics gained through hours of research and calling on our own personal areas of expertise in as clear and concise a format as possible.

BRINGING THE BATTLE HOME

Although *Harpoon II* is just a simulation, please remember that real men and women stand guard, ever ready to fight the real battles we fight on our computers. These individuals spend years preparing and training to fight these battles; it is logical to assume, therefore, that mastering *Harpoon II* naval combat also takes time. With this book acting as your personal version of the Naval War College, we hope to expedite your combat effectiveness and increase your appreciation for the people who do or have done this work for real.

SECTION
1

GETTING A COMMISSION

1 Navigating the New Interface

Harpoon II bears little resemblance to its predecessor. Whereas the original Harpoon used a fixed, inflexible group of three windows, *Harpoon II* uses a flexible, dynamic windowing system. The new system offers many advantages, but presents new challenges as well.

MENU TREE

First, a brief overview of the available menus is in order. The following outline shows the *Harpoon II* menu structure:

1. PC

- About
- Help
- Tutorial

Facing page: Knox class frigate testing the IVDS sonar array. U.S. Naval Institute Archives

2. File
   - Open
   - Save
   - Save As
   - Load Battleset
   - Resign
   - Quit

3. Settings
   - Start/pause Game
   - Time Compression On/Off
   - Toggle Rng/Bearing
   - Set Flagship
   - Edit Waypoint Orders
   - Colors
     - Save Current Palette
     - Load User Palette
     - Default Palettes
       - Aegis Display
       - Amber Display
       - OJ-663 Display
       - Grayscale Display
       - Conventional Display
     - Interface Colors
       - Windows/Frames
       - Widgets/Text
     - Map Colors
     - Weather Colors
     - Game Colors
     - Symbol Set
       - Stylized
   - NTDS
   - Game Preferences

4. Mission

- Create Mission
- Edit Mission
- Add Reference Point
- Move Reference Point
- Delete Reference Point

5. Window

- Game Status
- Unit Status
- Platform
- Order of Battle
- Legend
- Memory Remaining
- Message
- Current Orders
- Scenario Info
- Close

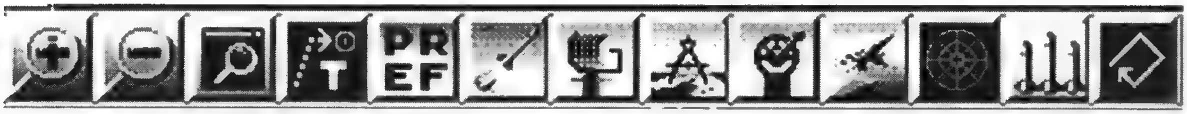
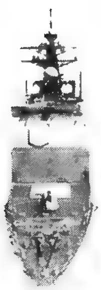


Figure 1-1. Toolbar

Each window also has a "toolbar" with the following functions (see Figure 1-1):

Attack	F1
Speed, Alt, Depth	F2
Nav Mode	F3
Formation Editor	F4
Logistics	F5
Air Ops	F6
Nav Zone Editor	F7
Window Preferences	F8
Sensors	F9
New Zoom Window	F10



WINDOW STRUCTURE

Effective unit management requires a thorough understanding of *Harpoon II's* windowing interface. The interface's versatility allows significant control flexibility, but can also be somewhat confusing at first. There are two types of windows: *map* and *data*. Map windows display and control game units, and data windows display information about the scenario and game units.

Data windows are fixed, known quantities; they are always available from the Message pull-down menu, even if you delete them. Data windows, such as the mission orders, unit status, and message windows, can be moved, reduced to icons, or deleted, and they can always be re-created by way of the Message pull-down menu.

Map windows come in two varieties: *required* and *zoom.* Each scenario has only one required window — the name of the scenario. Required windows usually appear as icons in the lower right corner of the screen. As long as the scenario exists, the required window also exists. Zoom windows begin and end life at the user's whims. The user can create or close new zoom windows at any time. Zoom windows are created from within another map window, but they are not merely a subset of the "parent" window. Each zoom window has a fully functional tool bar and full magnification control. A zoom window can be made larger or smaller than its parent window.

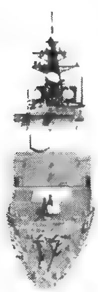
Always remember one thing about map windows: *All map windows are created equal.* Any legal command can be executed from any zoom window. In fact, commands can span across multiple windows. Select a unit in one window and press the Navigation button, plot a course in a second window, and then issue waypoint orders in a third. Additionally you can select a unit in one window, press the Attack button, and select targets in a separate zoom window. Every mission, patrol, or battle can each have its own customized display window, showing only the information needed for that particular operation. User-defined labels allow quick referencing between windows.

There is no reason to *overload* a window, or perform so many tasks in one window that it becomes cluttered and difficult to read. If the window's magnification needs to be increased more than two zoom stages, you most likely need to create a new window left permanently at the higher magnification. Because orders can be issued to any unit in any window from any window, because courses can be plotted across multiple windows, and because units can attack targets selected in separate windows, window overloading is rarely, if ever, necessary. The windowing interface received careful attention during the design process to prevent window overloading. Create as many windows as necessary with display preferences tailored to show only information relevant to that specific activity.

Use the Track toolbar function in a zoom window, for example, to keep tabs on an enemy surface group. Label the window with the name of the group and tailor the display preferences to show surface-search radar and anti-surface weapons ranges because those are the most relevant. Use another zoom window to monitor an enemy base, usually displaying units rather than groups so that individual items at that base can be monitored. Use a separate window to track each of your surface groups, and another window over any active air-patrol zones. Reduce unused windows to icons and then restore them when neccessary.

WAR LESSON 1.1

Some commands require that you press a toolbar button at the beginning and end of the command, such as plotting a course. Generally, try to execute the ending toolbar press in the same window as the beginning toolbar press regardless of how many windows are used to plot the course. Some commands occasionally get "confused" when multiple toolbars are used.



GROUPS VERSUS INDIVIDUALS

Individual units can only be viewed only as individual icons, but groups can be displayed as either a single group icon or a series of individual icons. Commands issued to a group icon affect the entire group, and commands issued to a unit in a group generally affect only the selected unit and can sometimes cause the unit to leave the group.

Groups allow easier control of multiple units. An attack order given to a group of 20 fighters cause all 20 individual aircraft to attack. A course plotted for a group naturally moves all units in that group. Usually, the Formation Editor controls placement of units within a group. Range circles, though, are not displayed for groups because different units in the groups may have different radar, fuel, and weapons ranges.

Some commands issued to a group cause that group to disband. When a group is ordered to land, the entire group returns to base intact. If the group uses all relevant weapons during an assigned task, however, the group disbands and each individual aircraft is automatically ordered to return to base. Although this technique is normally quite effective, you will see later that this automatic disbanding sometimes causes operational errors under certain conditions. When and why this happens as well as what to do about it are covered later in this chapter.

WINDOW OVERLOADING

Group Selection

Clicking on a group or unit selects only that group or unit. Sometimes, especially during attacks, multiple groups or multiple units must be selected. Selecting more than one group or unit is called a *group selection. Harpoon II* supports two types of group selection: shift-select and drag-select.

> **WAR LESSON 1.2**
>
> Never try to use a window for too many activities at once.

With *shift-selection*, you select one of the desired units by clicking on it. Press and hold the Shift key and click on more units. A white *selection box* should appear around each of the clicked-on units. The "group" of selected units can now be controlled together. Generally, the drag-selection technique works best: Using the mouse, simply press and hold the left mouse button and then drag the mouse until all desired units are within the resulting box. When the mouse button is released, all units should have a white selection box around them.

Details about when, how, and why to use the group-selection techniques are discussed in later chapters, but understand that group selection grants *Harpoon II's* windowed interface much of its flexibility and is highly advantageous in combat. Suppose that three airgroups of 10 F/A-18s each have been sent to attack a Russian surface group. The Russian surface group contains eight warships. Without group selection, the player must micro-manage the battle and execute numerous Launch commands to create a suitable missile spread. Using group selection, the player selects all attacking units, issues one attack command, selects all target units, and then allocates all missiles at once in the Attack menus, significantly simplifying the entire operation.

The Unit Status Window

The unit status window displays all information about friendly units in the current communications network but only limited information about friendly units not in the communications network and enemy units. Remember that when it comes to hostile units, the unit status window is only as good as the intelligence your forces have collected on that unit. Recon and patrol missions must regularly "check up" on enemy contacts to ensure that the unit status window shows valid and current information.

Also keep in mind that the Report sub-menu shows all emissions *ever* detected from that contact, not just current emissions. There is no way to tell from the unit status window alone whether any listed emission is active. Chapter 9 explores this issue and explains how to tell the current EMCON state of a hostile unit.

NAVIGATION AND NAVIGATIONAL ZONES

Harpoon II contains a navigational system considerably revised from the original *Harpoon.* As in the original, players still plot courses with waypoints, and each waypoint can include various orders. There the similarity ends. Unlike the original, each additional waypoint is easily added simply by dragging the Midpoint marker between any two waypoints to a new position. *Harpoon II's* staff assistant automatically handles all navigation and keeps the fleet from running aground. Though much improved, the new interface is still not intuitive. The following list describes some nuances:

1. **No waypoint exists until the second compass click.** Courses are defined by pressing the Nav Mode button, which looks like a drawing compass. Clicking once starts the navigation plot, clicking again ends it. Until the second click, no matter how many waypoints are plotted on the map, *no course is created.*

Therefore, no waypoint orders can be issued until after the second time you click the Nav Mode button. You can also double-click to end Nav Mode or press F3.

2. **Courses can extend across multiple windows.** After you press the first Nav Mode button, waypoints can be entered in any window regardless of whether that window displays the unit or group being plotted. Generally, though, you must click the Nav Button a second time in the same window as you did in the first. Otherwise, the navigator often becomes confused and erases the course.

3. **Unassigned aircraft become plotted after giving the carrier a course.** Aircraft with no orders normally show as Unassigned from the Air Operations menu. When a course is created, the aircraft status changes to "plotted." When a course for a ship carrying unassigned aircraft is plotted, both the ship *and the aircraft* become plotted. In other words, because the ship carrying the aircraft now has a plotted course, the aircraft on-board also have a plotted course. These aircraft must be unassigned using the Mission Editor before the player can control them manually.

4. **Assigning Waypoint Orders.** *Harpoon II* allows simple instructions to be defined for each waypoint. EMCON and flight profile changes can be made at any time. Radar, sonar, and ECM can be changed at each waypoint, as can speed and altitude. Complex orders, such as Attack Target are not supported.

These might seem like fiine details, but *Harpoon II* rewards players who can manage them. By taking the time to master the nuances of the interface, you will be rewarded with much more flexibility in your tactical planning.

The Navigation Zone

In a new addition to *Harpoon II,* players can define *navigation zones,* also called *threat zones* or *exclusion zones,* designed to control and protect friendly units. In the simplest terms, navigation zones tell a specific type of unit where it cannot move. For example, “submarine navigation zones” restrict submarine movements and “air navigation zones” restrict aircraft movements. Most navigation zones are called threat zones because the zone indicates a high-threat area for the unit in question. For example, you create an air-threat zone around an enemy base heavily equipped with surface-to-air missiles to prevent any friendly aircraft from wandering too close.

Each navigation zone type, such as sub threat, has four *categories* named A through D. Submarine threat zones may be a single category or a combination of multiple categories. For example, a particular submarine threat zone may be designated as categories A and D only, a second submarine threat zone as B only, and a third as B, C, and D. By default, every friendly sub honors all four categories. That is, by default, a friendly submarine cannot enter any type of submarine threat zone. Submarines, however, can be told to ignore one or more categories. For example, a friendly submarine may be told to ignore all category A submarine threat zones. Zone categories

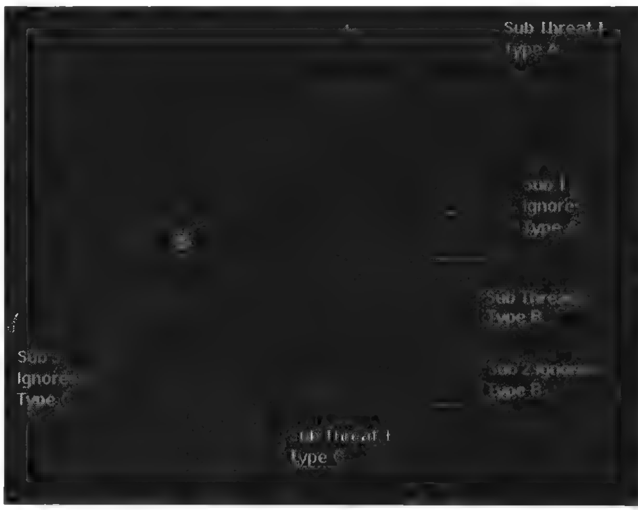


Figure 1-2. Submarine Threat Zones

are set when the zone is created; players edit them by selecting the navigation zone and double clicking the Nav Zone button. You edit aircraft by selecting the desired aircraft and then double-clicking the Nav Zone button.

Why do this? Consider the example in Figure 1-2. Three submarines are patrolling three areas. The first submarine is edited to ignore type A threat zones; the second, type B; the third, type C. Notice the patrol zones: The first zone is category A only; the second, B only; the third, C only. The first submarine can patrol the first zone since it ignores category A, but it cannot enter the B or C zones. Likewise, the second sub which ignores type B, can enter only the B zone, not the A or C zones, and the third sub can enter only the C zone, not the A or B zones. The need for such operational capabilities becomes apparent during discussions of friendly fire casualties later in the book.

Table 1-1: Submarine Threat Zone

Unit Type	Threat Zone Types Honored
Aircraft	Air Threat, Air Detection, General Exclusion
Ships	Ship Threat, Ship Detection, General Exclusion
Submarines	Submarine Threat, Submarine Detection, General Exclusion

WAR LESSON 1.3

Remember, threat zones refer to a threat to *friendly* units. For example, an air threat zone means "enemy forces in that area pose a threat to friendly aircraft," not "enemy aircraft in that zone pose a threat to friendly forces."

THE FORMATION EDITOR

Individual units, especially ships, usually operate together in groups. How these units are positioned within the group is called the *formation. Harpoon II* provides an interface, the Formation Editor, for altering and controlling a group's formation. Individual units, through the Formation Editor, are assigned *patrol zones* within the formation depending on their capabilities.

Effective use of the Formation Editor removes at least 30 percent of the player's workload. The formation a group of units adopts determines their defensive effectiveness. Understanding and effectively utilizing the formation editor is critical to fielding a viable defense. Most Formation Editor tasks can be delegated to the staff assistant. The staff assistant, or computer, does a reasonable job of performing the tasks, but it is less creative than human players. Inexperienced players should delegate all Formation Editor tasks to the staff assistant and then observe how it handles formations and air patrols. Experienced players generally want to control formations themselves to ensure optimum deployments at all times.

WAR LESSON 1.4

Hostile forces do not honor navigation zones you create during the mission.

Threat Axes

The Formation Editor is driven by three *threat axes,* which indicate the direction of AAW, ASuW, and ASW threats. Per standard naval doctrine, the ASW threat axis always points ahead of a moving convoy because submarines generally lie silently and wait for targets to come to them. The AAW and ASuW threat axes vary depending upon the direction of related contacts.

The AAW and ASuW threat axes can be delegated to the staff assistant for automatic generation or controlled by the player. If the threat axes are delegated, the staff assistant automatically determines, based on detected hostile forces, the most likely direction to expect an attack from. The resulting threat axes are displayed when the Formation Editor is invoked. If the threat axes are not delegated, a player must analyze contacts and draw the threat axes manually. When a threat axis is handled manually, it simply points in some direction from the center of the formation, or it can track a specific contact, always pointing at that contact no matter which way it — or the formation — is moving. The latter method is more desirable for updates based on a known position that will not vary or become a "lost contact," such as an enemy airbase.

Altering Threat Axes

To move or change a threat axis, refer to Figure 1-3. To move the threat axis, notice that you use the mouse to drag the curved "end" of the threat axis around the formation. To change the size of the threat axis, drag the straight "sides" of the threat axis. Also notice that the manual describes an *incorrect procedure* for assigning a threat axis to track a specific enemy contact. The manual incorrectly indicates that the contact to be tracked must be selected first. Instead, enter the Formation Editor, select any ship in the formation, select the appropriate threat axis and press the Threat Axis toolbar button. The mouse pointer then changes to the *targeting circle*. Finally, double click on the desired contact. The threat axis now tracks that target regardless of the formation's heading.

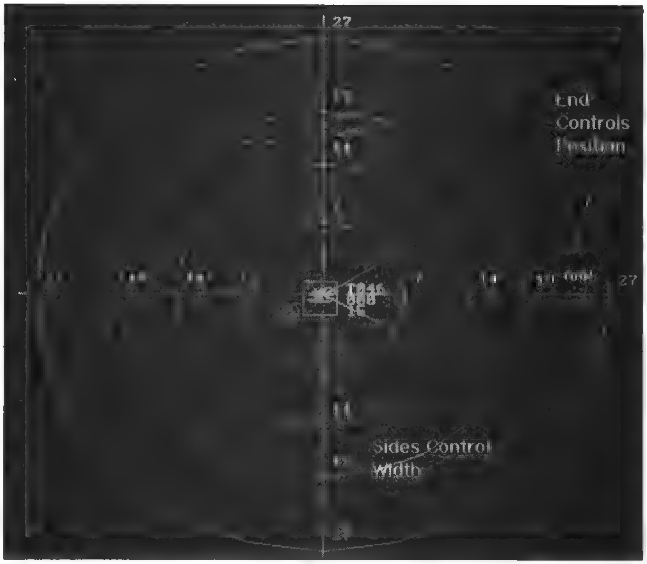


Figure 1-3. Threat Axis Modification

Patrol Zones

Within the formation, every unit is assigned a patrol zone. The unit in question maneuvers within the indicated patrol zone, performing its assigned function. Formation patrol zones are *always* maintained relative to a particular threat axis, as shown in Figures 1-4a and 1-4b. The patrol zone is defined relative to the threat axis; as the threat axis moves, the patrol zone moves accordingly. This reiterates the need for accurate threat axes. If a particular threat axis points the wrong direction, all patrols associated with that threat axis will also be wrong. Figures 1-4a and 1-4b show how a particular patrol zone moves relative to its associated threat axis.

WAR LESSON 1.5

The manual incorrectly describes the target-tracking threat axis procedure. Rather than clicking on the enemy to be tracked first, click on a friendly unit and then on the conflict of interest.

Figure 1-4a.

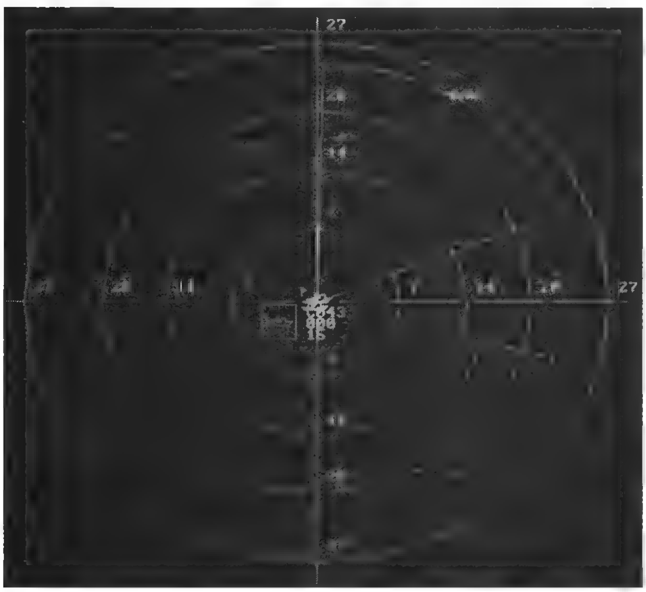


Figure 1-4b.

Defining a ship's patrol zone is relatively easy. Within the Formation Editor, select the ship, select the appropriate threat axis, press the Patrol Zone button, and draw the desired zone. The Formation Editor knows, based on the associated threat axis, whether this unit should conduct ASW, ASuW, or AAW operations. Regardless of the threat axis type, any ship will defend itself against in-bound attack. Last, the Formation Editor asks for a patrol type: *station keep, sprint-drift,* or *random,* which determines the type of pattern the unit uses in the patrol zone. Most AAW ships should station keep (to provide the best air cover for their companions), while most ASW ships should sprint-drift (their sonar works best while drifting quietly). The random selection is useful for static sub/ship patrols.

Defining aircraft patrol zones is less straightforward. There appears to be at least three different ways of assigning an aircraft a particular patrol zone. Each way combines toolbar buttons and unit

> **WAR LESSON 1.6**
>
> Unassign an air patrol by selecting the aircraft within the Formation Editor and double-clicking the Air Ops button.

selection in obscure ways to achieve the same result. Because all methods accomplish the same end result, we discuss only one method, which has been determined to be the most straightforward and reliable.

Begin by selecting any ship in the group and then select the appropriate threat axis. Next press the Patrol Zone button and draw the desired patrol zone relative to the selected threat axis. The Formation Editor, thinking that you selected a ship, asks whether the patrol zone should be station keep, sprint-drift, or random. *None of these are appropriate choices for aircraft.* Selecting any one of these three choices causes the highlighted ship to move to the new patrol zone. Instead *press cancel,* then double-click the Air Ops button. A new menu appears, asking whether the patrol should be *CAP* (combat air patrol), *AEW* (airborne early warning), *dipping sonar* (helicopters dipping active sonars into the water from very low altitude to search for submarines), or *sonobouy* (any ASW-type aircraft dropping rows of sonobouys in the water). After selecting the appropriate patrol type, the standard Air Operations menu appears allowing aircraft assignment. The assigned aircraft then launch and move to the designated patrol zone.

The Formation Editor and Unassigned Aircraft

Aircraft are associated to patrol zones rather than to patrol zones being associated with aircraft. In other words, a patrol zone continues to exist even when the associated aircraft returns to base or is shot down. The formation monitors all other aircraft in the group appropriate for each patrol zone. If the formation finds an unstaffed patrol zone (because the aircraft returned to base, was detached, was shot down, etc.) it looks for a ready, unassigned aircraft capable of staffing the patrol zone. If it finds one, it automatically assigns and launches the aircraft. Therefore, *don't be surprised if some of your unassigned aircraft seem to disappear after a formation-assigned aircraft lands.* The Formation Editor is just trying to adequately maintain the formation. When in doubt, check the Formation Editor and see whether the "missing" aircraft are patrolling there.

Formation patrols, such as a helicopter on a dipping-sonar ASW patrol, should patrol along the appropriate threat axis — in this case the ASW threat axis. Fighters should patrol along the AAW threat axis, and ships should configure to defend against the ASuW threat axis, positioning the bulk of the group between the high-value units and the threat. When formations and air patrols are delegated to the staff assistant, it automatically positions units along the appropriate threat axis according to their capabilities. If the player designates an inaccurate threat axis but delegates formation command to the staff assistant, the staff assistant deploys forces along the invalid threat axis without knowing any better.

Attaching and Detaching Units

Groups themselves can be edited within the Formation Editor. To *detach,* or remove, a unit from the group, select the unit or units and press the Detach Unit button. Any highlighted unit or units no longer operate with the group. *Attach,* or add, units to the

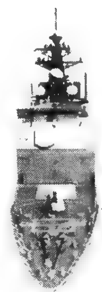
WAR LESSON 1.7

Be very careful when you use large formations near enemy positions.

group by first making them all visible with the Formation Editor, followed by dragging a box around the new unit and *at least one unit already assigned to the group,* then pressing the G key. The additional unit or units within the drag-box now operate with the group.

Warning! Formation Scale can be Deceiving!

Remember that all units within a formation are represented by a single group icon on any map unless that map is showing individual units. A formation generally spans 30nm or more, and, typically, carrier battle group air patrols easily span 100nm or more. The group icon, though represents the *center* of the formation, not an "edge." Therefore, a group icon may appear well out of range of enemy weapons, but an aircraft deployed 100nm from the center may actually be within enemy SAM range. Because the aircraft is part of the group, though, it is not displayed.



THE MISSION EDITOR

The Mission Editor is another way of assigning units automated patrols. The Mission Editor differs significantly from the Formation Editor in terms of operation, capabilities, and functions. Understanding the Mission Editor is imperative for *Harpoon II* play. The Mission Editor is not just a tool for the player's convenience — *it is the primary method through which the computer opponent conducts all operations.* Essentially, the computer player assigns its units missions and allows the

Mission Editor artificial intelligence to conduct the war. When the human player uses the Mission Editor, those forces also use the same artificial intelligence as the enemy. Using the Mission Editor significantly reduces the player's workload, but it also divulges how the enemy fights. Understanding the Mission Editor means understanding the computer opponent.

The Mission Editor revolves around the *one-third* rule. When more than one unit of a specific type is assigned to a mission, the Mission Editor attempts to keep only one-third of the assigned units on-station. The other two-thirds are held in ready reserve. When the first third runs out of weapons or fuel, the Mission Editor brings them home and launches the second third. When that unit must return to base, the final third launches, and then the cycle begins again. The one-third rule is *type specific:* That is, if three F-14s and three F/A-18s are assigned a mission, the Mission Editor keeps one F-14 and one F/A-18 on-station at all times. These guidelines don't apply to ships and submarines.

Mission Types and Attributes

First, outline the desired patrol area with reference points. Rename the reference points by using the Rename Reference Point hotkey so that their mission association is immediately recognizable. After creating four or five missions, the reference points become a confused jumble on the map. Renaming them something relevant restores some semblance of order. The area defined by the reference points do not restrict the assigned unit's movements. Instead, they dictate a "hangout" spot. Units remain in the hangout area until they detect an enemy. Units then readily leave the hangout area and investigate. How far a unit roams from the designated area depends upon the quality of its sensors; the farther away it detects contacts, the farther away it roams. Mission-assigned units generally investigate any unidentified contact and immediately fire on any known hostile contact.

Select the desired reference points and select Create Mission from the Mission pull-down menu. Figure 1-5 shows the mission attribute screen. Notice that most of these attributes cannot be changed after the mission is created unless the mission is deleted and then re-created, so choose them carefully.

> **WAR LESSON 1.8**
>
> Units assigned a mission ignore the Weapons Free/Weapons Tight option. The computer never fires on an unidentified contact and always fires on a known hostile contact.

1. **Mission Name:** A totally random name. Rename the mission to something more relevant.

2. **Delay Time:** The delay time indicates how long from the moment the mission is created the units should wait before beginning the mission. For example, you might want an AEW patrol to wait 15 or 20 minutes for a CAP patrol to arrive on station first.

3. **EMCON:** Controls the type of emissions the assigned units use. If you select passive, units *never* activate radar. If you select active, units *never* turn off radar.

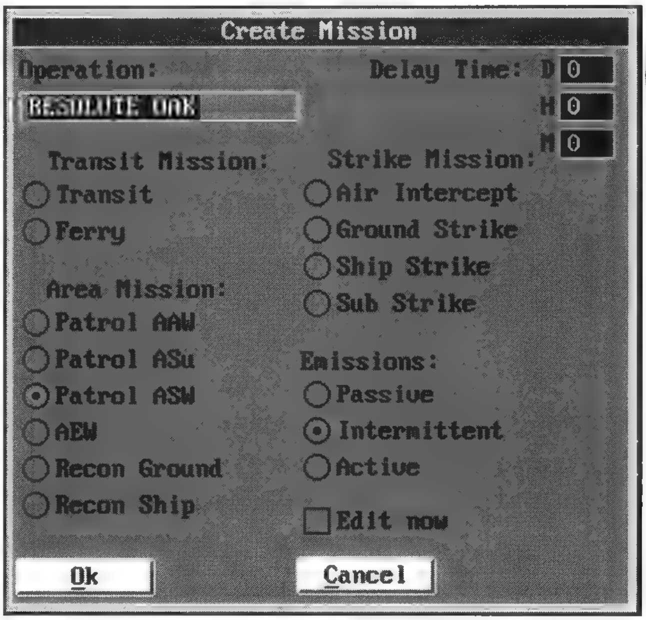


Figure 1-5. Defining Mission Attributes

4. **Patrol Missions:** Patrolling units "hang out" in the defined zone, watching for enemies. Patrolling units readily leave the patrol zone to investigate new contacts. The Mission Editor maintains control over patrolling units and dispatches them as it deems necessary, based on how close a given unit is to the contact of interest, how soon it can reach the contact of interest, and the perceived threat the contact poses. The Mission Editor may dispatch only a single unit to intercept a straying AEW aircraft, but dispatch several to intercept an in-bound group of Backfire bombers. The Mission Editor prioritizes contacts based on the mission type. Incoming missiles always receive first priority. The other priorities, in order, are:

   - *AAW Patrols:* Only investigate and engage aircraft.
   - *ASuW Patrols:* Engage any contact, but engage ship contacts first.
   - *ASW Patrols:* Engage any contact, but engage sub contacts first.
   - *AEW Patrols:* Ignore all contacts. Use the Mission Editor to set their radar posture yourself. These patrols should be well-protected.

   Patrol missions do not respect groups. If an air-group is assigned to a patrol mission, the Mission Editor tears apart the group and allocates individual units as it sees fit. This process is necessary so that the artificial intelligence can effectively respond to multiple targets under all circumstances. Patrol missions fire only *sufficient* weapons estimated to destroy a target, reserving other weapons for future engagements.

5. **Recon Missions:** Recon mission units "hang out" in the specified zone, regularly moving toward contacts and investigating. After the unit acquires a positive identification on the contact, it withdraws to the hangout area. The unit loiters until the contact ages sufficiently and then repeats the investigation. Recon units keep track of every contact within range, repeating the investigation until the contact is totally lost (either it sinks or moves completely out of detection range). Recon missions only investigate the specified unit type; targets of opportunity are ignored. Recon missions should obey three guidelines:

   - Assign only aircraft to recon missions.
   - Place hangout zones sufficiently close to ensure casual contact with enemy forces.
   - Protect hangout zones. Recon units spend significant time there and expect to be safe. Allocate sufficient defensive assets to keep enemies away from such hangout zones.

   Like patrol missions, recon missions do not respect groups.

6. **Transit Missions:** Analogous to plotting courses for groups. Transit missions respect groups and move them intact to the specified patrol zone where the group remains on-station. Transit missions do not seek out enemies, but actively engage anything hostile within weapons and sensors range. The game designers recommend moving carrier battlegroups with transit missions, although manually plotting a course seems just as effective. In either case, the Formation Editor must define an adequate defensive posture.

7. **Strike Missions:** Strike missions follow a simple rule: *See target, shoot at target.* A strike mission can attack a specific target. Group-select all desired target units and then Create Mission. Friendly units will launch, follow the shortest possible path to the target, and fire at all available targets when they're within range. The units continue the mission, rearming and relaunching as necessary, until the specified target is destroyed, at which time the mission ends. All assigned aircraft return to base and become "unassigned."

WAR LESSON 1.9

Strike missions, because of their simple logic, are not well suited for attacks against heavily defended enemies.

Alternatively, define a zone with reference points without selecting any targets, and then create the mission. Assigned units move to the strike zone and search for hostile contacts. Units engage the first contact of the specified type not already being attacked by another strike mission. They continue to attack the detected contact until it is destroyed and then search for a new contact. The mission continues indefinitely.

Assigning Units

The manual adequately describes assigning and removing aircraft from missions. Except for submerged submarines, units can be added or removed from a mission at any time. Submerged submarines, however, are out of contact with the flagship and do not accept new orders until they resurface and resume communications, generally one to two days after diving, depending on the submarine type and its previous orders.

Mission Editor Notes

The Mission Editor is designed for flexible operations but this fact can cause confusion if you don't understand it.

1. ASW Patrols. All mission types, except ASW patrols, fire only on positively confirmed hostile contacts. ASW patrols assume any submarine contact within the patrol area is hostile *and immediately fire on it.* Therefore, ASW patrols must not be assigned near friendly submarines to avoid blue-on-blue, or "friendly fire," engagements. Two friendly submarines must not be assigned ASW patrols near each other because they assume that the other is a hostile contact and attack it. When an ASW patrol mission is created, the Mission Editor automatically creates a submarine threat zone around the patrol area to keep out friendly submarines. Before a submarine can be assigned to that ASW mission or even enter that patrol area on a different mission, it must be ordered to ignore the threat zones (see the discussion on navigation zones earlier in this chapter).
2. Patrol units dynamically monitor their assigned reference points. Moving reference points moves mission patrol zones.
3. Mission-assigned units engage any hostile contact they detect, regardless of the Weapons Free / Weapons Tight setting. Therefore, mission-assigned units may be more aggressive than desired, engaging enemy contacts despite a Weapons Tight setting.

4. Missions should always have at least two, preferably three, reference points assigned. Using only one reference point confuses the artificial intelligence, slows the entire game down, and reduces the mission's effectiveness.

5. Occasionally a small letter *n* appears next to mission-assigned aircraft. This letter indicates that the automatic navigator is plotting a new course for that unit. The *n* will disappear shortly.

6. ECM-equipped units should not be assigned to missions. This is because in the current version of *Harpoon II* ECM gear is only used defensively and can not therefore contribute to your offensive.

7. Because of the simple logic, strike missions easily become confused. For example, assign six F/A-18s with Harpoon missiles and six A-6Es with HARM anti-radiation missiles to an ASuW strike mission. If the enemy ships are not currently emitting, the Mission Editor decides the A-6Es have no appropriate weapons for the attack and sends them back to base. The A-6Es should loiter and wait for the enemy to activate their radar. Complex and coordinated strikes should be handled by hand. Because the computer opponent has the "strike logic" available only for mission planning, human players have a significant advantage over it.

8. Try to assign to a mission all units of a given type at one time. For example, assigning six F-14s to an AAW patrol keeps two F-14s in the air at all times. Assigning three more F-14s, especially if they are already airborne, tends to confuse the logic of the

one-third rule. The original six F-14s still operate correctly, but the later-assigned aircraft often do not obey the one-third rule. If additional aircraft are needed in the mission, assign them as a group before they are launched.

FORMATION EDITOR VERSUS MISSION EDITOR

Given a specific task, such as a barrier CAP, which should be used, the Formation Editor or the Mission Editor? Each has a specific purpose, advantages, and disadvantages. Maximizing effectiveness requires understanding those differences.

The Mission Editor shows more detail and keeps the assigned units more accessible. The Mission Editor is generally more inquisitive and aggressive, detaching units to investigate contacts. The Formation Editor is generally less flexible, keeping units on-station and engaging enemies that come to them. Units assigned via the Mission Editor are more easily commanded by human players. As a general rule of thumb: *The Formation Editor positions units within a group and maintains group sanctity; the Mission Editor pulls units from groups and assigns them tasks.* For example, the Formation Editor commandeers unassigned aircraft within the group to fulfill formation duties, the Mission Editor commandeers units from assigned groups and assigns them to investigate and intercept contacts outside the mission zone.

WAR LESSON 1.9

When in doubt, press the Air Ops button.

AIR OPS BUTTON

The Air Ops button handles all aircraft-related activity, including readying, launching, landing, and reassigning aircraft. *When in doubt, press the Air Ops button.*

- *Ready Aircraft:* Select the carrier or base, and then press the Air Ops button.
- *Launch Aircraft:* Select the carrier or base, and then press the Air Ops button.
- *Land Aircraft:* Select the aircraft, press the Air Ops button, and then double-click on desired base.
- *Intercept Hostile Aircraft:* Select the target aircraft, press the Air Ops button, and then select intercepting aircraft.
- *Refuel Aircraft:* Select the recipient aircraft, press the Air Ops button, and then double-click on tanker.

Tankers and In-flight Refueling

The addition of tanker aircraft adds significant flexibility to *Harpoon II* air operations, provided that you understand the details of in-flight refueling.

- *Tankers have one fuel supply.* Tanker aircraft use the same fuel supply for their engines as for refueling other aircraft. Giving fuel to other aircraft reduces the tanker's own flight range.
- *Tankers transfer fuel at a fixed rate.* Tankers transfer fuel at a fixed rate and *always fill the recipient.* If the

tanker lacks sufficient fuel to completely fill the recipient, the recipient ignores the refueling order. Tactical aircraft, like the KA-6, generally have only enough fuel to refuel one or two other aircraft. Hopefully, future versions of *Harpoon II* will allow user-specified transfer quantities in lieu of the current "all or nothing" approach.

- *Send entire groups to tankers.* Try sending an entire airgroup to a tanker at the same time. If the tanker has enough fuel, the entire group is refueled; otherwise, the entire group ignores the refuel order.

ASSUMING COMMAND IN THE NEW WORLD

Harpoon II includes several subtleties "under the hood," many of which significantly affect play but which may never be noticed by players. The *Harpoon II* world resolves down to 18 inches. That means an object can exist every 18 inches, that courses have to be plotted accounting for objects potentially every 18 inches, and that missiles can miss by — yes, 18 inches. Dynamic weather moves throughout the play area, causing clouds, rain, and waves. Precipitation and clouds degrade electromagnetic, infrared, and visual sensors in varying ways. *Sea state,* or the measure of surface wave activity, varies with weather, ranging from calm seas (sea state 1) to 50 foot waves and gale-force winds (sea state 9). Increasing sea states degrades sonar performance — some types of sonar more than others.

Ambient noise, such as from cavitation, also have an impact on sonar performance, affecting different frequencies differently. Every unit in the database possesses multiple visual, infrared, and radar cross-sections that determine how easily that unit can be detected from various angles. Each ship has a damage-control team that may or may not be able to stop a fire, stop flooding, and so on. Some non-critical hits may force a ship to stop and make repairs, but its weapons may still be on-line, just waiting for your fighter to stray too close.

In short, a multitude of items occur behind the scenes. The more you know about, the better prepared you are and the better your combat performance will be. Before receiving your orders and proceeding to your ship, we suggest that you review several key sources of information:

- *Technical Notes:* See pages 153-162 in the *Harpoon II* manual.
- *MANADD.TXT:* Text file of additions to the manual in the *Harpoon II* directory.
- *FAQ.TXT:* Another text file in the *Harpoon II* directory answering many common questions.

Good luck and godspeed. You are hereby required to report for duty as ordered.

2 Tools of the Trade

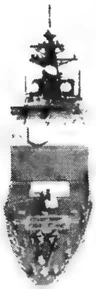
A familiar proverb advises, "Use the right tool for the job." Nowhere is this saying more applicable than in combat, indicated by a common derivative of the adage that warns, "Never bring a knife to a gunfight." Every task in warfare, from coastal patrolling to anti-submarine warfare to amphibious landings, possesses a set of platform, weapon, and sensor requirements. Usually, requirements for one combat task contradict requirements for other combat tasks, leading to mission-specific hardware capable of performing only a few combat functions. Ships have a finite amount of physical space, however, which limits the amount of deployable hardware carried on board. Supporting more than one combat task (anti-aircraft warfare (AAW) and anti-submarine warfare (ASW), for example) requires a ship large enough to hold both AAW and ASW mission-specific hardware. As costs for leading-edge defense technology continue to skyrocket, it is rarely fiscally feasible for a navy to produce a general-purpose ship that can fight all types of battles equally well.

Facing page: When you have a job to do, having the right tool on board can be the difference between victory and defeat. U.S. Naval Institute Archives

WAR LESSON 2.1

Never bring a knife to a gunfight.

Most of today's combat platforms, therefore, are compromises that excel at one primary task, usually are tolerably capable of a secondary mission, and are totally dependent on accompanying vessels for all other support. A single USN aircraft carrier, for example, can deploy more offensive might than the entire air force of many nations, but other than aircraft, it carries little defensive armament. The carrier depends on its aircraft and escort ships for protection.



THE SCOPE OF THIS CHAPTER

This chapter examines the roles, strengths, and weaknesses of various naval combatants. Before committing forces to battle, a commander must examine his available platforms, deploying them to maximize combat potency. Understanding the roles of ships in the command must precede the formation of an effective task force; a coach cannot form an effective team without understanding the abilities of each team member.

This chapter does not detail combat specifications for every platform available in *Harpoon II*; the *Harpoon II* online database and Appendix A, "Ship Utilization Chart," do this. Instead, this chapter is dedicated to understanding the classes of ships, their history, and their current design intent. Ship categories (battleship, cruiser, destroyer, etc.) are examined in detail while exploring a subset of the individual classes' suitability for Anti-Aircraft Warfare (AAW), Anti-Submarine Warfare (ASW) and Anti-Surface Warfare (ASuW).

Standard U.S. Navy warship designations are used throughout this chapter as the primary ship-categorization method. Categories of non-U.S. ships, especially Soviet-built ships, do not always fit neatly within this template. When discussing Soviet, CIS, or Ukrainian fleets, it may be necessary to refer to the Soviet method of ship categorization. Table 2-1 lists the primary U.S. categories and designations, and Table 2-2 lists standard Soviet categories and designations.

WAR LESSON 2.2

A coach cannot build an effective team without understanding the abilities of each team member. Likewise, a naval commander cannot build an effective task force without understanding the capabilities of each individual ship under his command.

Table 2-1: USN Warship Designations

Category	Type	Designation	Example
Amphib Assault	General Purpose	LHA	Tarawa
	Multipurpose	LHD	Wasp
	Cargo Ship	LKA	Charleston
	Tank Landing	LST	Newport
	Helicopter/VSTOL	LPH	Iwo Jima
	Transport Dock	LPD	Austin
	Command Ship	LCC	Blue Ridge
Aircraft Carrier	Conventionally Powered	CV	Kitty Hawk
	Nuclear Powered	CVN	Nimitz
Battleship	Gun	BB	Iowa
Cruiser	Gun	CA	Des Moines
	Guided Missile	CG	Ticonderoga
	Nuclear Powered Guided Missile	CGN	California
Destroyer	Gun	DD	Spruance
	Guided Missile	DDG	Adams
Frigate	Gun	FF	Garcia
	Guided Missile	FFG	Brooke
Mine Warfare	Mine sweeper	MSO	Acme
	Mine Counter-measures	MCM	Avenger
	Mine sweeper/hunter	MSH	Cardinal
Patrol Craft	Fast	PCF	Swift
	River	PCR	Plastic
	General Purpose	PB	Sea Spectre
Submarine	Diesel-Electric Attack	SS	Upholder
	Nuclear Attack	SSN	Los Angeles
	Nuclear Ballistic Missile	SSBN	Ohio

Table 2-2: Soviet/CIS Warship Designations

Name	Western Equivalent	Example Class
Nuclear Powered Submarine	SSN	November
Nuclear Powered Ballistic Missile Submarine	SSBN	Typhoon
Nuclear Powered Cruise Missile Submarine	No Equivalent	Charlie I/II/III
Nuclear Powered Missile Cruiser	Battle Cruiser	Kirov/Ushakov
Large Landing Ship	LPD	Rogov
Large Anti-Submarine Ship	DD	Kara
Large Missile Ship	DD	Sovremennyy
Cruiser	CA	Sverdlov
Small Anti-Submarine Ship	FF	Grisha I/III
Small Missile Ship	Missile Corvette	Nanuchka
Cruise Missile Submarine	No Equivalent	Juliett
Submarine	SS	Foxtrot
Border Patrol Ship	FF	Grisha II
Anti-Submarine Cruiser	CG/LPH	Moskva
Missile Cutter	Much Larger than PB	OSA I/II
Missile Cruiser	CG	Slava
Escort Ship	FF	Krivak
Medium Landing Ship	Small LST	Polnocny
Tactical Aircraft Carrying Cruiser	CV	Kiev
Torpedo Cutter	Larger than PB	Sherskhen

SURFACE SHIPS: BUILDING A NAVY

The relatively recent (in terms of combat history) introduction of the submarine notwithstanding, it goes without saying that surface ships are the navy. Tables 2-1 and 2-2, however, show us that "surface ship" is a broad term that encompasses many different types of hulls.

AIRCRAFT CARRIERS

Looking at the U.S. Navy of 1994, it is hard to imagine a navy without air power. The giant aircraft carrier forms the core of U.S. rapid-response firepower, especially with the U.S. withdrawal from numerous overseas bases. As more and more U.S. forces are pulled home, the carrier becomes the primary instrument for U.S. power projection. Given the political and military significance of the aircraft carrier in the 1990s, it is often overlooked that the aircraft carrier was first deployed only 70 years ago.

CV-1 Sets Sail

In October 1922, the collier Langley had finished conversion and received its first aircraft, formally becoming CV-1 in the U.S. Navy, just 15 months after Gen. "Billy" Mitchell's controversial display of airpower against the German battleship *Ostfriesland*. The legitimacy of airpower was still under question, as evidenced by Admiral Benson, then chief of naval operations, who said, "I cannot conceive of any use the fleet will ever have for aircraft." Despite the resistance, though, the Langley underwent the conversion. Capable of carrying 55 planes, its normal complement was 12 single-seat "chasing planes," 12 two-seat spotting planes, 4 torpedo-dropping planes, and 6 torpedo seaplanes.

This configuration, however, focuses mainly on reconnaissance with only limited offensive potential. Not until five years later, when Lexington and Saratoga were commissioned, with 90 and 79 aircraft, respectively, did the offensive potential of carrier aviation begin to materialize. The 1930s were much more open to the potential of aviation, with both Japan and the U.S. actively building aircraft carriers. By the time of the attack on Pearl Harbor, the Japanese had 6 carriers and the U.S. had 7.

Battleship Tactics for a Carrier Fleet?

When the majority of the USN's Pacific force was disabled on December 7, 1941, the USN was forced to rely on the three aircraft carriers in the Pacific to retaliate. Captain Wayne P Hughes reports in *Fleet Tactics: Theory and Practice* that the sudden emergence of the carrier presented five tactical problems:

1. **Tactical formations:** How should the available escort ships be deployed around the carriers?
2. **Dispersal or massing:** Should carriers be dispersed and operate alone? Should they be concentrated in groups? If dispersed, should they operate close enough to amass firepower by jointly attacking targets?
3. **Offensive versus defensive firepower:** What percentage of a carrier's airwing should be defensive fighter aircraft, and what percentage should be offensive strike aircraft?

4. **Daytime versus nighttime tactics:** In WWII, the carrier's aircraft ruled the day, but at night the aircraft was blind. By day, naval warfare focused on the aircraft; at night, it returned to the gun duels reminiscent of WWI.

5. **Split objectives:** Similar to the second problem in this list, during offensive operations one must decide how to divide available forces to meet multiple combat objectives.

WAR LESSON 2.3

Aircraft carriers are extremely potent offensive platforms, but only if the prudent commander realizes their limitations as well.

Although the offensive potential of the aircraft carrier and advances in sensor technology no longer limit most aircraft to daytime operations, the aircraft carriers of today and *Harpoon II* players still face problems 1, 2, 3, and 5 in the list.

Tactical Formations

Effective deployment of escorts to provide air, surface, and subsurface protection for the carrier is a core consideration of formation tactics. Formation theories and tactical problems are fully discussed in Chapter 4, "Introduction to Task Forces." Because aircraft carriers never operate without escorts, however, one cannot divorce formation tactics from carrier tactics. Aspiring *Harpoon II* carrier battlegroup (CVBG) commanders must recognize that carrier management relies on formation management.

Dispersal, Concentration, or Massing?

For maximum flexibility, carriers generally operate separately from other carriers with their own set of escorts if sufficient escorts are available to meet the formation needs. The issue of dispersal versus massing is not entirely independent of formation issues. If insufficient escorts are available, particularly for smaller navies, formation considerations may dictate carrier concentration, especially during combat operations; if two CVBGs are operating near each other and one loses most of its escorts in battle, formation considerations argue that the two carriers should rendezvous and share the remaining escorts rather than risk losing a carrier as well.

> **WAR LESSON 2.4**
>
> Concentrate or disperse carriers based on the availability of suitable escorts. Concentration of firepower through coordinated, multiple-carrier strikes based on the potency of available carrier airwings.

Concentration of force depends primarily on the potency of the carrier's current airwing. Small carriers, carriers with lightly armed aircraft, and carriers that have suffered heavy combat losses may be forced to strike together, especially against heavily fortified targets, although they may continue to maneuver independently of each other.

Offensive versus Defensive Firepower

Airwing composition is partially predetermined for the *Harpoon II* player. The carrier's aircraft inventory is preset by defense budgets, Pentagon planners, and *Harpoon II* scenario designers. The player, however, must still choose whether to arm multi-role aircraft offensively or defensively. No preset formula exists for configuring airwings; every tactical situation must be analyzed and the carrier tailored to meet the specific needs.

With an appropriately equipped formation, for example, the carrier USS *Saratoga* attacking somewhere like Libya would be more concerned with delivering sufficient firepower to the target than protecting itself. Some number of pure fighter aircraft still is necessary to escort strike aircraft, but fewer multi-role aircraft are necessary for the fighter role because the carrier is well protected by escort ships. In this case, the *Saratoga's* 24 F-14 Tomcats are probably sufficient fighters and most (if not all) her F/A-18s can be armed for strike missions.

On the other hand, consider the *Harpoon II* scenario *To The Death!*, which pits the *Nimitz* battle group against the *Admiral Kusnetsov* battle group and Keflavik airfield in the late 1990's. Under normal circumstances, the *Nimitz* would probably have 20 to 30 more aircraft than the *Kusnetsov* does. In this scenario, the *Nimitz* commander, based on available intelligence reports, must assume that the *Kusnetsov* is not carrying a full complement of aircraft and also be wary of Keflavik Airfield, which is undoubtedly stocked with long-range bombers.

Threat Analysis

This scenario provides multiple threats. When 30 in-bound Bears, Badgers, and Backfires launch 60 AS-6 anti-ship missiles at the *Nimitz* CVBG, all available fighters are needed to curtail the attack. Even if all 60 missiles are intercepted by air- and ship-based defenses, somebody has to stop the bombers from escaping or they will repeat the strike until they wear down the defenses and kill all U.S. ships.

Unfortunately, U.S. forces can expect fighters from the *Kusnetsov* to rally to the bombers' defense, creating a greater challenge for beleaguered U.S. fighters. This leaves few, if any, U.S. fighters available to escort strike aircraft, resulting in:

- Conservative attacks that minimize the risk to U.S. strike aircraft but also do less damage to the enemy.
- Strike packages forced to abort when enemy fighters approach because of the lack of escorts.
- Heavy combat losses if the strike packages ingress heavily defended corridors.

In all cases, the U.S. forces are fighting a defensive air battle against a technologically equal and numerically superior enemy. The U.S. cannot fight a war of attrition in this scenario.

Meanwhile, the CIS battlegroup is armed with a variety of surface-to-surface missiles, including some quantity of SS-N-19 Shipwreck missiles. After the U.S. battlegroup is detected, CIS forces will probably be within weapons release range at the time of localization and will launch immediately.

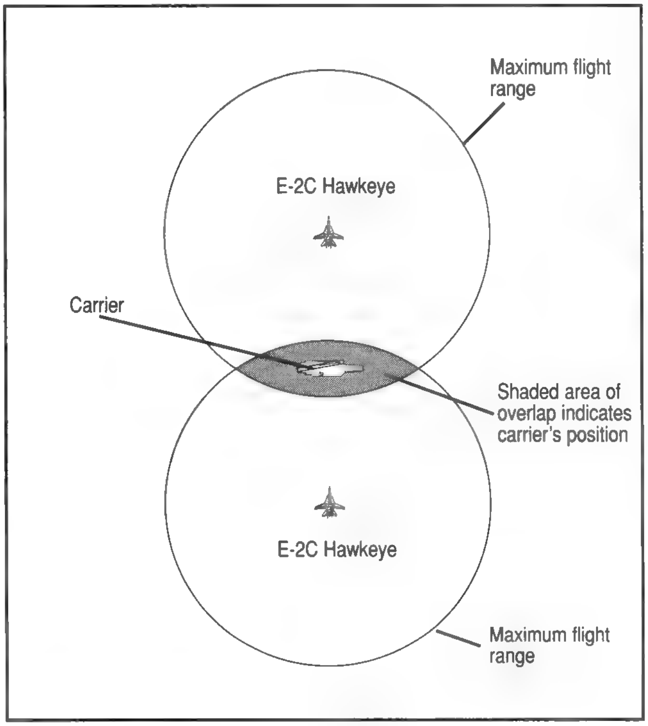


Figure 2-1. Aircraft stationing can betray the carrier's position

Formulating a Plan

In *To The Death!*, the U.S. is disadvantaged on all fronts, highlighting the importance of practical and effective aircraft allocation. U.S. forces must prevent CIS forces from obtaining an exact fix (and a subsequent firing solution) on the U.S. position. U.S. ships should operate under total EMCON, or emissions control, which means no use of any active sensor.

E-2C Hawkeye aircraft should be aloft and watching for in-bound bombers and they should operate as far from the carrier as possible. If the Hawkeyes are along the threat axis, they are closer to the battle site and are more likely to be engaged by enemy forces and, therefore, require greater protection. Also consider the physical positioning of the Hawkeyes, as shown in Figure 2-1.

The enemy knows the approximate range of the E-2C. When the Hawkeye activates its radar, the enemy knows its exact position and can plot a range circle around the Hawkeye, similar to Figure 2-1. If the position of more than one E-2C is known, multiple range circles can be drawn. Simple geometry tells the rest: The carrier must be inside the zone where the circles overlap. Aerial refueling complicates matters by increasing the range circles, thereby increasing the overlap zone and reducing the accuracy of the fix, but the general principle still holds.

Figure 2-2 shows what happens as the enemy obtains more and more fixes on U.S. aircraft. The CVBG on the left has deployed its aircraft in a wide pattern. Although this may prevent a surprise attack from a flank, when the aircraft are spread out, the overlap zone becomes smaller and smaller, providing a more accurate fix on the carrier. The CVBG on the right, however, has positioned its aircraft directly along the threat axis, creating a large area of overlapping range circles. The carrier's approximate location is known, but with less accuracy.

One can simply guesstimate the position of an enemy ship based on detected air contacts or try to determine a more specific fix. Activate the 1 degree longitude and latitude

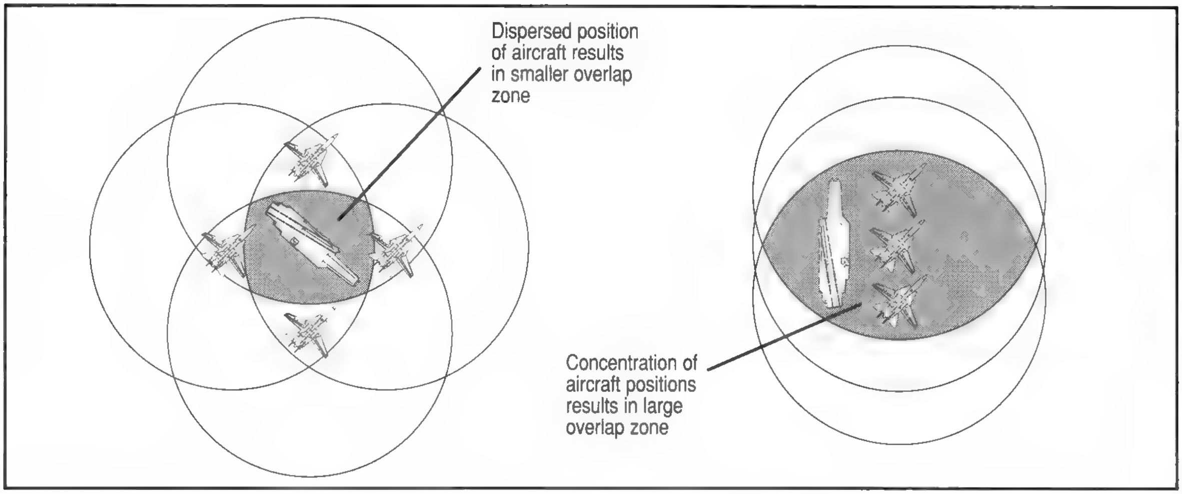


Figure 2-2. Effects of multiple aircraft stationing

lines in the display window. Place a piece of tracing paper over the monitor and mark the position of the enemy aircraft and at least two latitude lines. The distance between these two lines should be 60nm. The F/A-18, for example, has an approximate Combat Air Patrol combat radius of 280nm from its carrier (4.7 times the length of 1 degree of latitude). Using a drawing compass, set it about 4.5 to 5 times wider than the distance between the two latitude lines, and circumscribe a circle around any known F/A-18 contacts. Repeat this procedure for each known aircraft contact. If a contact is unknown, 300nm is a safe range estimate.

The process is not foolproof. Ranges are estimates based on maximum range, and there is generally no way to know how much fuel the aircraft expended before being detected, or if it was refueled

> **WAR LESSON 2.5**
>
> In lieu of using tracing paper, veteran players can accomplish the same cross-fixing technique by using reference points sequentially to trace the aircraft's flight path.

by a tanker. If aircraft are operating from multiple, dispersed carriers or fixed airbases, results become confused. All overlap regions become potential runways.

Split Objectives

Conflicting orders are not a problem in *Harpoon II.* The objectives have already been decided at higher levels and passed to the battlefield commander. Resources were likewise partitioned and passed down. By the time the scenario starts, the majority of decisions have been made. The resources available may not be sufficient to accomplish the objective, but things are as good as they're going to get. The commander may also be faced with multiple fronts, such as an enemy task force and an enemy airbase, as in the *To The Death!* scenario.

In *To The Death!*, splitting the U.S. forces is not a viable option for the U.S. commander because there are not enough ships to challenge the *Kusnetsov* group while leaving adequate protection for the *Nimitz.* The Russian commander also has a single objective: Sink U.S. ships. The U.S. commander, however, is faced with a two-front battle: the *Kusnetsov* group and bombers from Keflavik. Although assigned a single objective, the U.S. commander must determine how to allocate forces to deal with both threats. Should he concentrate on shutting down the runways at Keflavik to remove the bomber threat? Should he launch an alpha strike and send everything on the carrier against the enemy battlegroup at once? Should he divide forces and attack both targets? Should he pull back and wait for the enemy to come to him?

There is no one answer for this type of situation. Battlefield commanders make such decisions based on experience, current doctrine, skill of the aircrews, intuition, and a thorough understanding of their defensive and offensive capabilities. At this point, not enough information has been provided to determine a feasible battle plan for *To The Death!*. Determining a course of action requires an understanding of the other ships in the task force, the aircraft involved, and the weapons available, all of which are discussed later.

All Carriers Are Not Created Equal

Aircraft carrier size varies greatly from navy to navy, and not all aircraft carriers are created equal.

Super Carriers

U.S. aircraft carriers displace from 60,000 to 96,000 tons and typically carry around 80 fixed- and rotary-winged aircraft. A typical airwing consists of 20 F-14s, 20 F/A-18s, 20 A-6Es, 10 S-3B, 4 EA-6B, 4 E-2C, and 6 or 8 helicopters. The CIS' *Admiral Kusnetsov* falls within this same category, at 75,000 tons and around 40 aircraft, expected to be a mix of naval MiG-29s and Su-2s.

Mid-Size Carriers

The soviet-built Kiev class displaces around 44,000 tons and operates 18 Hormone-A ASW helicopters, 3 Hormone-B missile guidance/target designation helicopters, 1 Hormone-C SAR helicopter, and occasionally Ka-27 Helix helicopters. The Soviet Navy classified the Kiev class as an aircraft-carrying cruiser, which more accurately describes the class. The Yak-38 has a maximum combat radius of only 200nm and carries only short-range air-to-air or air-to-surface weapons. With 18 Hormone-A helicopters, Kiev mounts a formidable ASW campaign, but her surface-to-surface missile-equipped escort ships pose a greater anti-shipping threat than does her Yak-38s.

The French Clemenceau class is about one-half the size of a U.S. Navy carrier. The Clemenceau class displaces around 30,000 tons and carries around 35 aircraft, generally 16 Super Etendard strike aircraft, 10 F-8E Crusader fighters, 7 Alize ASW aircraft, and 3 photo reconnaissance aircraft. Potent aircraft, the F-8E and Super Etendard are outdated by fourth-generation aircraft on-board U.S. carriers and the *Admiral Kusnetsov.* A Clemenceau-class carrier still packs a considerable punch, but her aircraft suffer in range, endurance, avionics, armament, and survivability compared to more modern aircraft. Furthermore, the smaller airwing of the Clemenceau class amplifies the effect of any losses.

Comparable in size to the Clemenceau class, the Indian Navy operates *Virat,* formerly the HMS *Hermes. Hermes* had been converted by the British into a "commando assault carrier," carrying small strike aircraft because she was too small to operate the F-4 Phantom. In 1980, *Hermes* underwent another conversion that added a 7.5° ski jump, allowing her to operate Sea Harriers. In 1982, *Hermes* went to the Falklands as the flagship of U.K. forces. During that conflict, 15 Sea Harriers, 6 Harrier GR.3s, 5 ASW Sea Kings, 3 Sea King HC4s, and 1 Westland Lynx operated from her flight deck. In May 1986, she was purchased by the Indian Navy and renamed INS *Virat,* receiving yet another overhaul. With the Indian Navy, her maximum airwing of 30 aircraft will consist of Sea Harriers, Sea Kings, and Alouette IIIs.

The Small Carriers

The remaining fixed-wing carriers all displace less than 20,000 tons. India's *Vikrant* operates 12 Sea Harriers or a mix of Sea Harriers and helicopters. Britain's *Invincible* carries as many as 8 Sea Harriers and 10 Sea Kings. Brazil's *Minas Gerais,* formerly the HMS *Vengeance* from WWII, focuses on ASW, carrying 8 S-2Es and 6 SH-3Ds.

Spain operates two small carriers, the *Dedalo* and the *Principe de Asturias.* The *Dedalo* typically carries 8 Matador VSTOL fighters and 4 SH-3 ASW helicopters or 4 AH-1G Cobra helicopters. *Principe de Asturias* carries 8 AV-8Bs, 12 SH-60 and SH-3 helicopters. Italy operates the *Giuseppe Garibaldi,* with 16 SH-3D helicopters, 8 Sea Harriers, or 8 AV-8B Harrier IIs.

All ships in this category suffer from small airwings, short-range aircraft, lack of AEW aircraft (such as the E-2C Hawkeye), and lack of electronic warfare aircraft (such as the EA-6B). These carriers are not equipped to attack large warship task forces and are best suited for strikes against merchant vessels, lightly armed warships, and ground positions.

Helicopter Carriers

The U.S. and CIS operate ships designated as "helicopter carriers," which are as large as fixed-wing carriers in many navies. The U.S. operates three classes of "amphibious assault ships," which typically operate helicopters but can carry various versions of the Harrier VSTOL aircraft. The Wasp class LHD displaces 40,533 tons and can carry 20 AV-8Bs and 6 SH-60F ASW helicopters. The Iwo Jima class LPH displaces 18,825 tons with AV-8A Harriers and SH-3 helicopters. The Tarawa class LHA displaces 39,300 tons and carries a wide variety of helicopters, VSTOL aircraft, and even the OV-10 Bronco in addition to trucks, artillery, and armored personnel carriers.

A Summary of Aircraft Carriers

Aircraft carriers are potent offensive platforms, but they are also huge targets. Without sufficient escorts to defend them, they would be unable to survive the transit to the area where power projection is required. Carrier warfare faces five tactical problems, four of which confront the *Harpoon II* player in some capacity. Commanding an aircraft carrier means more than understanding the ship itself — it means understanding the capabilities of every platform in the task force and how to use each individual to maximum advantage.

BATTLESHIPS

Today the mighty battleships that once ruled the sea are generally considered outmoded dinosaurs — relics of an ancient era. The battleship began its career in the U.S. Navy in August 1886, when the *Texas* and *Maine* were authorized. During the next 20 years, the U.S. Navy built nine additional classes with armor and armament conforming with contemporary theories on naval engagement; however, none of the ships could exceed 18 knots and none had more than 4 large-caliber guns.

The History of the Battleship

In December 1906, largely as the result of Captain William Sims acting as Inspector of Target Practice, the first U.S. single-caliber battleship, *South Carolina*, was laid down. Nine classes of battleships followed the *South Carolina* before the Washington Naval Treaties of 1921-22 halted further construction. *South Carolina* was completed in March 1910, with a 17,617-ton displacement, 8 12-inch guns, and 22 3-inch guns. *West Virginia*, one of the last battleships unaffected by the Washington treaties, finished in December 1923 with 33,590-ton displacement, 8 16-inch guns, and 14 5-inch guns. The increase in size and armament indicates the doctrine of the era: the race to win the seas of the day would be won by the biggest and strongest.

Propulsion problems plagued U.S. battleships through 1913. The American turbine industry was slow to develop engines conforming to the high standards and low tolerances required. Fuel consumption was unacceptably high. Starting with the *Pennsylvania* in 1913, the General Board approved the universal fitting of turbines that increased top speed to 21 knots for all battleships after the South Carolina class.

Three classes of U.S. Battleships were constructed after the Washington Treaty expired: the North Carolina class, the South Dakota class, and the Iowa class. The North Carolina and South Dakota classes both displaced around 45,000 tons with a top speed of around 28 knots. Both classes carried 9 16-inch guns and 20 5-inch guns. The Iowas were a large advance over the previous two classes. Because the Iowas' were some 200 feet longer with a power output of 212,000 shp (compared to 130,000 for the South Dakotas), and their top speed increased to 35 knots. Iowa-class battleships have seen action in WWII, Korea, Vietnam, Lebanon, and the 1991 Gulf War.

Today's Battleship

There are no battleships in active duty in any navy at this time. Most battleships were scrapped or mothballed immediately after the end of WWII. The Iowas were reactivated for shore-bombardment duties in both Korea and Vietnam and then mothballed again in 1969. When the Soviet Navy deployed the 28,000-ton *Kirov* missile cruiser in 1977, the U.S. reexamined the need for large surface vessels. After much debate, four Iowas underwent modernization. The *New Jersey* was the first to complete this process and was officially recommissioned on December 27, 1982.

All four Iowas were eventually recommissioned in response to the *Kirov* (that is often compared to the obsolete "battle cruiser" class of the early 1900s) and her two sisters. In the age of long-range anti-ship missiles, the Iowas' 16-inch guns were hardly sufficient for ASuW, leading to Harpoon and Tomahawk missile installations. After the 1991 Gulf War, the budgetary ax fell again and the four Iowas returned to reserve status.

Using the Iowas

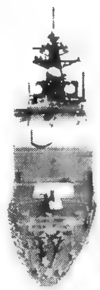
The Iowas still serve actively in the *Harpoon II* world. Although heavily armored, the Iowas require a fairly large screen of escort vehicles. Their heavy armor can withstand considerable punishment, but the Iowas do not have the indigenous sensors and weapons systems to effectively conduct either AAW or ASW, relegating these essential warfare tasks to their escorts in entirety.

In scenarios against a well-armed foe, *Harpoon II* players generally use the Iowas and their Tomahawk-TLAM missiles against land targets, especially in conjunction with carrier- or land-based airstrikes. Such tactics were used with success in the opening hours of Desert Storm. Depending on the target's defenses, TLAMs may be launched before the airstrike to soften the target and weaken enemy air defenses, or carefully coordinated with the airstrike to arrive at heavily defended targets simultaneously with the aircraft in order to overwhelm air defenses. Such tactics are discussed more in the Tomahawk missile section later in this chapter.

A Battleship Summary

The era of the heavily armored surface dreadnought seems to have ended. Most battleship tasks, such as shore bombardment (either with guns or missiles) can be accomplished with aircraft or guided-missile cruisers. The battleships of yesteryear wane in effectiveness while shrinking defense budgets prohibit construction of more modern vessels. Use the Iowas' TLAMs to destroy land bases, especially enemy airfields operating bombers equipped for maritime attacks. Always provide sufficient anti-aircraft and anti-submarine screens for Iowa class battleships.

> **WAR LESSON 2.6**
>
> Coordinate TLAM attacks with airstrikes to either soften targets before aircraft arrival or to overwhelm enemy air defenses during the strike.



CRUISERS

Cruisers are the "luxury car" of modern navies. Expensive to build and operate, only the U.S. and the Soviet Union have built cruisers in significant quantities since the end of WWII. Most countries, especially the U.K., have allowed their cruiser fleet to atrophy.

The History of the Cruiser

The U.S. Navy's building programs before 1916 focused on large battleships under the assumption that smaller ships, such as cruisers, could be built quicker than battleships during times of crisis. If problems erupted, the battleship fleet would be active and wartime production could focus on cruisers. By 1918, only the three cruisers of the Chester class could be classified as reasonably modern. Under a 1916 program, 10 Omaha class cruisers were built. The Omahas were much larger than the Chesters were and carried 12 6-inch guns. The Pensacola class followed a few years later with 8-inch guns. Additional cruiser designs of the 1930s vacillated between 6-inch and 8-inch guns. The Cleveland class, which accounted for a large number of ships completed during WWII, carried 12 6-inch guns, 12 2.5-inch guns, and numerous 40mm and 20mm anti-aircraft guns.

Since WWII, the cruiser has grown into an expensive, SAM-armed warship designed for high-threat operations. The U.S. navy operates both nuclear- and conventionally-powered cruisers, whose primary tasking is to protect carrier battle groups. The Soviet-built Sverdlov class is the only remaining example of the classic fire-support gun cruiser in a modern navy. The gun cruisers of other nations have been scrapped, converted to carry helicopters, or converted to SAM platforms, with the exception of a few aging designs still in service with the Peruvian navy. Only the U.S. and CIS navies operate a significant number of modern cruisers.

A Cruiser Summary

Cruisers are generally capable of either escorting other high-value units or operating as flagships for strike forces. Although there is no such thing as "enough weapons," cruisers generally can support simultaneous ASW and ASuW as well as AAW missions. Some guided-missile cruisers pack more firepower than do the modernized Iowa class battleships.

DESTROYERS, FRIGATES, AND CORVETTES

The three categories of destroyers, frigates, and corvettes have seemingly become irretrievably intertwined. Most resource books discuss the three categories in conjunction. For continuity sake, we will use role, rather than size, to determine in which category a particular ship falls.

The term "destroyer" holds varying meanings and applies to a confusing variety of hulls with a wide range of displacements. The post-war "destroyer" classification overlaps the pre-war categories of corvette, frigate, destroyer, and cruiser. The Royal Navy designates the 4,100-ton Type 42 class as destroyers, but the larger, 4,900 Type 22 as a frigate. NATO classifies the 5,560-ton *Kynda* as a cruiser, but the 8,000-ton Udaloys as destroyers. U.S. Navy Spruance-class ships are titled destroyers, but the Ticonderoga class, built on the identical hull but 1,800 tons heavier, are cruisers. Furthermore, the Royal Navy originally classified the Type C 67 as a corvette at 5,745 tons. Later, the category was redesignated as frigates; however, the hulls were given "D" pennant numbers (used for destroyers) rather than "F" (used for frigates). A good rule of thumb is that destroyers, regardless of size, tend to be capable escort platforms, able to operate independently, but they lack the overall potency of cruisers.

Frigates have varied in duties and size since the days of Nelson. Originally more of a reconnaissance or scouting platform, the frigate became the weapon of choice against German U-boats in the Atlantic in WWII. Today, the term covers a variety of special-purpose vehicles composing the backbone of many small navies and serving as the workhorse of larger navies. Modern frigates are generally designed as escort vessels with most Western-built frigates designed as merchant convoy escorts and most Soviet-built frigates designed as warship escorts.

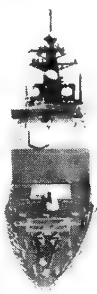
Corvettes were almost totally abandoned at the end of WWII. Generally possessing few sensors and armed with only guns, these ships fall somewhere between "frigate" and "PT boat." The Soviet-built Nanuchka III and Tarntul II classes are the exception, possessing both surface-to-surface and surface-to-air missiles. Because corvettes are small and relatively inexpensive, they are the platform of choice for many smaller, coastal navies. Their lack of endurance, however, make them unsuitable acquisitions for navies that focus on blue water operations.

Combat Deployment

Destroyer and frigate classes are too numerous to recount here. Appendix A provides a simplified "suitability" chart for most classes. The task assigned to a particular destroyer or frigate depends on the capabilities of the particular unit, the type and quantity of accompanying vessels, and the objective of the task force. For example, Garcia and Knox class frigates are intended for ASW work, and Brooke and Perry class frigates are designed for AAW duties. Commanders need only study the installed weapons systems for ships of this size to determine the best role for each individual class of hull. ASW-specific ships should generally be placed at the vanguard of the convoy, far enough away so that the noise of the main body does not interfere with passive sonar. AAW- and ASuW-capable ships should be placed along the threat axis between the threat and the main body. Such picket ships could also detach from the convoy and prosecute enemy contacts while the main convoy moves away, at the commander's discretion.

Placement of the escorts within the formation is a complex quandary. Placing pickets far from the main body allows engagement of hostile forces farther from the main body, but may leave the picket ship out of position to respond to a surprise threat on the opposite side of the formation, not to mention the chance that the picket will get hit while it's out by itself, far from help. Placing pickets too far from the main body also creates holes that enemy forces, particularly submarines, can slip through. A hostile submarine inside the formation can wreak havoc on the main body before the distant escorts can respond. Distant escorts may be able to engage hostiles, however, before they come within range of the main element.

Placing the picket close to the main body lets it engage contacts from any direction equally readily, but almost definitely brings the engagement closer to the ships being escorted. The closer the engagement occurs, the less time the main element will have to deploy any of its own countermeasures. If the escort is 40nm from the main body and engages in-bound SS-N-12 missiles 20nm away, the main body has 60nm worth of flight time, or roughly 30 seconds, assuming the missile is near maximum speed, to deploy ECM, chaff, and flares, and to maneuver. If the escort is 1nm from the main body and engages in-bound SS-N-12s 20nm away, the main body has only 21nm of flight time, or roughly 10 seconds, to respond. For additional study on formation considerations, refer to Chapter 4, "Seapower and Maritime Strategy."



SUBMARINES: MODERN LEVIATHANS

"Denizen of the deep," "silent stalker," "hunter killer," and many similar names have been applied to the submarine. Moving quietly beneath the sea, submarines arguably were the world's first "stealth fighters." Whether silently stalking a victim or threatening nuclear annihilation from some unseen hideaway, the submarine has become a fixture of naval warfare.

At the beginning of the 20th century, most nations, especially Britain and Germany, designed submarines as effective surface vessels, reserving their diving capability for escape and attack. This theory led to large hulls that performed well when they were surfaced, but with notably slower dive speeds. U.S. designs from 1911 onward, despite suffering from their own design incoherences, proved considerably faster submerged than their contemporaries.

WWII validated the submarine's combat capability. The German U-boats nearly isolated Britain from the rest of the world and required an Allied deployment disproportionately larger than the German U-boat fleet to curtail the U-boat's effectiveness. In the Pacific, U.S. submarines tallied some 4,859,634 of the 8,897,393 tonnage lost by the Japanese fleet; submarines alone sank more than half of all Japanese ships sank by U.S. forces! This fact is even more remarkable considering the absolutely dismal performance of U.S. torpedoes during the early part of the war.

Many navies concentrated on submarine development after WWII, increasing depth, decreasing noise, improving weapons and sensor performance, developing nuclear propulsion, and adding the weapons. The addition of missiles brought an entirely new mission to the submarine: nuclear warfare. Submarines typically fall into two classes: attack submarines and missile submarines.

Attack Submarines

Attack submarines are the deadly hunter-killers designed to ambush and destroy enemy ships and submarines. Diesel-powered submarines (designated "SS") use diesel engines to charge electric batteries and then use the silent batteries to power the vessel when submerged. This power system makes diesel submarines extremely deadly foes, but forces them to come to shallow depth on a regular basis to run the diesel engines and recharge their batteries. Depending how much a diesel submarine manuevers, its batteries can last an average of 100 hours. It is not unreasonable for a diesel submarine to remain submerged for two or more days. Nuclear-powered attack submarines (designated "SSN") generate slightly more noise than do their diesel-powered counterparts when submerged, but are freed from the surfacing requirements. Given the eight- to nine-year fuel supply, a typical SSN can remain submerged indefinitely, with respect to combat operations. Many smaller navies can afford only a limited number of diesel submarines. Such submarines still present a respectable threat, especially against other small navies operating older surface vessels.

The Soviet Navy developed a considerable number of submarines since the 1950s. Besides an array of SS and SSN classes, the Soviets developed a specialized class of missile-carrying submarine in response to the U.S. Navy's proliferation of CVBGs. Designated SSG and SSGN for diesel- and nuclear-powered variants, respectively, the Soviets responded to the U.S. carrier threat with massive numbers of attack submarines. The smaller inventory of U.S. submarines have been designed to operate as lone ASW hunter-killers, to conduct independent ASuW and recon operations in forward battle zones and to escort convoys and task forces.

WAR LESSON 2.7

When covert transits are necessary, position attack submarines beneath friendly surface vessels. The noise generated by the surface vessels masks the presence of the submarine.

> **WAR LESSON 2.8**
>
> Submarines should attack patiently, striking violently out of nowhere and then retreating. Submarines commanders must never get greedy; loitering in the combat zone risks detection and counterattack.

The attack submarine's hunter-killer role is an archetype of restraint and patience under pressure. Attack submarines should never hurry an engagement or get greedy. Close cautiously and patiently into attack position and be careful not to fire too early. The closer the submarine is to the target when it fires, the less time the target has to respond. Balance the salvo size to ensure destruction of the target without expending excessive ammo. A crippled, dead-in-the-water ship may be undetectable to the submerged submarine, forcing the submarine to come to periscope depth and risk detection. Also, being dead in the water in no way indicates status of weapons; a crippled ship may still have sufficient weapons to destroy the attacking submarine. Submarine commanders must not expend ammunition needlessly, however. Reloads are hard to come by during combat operations, and every weapon is worth ten times its weight in gold to the submarine. Finally, submarines should never get greedy. They should close on the target, kill it, withdraw, and watch what happens. Remaining in the combat zone risks detection and drawing enemy fire, especially from ASW aircraft in the area. Withdraw and reposition for another low-risk attack later.

Missile Submarines

Often called "boomers" in reference to the result if their missiles were fired, these submarines do not seek out and engage enemy ships. Although armed with torpedoes, boomers put as much distance as possible between themselves and other ships. Hiding beneath ice packs and creeping alone through the depths, missile submarines strive to keep the enemy guessing. Uncertain of the boomer's whereabouts, the enemy must assume that a nuclear attack can come from anywhere at any time, with little or no warning. The less contact a boomer has with the rest of the world, the better. The missile submarine's torpedoes only exist for self-defense purposes.

Command of a missile submarine in *Harpoon II* generally means careful maneuvering into launch position punctuated by a few moments of excitement during missile launches, after which come long durations of escape and evasion tactics while recovering to friendly waters. Opposing a missile submarine means finding someone who wants nothing more than to pass undetected and who will probably never intentionally reveal its position unless ordered to launch its ballistic missiles.

AIRCRAFT: ANGELS AND ARCHERS

Although initially reluctant, the navies of the world now accept airpower as an integral component of naval forces. Capable of delivering supplies, protecting ships, performing reconnaissance, screening enemy submarines, and striking targets miles inland where no ship could ever reach, fixed- and rotary-winged aircraft have become as important as the ships that carry them. Additionally, shore-based aircraft operating in conjunction with naval vessels provide even more support. Airpower forms an umbrella beneath which surface navies hide.

Please note that "aircraft" is not limited to fixed-wing types only. The helicopter has proven itself every bit as important as fixed-wing aircraft to the fleet, launching from the tight confines of destroyer and frigate decks where no fixed-wing aircraft could hope to operate. As with ships, *Harpoon II* contains too many aircraft types to list here. We instead analyze air operations based on categories rather than on individual airframes.

Strategic Bombers

Strategic bomber refers to large, heavy, long-range aircraft such as the B-52 and Tu-144. The only true bombers in Western arsenals are the B-1, B-2, and B-52, all of which belong to the U.S. None of the three types is intended for maritime attacks except for 30 B-52Gs modified to carry Harpoon missiles. U.S. strategic bombers, all under the command of the USAF, are intended to deliver conventional and nuclear weapons to land-based targets. Although the effectiveness of air-launched nuclear weapons against surface ships is not open to question, *Harpoon II* players are best served by reserving their strategic bombers for land attacks.

The Soviet Union left a heritage of numerous strategic bombers to its client states and the progeny CIS countries. The Tupolev Design Bureau created five types since the 1950s, with examples of each type still serving in CIS countries and clients of the Soviet Union. All five were designed with maritime attack in mind. The Soviet Navy, and presumably CIS naval authorities, held control over a large strategic bomber force. Four of the

WAR LESSON 2.9

If the enemy has Soviet-made strategic bombers available, expect them to attack your surface forces in groups of 8 to 12 aircraft, when available. If operating as the Soviet commander, attempt to coordinate these strikes with surface- and subsurface-launched cruise missile attacks to overwhelm enemy air defenses.

types, the aging Tu-16 Badger, the Tu-95/Tu-142 Bear, the Tu-22 Blinder, and the Tu-22 Backfire all come in strike and maritime reconnaissance versions. No reconnaissance variant of the final type, the Tu-160 Blackjack, has been reported. All five types are designed, or have been employed to either find or kill U.S. carrier battlegroups.

Attack Aircraft

The "attack aircraft" category, in this context, encompasses all tactical, fighter-size bombers. This includes interdiction and strike aircraft, close air-support aircraft, and tactical bombers. The A-10, A-6E, A-7, Harrier, Sea Harrier, AV-8B, Jaguar, F-111, F-117, F-15E all fit this category. Always remember: Not all attack aircraft are created equal! Attack aircraft are generally designed for a specific weapon or mission. They excel at that particular task but perform miserably at others. Always use the right attack aircraft against the assigned target.

Along these lines, misconception and misunderstanding plagues the F-15E. Derived from the same variant as the F-15A and F-15C, the F-15E is not intended for air-to-air combat. Although retaining the air-to-air weaponry of its predecessors, the F-15E is dedicated to deep-strike missions, not air-to-air combat. The F-15E suffers considerable weight penalties over the F-15C, making it much less suited for air-to-air combat. Furthermore, with fewer than 40 F-15Es in the entire inventory, it makes little sense to risk such a valuable strike asset in air-to-air combat when an F-15C performs the role better.

Soviet-built strike aircraft include the Su-17, Su-24, Su-25, MiG-27, and Yak-38. Like their Western counterparts, each performs a specific duty, although all are generally less capable than their NATO equivalents.

> **WAR LESSON 2.10**
>
> Above all else, always remember that an F-15E bears little in common with an F-15C. The F-15C is an air superiority fighter, and the F-15E is a strike aircraft. Use the right F-15 for the job.

Interceptors

Interceptor aircraft are designed to locate and destroy enemy aircraft at long range. The most common true interceptors in *Harpoon II* are the F-14, MiG-25, and MiG-31. Interceptors should always be configured with the longest-ranged ammunition available. For the F-14, that means the AIM-54 Phoenix missile and for the MiG-31, the AA-9 missile. Station a patrol of interceptors along the AAW threat axis at long range from the carrier or airbase to intercept bombers and cruise missiles. Never deploy the entire inventory of interceptors except under extreme emergencies; keep at least two or four aircraft on alert, ready to launch at the first sign of an attack. Although most effective when stationed on the outer perimeter, the long-ranged weapons of interceptors make scrambles a viable tactic. Interceptors emphasize long-range killing with little consideration for dogfighting. Interceptors should fire their long-range missiles and then immediately withdraw behind fighter cover.

Fighters

An overused term, the strict definition of "fighter" refers to aircraft designed to fight and kill other aircraft. Fighters differ from interceptors in having considerable more maneuverability and significantly shorter-range weapons. Most of today's fighters are designated "multi-role fighters," meaning that they retain some strike capabilities, with the F-15A/C the primary exception. The F-16, F/A-18, and MiG-29 are all multi-role fighters, being capable of both air-to-air and air-to-ground missions. The F-15C, however, remains the premier air-to-air fighter with no ground attack capability whatsoever.

Whereas interceptors are used to kill aircraft at long range, fighters patrol a specific area of airspace and engage any enemy that wanders in. Air control is measured in three levels:

1. **Air Defense:** A defensive posture in which friendly fighters operate in an area of uncertain or compromised security. Friendly fighters attempt to protect allied assets from enemy forces known or suspected to have penetrated the area of operations. An air defense posture indicates a lack of offense, generally against an equal or superior enemy, usually over friendly territory. Air defense zones generally indicate the "fronts" of the air campaign.

> **WAR LESSON 2.11**
>
> Bombers generally attack in groups. Counter by using waves of two to four interceptors in response. Always have interceptors available to counter surprise attacks.

2. **Air Superiority:** An offensive posture in which friendly fighters patrol a relatively secure region while preventing enemy aircraft from doing likewise. Enemy incursions generally still occur and escorts should be provided for ground attack and unarmed aircraft, but friendly forces clearly have the upper hand. Achieve air superiority over friendly territory first, and then advance into enemy-held airspace.

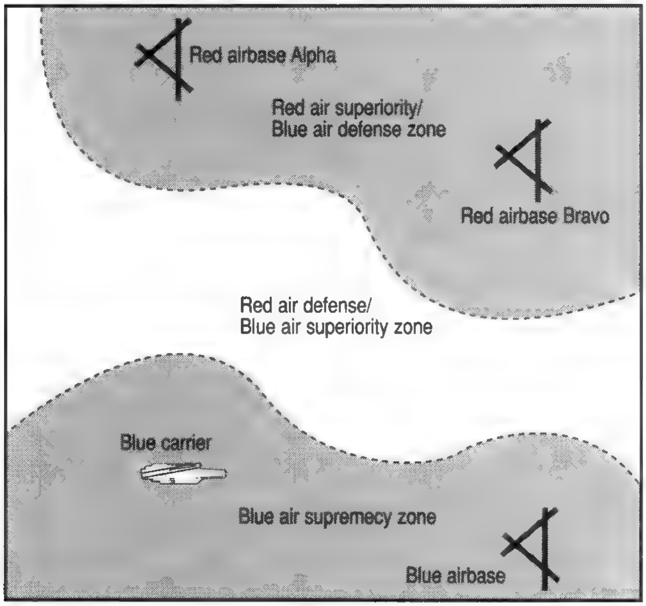


Figure 2-3. Zones of varying air control in a typical campaign

3. **Air Supremacy:** Ultimate control of allied and enemy airspace. Allied air units, armed or otherwise, can operate with impunity. Enemy forces either choose to not challenge or are incapable of challenging allied forces.

Figure 2-3 illustrates how the various operational zones can be classified in a typical air campaign. Friendly forces should achieve and maintain air supremacy around airbases and carriers to provide safe haven for returning aircraft.

Maritime Patrol and ASW Aircraft

Smaller than strategic bombers, maritime patrol aircraft such as the P-3, S-2, and Il-38 are designed generally for ASW operations but often possess some ASuW capability as well. These aircraft are generally slow but can remain on station for hours on end. They have little in the way of self-defense capabilities and should either be assigned fighter escorts or operate within regions of air supremacy or reasonable air superiority. Don't let maritime patrol aircraft stray too close to enemy surface action groups or they will most likely fall victim to surface-to-air (SAM) missiles.

This category also includes helicopters. Helicopters vary greatly in ASW capabilities, and missions must be assigned carefully. Some helicopters excel at locating enemy submarines, and others are unable to attack until others have already obtained a fix. Helicopters have considerably shorter ranges than fixed wing aircraft and must operate relatively close to ships. Helicopters allow surface vessels to prosecute enemy submarines while remaining out of the submarine's torpedo range.

Reconnaissance, Electronic Warfare, and Command and Control Aircraft

This broad category of usually weaponless or lightly armed aircraft is designed to keep tabs on enemy actions. Recon aircraft, such as the MiG-31R, E-2C, Il-76, and E-3, are the eyes and ears of the military. Guard them jealously; although they perform poorly in a fight, they keep allied forces apprised of enemy movements and provide warning of impending attacks. Airborne Warning and Control System (AWACS) aircraft, such as the E-3, control the skies by keeping tabs on every aircraft, allied and enemy, in the theater. Without these aircraft, friendly forces are literally blind.

Patrolling E-2s, E-3s, and IL-76s depend on active sensors, meaning that anyone with a radar-detection system knows when these aircraft are aloft. Knowing what they are and knowing where they are make them juicy targets for enemy fighters and interceptors. AEW aircraft

WAR LESSON 2.12

Never mix business with pleasure. Assign multi-role aircraft with a single mission at a time. Do not expect an F-16 to execute air-to-ground and air-to-air missions at the same time. Multi-role aircraft suffer performance penalties when carrying air-to-ground armament. Multi-role aircraft cannot carry enough of both armament types to ensure success at both missions. Focusing multi-role aircraft on a single task per mission increases their survival odds.

should never operate in a non-secured air zone. Areas under air defense conditions host a multitude of dangers for AEW. Although it is necessary to position AEWs as far forward as possible, it is more important to protect them.

WAR LESSON 2.13

If you station an AEW plane along the front, expect to lose it. Position AEWs as far forward as possible without entering contested air zones.

WEAPONS: THE ARCHER'S ARROWS

Weapons make the war. This section examines the capabilities of naval warfare's primary weapons and then discusses using them effectively. All war-making machines available to mankind carry a finite supply of weaponry. After exhausting that supply, the machine is defenseless and must somehow rendezvous with allied forces and resupply. Commanders of warmaking platforms must ensure that every item in their finite arsenal delivers maximum punch to the enemy, especially in light of skyrocketing defense expenses. A wasted weapon easily wastes $100,000 (if not many times more) and represents a missed opportunity to harm the enemy. Therefore, battlefield commanders must absolutely understand every operational detail of the weapons in their charge.

Likewise, battlefield commanders must understand every operational detail of the weapons deployed against them. The commander must know when, where, and how the enemy is capable of harming him. An F-14 carrying six Phoenix and two Sidewinder missiles easily represents $50 million even without any consideration for the crew. Placing $50 million at risk in combat is one thing, but losing such an expensive asset because the commander did not realize that the aircraft was at risk is intolerable. Therefore, it is not enough to understand all the weapons at your disposal; you must also understand all the weapons being used against you.

Missile Guidance Modes

A basic understanding of missile guidance systems is required to understand missile capabilities. Missiles use either radar or infrared (heat-seeking) systems to locate and track targets. Although missile-seeker systems vary greatly between missile types, all work by using variations of the following techniques:

Infra Red (IR) Guidance: These heat-seeking missiles home in on the heat generated by the target. Modern IR missiles can discern minute thermal differences of only a few degrees. Clouds, fog, rain, and other conditions that mask the target's heat emissions degrade the performance of IR missiles.

Semi-Active Radar Homing (SARH): This type of missile homes in on returns from the launching platform's radar. The launching platform, ship or aircraft, must maintain a radar lock on the target for the entire missile's flight. If the radar lock is broken, the missile loses the target and misses.

Active Radar Homing: Generally called "fire and forget" missiles, active-radar homing missiles have their own onboard radar used to locate and track the target. Usually, the launching platform must radar-lock the target to fire the missile, but once the missile engages its on-board radar, the launching platform can shut down its radar, essentially "forgetting" about the missile that will find the target on its own.

Inertial Guidance: This type of missile uses inertial guidance systems to follow a preprogrammed flight path to a non-moving target. Some types, such as the Tomahawk, also compare the surrounding terrain with on-board maps to verify proper position and course. Effective only against non-moving targets.

Many missiles use combinations of the preceding four types. Some missiles fly using inertial guidance until they're close to the target and then activate on-board radar. Other missiles use SARH guidance until they're near the target and then switch to active radar or go active. Additionally, missiles use varying flight profiles, meaning that they fly different approaches to the target, as shown in figure 2-4. Most anti-ship missiles fly very low over the ocean's surface until they're near the target and then "pop up" to a higher altitude and search for the target. Some air-to-air missiles climb during flight and then dive at the target. Missile flight profiles vary greatly and are generally heavily classified.

In all cases, one axiom holds true: Missiles are least effective when fired from near-maximum range. Most missile engines do not run for the entire flight. The missile accelerates quickly to maximum speed while the engine fires and then coasts partway to the target when the engine runs out of fuel. The farther the missile flies, the more likely it is to run out of fuel and be forced to glide. Gliding missiles lose speed, and reduced speed means reduced maneuverability. When a missile is fired from long range, it has little (if any) maneuvering energy left when it reaches the target and often misses if the target makes an unexpected maneuver.

Surface Attack Missiles

Surface-to-surface missiles have replaced the gun as the primary naval weapon. Guided land-attack and anti-ship surface-to-surface missiles provide greater impact with greater accuracy at longer ranges than do even the Iowa class battleships' mighty 16-inch guns. Likewise, aircraft carry a multitude of air-to-surface, anti-ship, and land-attack missiles. Long-range missiles coupled with long-range aircraft leave few locations on the globe safe from attack. The primary anti-ship missiles in *Harpoon II* are detailed in this section.

Western Anti-Ship Missiles

General Dynamix BGM-109B Tactical Anti-Ship Missile (TASM): With a 450nm range, the TASM is the longest-ranged anti-ship missile in western inventories. Its 1,000-lb. warhead and 95 percent accuracy rating (less enemy defenses, of course) devastates enemy ships. Uses inertial mid-course and either active-radar or anti-radar terminal guidance modes. Carried by ships and submarines.

McDonnell Douglas AGM-84/RGM-84 Harpoon: The mainstay of the Western navies' anti-ship arsenal. Flight ranges vary across numerous variants from 65–120nm. Highly accurate, its 500-lb. warhead is considerably smaller than that of the Tomahawk TASM but still quite effective. It is estimated that five Harpoon hits will destroy a Kirov-class surface ship, but as many as a dozen such missiles would have to arrive nearly simultaneously to overcome that ship's air defenses and achieve the requisite number of hits. Carried by ships, submarines, and aircraft.

British Aerospace Sea Eagle: In service with the Indian Navy and Royal Navy, the Sea Eagle has a 30–60nm range with a 330–440-lb. warhead. Flight paths are programmed before launch and are executed by an on-board autopilot. Salvo attacks can be programmed to attack a single target from multiple directions. Uses active-radar terminal guidance. Carried only by aircraft.

Aerospatiale Exocet: More than 100 of these missiles were fired in the Iran-Iraq war, doing considerable damage. Performed well for Argentina in the Falklands as well. Two Exocets struck the USS *Stark* in May 1987 by accident. Although heavily damaged, she was not sunk. The Exocet has a 26–40 nm range and uses active-radar terminal guidance. Carried by ships, submarines, and aircraft.

Kongsberg Penguin: Designed for use against small and medium-size surface ships operating in coastal waters, such as during an amphibious landing. Has a 264-lb. warhead with a ship-launched range of 12–25nm and an air-launched range of 17–37nm. An additional variant is being designed for U.S. Navy SH-60B helicopters. Inertial mid-course and infrared-seeking terminal guidance.

British Aerospace Sea Skua: Lightweight missile with a 77-lb. warhead and 12.4nm range designed primarily for helicopters and other light aircraft. Used with success by the British in the Falklands. Uses semi-active radar homing, therefore requiring the launching platform to maintain a radar lock on the target.

Soviet-Built Anti-Ship Missiles

SS-N-2 Styx: Ship-launched missile with 1,100-lb. warhead and 25–45nm range, depending on the variant. Both radar and IR-guided variants exist. This missile appears susceptible to electronic countermeasures.

SS-N-3 Shaddock: Anti-aircraft carrier missile used by surface ships and surfaced submarines. "A" (submarine launched) and "B" (ship launched) variants carry either a 2,205-lb. high-explosive or 350 Kt nuclear warhead with a 286nm range. "C" variant (ship and submarine launched) carries either a

5,000-lb. high explosive or an 800 Kt nuclear warhead with a 460nm range. This variant is exclusively a land attack weapon.

SS-N-7 Starbright: Used only aboard the Charlie I class submarine. Active radar homing. Carries either a 500 kg conventional or tactical nuclear warhead with 43nm range.

SS-N-9 Siren: Inertial guidance and terminal-active radar or infrared homing to the target; 500 kg conventional or tactical nuclear warhead. Installed in Nanuchka I and III class guided-missile corvettes and the Sarancha class hydrofoil. A submerged launch version is available for Charlie II and Papa class submarines. 30nm range unassisted. 60nm range with forward observer targeting via a video data link, such as those provided by maritime patrol aircraft.

SS-N-12 Sandbox: Improved-technology version of the SS-N-3. Carries a 2,205-lb. conventional or 350 Kt nuclear warhead with a 348nm range. Carried by both ships and submarines.

SS-N-19 Shipwreck: Believed to be another improvement of the SS-N-3/SS-N-12 family less susceptible to electronic countermeasures. Range estimated between 300 and 350nm. Carried by both ships and submarines (notably the Kirov and Oscar classes). With a speed of Mach 2.5, this is one of the most deadly missiles in the world arsenal; hence, it's name.

SS-N-22 Sunburn: A successor to the SS-N-9, which has not, to date, been used on submarines. Installed aboard Sovremennyy class destroyers and Tarantul-III-class missile boats. This extremely fast (Mach 2.5) anti-ship cruise missile flies at "sea skimmer" altitudes and is believed to be resistant to countermeasures. The Sunburn has a range of 68nm.

AS-2 Kipper: Air-launched anti-ship missile with a 2,205-lb. warhead and a 115nm range.

AS-3 Kangaroo: Few of these large, nuclear-armed, air-launched missiles remain in service. Has a 800 Kt nuclear warhead and a 405nm range.

AS-4 Kitchen: Developed for the Tu-22 Backfire bomber, this missile carries either a 2,205-lb. conventional or 350 Kt nuclear warhead. Has multiple guidance modes available, including anti-radar, inertial, SARH, and active-radar. Range varies from 186nm when launched at low altitude to 286nm from high altitude.

AS-5 Kelt: Air-launched anti-ship missile carrying a 2,205-lb. warhead. Has a 175nm range when launched from high altitude, or a 90nm range launched from low altitude.

AS-6 Kingfish: Modern, multi-role missile similar to the AS-4. Carries a 2,205-lb. conventional or 350 Kt nuclear warhead. Range varies from 348nm when launched at high altitude to 155nm from low altitude.

AS-7 Kerry: Tactical weapon with solid fuel propulsion. Pencil-beam radar terminal homing; 100 kg conventional warhead with a range of only 6 nm. Carried by Forger aircraft.

AS-9 Kyle: Anti-radar missile similar to U.S. HARM with a speed of Mach 3.0. Rocket propulsion and passive homing on electromagnetic radiation; 150 kg conventional warhead. Fitted on Badger, Backfire, Fitter-C, and Fitter-D aircraft; 60nm range.

AS-10 Karen: Solid fuel rocket with a speed of Mach 0.9. Electro-optical guidance. Conventional 100 kg warhead. Mounted on Fitter-D aircraft only. Range 6nm.

An Analysis of Anti-Ship Missiles

One thing is clear from this brief examination of anti-ship missiles: Soviet-built missiles enjoy a distinct range advantage over Western counterparts. The Tomahawk TASM, the West's longest-reaching anti-ship missile, is outclassed by even the antiquated SS-N-3C in terms of both range and payload. The accuracy of either missile notwithstanding, NATO task forces are unable to close within missile range of Soviet/CIS task forces without the threat of counterfire. The threat posed by Soviet-built air-launched anti-ship missiles is equally apparent. With ranges and payloads equivalent to the ship-based counterparts, formations of Russian bombers present a considerable threat to their targets.

This situation exemplifies the need for tactical formations and air-defense screens from both picket ships (such as Aegis cruisers) and aircraft, as well as careful tactics. General weapons tactics are discussed later in this chapter, and a thorough examination of formations and combat tactics follows in later chapters.

Torpedoes and Anti-Submarine Weapons

Underwater weapons fit loosely into three categories:

- Depth charges, rockets, and mines
- Torpedoes
- Torpedo-carrying missiles

The first category (depth charges, rockets, and mines) encompasses unguided, "blind" weapons fired in the general direction of a sonar contact. Depth charges and their descendant, ASW rockets, are short-range weapons, generally .5nm or less. These types of weapons are used only when a submarine has infiltrated a task force. Drop explosives en masse and hope for the best. Mines follow a similar principle: Position them in frequently traveled zones and hope for the best. These weapons rely mainly on luck rather than on skill to damage an enemy vessel. Mines have the disadvantage of non-discrimination. That is, they cannot tell a friendly vessel from a hostile one and detonate with just as much explosive glee when approached regardless of the flag being waved.

Torpedoes are basically acoustically guided, underwater missiles. Torpedoes rely on active and passive sonar to detect and track targets. Torpedoes show the same unnerving lack of discrimination as mines, and are perfectly content to acquire and attack the very submarine that launched them rather than the enemy. This situation led to the development of wire-guided torpedoes that trail a long copper wire through which the launching submarine can relay commands to the torpedo mid-mission, such as "I'm not the enemy, go away!" If the wire breaks, either because of maneuvering or because the torpedo goes too far away, the submarine loses all control over the torpedo and should depart the area until the torpedo detonates or runs out of fuel.

Torpedo-carrying missiles, called anti-submarine missiles, are a combination of the preceding two categories. When a submarine is detected, a missile carrying a torpedo is fired toward the contact. The missile drops the torpedo into the water and the torpedo activates its on-board sonar and proceeds to search for the submarine. Anti-submarine missiles allow surprise torpedo attacks on contacts too far away to engage otherwise. The launching platform has no control over the torpedo after the missile is launched. Like any other torpedo without wire guidance, it acoustically tracks whatever catches its attention.

WAR LESSON 2.14

It is advisable to ensure that all friendlies have cleared the area before firing torpedoes or anti-submarine missiles because of the often non-discriminating nature of acoustic tracking.

Air Defense Weapons

Air defense missiles come in two categories: air-to-air and surface-to-air (SAM), all of which use the same IR or radar guidance systems discussed earlier. Both types are deadly, but SAMs usually present the greatest threat to your aircraft. Aircraft can maneuver to avoid enemy fighters to some extent, but they must plunge headlong into SAM-infested territory without hesitation to perform their primary mission. The air-to-air missile threat is best visualized as two men with pistols stalking each other in a forest: Either man can win or lose depending on his skill. For the SAM threat, visualize the following scenario: A fire is burning at the end of a long alley. A man with a bucket of water needs to put the fire out but cannot get to it without going down the alley. Other men with guns wait along the alley and shoot at anyone who tries to get near the fire. Similarly, strike pilots must deliver their considerably-more-deadly payload on a target while enemy SAMs take potshots at them.

TIP 2.15

The fiery destruction of an entire group of strike aircraft may be the first, and only, warning you get that you are within enemy SAM range.

Furthermore, SAMs are deceiving. With sufficient AWACS coverage, enemy aircraft are usually detected before they reach a firing position, allowing defensive forces at least a meager opportunity to react. SAM missiles sites, though, are undetectable unless they are actively using radar. Only a single SAM site in a cluster may be using radar, therefore masking the size and lethality of the site. Also, *Harpoon II* does not display range circles of enemy weapons around enemy icons because the

WAR LESSON 2.16

No aircraft in *Harpoon II* can fly above SAM range; Some SAMs can reach higher altitudes than any aircraft in the game. Most SAMs, however, have minimum altitude limitations. Flying very low is generally the best protection against SAMs.

presence of various weapons cannot be confirmed. Without a discreet range circle to provide a visible warning, it is easy to allow aircraft to stray into SAM range.

The Soviets displayed a general fascination with size with respect to military equipment. Accentuated by ships like the *Kirov*, submarines like the Typhoon, and anti-ship missiles like the SS-N-3, Soviet-built SAMs are no exception. Other than range, specific SAM statistics that are useful include min-max, altitude and guidance type.

Dodging air-to-air missiles is not significantly safer or easier than dodging SAMs, but it has one main advantage: Given the appropriate resources, enemy fighters are usually detected before they achieve a firing solution. In all wars involving aircraft, the majority of downed aircraft never saw what hit them. Most of the time, the pilots never even knew they were being targeted until their aircraft burst into flames around them. Regardless of surface- or air-launched weapons, knowing the enemy is present has been proven to significantly increase air-combat survival odds.

Full details of air-to-air combat tactics will not fit in this book, nor are they necessary to the *Harpoon II* commander. *Harpoon II* commanders can rely on two simple rules:

1. Never send antiquated aircraft to battle a modern opponent (that is, don't send an F-4 Phantom to dogfight a MiG-29).
2. The one with the longest-range weapons generally wins (that is, he who can shoot and kill the enemy while remaining outside the enemy's return-fire range lives the longest).

WAR LESSON 2.17

Wasting ammunition can be hazardous to your health.

No matter how advanced the technology, no matter how high the price tag, no matter how effective the camouflage paint scheme, when a platform runs out of weapons, it becomes impotent. Warships came into existence for one reason: To deliver weapons against enemy targets. When the ship can no longer do that because of battle damage, being out of range, or running out of weapons, the ship can no longer serve its intended purpose. The ship may be salvageable or may only require resupply, but for the time being it is no longer battle-ready. The military calls this condition a *mission kill* or a *soft kill.* A soft-killed vessel presents no threat while providing a juicy, defenseless target. Don't become a soft kill.

Harpoon II scenarios rarely give one side a significant advantage over the other. Rushing head-to-head with the enemy and firing a massive missile volley at best depletes your magazines and makes you a soft kill. At worst, the enemy uses superior tactics and destroys you outright. Intelligent weapons use extends life expectancy. Use the following guidelines to prevent overexpenditure and underutilization of available armament:

1. **Look, then shoot, then look again:** In other words, don't attack blindly. Use aircraft, passive sensors, and judicious use of active sensors and positively locate the target before opening fire. After firing a salvo, observe the results before firing again. The attack may generate many repercussions: Previously undetected ships fear attack and activate their own sensors, thus revealing their presence. Inflicted damage may sufficiently preclude a follow-up attack. Damaged sensors can leave the enemy blind, allowing you to close and finish the kill with lighter

weapons. In short, know that the weapons being used are needed.

2. **Control salvo sizes:** Do not launch every missile in the magazines in a single blow. Resist the urge to decisively, undoubtedly, and utterly destroy the enemy by overallocating weapons. Although it may be nice to ensure a kill, every missile used unnecessarily represents wasted money and wasted combat opportunities and reduces the ship's defensive capabilities. Your enemy has a pretty reasonable estimation of your weapons load and can count. Overkill is never good.

3. **Match ordnance to targets:** Dire circumstances call for drastic, improvised measures, but general operations call for applying weapons as they were designed to be used. Do not send aircraft armed with Mk82 general-purpose bombs to destroy tanks. Do not send aircraft armed with BLU-107 Durandal antirunway weapons against ships. Unless executing a last-resort operation, consider the target and its characteristics compared to the capabilities of your weapons and then use the right tool for the job.

The Day After: Battle Damage Assessment (BDA)

Accurate, reliable assessment of the damage inflicted on the enemy is rare during combat. Human intelligence sources provide faulty information. Defense analysts misinterpret recon photos. Weather prevents satellite imagery and reconnaissance flights. The pressure of combat plays havoc with the mind, causing soldiers and pilots to misreport events. Damage assessment depends as much on luck as it does on skill and technology. Nonetheless, few types of intelligence are more important to battlefield commanders than BDA. Is the SAM site still operational? Are there bombers left in those hangars? Is the submarine restricted to slower speeds because of damage? Does that cruiser still have operational missile tubes? These and other similar questions rack the battlefield commander's brain after an attack.

Generally, err on the side of caution. If an icon completely disappears from the display, execute cautious attempts to reacquire it before closing on its last known position. It just might be "playing dead" and waiting for you. If a strike hits a ship but fails to sink it, never speculate about the extent of the damage. If a cruiser decreases from flank speed before the attack to creep speed after the attack, it probably suffered propulsion damage, but the commander cannot be sure and must certainly not assume anything about the status of its weapons and sensors. In such circumstances, assume that the target's weapons and sensors are operational until you have reason to believe otherwise.

Close cautiously on cripples. Try to avoid using your best weapons to finish off a wounded target, but be careful moving into position for the follow-up shot. Show no mercy. The cripple you spare may fire a cannonade as soon as you turn your back or may relay your position and status to other units in the area. Do not hesitate once in firing range. The SS-N-19 systems may have taken only minor damage, and repair efforts are about to bring them back on-line.

Strategic BDA is even trickier. Tomorrow, that runway you just hit may be operational again. Maybe it will not be operational until tomorrow night. Maybe it will be operational as early as tonight. The battlefield commander, until he walks on the shattered ruins of the airbase now occupied by allied forces, must assume that it has been repaired and is capable of retaliation. Perhaps you managed to sink three ships from a surface action group before the remaining five withdrew. Did they run away? Are they going to rendezvous with a previously undetected force and return? Are their magazines empty (a mission kill)? Should you withdraw? Should you pursue?

These questions have no clear-cut answers. There is only one formula to follow: Know your enemy, know your weapons, and know yourself. Initiate a plan based on the known status of the enemy compared against your remaining firepower. *Harpoon II* scenarios rarely last long enough for fuel to have a significant impact, but it should be a consideration: How long can you maintain the current level of flight ops before running out of Avgas? The decisions are hard and require considerable study and analysis. The consequences of error are usually lethal. Welcome to the captain's chair.

THE EYES AND EARS OF THE FLEET

Although modern naval battles occur at much greater ranges than their ancient counterparts, one fact has always been true in naval warfare: *You must know where the enemy is to defeat him.* In olden days, "seeing the enemy" meant exactly that: closing to visual range and engaging. Catapults, cannons, and guns all were originally limited to visual acquisition and targetting, all of which were only as good as the specific human eye directing the fire. Modern weapons have significantly greater ranges than did their antique counterparts, but still rely on accurate and current targeting data. A 300nm missile is useless if you cannot target an enemy at that range. Modern weapons are practically useless without modern sensors to direct them.

> **WAR LESSON 3.1**
>
> You can't fight what you can't see.

The "Mark One Mod Zero Eyeball," the sole sensor of bygone days, is now

Facing page: To kill the enemy, as has effectively been done here, you must first find him. U.S. Naval Institute Archives

supplemented by numerous other types of sensors, all of which are designed to increase detection range and effectiveness, as well as peer into the hidden depths beneath the waves.

ACTIVE VERSUS PASSIVE SENSORS

Proficiently employing a comprehensive sensor suite requires a thorough understanding of active and passive sensors. *Active sensors,* regardless of radar, sonar, etc., all radiate energy. They transmit some form of energy and then "listen" for echos of this energy. Echos indicate that the emitted energy, regardless of source type, hit something tangebile and bounced back. Active sensors, depending on their type, can penetrate darkeness, fog, and water to reveal hidden enemies.

Passive sensors, on the other hand, only "listen." Passive sensors *never* emit any energy of any kind. They cannot penetrate darkness or gloom, but are usually quite accute and can "hear" even the slightest emissions generated by other sources.

For example, consider a standard policeman's speed-radar gun. The radar gun is an active sensor. It broadcasts electromagnetic energy toward a car. The energy hits the car and echoes back to the radar gun. Through a process discussed below, the speed of the car is determined from the returned energy. The radar detector in the target car is a passive sensor. It emits no energy, but listens for police radar. When speed radar is detected, it alerts the driver.

WAR LESSON 3.2

In *Harpoon II,* passive sensors are checked every 15 seconds by the program.

This simple example illustrates perfectly the equilibrium between passive and active sensors. The radar gun provides the police officer with intricate details about the target car, but every use of the radar triggers every radar detector in the area, warning other drivers. Using the radar provides information to the police officer, but announces his presence to anyone listening to the appropriate frequencies. *Active sensor use, in a combat environment or otherwise, announces the emitter's presence to the enemy.*

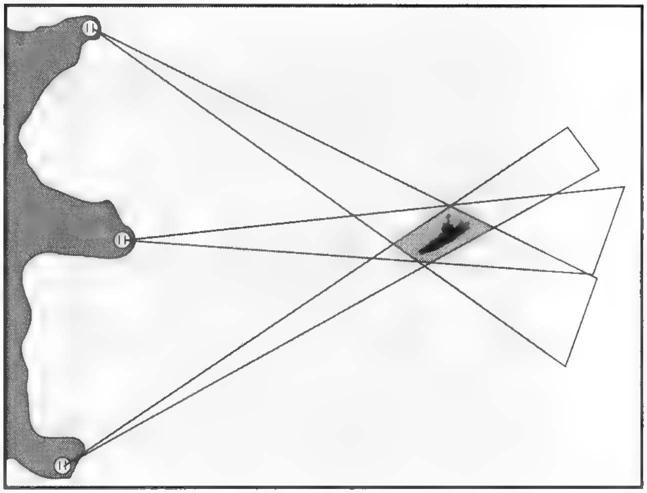


Figure 3-1. Triangulation of an active sensor by multiple bearing-only contacts

Military-application passive sensors are infinitely more sensitive and precise than are civilian radar detectors. Military passive sensors not only announce detection of an active energy source, but also indicate *the direction the source came from,* giving the listener a bearing-only contact on the emitter and specific frequency and pulse repetition-rate data that allows the active emitter to be classifed by type as well. Additionally, as shown in Figure 3-1, multiple receivers can combine a series of bearing-only contacts to reveal the exact position of the emitter. This process is known as passive *cross-fixing.*

CROSS SECTION

The term *cross section* describes how large a given object looks to a given sensor. For example, a F-117 Stealth Fighter has a low radar cross section (RCS) and looks small or indistinguishable on radar. A lumbering B-52, however, has a very large RCS and is easily detected by radar. Cross section values differ based on *aspect angle*, or the angle at which the sensor is viewing the target. For example, a turning B-52 presents a giant reflective surface to a radar viewing it from the side, but presents a smaller reflective surface to a radar viewing it from directly ahead.

Harpoon II models cross section values for each sensor type: radar, infrared, visual, and sonar from multiple viewing angles. These values generally affect only low-level combat details that are invisible to players. Understand, though, that an attack or search must account for these factors. A radar with a 300nm range may not detect a small target with a small RCS until it's only 150nm away.

RADAR

Radar, or *radio detection and ranging*, is the modern battlefield's primary long-range sensor. Active radar emits electromagnetic energy, or radio waves, into the atmosphere and listens for reflected echos of that energy as described earlier. Electromagnetic energy in a vacuum, travels at the speed of light and at some known percentage of the speed of light when it's moving through a non-vacuum based on the nature of that medium. By timing the interval between emitting a pulse and receiving an echo and by knowing the speed at which the radar waves travel through air, you can derive the distance the radar wave traveled since being emitted. Because the wave travelled from the emitter to the target and back to the emitter, the distance to the target is one-half the total distance the wave traveled as shown in Figure 3-2.

Range: Detection versus Detectability

The waves dissipate energy as they travel and whenever they strike a solid object. The farther away a target, the weaker the echos are that return to the emitter. If the target is far enough away, the waves completely dissipate before returning to the emitter. That target is out of that radar unit's *range*. Radar range includes many factors, but the strength of the originally emitted wave most directly affects radar range; the stronger the emission, the farther the wave can travel and, therefore, the longer the range the radar has.

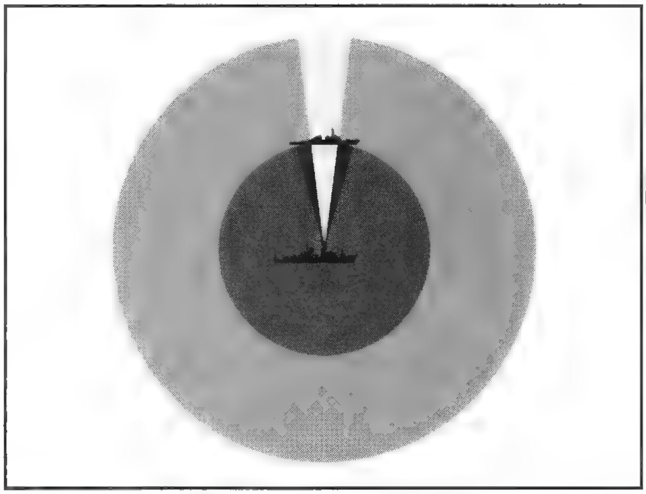


Figure 3-2. Radar Range

Range, however, is a two-edged sword. The farther the radar waves can travel, the farther away passive sensors can detect them. Assuming that a given radar has a 100nm range, for example, the radar waves must have sufficient energy to travel 200nm (travel 100nm to target, reflect, and travel 100nm back to emitter). The active radar can find only objects 100nm or less away, but its broadcasts that do not reflect from a target travel at least 200nm in theory. In

> **WAR LESSON 3.3**
>
> Active radar is detectable by enemy receivers at least twice the radar's usable range, and usually even farther. All ESM-equipped units in *Harpoon II* always monitor their ESM gear. Assume that all active transmissions will be detected by the enemy.

actuality, it can be much farther than that. Any passive sensor monitoring that frequency within a 200nm range detects those active transmissions. Active radar, therefore, provides a detailed picture of the environment within in its range, but betrays its presence to contacts outside of range.

Expect the enemy to always use *Electronic Support Measures (ESM)*, otherwise known as passive radar. Because passive radar only "listens," there is no reason not to use it. In *Harpoon II*, all units *always* monitor all available ESM equipment. ESM equipment identifies not only the emitter's bearing, but also a profile of the radar itself. Based on frequency, power levels, and other factors, the exact type of radar can usually be determined. When more than one radar is detected, the listener cross-references platforms against detected radar types, potenitally identifying the emitting unit.

Doppler Effect

Some modern radar rely on the *Doppler Effect*, which shows that the frequency of a wave (sound, electromagnetic, etc.) changes as the speed of the emitter *and* the listener change. Furthermore, a wave striking an object, such as an aircraft, reflects back to the emitter with a frequency shift due to the speed of the aircraft. Therefore, by measuring the precise frequency difference between an emitted and returned pulse, radar can also determine *how fast an object is moving.*

Normally, when radar is pointed toward the ground, everything on the ground, including the ground, reflects the energy back toward the emitter, making a bright but unitelligible glow on the radar operator's display. *Ground clutter* limited radar's capability against surface and low-level targets for years. By utilizing the Doppler effect and modern signal processing, though, any radar return with a frequency shift indicating it reflected from a stationary target can be ignored. Some radar, especially air-search radar, is designed to specifically ignore low-speed (under 60mph) and zero-speed returns because they generally are not combat aircraft.

> **WAR LESSON 3.4**
>
> Doppler-based radar reports the contact's speed in addition to range and bearing.

Continuous Wave and Pulse

Pulse radar broadcasts a single radar pulse and then times how long before it receives an echo. At some specific interval, if the radar has received no echo, it emits a new pulse. This pulsing ensures that the radar unit always knows the time interval between emission and echo reception, allowing the range calculations described earlier. Pulse radar has one limitation, though: As the effective range increases, so does the timing interval. At very long ranges, the timing interval becomes sufficiently long to render the radar useless; potential contacts can maneuver so much between pulses that the information provided by the echo is always outdated. Degraded or time-delayed information such as this is marginally acceptable for search purposes, but it is never adequate for targeting.

Continuous-wave (CW) radar does exactly that — constantly emits radar waves. Reflected returns still indicate a target, but there is no way to correlate a given return with a given emission. Therefore, the timing described earlier cannot be calculated and the range to the target cannot be determined. CW radar, therefore, provides bearing information but not range information. CW radar, though, has greater range than pulse radar does because it is not limited by interpulse timings.

Airborne Radar

What does all this mean to the battlefield commander? Combat situations often demand active sensor use. Simply keeping all radar units in "standby" at all times is hardly an acceptable plan.

The commander, therefore, must derive a plan for reasonable active radar use without surrendering too much information to the enemy. Such plans include judicial active-radar use and *airborne radar*.

Radar carried by aircraft enjoys several advantages over surface-based counterparts, as shown in Figure 3-3. The curvature of the earth limits surface-based radar ranges. As shown in Figure 3-3, the visual horizon at sea is approximately 12nm, based on the height of eye at Bridge level on a destroyer-size ship. Because radar is mounted on the mast much higher than this and because electromagnetic emissions curve slightly with the contour of the earth at sea level, the effective radar horizon is closer to 30nm. As shown in Figure 3-3, objects positioned above the radar horizon, such as aircraft and towers, are still visible to

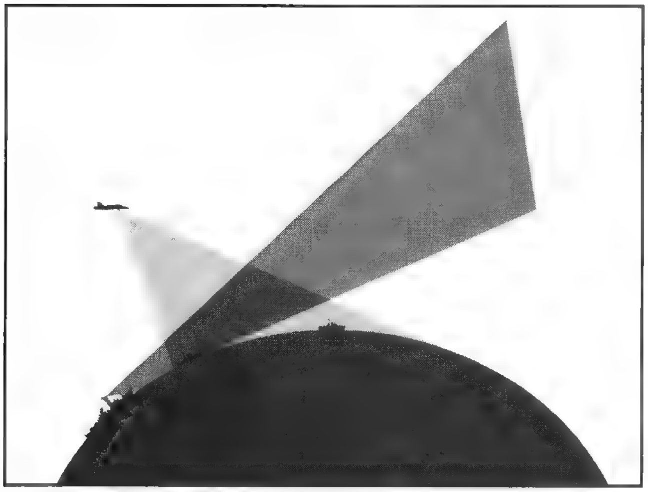


Figure 3-3. Airborne and surface radar ranges

surface-based radars at greater ranges, but the horizon masks objects on or near the surface.

The exact range at which the radar detects airborne targets depends on target elevation as well. High-altitude contacts may well be detectable at or near the radar's maxiumum range. If the same targets were flying at low or medium altitude, however, they would likely be below the radar horizon at that range and would not cross that horizon and be detected until much later. By using an airborne search radar, such as that of the E-2 Hawkeye, in lieu of a surface-mounted radar, you are raising the height of eye a significant amount. Increased height of eye means increased range before the radar horizon becomes a factor. At high altitudes, in fact, radar power becomes the limiting factor on detection ranges, not the radar horizon.

Airborne radar enjoys another advantage over surface-based radar: mobility. Aircraft move significantly faster than surface ships do. When an aircraft, such as an E-2C Hawkeye, flies 200nm from its carrier and then activates its 300nm-ranged radar, every radar detector within 600nm immediately goes off. Only the position of the E-2C is betrayed however; the carrier is still safely hidden 200nm away. Therefore, besides benefitting from longer surface-search and air-search ranges than most surface-based radar, deploying *Airborne Warning And Control System* (AWACS) aircraft also does not reveal other platforms in the area.

Radar Summary

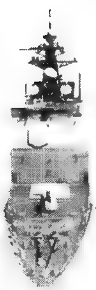
Active radar provides a revealing look at the environment, but betrays its presence to passive ESM gear far outside its actual detection range. Air-based radar, being freed of mobility and horizon constraints, can cover significantly more area with active sensors without revealing its parent ship's

WAR LESSON 3.5

Always weigh the information you stand to gain from active radar use against what you potentially give away to the enemy from the same decision.

location. When active radar must be used, it should be used sensibly. AWACS aircraft should be positioned far enough from the main group to protect its location, but must have sufficient fighter escorts to protect it from the inevitable attack. (Since it is visible to every unit in the theater with its radar active, attack is inevitable.) When stealth is desired but circumstances require an "active look" at the environment, radar should be used for only short periods (less than two minutes) to prevent betraying the emitter's exact position.

In the real world, weather and atmospheric effects have an impact on radar performance, but usually less drastically than the same effects have on other types of sensors. *Harpoon II*, modifies radar performance based on weather effects, but the end results are not generally noticable to the player.



ANTI-RADIATION MISSILES

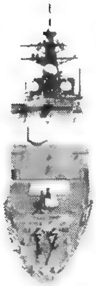
Anti-radiation missiles (ARMs) track specified emissions to the transmitter and destroy its antennae. The AGM-84 High-speed ARM, or HARM, performs this task admirably. Worse than merely betraying one's position, active sensor use may invite an ARM attack. Most attacks against radar-equipped targets should include an ARM component, if possible. The enemy cannot launch radar-guided missiles without activating radar. An active radar makes an attractive target for an ARM. Either the target deactivates active emissions or the ARM puts the radar out of service permanently. Either way, the target is unable to return fire.

INFRARED SENSORS

Infrared (IR) light lies just below the human perception range and is associated with heat. Although IR illuminators exist, the vast majority of military IR systems are passive. Few of these systems actually emit any IR energy; instead, they watch for other IR sources, such as aircraft and missiles. Synonymous with *heat-seeking,* IR sensors basically measure the temperature of the surrounding environment and flag any object differing from that temperature. In this context, "heat" is a relative term. Many IR sensors can also detect objects colder than the environment, such as a cold, metal tank at night, as well as heat sources. Most modern IR systems have extremly high resolution and can display photo-like, two-color pictures of the target. IR system ranges, though, are significantly shorter than radar systems, usually limited to under 20nm.

> **WAR LESSON 3.6**
>
> IR sensors look for anything signifcantly hotter or colder than the background environment. Each increment in precipitation reduces IR detection range by 20 percent.

Weather effects greatly affect IR sensor performance. IR requires a clear line of sight to the target; therefore, clouds and fog degrade IR range. Precipitation not only reduces visibility, but also impacts temperatures of individual units as well as the whole environment. In *Harpoon II*, precipitation bounds IR effectiveness. Precipitation, both rain and snow, varies in four increments, from none to heavy. *Each increment in precipitation level degrades IR detection range by 20 percent.* These effects are cumulative (the first step reduces range to 80 percent, the second step reduces range to 64 percent.) Therefore, light rain degrades IR ranges to 80 percent of normal, moderate rain reduces IR ranges to 64 percent, and heavy rain cuts IR ranges in half, down to 51 percent of the normal maximum. An IR system with a 20nm range would be reduced to roughly 10nm, and a 6nm-range system, down to a mere 3nm.



VISUAL SENSORS

In addition to the human eye, the military employs other types of visual sensors, such as the Television Camera System (TCS) carried by the US Navy's F-14. As indicated, these systems operate in the visual-light spectrum, but with higher range and resolution than the human eye. The range of the human eye varies greatly from individual to individual and with the size of the target, but usually remains much less than 30nm for all combat purposes. Other optical systems expand this range. The F-14s TCS, for example, is quite effective against large targets 60nm or more away.

Visual sensors, though, fall victim to cloud cover, time of day, and precipitation. Cloud cover reduces visual range by 16 percent. Overcast or thick fog, therefore, reduces visual range to 59 percent. Visual range, broken into daylight, twilight, and darkness, has a large impact on visual range. Twilight and darkness reduces visual range 33 percent per increment, in addition to cloud effects. Therefore, overcast-at-night visual range drops to 25 percent of the normal, clear-weather visual range. Finally, precipitation additionally reduces visual range by 25 percent

WAR LESSON 3.7

Cloud cover reduces visual range by 16 percent per increment; time of day, 33 percent per increment; and precipitation, by 25 percent per increment.

per increment. Light rain, therefore, reduces overcast-at-night visual range to 18 percent, moderate rain down to 14 percent, and heavy rain down to 10 percent. A sensor like the F-14's TCS, normally effective out to 60nm, would be reduced to 10nm effective range.

SONAR

Electromagnetic (EM) waves and sound waves behave quite similarly except for their respective speeds through a given transmission medium. EM energy moves considerably faster and farther than sound through a medium like air, but sound moves considerably farther than EM waves in water. Radar and radio communications work fine above the surface, but are essentially useless underwater. *Sonar,* or *sound navigation and ranging,* uses sound underwater as radar uses EM waves in the air. The exact speed and range of acoustic energy underwater varies with temperature, pressure, and salinity, but averages roughly four times faster than the speed of sound in air. Oceans may seem to be a simple, homogeneous, amorphous mass of moving water, but in actuality, large bodies of water form a complex, dynamic, and protean environment, highly unstable by human standards. Before understanding how sonar works, you must understand how sound travels through this environment.

OCEAN LAYERING

The ocean is a dynamic environment, continually mixed by wind, waves, currents, and tidal action. These forces have greatest effect near the boundaries, but are present throughout the body of water. At any given point on the surface, large variations in temperature are common, because of the mixing of water from wind and wave action as well as the effects of heating and cooling. During the day, the sun's rays warm the surface layer, exciting individual water molecules in the energy-transfer process. This process causes individual particles to spread out, making the entire layer of warm water less dense than it's cooler counterparts. The depth to which this warming occurs varies with the length of the day and other factors, but all water within that depth is raised to a constant temperature. As such, it is referred to as the *surface isothermal layer.*

Concurrent with this surface activity, the forces of deep ocean currents are at work. The coldest, densest layers of water slide away from the continental shelves, following the bottom contours until they collide with one another. At the points of these collisions, an upwelling of cold water reaches the surface and spreads. This process creates circular eddies, which can be hundreds of miles long, that draw the warmer surface water down hundreds of feet, spreading it in layers throughout the ocean. This layering is best illustrated by viewing the system as a microcosm, with the understanding that the entire process is occurring simultaneously at many points throughout the ocean. The formation of ocean thermal layers is shown here.

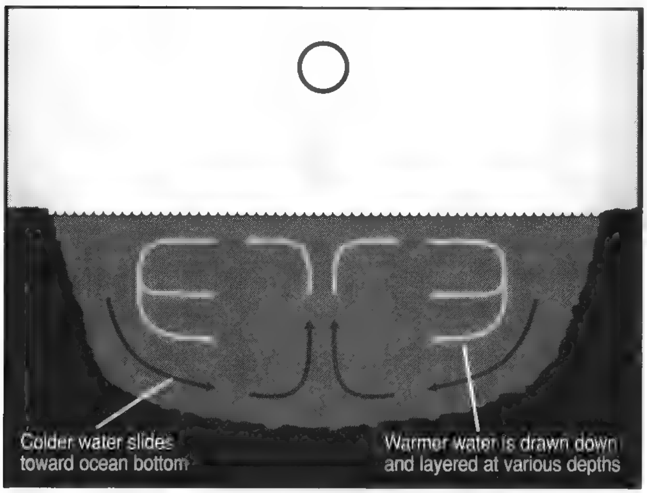


Figure 3-4. Formation of ocean thermal layers

Now that you understand how thermal layers are formed, you must learn how to use this knowledge on the battlefield. Remember that your objective is to see without being seen. In proper military parlance, this objective would be better stated as "to detect the enemy without being counter-detected." In pursuit of this goal, you will discover that thermal layers can either work for you or against you.

SOUND PROPAGATION

A *sound wave* is a pressure wave that emanates from a source. At the source, the intensity of the wave is the strongest. The unit of measure for this intensity is the decibel (dB). As the wave moves away from the source, it expands and loses strength, and its energy is spread across the increased surface of the wave until it dissipates altogether. If you were to measure the energy of the wave at the midpoint of the cycle, you would find that the decibels had decreased significantly from the source level. This reduction occurs because of transmission loss, an aggregate measure of several other factors, including spreading loss, surface boundary loss, bottom boundary loss, attenuation, and sound velocity distribution. To best understand how these factors interact with one another, each is addressed separately.

Spreading Loss

In a purely homogenous, unbounded medium, which we have already established the ocean not to be, sound emanates from an omnidirectional point source in straight rays. The leading edge of these rays would compose a spherical wave front. As the sphere expands, or propagates through the medium, it's surface area naturally increases. Because the same initial energy must be spread across the entire wave front, the farther from the source the wave travels, the more the intensity of the sound at any given point on the front must continue to diminish.

The Surface Boundary

Because the ocean is not an unbounded medium, you must also consider what happens to the pressure wave when it collides with the surface boundary. If the surface is completely smooth, which is occasionally the case, it acts as a perfect reflector. The wave strikes the surface and bounces back in a new path determined by the angle of incidence at the time of contact. This concept is best illustrated by focusing on just a small portion of the spherical wave front as it reaches the surface.

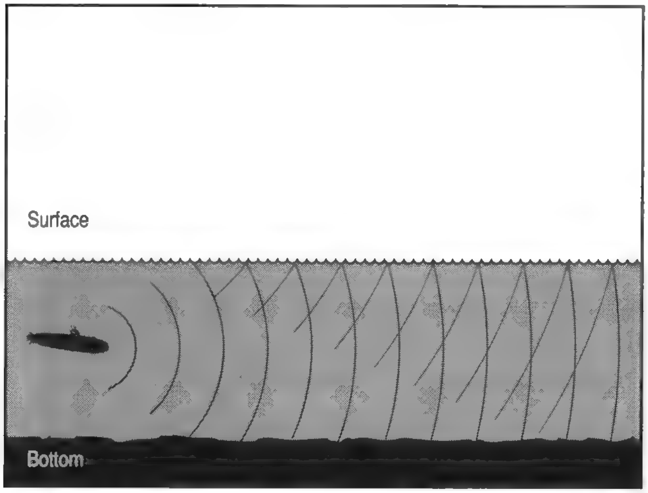


Figure 3-5. Reflection at the surface boundary

When the surface of the ocean is rough, as is more often the case, the pressure wave is still reflected, but it experiences losses because of scattering on the uneven surface. Small portions of the main wave are reflected in different directions than the main front, which again lowers the sound intensity of the wave. This effect is minimal compared to other aspects of transmission loss, but it cannot be ignored in any proper evaluation of sonar performance.

The Bottom Boundary

The bottom boundary behaves in much the same manner as the surface boundary does. There are losses from scattering due to uneven terrain features, but there are also absorption losses due to bottom composition. A hard rock surface would have little effect, and a thick layer of silt or ooze would absorb a great deal of any reflected wave front.

Water depth also influences bottom bounce propagation. In deep water, pressure and layer structure act to trap reflected sound waves and preclude them from returning to the surface. In shallow water, a strong sound wave may bounce back and forth between the surface and bottom boundaries several times before dissipating (as shown here).

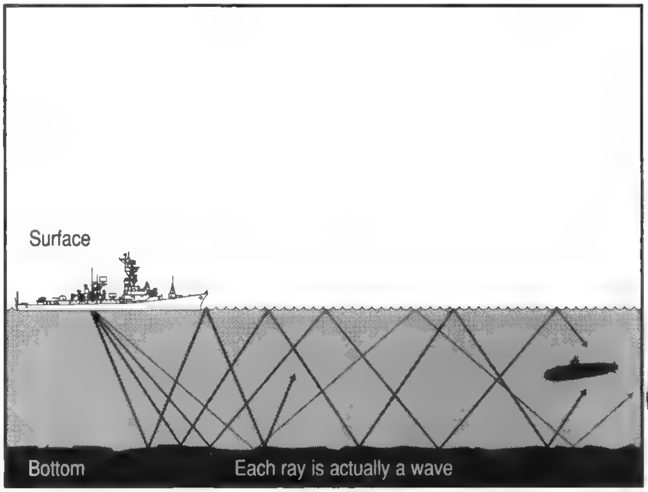


Figure 3-6. Sample shallow water bottom bounce path

Attenuation

Attenuation is a composite measure of loss due to two other factors: scattering and absorption. Some instances in which scattering and absorption come into play were touched upon briefly in the sections on surface and bottom boundaries. Additional scattering occurs because of the presence of other bodies in the medium, such as whales, schools of fish, even thick plankton concentrations. Also, some absorption is inherent in the repeated pressure fluctuations that comprise the wave front. The primary factor that determines the amount of absorption loss from this source is the frequency of the sound wave.

The waves generated by low-frequency sound sources, such as engine noise, experience less attenuation over time and distance than do high-frequency sound waves. This relationship is critical to tactical thought. Active sonars use concentrated pulses of high-frequency energy that travel to the target and are reflected back to the source in the form of a return, or echo. The use of high-frequency waves is required to achieve proper target definition.

Definition is the sonar suite's ability to determine the difference between a solid echo, such as what is produced by the metallic hull of another submarine, and a mushy return from a school of fish.

Because high frequency is necessary for this purpose, active sonar transmissions will experience greater attenuation over the same distance. Because active sonar pulses must also return from the object of interest, the distance over which attenuation is a factor is doubled. What this means to you, the *Harpoon II* commander, is that active detection ranges are generally shorter than passive detection ranges.

WAR LESSON 3.8

Active sonar detection ranges are generally shorter than passive sonar-detection ranges.

Sound Velocity Distribution

Sound waves are also influenced by the "artificial" boundaries created by thermal layers. In fact, the change in water density (caused by the sharp temperature gradient) has probably the single greatest effect on a sound ray's direction of travel. When a sound wave hits the layer, a portion of the energy is reflected back, but a much greater portion of the energy is refracted, or bent, through the layer. Again, the amount of refraction depends on the angle of incidence when the ray strikes the layer. At steeper angles of incidence the sound is hardly refracted at all and penetrates through the layer. As these sound waves travel down into deep water, the speed of sound rises as the water pressure increases (sound travels faster through denser mediums).

In really deep water, (more than one thousand feet) the lower edge of the sound wave begins to travel faster than the upper edges. This causes the sound wave to slowly bend back towards the surface in a long, sweeping curve. In this manner, sounds generated by a noisy ship or submarine may disappear down into the depths, only to reappear on the surface several miles away. The area where the sound rises back to the surface is called the Convergence Zone (CZ).

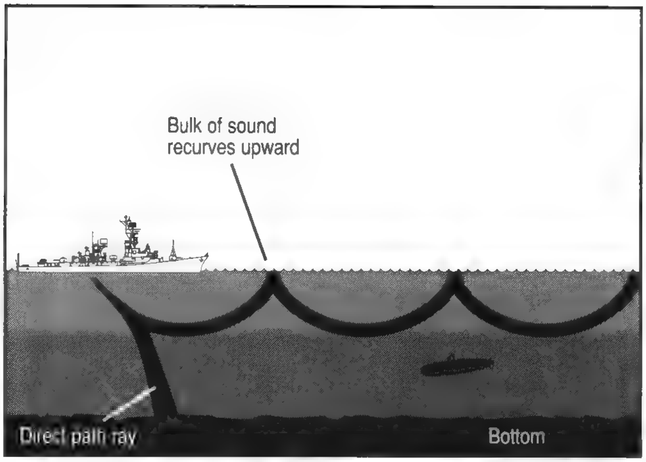


Figure 3-7. Refraction at the thermal layer from a surface source

Additionally, sounds that rise to the surface in a CZ may then be re-reflected off the surface and back down into the depths again, starting another long journey downward and outward. Convergence zones tend to appear at about 20 to 30 mile intervals, depending on a host of environmental conditions, and form a series of concentric circles around the original sound source. The technical term used to describe this type of circular shape is an annulus.

The convergence zone phenomena allows platforms with sensitive passive sonars to passively hear sounds made far out in the convergence zones, even though the range from the source of those sounds might be further than they could hear normally. Many modern sonar sets can hear noises generated two or three convergence zones away (90 miles or so). Please note, however, that CZ contacts are not constant contacts, like

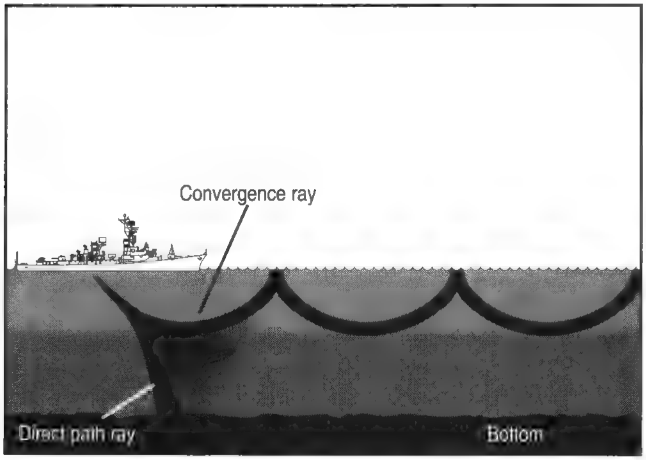


Figure 3-8. Hiding in the shadow zone

those displayed on a radar screen. Rather, they are present only while passing through the annulus of the CZ. To maintain a CZ contact, it is necessary to match course and speed to keep it within the annulus.

The portion of the ray that is bent downward through the layer is referred to as the *direct path ray*. Direct path contacts are always short-range contacts, on the order of from 4,000 to 8,000 yards.

When surface ships conduct active sonar operations to locate submarines, they have a blind spot, known as the shadow zone, between the direct path ray and the convergence ray that subs may use to their advantage.

When the water is deep enough to permit several thermal layers to co-exist, the conditions are right for the formation of a sound channel. When a layer of warm water is bounded top and bottom by colder water, any sound emitted within that layer tends to be trapped between the two boundaries. The sound channel acts as a conduit for the radiated noise, allowing greater propagation within the channel, but also precluding detection of noise sources outside the channel.

TYPES OF NOISE

Sound, or noise, may be segregated into two categories: broadband and narrow-band. The suffix in each of these terms refers to bandwidth, or that portion of the total spectrum of sound frequencies contained in the signal.

Broadband noise contains many frequencies, narrow band a distinct few, but the tactical information that may be garnered from each differs.

Broadband Noise

Broadband noise sources include flow noise, generated by water moving past the hull, propeller noise, and cavitation. *Cavitation* is a condition that occurs only at high speeds. When a ship or submarine is operating above cavitation speed, a low-pressure area forms on the trailing edge of each propeller blade. Air bubbles collect in these areas until their volume becomes sufficient that they are thrown off into the propeller's wake. When this process occurs, the bubbles collapse in the higher-pressure water. The sound they make is distinct, similar to the sizzling sound of a steak on a grill. When this sound is present, the contact is known to be operating above 20 knots.

> **WAR LESSON 3.9**
>
> Broadband noise travels farther than narrow band noise does. As such, it is the initial source of detection for passive sonar contacts.

Without cavitation, some indication of speed may also be gained by timing the revolutions of the propeller, or blade rate of the contact. As commander, you need not be concerned with the details of this process — you have far more important things to do. Rest assured that your crew is fully trained to perform this function.

Broadband noise generated by ships and submarines also tends to be of lower frequency than narrow-band noise. Remembering the discussion about attenuation, this means that broadband noise tends to travel farther than narrow-band noise before dissipating. As such, the tactical implications of this knowledge are as follows: The initial source of detection is a broadband contact, and, from that contact, the speed of the target can be determined.

Narrow-Band Noise

Narrow-band noise consists of discrete tonals and their harmonics (that is, multiples of the base frequency) that are produced by the operation of machinery. For example, every ship or submarine requires electricity in order to operate. The source of this electricity is a generator that operates at the prevalent frequency of the nation that constructed it. You possess a distinct advantage in this respect. As you know, the U.S. operates electrical equipment at a base frequency of 60 hertz (Hz), while almost all the rest of the world uses 50Hz. In most instances, therefore, if you see frequency lines of 60, 120, 180, or 240Hz, you may rest assured that the contact is friendly. The fourth harmonic, 300Hz, is ambiguous because it is a multiple of either base frequency.

These discrete tonals are not limited to generator operation, however, and different frequency lines, or spikes, appear for auxiliary machinery as well. The composite profile of these spikes is known as a *sound signature* and, because each class of ship or submarine has different machinery configurations, each sound signature is as identifiable as a fingerprint. Furthermore, in the real world, anomalies between ships within a class have made it possible to type a contact down to the hull number without ever setting eyes on it.

Being able to process the information contained in narrow-band noise is necessary to move from simply knowing something is there to knowing what that something is — in military terms, to move from detection of the contact to classification of the contact. Classification is critical because rules of engagement usually preclude you from firing on a contact that has not been classified.

Ambient Noise

Ambient noise is a combination of broadband and narrowband noise produced by biological sources, wind, ice floes, tidal action, and other phenomena that occur naturally in the environment. The level of ambient noise is important to passive sonar operations because it forms the background against which all other sound signatures must be picked out. The higher the ambient noise, the stronger the sound source must be in order to be detected. Ambient noise is highest in shallow water near the ocean boundaries. As such, the tactical significance of ambient noise is this: With all other factors considered, when, operating in shallow water, passive detection ranges are much shorter.

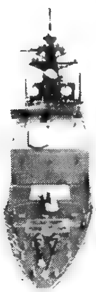
> **WAR LESSON 3.10**
>
> Ambient noise is very high in shallow water, making passive sonar operations extremely difficult, if not impossible to conduct.

Transient Noise

Transient noises create a brief but recognizable burst of sound that discloses tactically important information. Examples include the loading and flooding of torpedo tubes, the blowing of emergency ballast tanks, and even the creaking of a pressure hull operating near maximum crush depth. In *Harpoon II*, these detection issues are resolved exclusive of your interaction.

Self Noise

Self noise is composed of broadband and narrow-band noise generated by your own actions. Aside from the obvious effects of high levels of self noise in providing information to the enemy, self noise is even more significant in raising the threshold of detection. Self noise acts in conjunction with ambient noise to raise the base sound level, above which all other signals must be in order to be detectable. This means that when platforms are traveling at speeds greater than 20 knots, the flow noise of water passing over the sonar dome is so great as to preclude most passive detection. In other words, at high speeds, you are flying blind.



DETECTION VERSUS COUNTER-DETECTION

Having assimilated the information that has been presented so far, it is now important to examine the application of that knowledge in some of the tactical situations you encounter throughout your tour of duty. This discussion is not intended to be comprehensive, because you will learn other tactical considerations that transcend these generic examples. Rather, these lessons are best used as the foundation of a body of knowledge you build on throughout this book — knowledge that is essential to survival in a war at sea.

Note: The surface ships used in the following examples are warships that employ modern hull silencing techniques. Merchant shipping does not enjoy these types of luxuries, so these platforms are easily detected at much longer ranges than those depicted in the examples.

Ship Versus Sub, Low-Speed Passive Ops

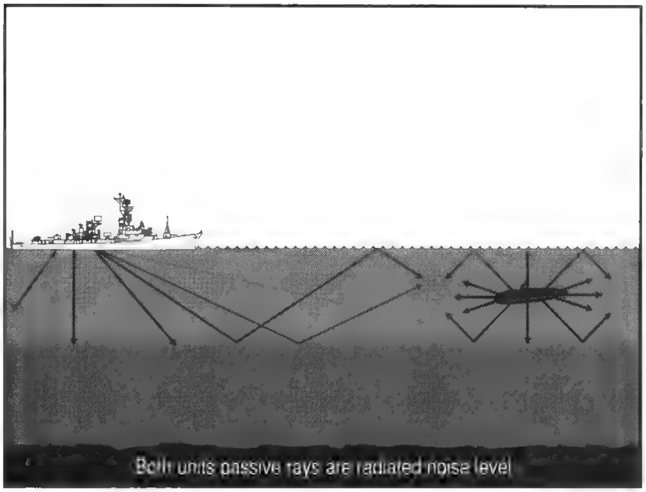


Figure 3-9. Surface layer detection range: submarines enjoy a 2:1 advantage

A surface ship is operating at a slow search speed of 5 to 10 knots. The submarine is cruising at a scant 4 knots, towing a passive sonar array. Both platforms are within the isothermal surface boundary so the propagation paths of their radiated noise are the same. Furthermore, neither platform is inhibited by self-noise levels that would preclude detection of the other.

With all other conditions equal, a submarine's minimal sound signature and highly sensitive sonar suite should allow you to detect the surface ship at 3 to 5 times the range it can counter-detect you. This ability affords submarines the luxury of a casual approach and deliberate attack, the result of which should be one less Skimmer (what submariners call surface ships).

Retaining the same initial configuration, if the ship were transiting at high speed, it's self noise would preclude passive detection of the submarine at any range, even if right on top of her. Likewise, if the sub was transiting at speeds greater than 20 knots and the surface ship remained at low speed, she would be easily detected at 3 to 5 times the range at which she might counter-detect the ship.

Ship Versus Sub, Passive Ops Below the Layer

In this situation, there is a single thermal layer at 200 feet. If a submarine is cruising beneath the layer at 400 feet, or

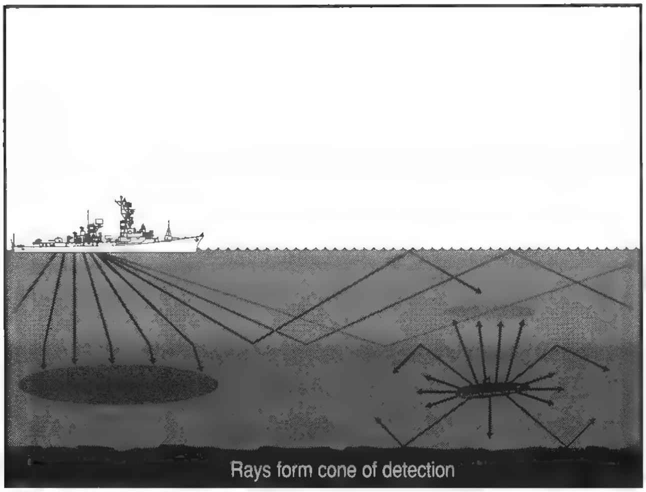


Figure 3-10. Detection ranges are shorter below the layer

best depth, the detection and counter-detection parameters change drastically. If both platforms remained at low speed, say 4 to 8 knots, for example, most of their radiated sound would be trapped on their respective sides of the layer. As such, only those sound rays emitted directly at the layer would penetrate, creating a narrow cone of noise. This cone could be detected by the opposing unit only when in close proximity to it. Detection and counter-detection ranges in this situation, therefore, would be extremely short. The submarine would still possess an advantage, but a hastily fired shot would be necessary to put the ship on the defensive.

As the speed of either platform increases, its capability to detect the other decreases, and its counter-detection range increases, though never to the same range as is experienced when both platforms are in the same layer.

As you might expect, you could substitute an enemy submarine for the ship used in each of the past two examples without altering the general conclusions that are drawn. Because enemy submarines are quieter than their surface counterparts, you should expect some reduction in the initial detection range. As always, this range is variable with speed, but a general rule of thumb is 25 percent shorter ranges against SSNs (attack submarines) and 40 to 50 percent shorter ranges versus SSBNs (ballistic missile submarines).

Multiple Layer Passive Ops

The most frequent condition you encounter is that of multiple thermal layers, which creates a complicated sound profile with more than one sound channel. Surface ships encountered in this environment are still subject to the conditions in the preceding examples. Submarines, however, are in their environment of choice.

Surface Ships Conducting Active Sonar Ops

Detection of the enemy is not an issue when they are using active sonar. The power levels generated by their transducers are so high that the water around the sonar dome literally boils with each transmission. In the proper water conditions, active sonar transmissions can be heard more than 100 miles from their point of origin. In many scenarios you encounter as a *Harpoon II* commander, many enemies who employ active sonar are immediately detected, if not classified.

Your objective, therefore, is to avoid counter-detection. In shallow water, where bottom-bounce conditions prevail, this avoidance is difficult. You should engage active platforms as soon as they come within your weapon's envelope, even if it means sacrificing the element of surprise.

In deeper water, use the shadow zone to your advantage. Resist at all costs the temptation to go active with your own sonar. You gain no tactical advantage by doing so and afford the enemy immediate targeting data.

Thermocline

Solar radiation heats the water's surface, and warms the surface layer, a channel of water beneath the surface extending 10 to 100 meters deep. Below the surface layer, temperature drops rapidly as depth increases in a region called the *thermocline.* The thermocline's depth and width vary greatly with season and latitude, with additional thermoclines forming above the permanent thermocline during particular seasons. The permanent thermocline extends down to 300 or 400 meters in equatorial waters and down to 500 to 1,000 meters in subtropical areas. Below the thermocline, temperature remains fairly constant to the bottom. In *Harpoon II*, the permanent thermocline always begins between the shallow and intermediate depth bands. The thermocline tends to collect both organic and inorganic material and therefore varies in density than its neighboring layers.

Background Noise

The ocean is an extremely noisy environment. Underwater volcanoes, waves, storms, and ocean animals constantly fill the depths with background noise. Every ship and submarine generates noise at it moves. The sonar operator must distinguish sounds generated by a hostile unit from the natural sounds of the ocean and from those generated by the operator's own ship and group. Low-frequency noises travel farther than high-frequency noises and are generally less distinguishable. Low frequency analysis requires a computer-controlled signal processor to monitor large sections of ocean and integrate the sounds detected therein. Over long periods of time, manmade sounds stand out, appearing relatively consistant opposed to the basically random environmental sounds. This signal processing takes time, though. In *Harpoon II*, passive low-frequency sensors continually gather data, but the program checks the results of signal analysis only approximately once every five minutes. High- and medium-frequency sounds can only be heard close to the source, but they stand out well against inherent background noises. Therefore, high- and medium-frequency sensors are sampled at the standard 15-second interval.

Under certain conditions, background noises become loud enough to mask all manmade noises. A ship or submarine at high speed generates sufficient noise to render its passive sonars useless. Wind and storms on the surface create waves. *Harpoon II* measures waves as sea state. Each sea state above 1 shortens passive sonar's detection range by approximately 15 percent. Shallow waters teem with life, waves crash against beaches, rivers merge, and the shallow bottom causes strange reflections. Sonar performance is significantly degraded in shallow waters.

COMMUNICATIONS

Communications between units shares sensor data, providing a complete look at the battlefield. When a unit withdraws from the communications network, either willingly or because of damage, it no longer exchanges sensor data with allied units. An out-of-communications unit proceeds according to its last known orders, accepting no new instructions until communications are restrored.

Submarines

Why, then, would any unit ever be intentionally removed from the communications network? When using "full realism" difficulty settings, submarines may communicate only when they're at periscope depth. Standard communication, such as radio, does not penetrate water well. *Extremely low frequency (ELF)* sounds can transmit messages deep under water, but they have an extremely low bandwidth, forcing ELF messages to be extremely brief. Consequentially, ELF transmissions are usually reserved

> **WAR LESSON 3.11**
>
> Submarines assigned missions "phone home" for new orders if they have no contacts to investigate. Under these conditions, submarines rise to periscope depth every third waypoint. Because the Mission Editor plots waypoints randomly, the interval between "phonings" is also random, but often spans days.

for emergency communications and are rarely used for routine conversations with patrolling attack submarines. When a submarine dives, unless it has been assigned the flagship, all contact is lost and the computer artificial intelligence controls it according to the last specified orders. Submarines on patrol eventually reestablish communications when they have completed their assigned task or have lost all contacts.

A submarine that is assigned to a mission and that has no contacts to investigate "phones home" for new orders *every third waypoint.* Because the Mission Editor plots courses randomly, the interval between "phoning" is likewise random. The interval often spans days; it is not unusual for a nuclear submarine to remain out of contact for several days.

Directional Communications

Harpoon II includes two types of communications between surface units: directional and broadcast. *Directional communications* transmit line-of-sight only. Any potential eavesdropper must lie directly between the two parties to even detect the transmission. Many directional communications transmit to overhead satellites and then back down to other allied units, making it difficult for eavesdroppers to lie along the communications path. *Broadcast communications,* however, simply transmit radio energy, much like an active radar. The communication itself may be scrambled and unintelligible, but enemy ESM gear will detect the EM energy and at least knows that *somebody is talking.* Using the passive-sensor techniques described earlier, the enemy may even pinpoint the transmitter.

Many aircraft communicate only via broadcast systems. Keeping them under the player's control means keeping a broadcast, or detectable, communications link established at all times. Certainly some tactical situations require stealth that is not available while maintaining communications. When you're preparing aircraft for a surprise attack, give them explicit and detailed orders before deactivating their communications. After their communications gear deactivates, the player cannot reestablish contact; the player must wait for the out-of-comm units to radio base and request orders.

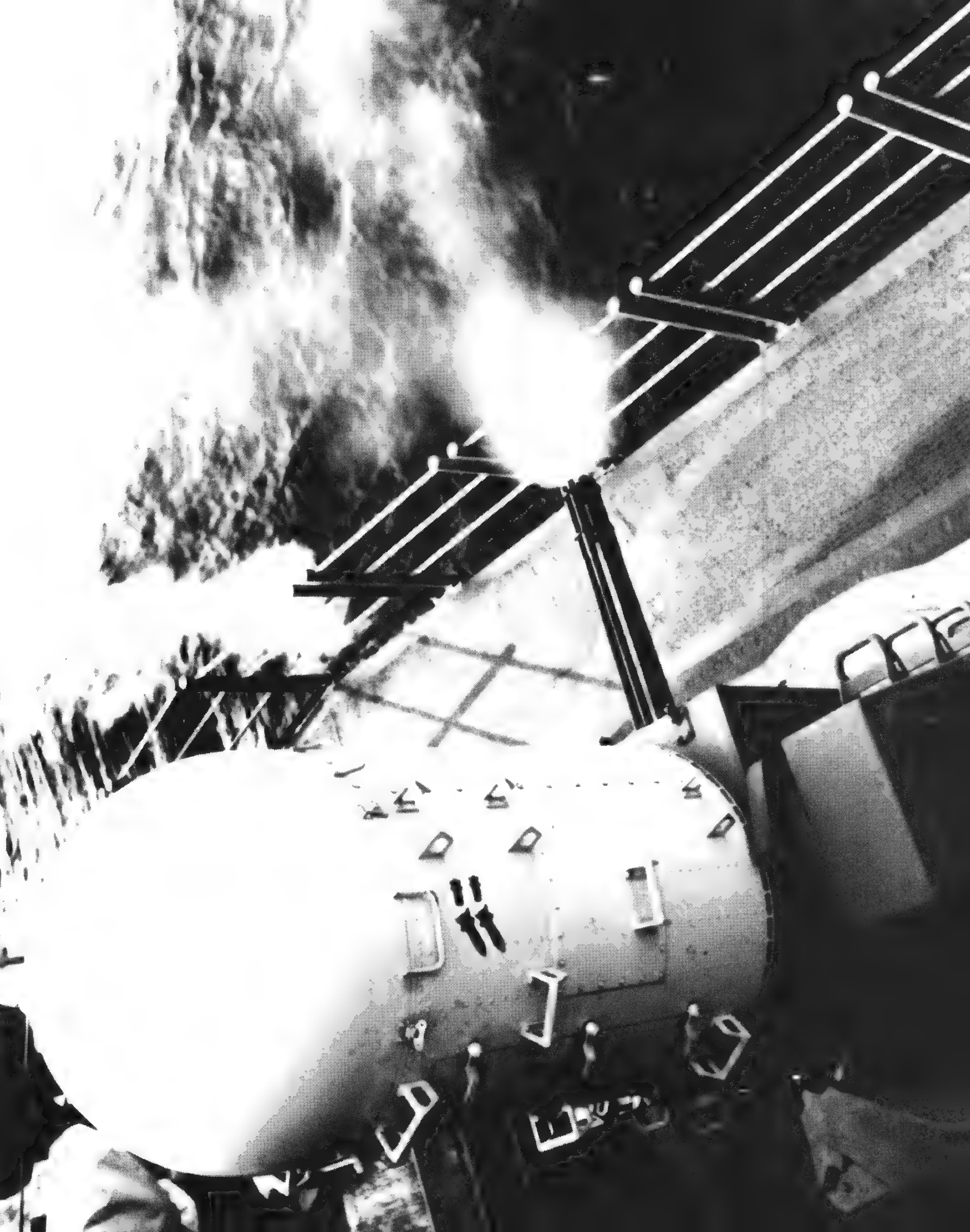
EMCON

EMCON, short for *Em*issions *Con*trol, is the task of managing active sensors and broadcast communications to maximize allied effectiveness while surrendering minimal information to the enemy. There are no definitive rules regarding EMCON. Effective EMCON requires experience, a thorough understanding of enemy ESM gear, and a healthy dose of "gut feeling." Broadcasting for two minutes will probably give the enemy a good fix on the transmitter's location. Broadcasting 45 seconds will certainly catch the enemy's attention, but may not provide an accurate bearing. Unfortunately, 45 seconds may not thoroughly examine the combat environment either. The battlefield commander must weigh the need for stealth and secrecy against actively examining the environment. In the end, it comes down to the types of sensors available and the commander's personal style. Try the following techniques:

- Use afloat active sensors randomly — never use a predictable pattern to active sensor use, and always keep active bursts as short as possible.
- Position active sources wisely — use airborne active sensors as much as possible and position them far from the main group. Provide sufficient defenses, such as patrolling fighters, to fend off the inevitable attack on the transmitter.
- Keep active sensors on at land bases — their position is already known. Active sensor use surrenders nothing.
- Use active sensors when threat of counter-detection is irrelevant — if the enemy knows where you are, active sensor use betrays nothing.

SECTION 2

TAKING COMMAND



4 Seapower and Maritime Strategy

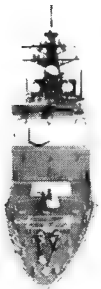
Every nation with contiguous shoreline has developed some form of maritime strategy. Maritime strategy is the delineation of national objectives relevant to the use of the sea. Such objectives might be as simple as the protection of coastal fisheries or they can include the protection of merchant shipping interests across the globe. Regardless of the breadth of issues encompassed by a given nation's maritime strategy, the measure of their ability to support that posture is *seapower.*

> **WAR LESSON 4.1**
>
> Of greatest importance to you, the battlefield commander, are specific force capabilities versus known and potential threats. These tactical capabilities can be quantified by operational analysis within acceptable levels of error. As such, a firm grasp on the manner in which these studies are conducted is essential to long-term success in *Harpoon II.*

Can seapower be measured? The mathematical discipline of operational analysis might lead us to believe so, but a firmer understanding of the differences between strategy and tactics proves that this isn't the case. Because seapower is an aggregate assessment of the offensive and defensive potential of all forces

Facing page: The last-ditch line of defense. Phalanx Close In Weapons System (CIWS) engages inbound hostiles. U.S. Naval Institute Archives

that may be brought to bear in the maritime environment, exclusive of a specific situation or opponent, it is a subjective determination. As such, the use of the term *seapower* is usually confined to policy and budgetary debates outside the realm of hostilities.



WHAT IS OPERATIONAL ANALYSIS?

In its simplest form, *operational analysis* (OA) is a mathematical assessment of probability and statistics that aids decision making. Because such analysis is complex and time consuming, it must occur during mission and contingency planning, as opposed to during the heat of combat. Properly conducted, OA studies are at the heart of formation management, force composition, strike planning, and virtually all other tactical decisions that occur before the initial salvo.

Though the OA process is complicated in execution, it is easily expressed in seven steps:

1. Define the problem statement clearly.
2. Determine the relationship of constants and variables in the equation.
3. Define the desired objective.
4. Evaluate all contingencies against the expected outcome.
5. Eliminate actions that do not meet the objective.
6. Refine the model if necessary.
7. Repeat the process until ambiguity between remaining courses of action is resolved.

One thing should be apparent from this definition, OA is *not* an exact science. Two commanders beginning with identical problem statements and expected mission objectives may approach the tactical situation in vastly dissimilar ways. Their differences are often based on subjective factors, such as prior experience in similar situations, but it will influences the objectivity of the OA process because of the weight they attribute to certain variables.

Does this render the process invalid? Certainly not. Both commanders in this example have used the quantitative approach to develop logical solutions to the same problem. That the solutions are different is irrelevant. Each is capable of accomplishing the objective within the range of error built into the statistical model.

PUTTING IT INTO PERSPECTIVE

Undoubtedly, this discussion of probability and statistics has caused more than a few of you to cringe in anticipation of the first equation. Fear not — you have not purchased a math book by mistake. OA methodology is used to illustrate certain planning considerations in Chapter 5, but the intent is not to force mastery of this difficult topic. If you want such a course of study, no greater textbook can be found than *Naval Operations Analysis*, available from the Naval Institute Press. In lieu of making you a mathematician, however, the goal of this book is to make you a tactician. Becoming conversant in operations analysis is only one step of that process.

Played at the maximum difficulty setting, *Harpoon II* requires you to think like a naval professional and holds you accountable if you do not. You are given less and asked to do more with it. If you are unable to fill in the gaps in information provided, whether it's proper evaluation of limited intelligence or redistribution of force posture to meet an emerging threat, you will fail. Naval officers have luxuries you do not have, in the form of ongoing experience and some of the finest training in the world. You have a bigger luxury. If you are wrong, it doesn't kill you.

Herein, we eradicate as much as possible the disparity in knowledge that exists between you and the naval professional in an unclassified text. You learn to evaluate, anticipate, and, above all else, decide. These are the functions of leadership, and, by purchasing *Harpoon II* and this text, you are bound to uphold them. The journey is long and arduous but, for those who persevere, the rewards are immeasurable.

THE MISSION

In all strategic and tactical thought, the primary emphasis must be placed on the mission. Strategic missions are broad-based general statements in support of the national maritime posture. *Harpoon II*, as a rule, does not deal directly with strategic missions. Tactical missions flow from strategic objectives, however, and it is here that the *Harpoon II* commander interacts with the big picture.

Specific tactical objectives differ, but all naval missions fall within one of three broad categories: sea denial, sea control, and power projection. Each nation possesses varied capabilities to execute the different mission types. Furthermore, within a given navy, the grouping of different units into task forces dictates the indigenous on-scene capability to act in support of one or more of the three mission profiles. To be successful, therefore, you must be capable of correctly identifying the type of mission required and allotting a task force capable of completing the objective. Subsequent to the discussion of the three mission profiles, you are introduced to some of the broad weapons systems that are best suited to each strategy.

Sea Denial

The objective of *sea denial* is inherent in its title: to deny the enemy free use of the sea for its own objectives. As a rule, sea denial campaigns are methods of limited warfare practiced by inferior forces against a superior foe; guerrilla warfare at sea, if you will. For this reason, they are rarely decisive for the practitioner, at least with regard to forcing a shift in the balance of power. These actions do, however, afford some other advantages to astute commanders.

First, in pursuing sea denial, you generally have the option of determining the time and method of engagement. You have the offensive initiative, and your opponent must constantly be on defensive alert. If insufficient force may be brought to bear or the risks of a given attack are too great, you don't have to commit to the battle and waste precious assets. Instead, it is possible to delay the impending attack until the tactical situation is more favorable.

Second, successful sea denial does not require you to destroy every enemy unit — only a sufficient portion to render the enemy's objective untenable. Such losses are referred to as "unacceptable losses," and the origin of their lack of acceptability may be either militarily or politically motivated. In the first instance, inadequate forces remain to physically complete the mission at the desired level of risk. In the second, sufficient force may remain, but the loss of a politically sensitive unit forces the offending nation to reevaluate its strategy.

To illustrate the latter case, consider the punitive strike conducted on Libya by U.S. forces. Part of the dispute between these nations involved Libya's proclamation of a "line of death" in the Gulf of Sidrah, an area clearly recognized as international waters. In essence, Libya had declared a sea denial campaign and threatened the safety of all intruding ships and aircraft within the contested area. As part of the U.S. Navy's policy of "freedom of navigation" to reinforce international recognition of the 12-mile territorial limit, units began to challenge Libya's threats head-on. Granted, none of Khadafi's naval or air forces were a match for U.S. might but, had the Libyans succeeded in damaging a U.S. carrier or in inflicting hundreds of casualties during these skirmishes, they could rightfully have claimed victory. Why? Because popular and political pressure at home in the U.S. would have found these losses unacceptable in the face of the given adversary.

WAR LESSON 4.2

A campaign of sea denial is most appropriate when you are faced with a superior adversary. Properly conducted, it can force a political resolution more favorable than the eventual military outcome or, as a minimum, delay the enemy advance long enough to allow friendly forces to commit a more capable defense.

Sea Control

Sea control, the antithesis of sea denial, is the practice of constructing task forces of sufficient multimission capability to preclude the enemy from confounding operational plans. Put simply, it ensures that you can go where you want to go and do what you want to do whenever you want to do it. Through proper task-force construction, screening, and surveillance, you ensure that every precaution has been taken to meet enemy threats as they emerge.

Because proper sea control requires a preponderance of force in the field, it is never practiced by the inferior side.

Despite the quantitative or qualitative advantage inherent in the adoption of a policy of sea control, it is still possible to lose that advantage through poor resource management. One of the most common mistakes in this respect is the adoption of a policy of dispersal vice concentration.

To explain, if you are in possession of the superior force, it should be concentrated in such a way that units are mutually supporting for defensive and offensive purposes. This does not mean that every asset has to be in a single group; simply that it is better to build two strong, self-sufficient groups than four smaller, less capable groups. Granted, you are placing your eggs in fewer baskets, but the baskets are more durable.

Conversely, inferior opponents cannot meet concentration with concentration because the odds are stacked against them. As such, they adopt a posture of dispersal. By putting their eggs in many baskets, they are hoping that at least a few of them will make it to market without being broken. If they succeed in this endeavor, the campaign of sea denial defeats that of sea control.

If you, as the superior force, adopt dispersal versus dispersal, you have completely sacrificed the initial strength advantage and have compromised overall survivability. Furthermore, you gain no tactical benefit from doing so unless the dispersion was necessary because of the presence of tactical nuclear warheads in the enemy arsenal.

WAR LESSON 4.3

Sea control is appropriate whenever one possesses a distinct numerical or qualitative advantage over the enemy. Furthermore, in the conduct of such a policy, concentration of force is of paramount importance. Failure to do so often results in defeat in detail.

Power Projection

Power projection is also somewhat self-explanatory. It is the capability to project power into enemy territory for the accomplishment of military or political objectives. Less apparent, perhaps, is that a measure of sea control must be gained in order for power projection to be successful. The apparent exceptions to this rule are submarine-based ICBMs and ship- or sub-launched land-attack cruise missiles, such as TLAMs. Closer analysis yields that these are not exceptions, however, but rather long-range extensions of the same idea. It is still necessary for the bastions from which these launch platforms can reach their targets to be firmly within the control of the side contemplating the action. If this were not the case, the platforms themselves would be subject to attack.

The classic case of sea control in support of power projection is that of the amphibious assault. Because of the prolonged time on-station required for the insertion of a landing force and subsequent support of the beachhead, amphibious operations place ships in greater peril than do any other type. As such, without sea control of the amphibious-objective area, such operations are simply too risky to conduct.

The most recent example of effective sea denial that precluded power projection was the mining of the Kuwaiti coastline during Operation Desert Shield and Operation Desert Storm. With an antiquated mine inventory valued at less than $1 million dollars, Iraq

WAR LESSON 4.4

The lessons to be learned from that situation are twofold. First, only a superior force can conduct sustained power-projection operations. Second, with proper planning and limited resource use, an inferior force is still capable of denying such operations for an extended period of time.

succeeded in immobilizing an entire amphibious task force and complicating its contribution to the eventual liberation of Kuwait.

THE WEAPONS OF DENIAL

Although virtually any weapons system can contribute to a campaign of denial, the premiere players in this arena are mines and submarines. Their effectiveness in this role, however, hinges on proper employment. In the next few sections, you are introduced to these assets from a big-picture standpoint. In Chapter 8, you are provided with all the salient detail necessary to incorporate these assets into a *Harpoon II* battle plan.

Figure 4-1. Attack submarines (SSNs) are the premiere weapons system for a campaign of sea denial

Weapons That Wait

Of all weapons, mines are the only ones designed exclusively for the role of sea denial. They are inexpensive to produce compared to other weapons systems and can provide a tactical benefit far in excess of the costs necessary to deploy them. Their versatility in application is also noteworthy. Mines may be employed offensively or defensively, covertly or overtly, and the mere threat of uncertainty that surrounds a suspected minefield is often sufficient to give pause to the most capable forces.

Each nation possesses varied capability for mine and counter-mine operations. The full extent of these capabilities may be accessed in the *Harpoon II* database. To understand some of the data fields listed therein, you should first have a grasp on the different mine types and their capabilities.

Mine Types

The first mine that was devised, more than 100 years ago, was essentially a moored contact mine. The design proved so credible that it has continued in different iterations to this day. Because it has been around the longest, this design is also the easiest type of mine to counter. Unfortunately, mine design continues to outstrip countermine technology, and many other types frequently elude the most dedicated sweeping efforts, requiring individual attention to counter.

Today's mines include floating mines, magnetic mines, pressure mines, acoustic mines, electrode potential mines, and combinations of these types. Pressure mines lie on the bottom in shallow water and detect the pressure wave generated by a ship's hull moving through the water. Designed to detonate when peak pressure is reached, they may also be equipped with counters to allow the passage of a preset number of ships before arming themselves. These types of mines are particularly difficult to sweep using conventional methods. Acoustic mines can be programmed to look for a particular sound signature, whether it's a class of ship such as an aircraft carrier or even, for some advanced manufacturers, a specific hull within that class. That's right — somewhere in the world today, a mine may have the USS *Nimitz*'s name written on it.

Magnetic mines are most effective against noncombatant ships, such as merchants and auxiliaries. The reason for this segregation is that most warships employ some form of degaussing, which reduces their susceptibility to this type of mine. For this reason, many magnetic mines also employ other detonation triggers, including any of those discussed thus far. Indeed, these combination mines are the hardest to sweep. Because of that, they are also the most prevalent among technologically advanced nations. Less developed nations are most likely to employ moored and floating-contact mines because they are the least expensive to construct.

The final type of mine to be discussed is the captor mine. The term CAPTOR stands for en*cap*sulated *tor*pedo. These mines are actually acoustically triggered, but they are discussed separately because they are designed exclusively to counter enemy submarines. They seek a submarine sound signature and, when the signature goes from up Doppler to down Doppler, signifying the closest point of approach to the mine, the torpedo is released. Currently *Harpoon II* supports no mines, though they might be added in a future upgrade.

Offensive Employment

Offensive minefields are placed either outside the enemy's ports to affect containment or in other chokepoints through which they must transit to reach the area of operations. In the former case at least, covert insertion of the minefield is necessary. The platform of choice for covert mining is the submarine. The mining of straights and narrows, also known as *chokepoints*, may be covert or overt. The former is more likely to inflict some surprise damage on a passing ship, though it may not be the desired target. The latter can offer a more significant psychological advantage and delay the enemy approach even more. The reason is that, if an area is known to be mined, the opponent must devote considerable time and effort to clear a channel through that minefield before any high-value units are allowed to transit it.

Defensive Employment

Defensive minefields are generally placed in home waters with known transit channels for friendly shipping. They can be small-scale undertakings around ports and harbors, designed primarily to ambush enemy submarines, or they can be full-scale barriers to protect an entire coastline from amphibious assault or any other in-shore operation. The presence of the latter type during World War II is what precipitated the formation of Navy Underwater Demolition Teams (UDTs). These units are trained to clear landing-craft approach lanes before the initial assault. Unfortunately, because of budgetary constraints and other considerations, there are many fewer of these types of units than there used to be. Therefore, they are not directly modeled in the *Harpoon II* system. All countermine efforts in *Harpoon II* are undertaken exclusively by MCM-capable shipping and helicopters. To explain their use, it is first necessary to analyze how *Harpoon II* models mine warfare.

The Numbers Game

Although the *Harpoon II* mapping system is capable of displaying any location in the world down to a few square meters, to plot the exact location of every mine deployed in the game would overload the game's memory requirements. The design team plans, therefore, to go for a simpler method of calculation. You specify the area to be mined in the form of a polygon, and then allot however many mines to that area you want, up to the maximum inventory on hand. With this data, the program automatically calculates field density, which acts as a percentage chance of detonation against any target that enters the field. The damage inflicted from the detonation is a factor of the target type, mine type, and the proximity of the blast, which is randomly generated within the governing algorithm.

Likewise, efforts to clear a given minefield are handled in the abstract. Each MCM capable unit is rated for effectiveness and, the smaller the area swept per unit time, the greater that rating. In other words, an MCM sweeping at bare steerageway of 3 knots is more likely to find and eradicate mines than one attempting the same operation at 12 knots, but it takes four times as long to cover the same area. The latter is likely to become a casualty itself, in fact, if influence mines are present. The more MCM assets involved in the operation, and the more time they spend in the area, the lower the field density of the minefield becomes.

Several things are important to understand about this relationship. First, the MCM assets do not know the exact boundaries of the field. Considerable time may be wasted, therefore, sweeping areas outside the field. Second, despite the most concerted MCM effort, it is almost impossible to reduce the field density to zero in the course of a game. The mine threat, therefore, never really goes away — it is simply diminished to the point where the aggressor is willing to take the risk and transit the field.

WAR LESSON 4.5

After mine-laying has begun, it is impossible to determine the extent of the actual threat until the area has been thoroughly swept by MCM assets. In the ensuing period, which can prove quite lengthy, the commander is constrained in all subsequent tactical thought and has lost the advantage of strategic mobility. Because of that, any inferior force with mine assets can, with proper employment, pursue a campaign of sea denial for an extended period.

Silent but Deadly

Submarines retain the distinction of being the second weapon of choice in any campaign of sea denial because they are often the first platforms to enter a contested area. Silent and swift, submarines are capable of inflicting the first punch and then slipping away to return at their leisure. Because of their stealth, they remain the most survivable platform in the field. When their activities are coordinated via effective surveillance and intelligence gathering in the targeted sector, a properly managed hunter-killer group is capable of immobilizing and destroying any size force that lacks strong ASW capability. Furthermore, even in the presence of good ASW, submarines are often capable of inflicting excessive damage for their numbers. Also, as previously mentioned, these assets are capable of conducting offensive mining operations.

As before, for submarines to play their part in a campaign of denial, they must be skippered by competent players. The next few sections introduce you to the basics of submarine operations. For additional detail on their incorporation into an overall battle plan, refer to Chapter 8.

Take Her Down

Submarines are largely independent players in most operations. They are provided with a mission, specific rules of engagement, and designated reporting periods and conditions. Beyond that, submarine skippers are afforded a tremendous amount of autonomy in the completion of that mission. Realizing this, the *Harpoon II* designers have taken many steps to eliminate the micromanagement that occurred in earlier versions of the system.

In *Harpoon II* submarines will reestablish contact every third patrol leg. While at periscope depth with its communications mast raised, the sub is more vulnerable than at other times. Therefore, you must maximize these limited opportunities to alter submarine rules of engagement (ROE), mission tasking, and movement orders.

When submarines fail to make a scheduled reporting period, it can mean one of several things. The worst possible scenario is that the submarine has been detected and sunk since the last reporting period. Another alternative may be that the submarine is in the process of an engagement at the time of reporting and is not risking detection until after the engagement has been completed. A third possibility is that the submarine conducted an engagement earlier in the period and sustained damage that precludes communications. In any of these instances, you have to wait until (as a minimum) the next communications period or until the end of the game to ascertain the fate of the submarine in question.

Submarine Missions

Submarines may be assigned to a variety of missions, inclusive and exclusive of the sea denial role. Within that role, submarines may conduct covert mining (as discussed earlier), commerce raiding (as was the practice in WWII), and pursue enemy task forces. In all capacities, patience is the watchword.

Exclusive of sea denial, submarines may be used for reconnaissance, early warning, strike warfare, and battle damage assessment (BDA).

The only other mission area is unique enough to warrant its own coverage. Specifically, we are referring to a submarine operating in direct support of a battlegroup (SSNDS). This asset is usually stationed in a distant sector on the Formation Editor as an ASW barrier patrol. Because of the

WAR LESSON 4.6

The savvy submarine commander does not rush into position in the hope of getting off a quick shot and retiring. Instead, the methodical approach is best. Maneuver for firing position while remaining below cavitation speed. Use stealth and surprise to advantage. Deliver a decisive salvo of torpedoes or missiles when the enemy has little time to react and escape in the ensuing confusion.

special communications gear contained in the active sonar suites of surface ships, submarines operating directly with the battlegroup may be alerted to come to communications depth at any time. The device that facilitates this communication in the U.S. Navy is known as Probe Alert. Because these transmissions are distinctive, commanders sometimes radiate them even when a submarine is not operating in direct support to cause any enemy submarines in the area to suspect the presence of an SSNDS asset.

THE WEAPONS OF CONTROL

All weapons systems are capable of supporting sea control, but good sensor management forms the heart of this strategy. Though you may not consider sensors to be weapons systems, in reality they are the prime weapons system, without which no others would be viable. To comprehend this rationale, you only have to consider the sequence of engagement. To prosecute any contact, it must first be detected, localized, tracked, and targeted. Inaccuracies in any of these four steps preclude an accurate firing solution. Without an accurate firing solution, the contact cannot be engaged and the threat it presents remains valid.

Search Plans

Figure 4-2. Sensors, like this variable-depth sonar on a Knox-class frigate, are at the heart of any strategy of sea control.

The outcome of most engagements in a war at sea is determined before the initial salvo. Indeed, the commander with the most effective search plan usually emerges victorious. To develop search plans that maximize the strengths and minimize the weaknesses of friendly forces, the prudent *Harpoon II* commander must be completely conversant with the nuances of both acoustic and electromagnetic sensor modeling, as explained in the game manual on pages 156-160.

For the purpose of planning search or scouting strategies, the generic term *sensors* includes every active and passive asset available, from the Mark 1 Mod 0 eyeball to the SPY-1 radar system. The tactical nuances of sensors provided in Chapter 3 are important, but you should avoid trying to match detail to the concepts about to be presented until you fully understand them. For now, you must concentrate solely on the importance of scouting to the overall battle plan.

When weapons were limited to line of sight, the lookout on the masthead sufficed as a complete scouting plan. With each increase in weapons range, however, the scouting problem is additionally complicated. Remember that, in war at sea, the range rings of the various weapons systems radiate

> **WAR LESSON 4.7**
>
> As a practitioner of sea control, remember that you possess a superior force which is concentrated and mutually defensible but that you cannot shoot what you cannot see. Therefore, the first steps in any effective sea-control policy are the establishment of search plans and emissions-control policies (EMCON) that support the objective.

concentrically from formation center. If you cut a 60-degree slice of that pie in the direction of formation travel out to 100 nautical miles, for example, it represents a fixed area of scouting that must be covered. By increasing the outer boundary to 200 nautical miles, you quadruple the area to be scouted rather than just double it.

Using this example, it becomes evident that the maximum effective range of the enemy's most capable weapons system is a baseline attribute of any scouting plan. If the enemy's most capable weapon is either an air- or surface-launched variant of the Harpoon missile system, your basic search plan must ensure that any aircraft or ship that approaches close to that 60-mile window from your force has been detected, tracked, and localized. If someone has reached a point where he can shoot you, you must be aware of that. Ideally, however, you want to have detected him well before he can reach his launch points, so as to allow yourself battle space to react to the emerging threat. Because of the need for that reaction time, the effective rule for any scouting plan is in War Lesson 4.7.

Sensor Management

Chapter 3 introduced you to some of the fundamentals of sensors and introduced the ongoing debate about the tradeoffs incumbent in passive versus active sensor use. Before delving into specific situational sensor strategies in Chapter 5, you must first place the entire issue in perspective. In doing so, you will find that, regardless of the type of confrontation (air versus surface, surface versus sub, and so forth), a general framework exists for sound tactical decision making.

> **WAR LESSON 4.8**
>
> The maximum range of your search/scouting plan should equal 1.5 times the maximum range of the enemy's most capable weapons system.
>
> Naturally, if you have the capability to search at greater distances than that amount without unduly taxing the group's resources or volunteering too much information to the enemy, you should do so. An example might be conventional CVBG ops against a diesel submarine threat equipped with 10-mile torpedoes. Though detection at 15 miles might afford sufficient time to counter the threat, the BG could certainly field a 60nm screen without compromising other mission areas, so why not do so?

Area Versus Local Encounters

It has been noted that, regardless of the tactical environment, encounters may be distilled into three distinct phases: detection, localization, and prosecution (that is, engagement). Purists might want to add classification and damage assessment to this listing, but, for our purposes, classification is considered integral to localization, and damage assessment a part of the prosecution effort. In this analysis of the three primary tactical environments — surface, subsurface, and air — tactics are evaluated for both area and local encounters in light of the aforementioned three phases.

ASW

Consider first the vital task of anti-submarine warfare. Soviet emphasis on noise reduction and deployment of advanced torpedoes (including several varieties of wake-homers) have served to greatly enhance the survivability of their submarine forces and, to a lesser degree, those of their export customers. These technological advances have also increased the chances for Soviet-built submarines to infiltrate U.S. formations and wreak havoc on high-value units before being counterdetected. A great deal of pressure has been placed on Western forces, therefore, to conduct successful area ASW.

Area ASW relies almost exclusively on passive acoustic technology, a field in which the U.S. retains a slight qualitative advantage over the Russians. The detection phase for area ASW can commence via HUMINT (that is, spies), space-based sensors, SOSUS, sonobuoy, towed array, or active sonar CZ contact. HUMINT, SOSUS, and space-based sensors can also provide target information to friendly SSNs via the SUBOPAUTH communications network. After a search area is determined, SSNs utilize onboard passive sensors to localize and track potential targets. When a target is identified, the objective is to close within weapons range undetected and launch a passive surprise attack. If the initial attack is unsuccessful or if an SSN is itself surprised, active sonar is employed to complete prosecution.

SSNs performing local ASW operations, such as choke-point protection, do not have to rely on outside support to vector them toward their targets. Instead, these submarines can remain totally inactive until targets approach to within their weapons-release range. Again, however, the emphasis remains on passive acquisition and targeting. With regard to the SSN ASW mission, therefore, tactics for area and local engagements are essentially the same.

Area ASW has traditionally been the primary mission of maritime patrol aircraft because of their range, endurance, and payload capabilities. The methods these aircraft employ include magnetic anomaly detection (MAD) and acoustic processing of both passive and active sonobuoys. Passive sonobuoys are deployed in patterns, spaced at distances equivalent to their detection range, and account for the vast majority of initial contacts made by these aircraft. Active buoys and MAD are utilized for localization and determination of attack criteria. Operation Ratcatcher, in which Sweden must counter an unknown submarine threat, provides some excellent opportunities to utilize maritime patrol aircraft in this manner. For additional details about those specific tactics, see Chapter 7.

The primary sensor for area ASW in the surface community is the towed array sonar. Ideal area prosecution for surface units involves minimal risk to the detecting platform. Contact is made via passive sonar, and indigenous air assets are launched and vectored to the target to prosecute. Helicopter assets utilize either sonobuoys or MAD to localize and launch against the target. Dipping sonars, if available, are also excellent tools for this task.

If surface units did not have the luxury of indigenous air assets, they would be required to close to within the submarine's weapons envelope before conducting any attack — a distinct disadvantage and very difficult without being counterdetected, unless the target submarine is transiting at high speed. Surface units, devoid of air assets, are therefore the poorest choices of all in area ASW missions.

In localized ASW, the surface platform is capable of utilizing active sonar to its advantage because the element of surprise has already vanished. In fact, in all the instances discussed thus far, the primary consideration for changes in tactics has been the point at which the element of surprise is lost, as opposed to changes driven by area versus local engagements. It becomes important, therefore, to examine AAW and ASuW to determine whether the same conclusions are applicable.

AAW

With regard to anti-air warfare, operational commanders must assess the level of threat in conjunction with the nature of the mission. The goal is to strike an appropriate balance between the information given away via electronic emissions and the information required for the defense of friendly forces. For example, assume that the mission requires transit to a point off the enemy coast in a power-projection role. This is an example of an area AAW mission to establish sea control for subsequent operations.

In this instance, the need to avoid detection until after the completion of the initial strike sortie dictates a policy of total EMCON during the approach phase. After the carrier air wing has conducted its initial strike, however, the presence of the CVBG is known and the use of active air search sensors provides an extra measure of detection without telling the enemy anything he doesn't already know. The CVBG has progressed from an area to a local AAW problem and, concurrently, from passive to active tactics. Again, you see that, as soon as the element of surprise is lost, emissions tactics change.

Figure 4-3. EW Technicians conduct OTH targeting via correlation of passive ESM cross fixes.

ASuW

Area ASuW tactics revolve around over-the-horizon (OTH) targeting via air assets, either indigenous to the ship or CVBG, or provided via an external source, such as maritime patrol aircraft. Long-range anti-ship cruise missiles such as Tomahawk and Harpoon can be launched via second-hand OTH data, such as that provided via aircraft or via passive ESM cross-fixing. In either case, when attacks are conducted in this manner, the attacking unit is not required to actively radiate its own sensors and can therefore usually remain unmolested by a counterattack. This also means that it is free to conduct follow-up attacks as required.

After it's detected, however, the unit or group of units is considered to have entered a local ASuW situation, in which it is advisable again to switch to active tactics. By powering up its radar after detection, the group or unit is capable of mounting a more effective AAW defense and, therefore, is more survivable under the new circumstances.

Emissions Posture Summary

By now, it should be apparent that tactical differences exist between area and local engagements in all the major warfare areas: ASW, AAW, and ASuW. More significantly, however, these shifts in tactics are driven less by geographic factors than by the element of surprise. When the enemy is uncertain of your location, passive tactics are the norm. After you have reason to believe that you have been detected, it is far safer to switch to active tactics than to go to your grave quietly.

> **WAR LESSON 4.9**
>
> All engagements may be classified as area engagements and are therefore driven by passive tactics, until such time as the unit or group has been detected by the enemy. When this detection occurs, the encounter should be reclassified as a local engagement and survivability of friendly units enhanced by a shift to active tactics.

CVBGs, Sea Control, and Power Projection

As noted, it is impossible to discuss power projection exclusive of sea control. Power projection can be utilized to attain a measure of sea control, and sea control provides the safest environment from which to conduct power-projection operations. The term *sea control* must be understood to include control of the airspace above, and waters below, the area in question. The primary sea-control force for the U.S. is the CVBG. To establish sea control, the CVBG possesses a number of capabilities and must assess which of these to exploit on a case-by-case basis centered on the existing threat.

If the primary threat to sea control involved enemy submarines, for example, CVBG ASW forces would be required to sanitize forward areas before the arrival of the carrier. The greatest degree of success could be expected through utilization of the supporting arms concept via combined air, surface, and subsurface prosecution of the threat.

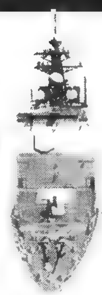
If enemy surface units posed the primary threat, the ideal prosecution is via war at sea (WAS) strikes using HARM and the air-launched variant of Harpoon. In this manner, the threat can be eliminated by engaging the enemy far from friendly units with assets that are easily reloaded (as opposed to the fixed missile inventories of surface combatants). Failing this option, the secondary choice is prosecution via a detached surface action group (SAG). Each of these options draws potential defensive resources away from the CVBG, however, and must be carefully considered whenever more than one threat to the CVBG exists.

Whenever the primary threat to sea control is either land- or sea-based aviation, your paramount concern must be the destruction of the enemy's capability to mount the threat rather than the destruction of the threat itself. By this, we mean destruction of the aviation-capable ships or neutralization of the enemy airfields wherever possible. Failing this, control may also be derived by destruction of the airframes themselves via CAP and AAW defensive fire.

Whenever the CVBG is forced to operate in a hostile multi-threat environment, it faces the greatest difficulty in establishing sea control. Combinations of the area and local tactics discussed up to this point have to be orchestrated precisely, in such a way that the CVBG commander accomplished the desired objectives in all areas without opening up to potential retribution in any of the three areas. Naturally, the greater the number of available resources to each mission area, the easier the task. After sea control is established, classical power projection operations, such as naval gunfire support (NGFS) and amphibious landings, may be conducted under the protective umbrella of the carrier airwing.

WAR LESSON 4.10

CVBG combat operations are generally offensive in nature, are forms of power projection, and strive to attain sea control. After sea control is achieved, CVBGs are utilized more frequently in a defensive role for other forces, such as amphibious groups and convoys.



THE WEAPONS OF POWER PROJECTION

Given that the CVBG has just been portrayed as the premiere weapons system for both sea control and power projection, due to the interlinked nature of these missions, it is now important to address the other players, both those who are integral members of the CVBG and those who are not. The former include the carrier airwing and all forms of cruise missiles, and the latter include ballistic missile submarines and amphibious assault groups. Though some purists might argue the point, all these weapons systems can collectively fall under the heading of strike warfare.

STRIKE WARFARE

Whereas power projection deals almost exclusively with operations designed to project power ashore in support of the land battle, strike warfare allows for all of that and a slightly broader view as well. Strike warfare also encompasses over-the-horizon operations against targets at sea. Because of that, planning considerations relevant to the use of cruise missiles and carrier air assets must be discussed first.

Strike Planning/Tomahawk

The recent introduction of vast numbers and types of Tomahawk-capable platforms has provided strike planners with a great deal more flexibility than they have enjoyed in the past. For conventional strikes, surface- or subsurface-launched cruise missiles may be utilized in complement of tactical air (Tacair), thereby increasing its effectiveness, or independently if the circumstances dictate such employment. For tactical- or operational-level nuclear warfare, the introduction of nuclear-capable Tomahawks has vastly complicated enemy countertargeting and defensive efforts.

Specific points to consider about Tomahawk employment include:

- The greatest advantage of either variant of Tomahawk is the elimination of aircrew risk. It is sometimes militarily or politically unacceptable to accept the possibility of downed aircrews turning up as POWs in media coverage. In such instances, Tomahawk provides a viable, albeit expensive, alternative.

- With regard to expense, the nature of the target must be valuable enough to justify the expenditure of this weapons system. Conventionally delivered munitions are more numerous and vastly cheaper unless, because of the defensive posture of the enemy, projected airframe losses would override the cost of the Tomahawks anyway.
- Exclusive of the nuclear variant, warhead size might also pose a factor in the determination of whether to use Tomahawks. If the target were sufficiently hardened, more missiles might be required to ensure a hard kill than are available for expenditure.
- In some instances, the absence of a thinking, reacting aircrew might also be a detriment to mission accomplishment. Against potentially mobile targets or targets on which the intelligence was somewhat dated, it would be difficult to develop any degree of certainty with regard to exclusive Tomahawk strikes.

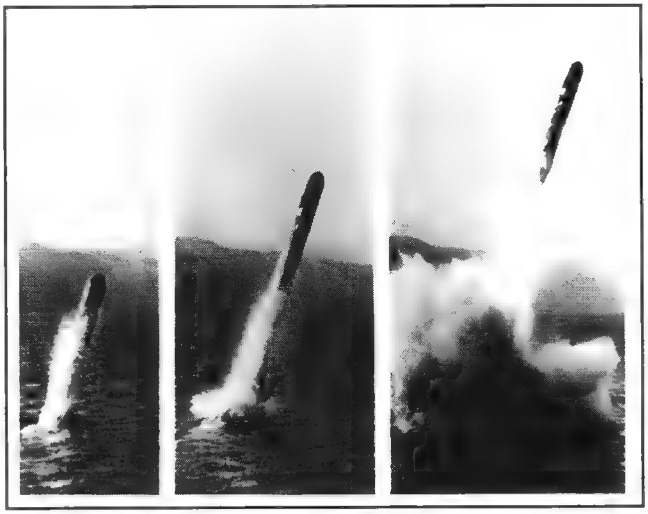


Figure 4-4. Submerged launch of a Tomahawk cruise missile. Properly equipped SSNs can operate close ashore as a tremendous force multiplier for strike planners.

- Terrain around the proposed target may restrict or channel the avenues of approach for conventional airstrikes into enemy "killing zones." In these instances, the terrain-following package of the

Tomahawk missile could allow attacks from an unexpected quarter, thereby achieving surprise and increasing the survivability of individual missiles.

- Tomahawk-only strikes do not possess the advantage of indigenous suppression assets that would be included in a normal airstrike (that is, standoff jammers, HARM, or SHRIKE). Also, Tomahawks do not possess terminal defensive measures, such as chaff and IR decoys.
- The exceptionally low flight profile and radar cross-section of the Tomahawk missile significantly decreases enemy-detection capability and, consequently, reaction time.
- Time constraints of the mission itself can also be a factor. If a quick reaction strike is necessary, insufficient time might exist to program the missiles for their intended targets. Conversely, however, if the targets are part of the preprogrammed library of threats, TLAMs can be airborne in much less time than it takes to brief, load, and launch a strike package based on carrier air.
- Tomahawks are "fire and forget" systems, but they also cannot be recalled after they are launched.
- Tomahawks are not as influenced by weather as Tacairs are.

WAR LESSON 4.11

The decision to include the Tomahawk in any strike package is highly dependent on the nature of the expected threat, the amount of damage required, cost comparisons (including the non-quantitative factor of aircrew risk), and other factors particular to the specific situation, all of which must be considered before Tomahawks are committed.

- Finally, and most important, Tomahawk affords flexibility to the strike planner because it is no longer necessary for the presence of an aircraft carrier to threaten or actually conduct strikes against the shore.

Strike Planning/Aircraft

Given the aforementioned flexibility afforded strike planners due to the introduction of the Tomahawk, the focus must now turn to the strengths and weaknesses or using conventional airframes instead. In this discussion, you will find that many of the weaknesses noted about cruise missiles are concurrent strengths for manned aircraft and vice versa. As such, the two types of airframes generally complement one another very well whenever joint strike packages are both feasible and appropriate.

Specific considerations about the employment of conventional aircraft for war at sea (WAS) strikes include the ones in this list:

- Coordination to achieve simultaneous time on top of the intended target is easier with a manned WAS strike than with salvos of cruise missiles from several firing platforms, some of which may be widely separated and therefore at a communications disadvantage.
- WAS strikes can provide indigenous jamming support in the terminal phase.
- WAS strikes are not limited to a preset trajectory and may maneuver to avoid or complicate defensive fire.
- WAS strikes may carry a greater variety of ordnance, thereby allowing strike planners to tailor loadout

to target type as well as to include ordnance specifically designed to suppress the target's defenses, such as HARM or Shrike.

- WAS strikes can perform a degree of battle damage assessment before returning to base.
- Based on this capability, WAS strikes also have the flexibility of greater secondary target selection in the terminal phase, thereby minimizing the expenditure of ordnance on primary targets that have already been incapacitated.
- WAS strikes are more detectable en route than sea-skimming or terrain-following cruise missiles.
- WAS strikes require more time to assemble and proceed to the target.
- WAS strikes encompass a risk to life whereas cruise missiles do not.
- WAS strikes are more easily engaged by interceptor aircraft than their counterparts are.
- WAS strikes decrease CVBG defensive assets during the period they are away from the group.
- WAS strikes have the capability to be recalled, if necessary.
- WAS strikes can be affected by weather considerations.

WAR LESSON 4.12

Exclusive employment of cruise missiles provides the minimum risk to friendly forces, but it does so at the expense of total offensive capability. Combined strikes provide the greatest offensive punch, but are difficult to coordinate and require the greatest expenditure of resources.

SSBN Operations: The Long Arm of the Law

The ultimate player in power projection is the ballistic missile submarine, lurking silently in the depths, the harbinger of the apocalypse. The cold war may be over, but SSBNs still go out on patrol around the world. Although their appearance in the Harpoon series is infrequent, you should know what to expect when you encounter these denizens of the deep.

SSBNs are most vulnerable when they are departing their home port and transiting to their patrol stations (also known as bastions). Because of this, they often have SSNs precede them to clear a path and occupy any unwelcome intruders. After SSBN are on-station, they creep along the bottom in their assigned zone, never coming above bare steerageway of about 3 or 4 knots. In this "quiet ship" configuration, late generation SSBNs, such as the Typhoon and Ohio classes, are virtually undetectable.

The tactical problem is often complicated even more by the presence of one or more SSNs in the area as well. These "guardian angels" or "linebackers" are present to draw attention away from the more valuable SSBN and engage anyone who comes calling. You must be aware of their presence, even though you may not hold contact on them, whenever you intend to "bust the bastions." The only suitable platform to attempt this kind of mission is another SSN, or multiple SSNs.

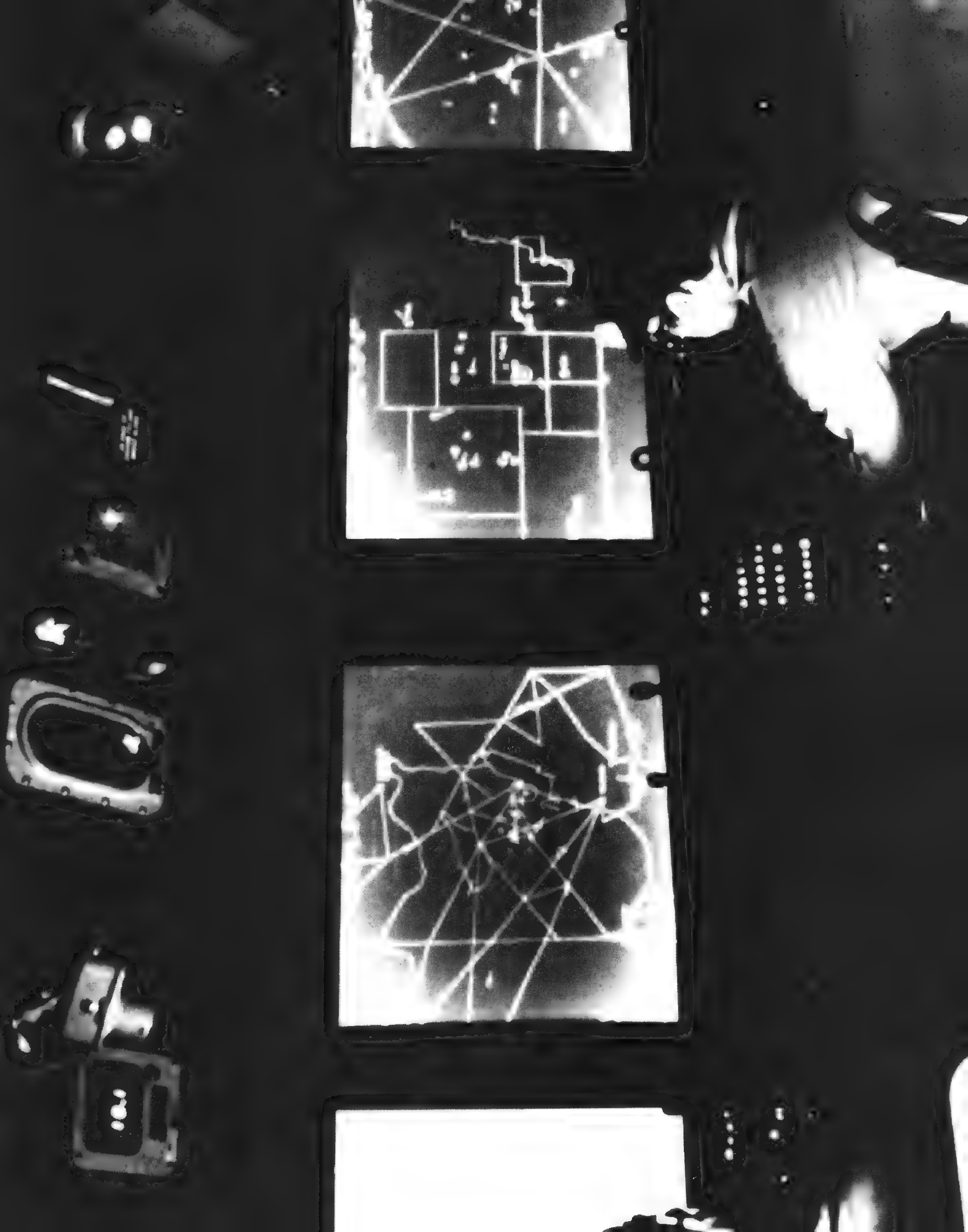
Amphibious Warfare

Proper modeling of amphibious power-projection operations would be a game all unto itself. In Harpoon and *Harpoon II*, you "accomplish" an amphibious objective by getting the appropriate amphibious force to the debarkation point and protecting them for a fixed amount of time that coincides with what would be necessary to establish a beachhead and conduct the operation.

Consequently, the important point to remember is as follows. Because amphibious assault ships are specialized platforms, they also possess little indigenous firepower other than the embarked marine landing force. This vulnerability, combined with a lack of mobility during the conduct of the landing, means that amphibious forces must be screened and protected by other assets while they accomplish their power-projection mission. In essence, you see again that sea control is interrelated with power projection at almost every level. By failing to deal with the mine threat posed by Iraq in the Gulf War, the Coalition Command was unable to achieve sea control, which precluded the amphibious task force from executing its primary power-projection mission.

CONCLUSION

The naval commander must draw from a diverse force mix to achieve the mission, each element of which is capable, to varying degrees, of contributing to all the primary mission types: sea control, sea denial, and power projection. Successful commanders plan their strategy and allocate resources in a manner that emphasizes the strengths of each platform and minimizes the weaknesses an astute enemy can capitalize on. In other words, force the enemy to play to your strengths, and never allow him to do the same to you.



In war every problem, and every principle, is a duality. Like a coin, it has two faces. This is the inevitable consequence of the fact that war is a two party affair, so imposing the need that while hitting, one must guard.

– B.H. Liddell Hart

MISSION PLANNING

Throughout history, military commanders have been faced with a myriad of choices in the planning of operations and campaigns. Unfortunately, all the options considered by the commander of a given operation are not always available to historians. This absence of information allows some historians to take a greater latitude in their analysis than is equitable to the given commander, by focusing only on the results of his final decision. Sound

Facing page: Aegis command & control consoles and displays aboard the USS Ticonderoga (CG-47). Where mission planning begins. U.S. Naval Institute Archives

military planning, like sound historical analysis, must account for all aspects of the situation. It must also avoid assumptions at all cost and never bias any single point in the face of valid counterpoints.

War is no longer a set piece affair, in which contestants walk politely within striking distance of one another and then exchange blows according to a set of preordained rules. War is a dynamic process without hard and fast rules to guide the combatants.

Analysts tend to use maxims or principles in the discussion of warfare, but their worth lies not as constants, as Mr. Liddell Hart so aptly pointed out, but rather as malleable sources of inspiration an enlightened commander can apply at a decisive point in the engagement.

All tactical thought, from Sun Tzu to the modern day, contains contradictory elements if viewed exclusively from an academic standpoint. To practitioners of the art of war, however, the dichotomy is easily held because they understand that each part of the contradiction is equally true at different times. It is more important, therefore, that a student learn battlefield dynamics than memorize lists of tactical axioms. Without knowledge of the former, it is impossible to know when the application of any of the latter is relevant.

WAR LESSON 5.1

Sound military planning must consider the possibility of achieving surprise but, more importantly, must also consider all the methods available to the enemy to keep from being surprised. You cannot assume that he will cooperate with your plan by behaving in a given manner. If he has the capability to do something, and that something would unravel your plan, assume he will do it and revise the plan.

Given that, let's explore how to incorporate your understanding of specific axioms into a working battle plan. Consider, for example, the element of surprise. The importance surprise can have on the eventual outcome of an engagement is probably the topic most widely commented on by military theorists throughout history. Viewing their separate axioms in the aggregate, the general consensus is that surprise is a highly valuable asset when you can achieve it without sacrificing the mission to do so. In Chapter 4, you also learned that, in modern warfare, the loss of surprise is often the driving factor in a shift from passive to active tactics. You have *also* learned that he who shoots first generally wins. Consequently, your task as a planner is to develop an approach to the specific problem that allows your force to get off the initial salvo undetected and then follow up as necessary. To do this, *you must anticipate all the alternative capabilities the enemy has to avoid being surprised.*

THE PLANNING PROCESS

The following five concrete steps must be followed in all tactical planning:

1. Define the mission.
2. Evaluate enemy capabilities to thwart that mission.
3. Assess the geography in the area of operations.
4. Determine a scheme of maneuver.
5. Plan force disposition and stationing.

As you proceed through the planning process, always ensure that you allow sufficient flexibility to respond to emerging threats. Furthermore, if you have reason to believe that one or more of the potential threats has a high probability of occurrence, you should develop an entirely separate contingency plan for that possibility. To be effective, contingency plans must be capable of being integrated into the base plan of attack without significant changes to the scheme of maneuver or overall force posture.

The Mission Statement

First and foremost, you must define the mission objectives clearly. Remember that completion of the mission is the primary consideration of all military commanders. All factors that affect, or may affect, mission completion must be considered in the planning process and contingencies provided for their occurrence.

Know the Enemy

Second, you must assess enemy capabilities to obstruct the accomplishment of that mission. The commander should consider two questions in evaluating each enemy capability. Can the enemy carry out the action? If so, would it directly affect the accomplishment of the mission? If both are answered affirmatively, the commander should retain the enemy capability and carry it forward for additional analysis. After all enemy capabilities have been analyzed sufficiently to establish that their accomplishment would impede the mission, the commander should review the complete list to eliminate duplication and, where appropriate, combine related abilities.

Based on an analysis of the situation from the enemy's perspective and on what may be known of the enemy's intentions, the next step is to list the retained capabilities in order of probability. Consideration of enemy intentions is frequently necessitated by the limited resources available to your own *and* enemy forces. To apply enemy intentions uncritically, however, or to base a decision entirely on what you believe an enemy will do can be an extremely dangerous practice. The danger is that the commander may eliminate from additional consideration some viable enemy capabilities on the basis of conclusions drawn exclusively from estimates of enemy intentions.

Regardless of how convinced the commander may be of the accuracy of the enemy's intelligence, he can expose his plan to the grave risk of being unprepared if he fails to consider some enemy capability because of what he believes the enemy might do. This does not preclude a study and analysis of reliable intelligence or particular knowledge of the enemy (such as information contained in the *Harpoon II* database) to determine enemy intentions. Proper exploitation of intelligence may reward the commander with great success and economy. However, you should apply the fruits of this analysis only to estimate the relative probabilities of enemy capabilities, not to eliminate them from consideration.

> **WAR LESSON 5.2**
>
> As a general rule, consideration of enemy intentions should influence the ordering but not the number of retained enemy capabilities.

A Lesson in Geography

The naval officer assesses the effect of geography on the area of operations a little differently than do his counterparts in the other services. Conventional topography is important in two instances: first, when one will send air strikes ashore and seek to use this topography to advantage in planning ingress and egress routes of the strike elements, and second, when one is forced to operate close to the shore and the topography delays detection of outbound enemy air strikes. Bottom topography is critical if the enemy possesses either a mine or submarine threat or if your own force will employ these assets. Finally, other continental features are important whenever they compress the battle space afforded the commander.

To explain, *battle space* is a theoretical bubble around a force in which the commander feels comfortable in detecting, tracking, and engaging threats before they can pose a significant danger to the main body. Whenever units are forced to operate in confined waters — the Tsugaro Straits off Japan or the Persian Gulf, for example — the battle space has been compressed. Because the units are limited in the option of maneuver, the enemy can more easily establish effective barrier patrols or minefields. Also, the commander is constrained by physical borders, such as reefs or shallows or legal borders like the 12-mile limit, in the positioning of pickets and screening units, which further reduces the reaction time allotted any threat that does materialize.

The significance afforded geographic features also varies based on the enemy's capability to capitalize on any of these areas. If, for example, you face an adversary without a known subsurface or mine threat, the only precautions necessary to sanitize a chokepoint before passage might be a surface or air sweep to identify and eliminate surface threats. Conversely, the possible presence of even an antiquated diesel boat in narrow shallow waters is too deadly a contingency to be ignored. The prudent commander, therefore, must study the enemy order of battle and understand its capabilities.

Because you can never know an enemy's intentions with any acceptable degree of certainty, contingency planning must always remain focused on capabilities, no matter how remote their realization may seem. This does not mean that the commander never enters the straits on the premise that a diesel boat might be lurking (such timidity is tantamount to failure); rather, he ensures that all prudent precautions are taken before risking the critical asset.

Devising the Scheme of Maneuver

Although many of the comparisons between ground and naval warfare tend to oversimplify the peculiarities of each to reach a common ground, the basic tactical precepts of fire and movement are equally important in each arena. The objective of the tactical commander is the delivery of firepower in support of the mission.

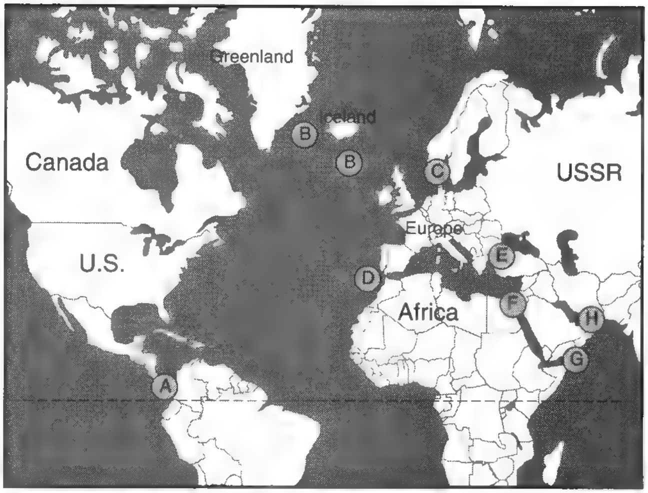


Figure 5-1. Virtually all of the World's Waterways Have Chokepoints Which could be Contested in Time of War

Maneuver is the method that allows the commander to attain position to deliver that firepower. Mobility is also significant to naval forces as an enhancement to survivability. Forces may strike decisively on a given day, avoid counter-detection, and mass for another strike hundreds of miles away the next day.

The ability to mass decisive firepower and move it quickly through the theater of operations is irrelevant if you cannot find a target on which to employ it. Excluding land-based assets, which are all considered pretargeted anyway, enemy forces enjoy the same degree of safety through mobility as your own forces do. Therefore, he who finds the enemy first while avoiding detection generally wins. Thus, from the initial stages of planning to post-mission egress, the primary focus of the commander must be on scouting.

After the threat posed by an enemy force is located, it is diminished severely, and not only because the enemy has lost the element of surprise. If sufficient force exists, the commander may mass it against the threat to eliminate it. If one has limited resources against a superior threat, avoidance of the threat becomes the best option. If one knows the enemy's whereabouts and he remains uncertain of yours, avoidance is not difficult to achieve.

The latter example holds a fundamental truth that must be internalized: Scouting and intelligence gathering are not one-sided propositions. As one attempts to gather targeting data on the enemy, it is also necessary to make every effort to deny him the same luxury.

The approaches one considers in this struggle depend on the geography of the area of operations, the assessment of enemy capabilities, and the specifics of the mission.

> **WAR LESSON 5.3**
>
> Never forget the importance of mobility and tactical maneuver. "After being located" does not always equate to being continually located. To be effective, the enemy must not only locate you but also localize and refine your position with enough precision to support an attack solution. Targeting a moving battle group can necessitate a large effort, both in time and assets required.

Having invested considerable thought in the geographic anomalies of the area and the capabilities of the enemy OOB, it is now time to *plan intended movement* (PIM). Keeping in mind that maneuver is the achievement of scouting and firing position over time, one must consider any time constraints imposed by the original mission on the ultimate objectives. Do the critical high-value units of the force have sufficient time to make a leisurely, cautious approach to the objective, or is it necessary to serve political expediency and rush to the fore? The answer to that question determines the degree of planning flexibility afforded the commander in determining the eventual timeline of engagement. Furthermore, the timeline has a direct impact on tactics.

The geographic and navigational models of *Harpoon II* allow unprecedented realism in performing these stages of mission planning. Players who are willing to invest the planning time to consider the specific geography of the area of operations are rewarded with commiserate improvements in their tactical success rate. Consider the satisfaction of the commander who correctly anticipates the presence of enemy forces and develops a contingency plan to eliminate that threat compared to one who destroys them only after their weapons are expended. In the latter case, even if the enemy units inflict minimal damage, they have achieved a degree of mission success by attriting the commanders defensive weapons magazines, which can prove crucial in subsequent engagements.

Formation & Stationing Considerations

After PIM is established, the commander must determine the general disposition of the force. Naval warfare differs from its ground counterpart in this respect because the geographic proximity of unit placement is a function of defensive strength versus offensive strength. Thanks to passive targeting and over-the-horizon missile capability, it is no longer necessary to form a line of battle to concentrate force on the enemy. With proper command and control, widely dispersed units can put their missiles on target within seconds of one another, as evidenced in Operation Desert Storm. These same units, however, are less capable of defending themselves as individuals as opposed to supporting one another in a well-designed formation with overlapping missile coverage. Given that, one would expect the use of supporting defensive formations to serve inferior and superior forces equally well. Reality does not prove this out, however, and the use of defensive formations is actually more critical for the superior force. Consider the rationale that supports this conclusion by examining a hypothetical conflict between big-water navy Blue and littoral-nation Orange.

Blue sacrifices superiority if its forces are divided in such a way that they might be engaged piecemeal. Yet by massing the forces to support one another defensively, Blue simplifies Orange's targeting after the force is located. Orange is better off to disperse its units in the face of Blue's superiority. Why? It forces Blue to detect, classify, and engage each individual element of the Orange force, which precludes simultaneous action against all of them. While the first elements are being engaged, Orange is buying time to get its other units into position to conduct a coordinated offensive strike against the Blue force.

By adding names to the faces, astute players will note that the classic example of the aforementioned discussion is the war that never was. U.S. war games focused on how they would use CV Task Forces to project power on the Soviet mainland, and their Soviet counterparts built their bastion concept around the approach illustrated for the inferior player.

WAR LESSON 5.4

The lesson to learn and apply in all mission planning, regardless of the nationalities involved, is that unit concentration universally favors the superior side and dispersal is the tactic of choice when outnumbered or outgunned.

The Threat Axis

The threat axis is the commander's estimate of the likely direction from which an attack can emanate. The threat axis always exists, whether it applies to a single unit or a group of units, but it is really most significant in formation planning for the latter. Although this sounds simple to understand, there are nuances to the establishment and operational use of a threat axis that must be clarified from the outset to alleviate later confusion.

First, a threat axis is always stated in True bearing, as opposed to Relative bearing. This means that a threat axis of 000 degrees is due north, regardless of the compass course the formation is steering. Second, a threat axis may be defined as a single bearing, an arc of bearing (090-120 degrees, for example), or it may be designated as 360 degrees. In the latter case, it means that the force is operating far enough within the engagement envelope of the enemy that the strike could come from any sector.

Also, formations may have a single threat axis defined, or separate ones for each warfare area, such as the ASW axis, the AAW axis, etc. This latter case occurs infrequently because it can lead to confusion within the formation, but the omniscient role of the player in *Harpoon II* allows mixed formation dispositions if desired, without fear of similar consequences. Finally, the location of the threat axis changes over time as the force moves along the PIM.

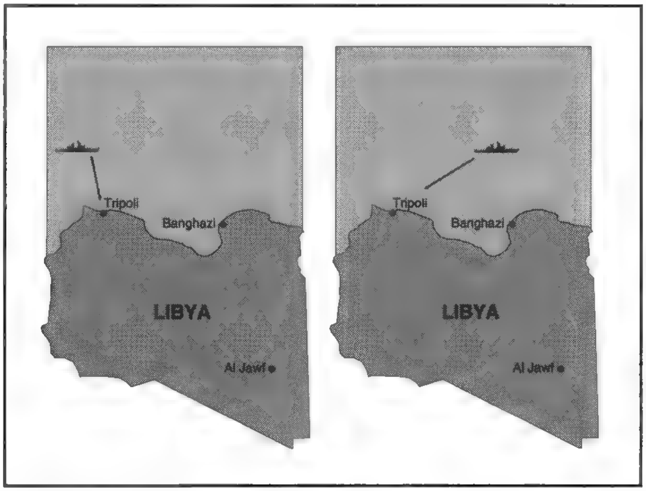


Figure 5-2. The Bearing of a Threat Axis can Change as the Force moves along PIM.

Force Composition

The major factors in determining station assignments in a formation, other than the location of the threat axis, are the capabilities of the platforms themselves. Although virtually all modern ship designs emphasize multimission capability (the ability to conduct

AAW, ASW, and ASuW, for example), the reality is that each class has a specialty within the three warfare areas and some limited ability to conduct the other missions. Commanders must analyze their force mix and categorize ships accordingly before proceeding deeper into stationing considerations. Because of the aforementioned emphasis on the defensive nature of formations and the knowledge that ASuW is primarily offensive in nature, this categorization should focus on AAW and ASW abilities.

Formation Structure

A formation is a method of layered defense. Picket ships, CAP, and airborne early warning (AEW) aircraft provide surveillance to 200nm and beyond. The outer screen typically occupies sectors between 12 and 24nm from the main body. The inner screen is stationed within visual contact of the HVU, usually under 10nm from formation center.

Because the employment of detached action groups (such as SAGs and SAUs) or picket ships are specialized tactics, the placement of these assets are excluded from this discussion. The circumstances for their use, as well as the proper stationing in relation to the threat axis, are addressed in the appropriate warfare section of this book. At this stage, it is important for the commander to focus exclusively on the functions of the inner and outer screens. Standard placement of the high-value unit (or units) in the center of the screen is assumed.

The Outer Screen

The function of the outer screen is to detect and engage any units that have leaked through the pickets and threaten the main body. To accomplish this mission, the outer screen must be capable of performing in all the mission areas. ASuW is a given, so the composition of the outer screen should be equally capable in the other mission areas, skewing any advantage toward ASW. Also, the ASW platforms chosen for the outer screen should have the best passive-detection suites and the capability for stand-off engagement of contacts with helicopter assets.

Figure 5-3. Helicopters are the Platform of Choice to "Pounce" on Enemy Submarine Contacts Detected by the ASW Screening Force.

ASW assets are more effective in the outer screen because their separation from the ambient noise generated by the main body is critical to passive detection of submarines. Also, because the size of the sectors in the outer screen are so much larger, ASW assets can sprint to the forward corner of their area and drift at bare steerage back through the sector. Their vulnerability is increased while sprinting, but they are extremely effective on the return leg. A ship like a *Spruance* with a towed array sonar, operating at five knots or less, is virtually undetectable to submarines.

AAW assets are present in the outer screen for two reasons: to provide covering fire for the relatively vulnerable ASW platforms and to engage short-range ASuW missile-equipped aircraft before they reach their launch points against main body assets. In evaluating platforms for this role, the maximum effective range of the SAM battery is more important than salvo rate.

Aircraft are slower than missiles, and by employing greater-range missiles, the outer-screen AAW asset can conduct more engagements within the fixed amount of battle space. The more engagements, the greater chance the strike will jettison ordnance and go home.

The Inner Screen

ASW units selected for the inner screen should have the best active sonar suites, to allow for delousing (ensonifying the area beneath the HVU) and an immediate targeting solution on any contacts that have penetrated the outer screen. Helicopter capability is important, but only if two or more inner-screen assets are helo-capable. This restriction is due again to the need for immediate and decisive action, which negates the effectiveness of an asset chocked and chained to the deck. With one helo always in the air in an ASW configuration, the commander can use it to "pounce" on any contacts generated by the inner screen.

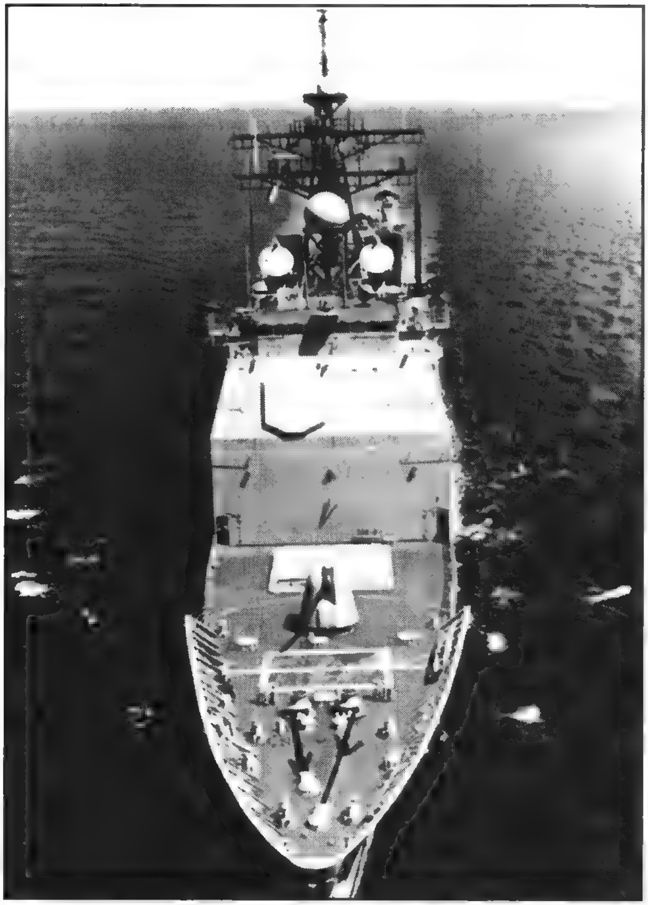


Figure 5-4. Aegis Cruisers are premier AAW players and integral to any U.S. Carrier Battle Group that deploys

The emphasis for assignment of AAW assets to the inner screen should be rate of fire rather than range. It is assumed that any air contacts penetrating to the inner screen are missiles. As such, they travel faster than their launch vehicles do and there are more of them as well, because each aircraft generally launches more than one missile. The more defensive firepower one can put in the air, the greater number of in-bound vampires attrited, and the less burden to be borne by point-defense systems such as Phalanx.

Aegis is the premier AAW suite for inner-screen defense because of its all-aspect engagement ability and lack of launcher limitation for vertical launch-equipped systems (VLS). Because of this, no modern U.S. CVBG puts to sea without a VLS cruiser tethered on a 4,000-yard leash to the carrier. Cruiser skippers who were used to the relative independence of picket duty prickle at the current situation, but it is a reality of the latest tactical doctrine.

WHAT TO DO WHEN THE PLAN FALLS APART

If you have developed a flawless plan that your enemy resolutely cooperates with, the topic of this section is moot. The commander already is engaging the enemy in the desired order. The frequency of this occurrence, however, is too infinitesimal to be measured. As stated, war is a dynamic process. The commander must be capable, therefore, of altering the existing battle plan on the fly and redefining the order of engagement instantaneously. To do so, he must evaluate the threat of each new contact in terms of potency and immediacy.

Potent threats are those forces that, if left unchecked, are capable of precluding mission accomplishment. Naturally, this grouping has varying degrees of potency. Some units may be eminently capable of executing the threat; others only noteworthy on a good day with a great deal of luck. Either way, it is the commander's task to examine every new contact against the enemy OOB and assess the degree of threat to his own force. Immediate threats may or may not be capable of precluding mission accomplishment, but they do pose a clear and immediate danger to friendly forces, usually stemming from the fact that they have already attained weapons launch positions.

Remembering that the commander has already been cautioned to know the enemy, platform-specific guidance about the level of threat is not presented here. Indeed, the number of variables inherent in such an analysis would require volumes for all the ships, aircraft, and submarines depicted in *Harpoon II*. Instead, players should employ their knowledge of sensor and weapons ranges to categorize each contact within this hierarchy:

A. Potent and immediate (in-bound cruise missiles, for example)

B. Immediate only (diesel boat detected in outer screen, for example)

C. Potent only (SAG detected at 350nm, for example)

D. Neither potent or immediate (gunboat at Anchorage, for example)

The appearance of a Class A threat is occasion to drop everything else and eliminate the interloper. Class B threats also require swift action, but one should prosecute them without pulling assets off the main tasking. Class C threats should be the warrior's bread and butter because they are detected before they have achieved launch positions. This allows for a methodical massing of force over the horizon to destroy them, or, if their defenses are too strong, enough time has been purchased to maneuver to avoid the threat. Class D threats are also known collectively as "targets of opportunity." Their destruction can aid the overall effort in some way, but it is not essential to success by any stretch of the imagination.

WAR LESSON 5.5

The order in which to engage enemy contacts is determined by potency and immediacy. All other criteria are irrelevant.

Please note that firepower is not the only criterion for threat classification. An ocean-going tug can be a Class A threat if it is providing targeting data to one or more shooters somewhere over the horizon. Similar concerns must be exhibited with flag merchants of the hostile nation. Remember to assess enemy capabilities rather than intentions.

PROACTIVE VERSUS REACTIVE PLANNING

If you have been paying attention, you have probably noticed that the majority of planning issues discussed so far have been reactive in nature. The focus has been on the defense of the force during the critical period when it transits to the objective area. Now it is time to switch hats and look at the offensive side of the coin. Because the vast majority of naval operations that occur in hostile waters are power-projection operations, we return the focus to strike warfare. Taking the perspective of a strike planner, you will find that many of the offensive planning considerations mirror their defensive counterparts.

Strike Warfare

Strike warfare is the art form that supports the power-projection mission. Although all the warfare areas are warrior arts to the aficionado, strike warfare is elevated above the others in the mind of many practitioners minds because it requires precise coordination and timing. Like an orchestra conductor, the strike planner must blend a number of diverse elements into a harmonious whole, building to a crescendo designed to leave a lasting impact on the recipient of the art.

The audience of the strike planner may consist of enemy surface or ground forces, each requiring a slightly different finesse in prosecution. The tools of the strike planner are expendable assets (missiles, for example) and retrievable assets (manned aircraft, for example). Fiscal realities force a limited supply of each asset, but the latter are more significant because they may be employed repeatedly, if the strike planner has performed his duties correctly. Here, we arm the *Harpoon II* strike commander with all the skills necessary for mastery of the art.

Elements of Strike Planning

Every strike plan is composed of several steps. The commander must progress through each of these in the formulation of a viable plan. In order of execution, the elements that require consideration are summarized in this list:

1. Target value
2. Target location, composition, and defenses
3. Strike composition, armament, and support
4. Ingress and egress routes
5. Timing of the strike
6. Battle damage assessment (BDA)

Each of these elements is examined in detail in these sections. For the purpose of continuity, a land strike is assumed. Special considerations for strikes against naval task forces in support of the ASuW mission are discussed in that warfare section. As you progress through the text, it is important to remember that, although each topic is examined individually, none of them operates exclusively of the others. In the formulation of a plan, if the commander is unsatisfied with his assessment of any of the planning steps, it is generally wisest to scrap the plan until the limiting factor that gave you pause has been eliminated.

Target Value

One of the inherent advantages afforded the strike planner is that of timing and initiative. Because his is a proactive versus reactive commitment of force, he has the ability to decide when and where this should occur. Keeping that thought in mind, the second point to ensure is the strategic value of the target. For the commander to be willing to commit portions of his force to the destruction or reduction of a target, the target must have some significance to the achievement of mission objectives. Although this may seem a moot point, in reality it is a common mistake.

Remember the earlier point that the conduct of war is never static; that while you are fighting, you must also guard? With this in mind, consider astute opponent Blue, who offers a sacrificial lamb to the strike planner, Orange, who is closing Blue's coast to attack a port or airfield. This offering might take many forms, but we consider it to be an attractive surface action group that is out of position to contribute to the immediate tactical situation. As Orange nears its primary objective, Blue directs the SAG to radiate and make its presence known. Blue hopes that the SAG, although not an immediate threat to Orange, will prove so tempting a target that it cannot be passed up. If Orange complies with Blue's deception and commits a significant portion of his strike package to the target of opportunity, he has unwittingly shifted the tactical advantage of initiative to Blue.

As a minimum, Blue can delay the attack on the prime objective and attrite portions of Orange's strike package directed at the SAG. This reduces the number of missiles and aircraft available for Orange's subsequent efforts against the primary target, which increases Blue's chance of survival. In the optimum case of this deceptive effort, however, Blue is now in position to strike Orange's main force first, while his attention and a bulk of his forces are directed elsewhere.

Blue can be decisive in this action or, even if marginally successful, his efforts can reduce the Orange force to the point that its commander deems it unwise to continue operations against the Blue base. Although this case illustrates a potential use of strategic deception, the required lesson for the strike commander in *Harpoon II* is to ensure that the target of one's efforts supports the mission objective.

Target Location and Composition

Although strike planning against fixed targets such as port facilities and air bases is simplified because of their lack of mobility, location and composition still require analysis. The location of a target is important because it determines both the line of demarcation of the striking force and the envelopes of engagement of supporting forces. The *line of demarcation* is the maximum range at which a strike commander can begin to employ force on the intended target. Because this line reflects the extended ranges of attack aircraft at reduced weapons loads, it is most often not the effective strike range. To obtain the maximum effective strike range, the commander must consider the feasibility of in-flight refueling for all the fully loaded strike elements he has determined necessary to conduct the strike.

The inverse of the line of demarcation is the maximum engagement envelope of enemy long-range air assets and land-based surface-to-surface missile systems. Within this context, it should be apparent that the strike commander must not only be concerned with the capabilities of the targeted base, but also must consider the proximity of other bases to the target that can multiply enemy defenses.

The composition of land targets has also been modified considerably in *Harpoon II*. Previously, the commander faced a generic AAA capability, a radar and runway-based aircraft. In *Harpoon II*, bases possess discrete targetable components. There are individual SAM and AAA sites, ground radar installations, command and control bunkers, weapons storage bunkers, fuel- and lube oil-storage facilities, hangers, runways, and other support facilities. The destruction of any of these targets impedes the enemy commander from performing the relevant functions until repairs are effected.

Strike planning now requires the commander to divide components of the striking force to deal with each of these elements in turn. Although it may seem that this complicates the strike planning process (and it does to some degree), it also provides greater flexibility in terms of tailoring strikes to support specific needs. For example, if one is attempting to preclude a secondary base from supporting the object of a main attack, it isn't necessary to try to strike that base's runways to keep aircraft on the ground. The naval commander seldom has enough aircraft and missile resources on hand to conduct a simultaneous attack on two or more land facilities. The strike package aimed at the secondary base, therefore, may consist exclusively of jamming and fighter aircraft. The jammers can confuse the command and control of the base's radar picture, engage active radar with home on radiation missiles (HARM), and distract airborne interceptors away from the main group. The fighters can conduct an offensive sweep of the interceptors, again to preclude their efforts to support the base that is the object of the primary attack.

Another example of this approach is a strike targeted specifically at the weapons bunkers of an installation. If it is destroyed, the enemy would have only those assets that were at the SAM sites or already on the hardpoints of aircraft to conduct additional offensive or defensive operations. Plus, there is always the chance of some beneficial secondary explosions. As you can see, the possibilities are endless. As a strike commander in *Harpoon II*, the important thing to remember for this phase is to match the specific target types to the mission requirements and to always remain aware of both the line of demarcation and the enemy's zones of engagement.

Target Defenses: Understanding IADS

All developed nations of the world employ some form of IADS, or *Integrated Air Defense System,* to govern their air defense network. Although the sophistication of IADS networks varies with the technological capability and economic resources of the nation modeled, the basic components of an IADS system remain the same.

At the heart of the system is the command and control bunker, the total number of which depends on the number of assets to be managed and the area that must be covered. When there are multiple bunkers, there is a chain of command between the least secure (those managing front-line assets) and the most secure (regional and national command sites). Each bunker coordinates the efforts of two or more of the following assets: fighters and interceptors, radar sites, and SAM and AAA batteries. The deployment of the latter three may be fixed or mobile. Naturally, the presence of mobile assets complicates strike planning, and the commander must make every effort to have the most reliable intelligence on enemy force dispositions as the plan is developed. To ensure the success of the strike and minimize losses during the strike, the commander must evaluate enemy IADS capabilities and either suppress or destroy these defenses as a part of the strike package.

Strike Composition, Armament, and Support

With a firm grasp of the aforementioned factors, the commander may now analyze which elements of the force are best suited to conduct the mission and what weaponry they will carry to do so. In discussing these dispositions, you will hear references to the terms strike force, strike group, and strike element. Understanding their relationship is important. A *strike element* is a single sortie group of one to six aircraft of the same type. Strike elements may be larger, but it is generally not advantageous to do so because this simplifies enemy intercept and counter-targeting efforts. *Strike groups* are composed of all strike elements, regardless of type, originating from the same unit. A *strike force* is all the assembled strike groups that will attack the same target, regardless of their point of origin.

Some targets may be prosecuted by a single strike element, such as a pair of Harpoon-equipped A-6 Intruders engaging a group of missile patrol boats operating outside the enemy air defense envelope. In this scenario, because the weapons of the strike aircraft outdistance the range of the enemy's best AAW weapon and because the strike planner need not be concerned with enemy air intercept, a small aircraft group is sufficient to deliver decisive force. Other targets may require the coordination of all aircraft and Tomahawk Land Attack Missiles (TLAM) within one or more CVBGs to penetrate and saturate enemy defenses. The more sophisticated the IADS, the more diverse one's approach must become.

> **WAR LESSON 5.6**
>
> The more mobile and advanced the enemy's air defense capability, the greater number of resources which must be committed to ensure destruction of the intended target.

Consider the approach adopted by the Coalition Command at the outset of the air war against Iraq. Iraq's IADS at the commencement of hostilities was estimated by intelligence to be seven times more lethal than the one deployed around Hanoi at the height of the Vietnam War. Hanoi's concentration of SAM sites virtually precluded low-level precise delivery of munitions throughout the war because of unacceptable loss estimates, yet Iraq's system exacted one-third the casualty rate per 1,000 sorties during Operation Desert Shield and Desert Storm. The reason behind this seeming inconsistency between expectations and results lie in the systematic reduction of Iraq's IADS through proper strike planning.

The approach of Major General John Corder, U.S. Air Force, who acted as the director of Central Command Air Operations, was comprehensive yet easy to understand. *Harpoon II* commanders should use it as a guideline in their planning of major coordinated strikes by diverse elements. The precursor of the attack was a massive barrage of communications and radar jamming by coalition aircraft. The jammers remained in position to engage and destroy enemy radar sites with HARM, ALARM, and other anti-radiation homers as they went active. From behind the wall of electronic noise emerged 100 TLAMs directed at fixed radar sites and command and control facilities. F-117's supplemented the TLAMs against the most hardened facilities and succeeded in severing the head from the IADS structure. Lacking central coordination and targeting information, the remaining pieces of the IADS were left to operate independently against the successive waves of strike aircraft operating with supporting fighter escort. With their eyes and ears destroyed, however, all shots fired at aircraft by these facilities were unguided and, therefore, inaccurate. The results of successful planning, timing, and coordination are telling: one F/A 18 lost on the night of the strike and virtual decimation of an entire nation's air defense system.

Ingress and Egress

As mentioned, it is critical for the strike planner to make every effort to ensure survivability of retrievable assets. One of the simplest methods of doing so is to plot ingress and egress routes for the strikes to avoid ancillary defenses, remain undetected for as long as possible, and minimize the time spent within the enemy zone of engagement. In this section, we highlight how to accomplish these simple yet often overlooked tactics.

Although it is not always possible, due to the overlapping nature of defensive air networks, the strike planner should strive to avoid entering the weapons envelopes of units other than the primary target and avoid theirs as well if sufficient stand-off weapons exist. To do so, refer frequently to the tactical overlays provided for the *Harpoon II* map. In the mission planner, plot air group movement to avoid overlapping circles of enemy air coverage. Furthermore, if one must pass through these circles, do so as close to tangentially as possible. This presents the enemy with a long-range crossing shot, which has the lowest percentage of intercept of all possible engagement postures.

When the transit phase is complete and forces are in position to conduct the attack, the planner should allow for a direct path from the edge of the enemy weapons envelope to the launch range and back again. This path minimizes the time that strike elements may be counterattacked. Furthermore, by adopting a multiple axis attack (some of which can be deceptive groups), the strike planner spreads the enemy defenses among the strike elements, which again increases the chance of success.

Remember also that, to be targeted, one must be detected. The longer the strike planner can delay that detection, the more survivable the strike elements and the greater chance of success for the strike force as a whole. The primary

Figure 5-5. Altitude has a Direct Bearing on Counter-Detection Range

methods of influencing these variables in the *Harpoon II* model are via altitude assignment and EMCON posture. The section on electronic warfare should have emphasized the tactical trade-offs related to EMCON posture adequately, so we focus exclusively here on altitude effects.

Radar is essentially horizon-dependent when it comes to maximum range. This is why a surface-search radar has very limited maximum range in comparison to an air search radar, some of which are capable of seeing in-bound aircraft at hundreds of miles, provided the aircraft are above the radar horizon. To understand the importance of the radar horizon, consider Figure 5-5.

Both A and B are elements of the same strike group at 150nm from their intended target, represented by the generic surface ship. Note that A is already detected by the air search radar of the target because, by being at high altitude, he is above the radar horizon. B, however, is operating at very low altitude. He will not cross the radar horizon, therefore, until about 25nm from the target, which minimizes enemy reaction time and allows for a more effective attack. If B were a cruise missile rather than an aircraft, this range could be even shorter, on the order of 15nm, because of the extremely small radar profile and sea-skimming altitude of the missile.

Note that the radar horizon generally extends beyond the visual horizon because of the tendency of electromagnetic radiation to curve in the lower atmosphere, particularly at sea level. This phenomena would be insignificant if it did not have tactical implications. Remembering that radar requires the reflection and return of the transmitted signal to the antenna, the strongest returns are generated in the center of the transmitted waves.

Argentine A-4 pilots utilized this knowledge to perfect low-level approach patterns during the Falklands War. In essence, what they did was adopt a very low profile similar to aircraft B in the preceding example. As soon as the ESM threat warning gear lit up, however, to indicate their crossing of the radar horizon, they dropped in altitude. The momentary exposure was insufficient for British radar operators to discern the contact and skilled Argentinean pilots were able to conduct this maneuver up to three times on a standard approach at progressively closer ranges. This technique, which came to be known as "pecking the lobe," was employed with great success to compress the battle space and reaction time afforded the British commander. Were it not for fusing delays associated with the Iron Bombs carried by the A-4s, it is likely that many more hulks of British warships would litter the ocean bottom around the Falklands.

Strike Timing

In larger strike packages, it is necessary that the commander divide these forces into distinct groups and elements and assign each a mission that supports the concerted effort. This increases the survivability of individual elements because the enemy's counter-targeting is complicated and decreases the amount of ordnance lost due to jettisoning when the enemy does intercept, but it also complicates the coordination effort of the strike planner. As noted in the beginning of this section, the strike planner is analogous to an orchestra conductor. In that role, if even one element of the whole fails to show up on time or plays out of concert with the others, the entire movement is jeopardized.

The easiest method of establishing the timeline for the strike is to work it backward, from the moment the last weapon would be delivered to the launch times for the various elements. The planner can discount flight-deck limitations to a degree in the *Harpoon II* model because it allows for the assembly of each strike element in loiter before proceeding to the target. The critical considerations are missile time of flight (if one is using these assets as a part of the strike package), aircraft time of flight (which can vary between strike elements if the planner has implemented circuitous maneuver or a multiple axis attack), and weapons time of flight for the aircraft armament packages selected. Naturally, if one is using point weapons, such as free-fall bombs and munitions canisters, this latter consideration can be discounted. Otherwise, with guided or precision munitions, their time of flight must be considered.

By starting with a time of impact and considering weapons flight time, including TLAMs, from the selected launch points, the commander knows what time the launch platforms must arrive at those points. When this is known, the commander can again work backward along the plotted movement leg for each aircraft element and determine the time at which they must clear the deck to commence the mission. The objective of all this number-crunching is to achieve a condition known as simultaneous time on top (STOT), which is the equivalent of strike planner's nirvana. When STOT occurs, it means that all of one's ordnance arrives at the same instant, which is guaranteed to saturate the most cohesive enemy defenses.

Battle Damage Assessment (BDA)

Figure 5-6. An example of what happens when a strike plan comes together. This catastrophic damage was inflicted by a single air-launched Harpoon missile.

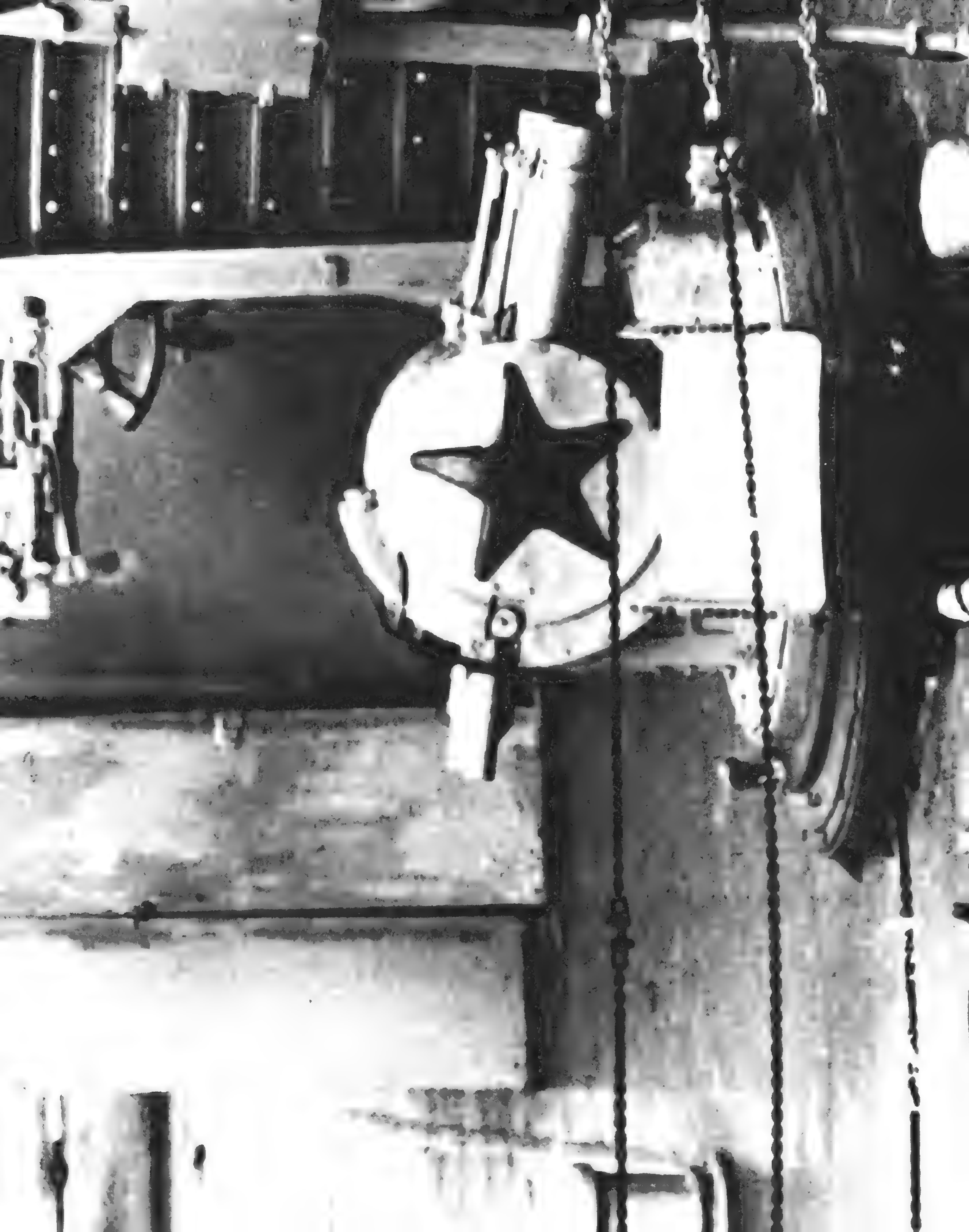
After any attack, the commander must conduct reconnaissance to assess the effectiveness of the attack and determine the need for any follow-up attacks on the same target. If manned aircraft were part of the strike package, an initial assessment of the damage inflicted is provided to the commander on their return. This assessment may be inaccurate, and the commander can refine its authenticity (in the case of ASuW attacks) by including a reconnaissance aircraft as one of the last elements to enter the target area. In strikes against land-based targets, the commander may obtain accurate satellite data on the effectiveness of his strikes after a period of a few hours.

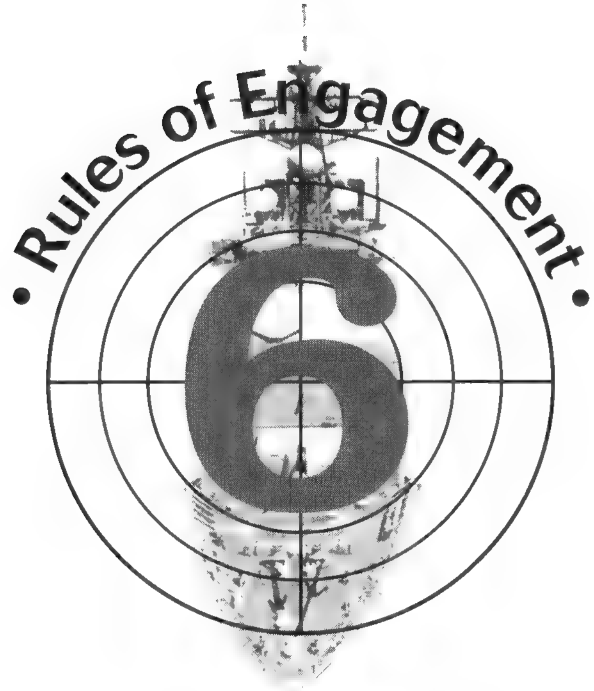
Strike Planning Summarized

Strike warfare is the heart of power projection. All strike-warfare planning must progress through the six steps delineated here. It is the commander's task to ensure that sufficient force exists to accomplish the mission commensurate with the need to husband limited resources. Understanding the strengths and limitations of the enemy IADS as well as the strategic placement of those forces is essential to planning. There may be some application of force before the main strike, such as the HARM attacks discussed previously, but the prudent commander always plans the main effort to STOP the enemy dead in his tracks.

LIMITATIONS OF THE HARPOON II STAFF

By now you should have a feel for the plethora of issues that must be addressed in any comprehensive battle plan, as well as some of the specific mechanics of operational-level planning that are normally accomplished by a highly trained, specialized staff. Unfortunately, the staff functions in the Harpoon series are not as comprehensive as one might expect in the real world. It is incumbent on you, therefore, to make up for their limitations. In other words, if you want something done correctly, do it yourself!





6 Rules of Engagement

Rules of engagement, or *ROE*, define the parameters of conflict. Dictated from above, ROE place restrictions and liberties on the battlefield commander that are designed to "control" the scope of the conflict. ROE are not specifically designed to place the battlefield commander at a disadvantage, although this is a frequent consequence of poorly written ROE. Properly constructed ROE are designed to view the broader context of national interests and provide situational guidance to Task Force and unit commanders. The National Command Authority (NCA) expects battlefield commanders to dot every *i* and cross every *t* specified in the ROE, consistent with the commander's primary obligation to protect his ship and crew. When the two doctrines come into conflict (which is never supposed to happen in theory but occasionally does), the safety of the ship is considered the paramount, overriding concern.

ROE AND THE MISSION

The naval officer's credo is to think first of the mission and then of the mission, and when all else fails, revert back to the mission. This credo does

Facing page: Intelligence photograph of a Soviet chaff launcher. U.S. Naval Institute Archives

not imply that you must pursue the objective with the self-sacrificing tenacity of the Kamikaze. Your government has placed billions of dollars of weaponry at your fingertips, but it expects to retain control over the expenditure of these assets. Two methods of control exist.

The first method of control is a body of doctrine giving an explicit weapons-employment doctrine for every foreseeable contingency. Known collectively as the Rules of Engagement (ROE), this document dictates a commander's appropriate response and use of force in situations where it is not timely or feasible to obtain guidance from a higher authority.

The second method of control is the concept of "acceptable losses." In layman's terms, it means ensuring that the cost required to obtain the objective does not exceed the benefit of doing so. These quantitative considerations are implied at best, and the naval professional must use experience and judgment to place them in perspective during planning and execution. All references to acceptable or unacceptable losses stem from either political or economic motivations.

As an example, consider the punitive air strike conducted on Libya several years ago. The operation was an unqualified success because the commander took care to ensure that all his pilots returned home and civilian casualties were minimized. Assume for a moment, however, that a mosque was hit and hundreds of civilian casualties were inflicted. Even though the commander completed the mission, the ancillary damage would constitute politically unacceptable losses. Likewise, if a number of U.S. aircraft were lost to inferior air defenses because of poor planning, even a successful mission could be viewed as an economic failure or a political debacle in the eyes of the media. When mission tasking is received, therefore, the first step in achieving victory conditions is to classify the type of mission and determine the specific objectives, both explicit and implied.

FIRE CONTROL

ROE consider the safety of not only the unit in question but also other friendly and neutral forces in the area. For example, ROE are frequently used to define specific areas of operation and exclusion zones for each force. A specific example might be precluding a CVBG from attacking a nearby enemy airbase, even though the CVBG is well within strike parameters because significant other forces are already committed to that target. In this instance, if the CVBG were allowed to coordinate independent strikes in the region or allow its pilots to pursue targets of opportunity in that area, the risk of Blue-on-Blue, or friendly fire, incidents increases to an unacceptable level.

Alternatively, ROE restrictions might be imposed on the CVBG because allied forces are operating the same type of aircraft as the enemy within the region. During the 1991 Persian Gulf War, both the Iraqis and Coalition forces operated variants of the French-built Mirage aircraft. To reduce risk, Coalition forces restricted flight operations for allied nations using Mirage aircraft to specific, well-defined exclusion zones, therefore preventing misidentification of the friendly Mirage flights by other Coalition pilots and inadvertent Blue-on-Blue engagements.

Along similar lines, the ROE may be restricting the CVBG from striking because sufficient airstrikes have already been performed and ground forces are moving in now. Further interdiction runs would needlessly waste ammunition and potentially damage resources the Allies want left intact. Additionally, such strikes might also place friendly ground forces at risk from allied weaponry. The ground forces may need close air support (CAS) operating in the area, but not large numbers of strike fighters.

Even with such rules in place, however, accidents continue to happen. Blue-on-Blue engagements have accounted for a significant percentage of U.S. casualties in every major military deployment of the 20th century, especially in the early decades when sensor technology was just beginning to emerge. World War II anti-aircraft gunners had a saying: "There are only two types of aircraft: friendly outgoing and hostile incoming," which means that any inbound aircraft was assumed to be hostile until proven otherwise. Estimations of the frequency and impact of Blue-on-Blue engagements vary widely, reportedly accounting for 25 to 50 percent of U.S. and allied casualties in WWII and Vietnam. Most recently, during the Gulf War, a full 25 percent of Coalition deaths were the result of friendly fire. Thirty-five of the 148 American deaths and 72 of the 467 American wounded happened during Blue-on-Blue engagements. Additionally, nine of the 35 British fatalities were Blue-on-Blue victims. Commanders must understand, therefore, that ROE consider other allied forces within the field of fire and attempt to control the engagement and limit Blue-on-Blue fatalities.

POLITICAL RESTRAINT

ROE also consider the ramifications of permissible actions. What will happen tomorrow if friendly forces fire today? Will the leaders of the two nations exchange snide insults on CNN; will a regional conflict begin; or will a full-scale NATO-versus-CIS war erupt? ROE vary greatly depending on the capabilities of and the threat posed by the enemy. For example, turn the clock back to 1985, to the middle of the "Reagan Era." ROE for U.S. forces operating near Libya allowed greater liberty and self-initiative than for similar forces operating near the Bering Strait. The reason for the disparity is simple to understand: The risk and the stakes were different for each theater of operations.

WAR LESSON 6.1

ROE are significantly more stringent and restrictive in environments in which escalation of hostilities is undesirable.

If a pair of F-14s down a few Libyan jets, the American public will launch a volley of cheers to the current President (regardless of his political stature otherwise). The U.S. would receive letters of support from allied nations, a few miscellaneous condemnations from a handful of non-aligned nations, and a slew of ethereal insults and threats from nations incapable of following through on said threats.

Consider, however, a similar exchange between U.S. and U.S.S.R. forces during the same era. In the best case, all surviving combatants would immediately withdraw. Both nations' military hierarchies would demand answers from their participants. Each side would examine in detail the combat performance of the other while chastising its own participants for potentially revealing friendly combat capabilities. Both sides might conveniently "forget" the incident by writing it off as an accident rather than risk political contention at home, political embarrassment around the world, and continued military action against a capable foe. In the worst case, nearby combatants would join the fray, and losses for both sides would escalate beyond "the forgettable point," where one or both nations would be forced to retaliate and escalate hostilities.

Neutrals and Interested Third Parties

The status of neutral nations also have an impact on ROE. A significant ally of the target nation may remain neutral as long as U.S. forces do not violate certain conditions. The neutral country may remain convinced that the U.S. has no ill will toward it as long as the U.S. keeps its distance. Therefore, ROE may dictate maneuvering restraints and very detailed identification criteria before classifying any contact as hostile. Neutrals may allow allied nations to pursue their own military interests as long as the neutral nation's interests are also maintained, illustrated by the position of Israel during the Gulf War.

President George Bush built a strong coalition against Iraq, supported by other Arab nations — support that would have been jeopardized had the Israelis entered the conflict. To maintain the support of multiple Arab nations, therefore, the Coalition asked Israel to remain neutral, despite numerous unprovoked Iraqi missile attacks against Israeli cities. Many observers feared that Arab nations siding with the U.S. against Iraq would prefer to side with Iraq against Israel. To ensure Israeli neutrality, the U.S. dedicated a significant anti-SCUD force. Undoubtedly, Coalition forces attended to Israeli interests. In the end, Israeli forces remained outside the conflict, and the Arab nations remained within the Coalition against Iraq.

WORKING WITHIN ROE

ROE do not always keep in mind the best interests of the individual combatants. ROE dictated to U.S. pilots in Vietnam bordered on insanity. The battlefield commander may often find himself confronted by ROE that significantly hamper his war-making capabilities. The commander, despite ROE, always remains responsible for the safety of his charges. The men under his command must be secure in the knowledge that he considers their survival a paramount concern in order for them to obey orders with the unquestioned loyalty necessary for efficient application of force.

In an unspoken sense, the battle commander is getting paid to know when to disregard ROE and protect his ship, his airplane, his men, and so on. He must discern between a lone Bear shadowing his force and a mass bomber assault. The commander must know the difference between the letter of the law and the intent of the law. It is unlikely that any rule was intended to directly jeopardize the ship, although ROE written by politicians rather than by military leaders often appear to do exactly that. In the end, survival is better than receiving a posthumous award for following ROE.

Follow the ROE to the best of your ability until the units under your command are directly threatened, and then protect your forces and deal with the ramifications of possible ROE violations when you're safely back ashore.

Reading Between the Lines

ROE assigned to U.S. pilots operating in Vietnam were nothing short of ludicrous. Designed to kill enemy aircraft at long range using missiles, the principal fighter of the U.S. — the F-4 Phantom — was ill-equipped for classic, close-range dogfighting. ROE designed with political aims first and military objectives last (if at all), however, placed the F-4 at the greatest possible disadvantage.

> **WAR LESSON 6.2**
>
> Faced with a choice between violation of ROE and the safety of the ship, remember that it is better to be judged by 12 than carried by 6.

ROE dictated that enemy SAM sites could not be attacked during construction to prevent harming Soviet "advisors." Enemy aircraft could not be destroyed on the ground unless they were trying to take off. Strike aircraft could not hit targets of opportunity. SAM and AAA sites located on farms could not be attacked. Ships carrying war supplies could not be attacked. Surface-to-air defenses within ten miles of Hanoi could not be attacked. Enemy aircraft on "training flights" could not be attacked. An enemy had to be positively identified visually before being attacked. In short, ROE dictated to U.S. pilots protected enemy lives better than they protected U.S. aircrew lives.

The U.S. pilots, however, were not without ingenuity. Although some rules couldn't be circumvented, others could be bent. For example, the F-4 was hands-down the fastest aircraft in the theater. When enemies were detected at long range, one F-4 would accelerate to maximum speed and fly toward the targets. At supersonic speeds, the "looker" F-4 would approach the target, visually identify, and exit from the area before the enemy could turn to engage. The "looker" would radio back the visual identification to his wingmen (the "shooters"). The shooters could then engage the visually identified targets at missile range. The solution was not perfect and did not work under all circumstances, but it was better than nothing.

ROE and International Law

ROE are not the same as international law. International law affects warfare on a larger, political scale, preserving the oxymoronic concept of "civilized warfare." ROE fall beneath the umbrella of international law and political and military objectives. If the strategic objectives fall outside the bounds of international law, ROE change accordingly. International law protects the interests of the international community; ROE protect the interests of the specific nation. ROE therefore are usually classified. The less the enemy knows about when and where you will fire, the better.

WAR LESSON 6.3

When ROE prohibits the most appropriate combat tactic, try bending the rules through ingenuity, cunning, and guile. Don't violate the ROE outright — look for ways around it.

ROE and international law do interact directly in certain tailored operations, however. As an example, the U.S. routinely conducts Freedom of Navigation (FON) operations designed to reinforce the statutory 12-nautical-mile limit established as the boundary between territorial and international waters in maritime law. Certain nations of the world (North Korea and Libya are the most infamous) claim excessive exclusion zones beyond the internationally recognized boundary and have been known to harass and damage shipping vessels that do not respect their unrecognized claims.

FON operations are designed to challenge unreasonable claims and establish with might the right of the law as written. Groups that conduct these operations, therefore, are generally well-defended because the provocative nature of the mission is a given. These groups do not necessarily have permissive ROE that allow commanders to act proactively against possible threats. Rather, they have a series of precautionary measures (or graduated escalation, if you will) that must be taken en route to a hostile confrontation. These measures are necessary to ensure that any subsequent international court of inquiry would validate the peaceful intentions of the U.S. force in the event that a hostile engagement did occur. This respect for appearances in the court of international opinion is a necessary evil for the battlefield commander, and it serves to keep reactionary forces in check across the globe. Teddy Roosevelt summarized this doctrine best when he said, "Speak softly and carry a big stick; you will go far."

ENEMY ROE

In *Harpoon II*, you have to be concerned not only with your own ROE but also with that of your opponent, who naturally has his own strategic and political objectives. Rarely are you informed of the enemy's ROE or battle plans.

ROE for AI

The *Artificial Intelligence* (AI), or computer-controlled opponent follows simple ROE:

1) **Do not violate exclusion zones** — The scenario designer sets the combat theater and navigation restrictions by creating exclusion zones when the mission is designed.

2) **Identify unknowns** — If the contact is unidentified, the AI proceeds to investigate and identify it. The AI never intentionally fires on neutral or unidentified contacts, although weapons do occasionally go astray.

3) **Kill hostiles** — After the AI identifies a contact as hostile, it prosecutes the contact with relentless zeal.

ROE CASE STUDIES

ROE are defined by humans and are likewise subject to fault. Despite the best intentions, ROE may be insufficient or inadequate in scope, and they do not necessarily indicate combat readiness. All the ROE in the world cannot protect a ship that is unprepared for war.

USS Stark

On May 17, 1987, the frigate USS *Stark* was hit by two Exocet anti-ship missiles that were fired (reportedly by accident) from an Iraqi Mirage F1 aircraft. The frigate was part of a U.S. "show of force" effort in the region. ROE granted *Stark* sufficient self-defense authority. She could have downed the Iraqi jet without significant consequence, yet she did not. Why?

First, *Stark* received faulty intelligence stating that Iraqi F-1s would not operate that far south in the Persian Gulf. Also, the F-1 was reportedly capable of carrying only a single Exocet missile. Unfortunately, an Iraqi F-1 did come that far south into the Gulf. Worse, the F-1 actually carried two missiles.

Second, *Stark* suffered problems with its 20mm Vulcan Phalanx Close In Weapon System (CIWS), the system designed to shoot down in-bound anti-ship missiles. The crew had not practiced firing the CIWS on the ordered schedule because of unwarranted concerns for aircraft in the region. CIWS engagement criteria could easily have precluded any threat to nearby air traffic during test firings. Additionally, because of mechanical problems, the crew was reluctant to use the system more than was absolutely necessary, effectively "saving" whatever limited usability was left for a last-ditch emergency. During the post-attack investigation, crew members incorrectly answered many CIWS procedural and operational questions, indicating inadequate training and readiness levels. As an aside, the gun in question was undamaged during the attack. Later evaluation proved that the weapon did have a malfunction which could have prevented successful engagement.

Third, ROE differed between USAF and USN forces operating in the region. At the time, the U.S. loosely allied itself with Iraq against Iran. USAF E-3 AWACS aircraft categorized unidentified air contacts over Iraq as "unidentified, assumed friendly," and USN forces categorized them as "unidentified, assumed hostile." This discrepancy led to data-link difficulties at the beginning of the incident.

Finally, officers on board *Stark* were distracted at the time. According to off-the-record sources, the TAO and XO were involved in an argument at the time over an administrative matter unrelated to the imminent attack. The ship's Track Supervisor detected the incoming aircraft and twice asked for permission to initiate the "checkoff list" (that is, to prepare for an airborne attack) while the TAO and XO continued to argue. The Track Supervisor moved to the TAO console and demanded to know why standard defensive procedure was not being followed. Reportedly, the TAO and XO stopped arguing and the TAO attempted to regain control of the situation. At that point, it was too late.

Regardless of the accuracy of the unofficial reports, the *Stark* was fully permitted to defend itself, but through a series of circumstances, was unprepared or unable to initiate defensive measures in time. ROE, no matter how permissive, could not have saved *Stark*.

Even though official naval records differ, one view of the incidents surrounding the USS *Vincennes* is as follows. July 1988 found the U.S. once again active in the Persian Gulf, when the USS *Vincennes* downed an Iranian Airbus — a commercial passenger jetliner. Contradictory on- and off-record reports from multiple participants on multiple ships cloud the event. ROE at the time granted ship captains considerable self-defense initiative, but apparently required captains to request permission before engaging when the ship itself was not in jeopardy. What follows is a compilation from both official and off-record sources of the *Vincennes* incident.

It is widely believed that the captain of the *Vincennes* bent the prescribed ROE to the limit, but never actually broke any rules. Without violating any orders, Captain Rogers apparently took an aggressive stand, operating very near the Iranian border. Many observers believe that the Captain wanted to provoke an Iranian engagement. At some point, the USS *Montgomery* reported that it was under attack from small Iranian gunboats. The *Vincennes* dispatched a helicopter to investigate.

The circumstances surrounding the helicopter flight are vague at best. Off-record sources report that the helicopter approached closer to the Iranian ships than was permitted by ROE. Upon closure, the helicopter crew reported taking gunfire from one or more of the Iranian gunboats. This fact cannot be independently verified because no bulletholes were found in the aircraft. Whether the gunboat actually fired at the helicopter or fired warning shots toward the helicopter, or whether the helicopter crew mistook something completely different for gunfire may never be known. After receiving reports of the gunfire, the *Vincennes* proceeded at high speed toward the helicopter, closing in on the suspected gunboats. Official reports indicate that the *Vincennes* cruised past other Iranian ships that were not accused of attacking U.S. forces. Then Captain Rogers requested and received permission to engage the Iranian ships. The *Vincennes* closed and exchanged gunfire with the forces suspected of firing on the helicopter.

Meanwhile, the Aegis cruiser detected an aircraft taking off from Bandar Abbas airport. The *Vincennes* interrogated the aircraft's IFF equipment and received a mode II (military) and a mode III (civilian) response. It appears that the *Vincennes* received multiple IFF signatures from multiple aircraft at the airport and that the aircraft in question, the Airbus, replied with mode III, but that an Iranian F-14 simultaneously submitted a mode II reply. The radar operator on board the *Vincennes* apparently did not recognize the potential for multiple replies from a crowded airport. Assuming that the aircraft in question, the Airbus, had generated both replies, the *Vincennes* never interrogated its IFF again after it was clear of the airport.

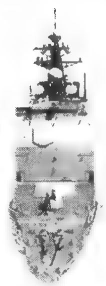
The Airbus proceeded into a widely used commercial airlane toward its destination. Although not defined as any type of combat or exclusion zone, given the volatile nature of the area at the time, it was unwise for civilian aircraft to operate there. The *Vincennes* and an accompanying frigate, USS *Sides*, both tracked the in-bound aircraft as the *Vincennes*' guns blasted at the Iranian gunboats. The *Vincennes* radar crew erroneously told Rogers that the aircraft was military and flying a hostile flight path. Rogers ordered warnings broadcast on the emergency "guard" frequency, which went unanswered. Reportedly, heavy radio communications on other channels distracted the Airbus' crew.

Captain Carlson, of the *Sides*, reported that he knew that Rogers intended to fire on the incoming aircraft when it broke 20 miles. Carlson classified the aircraft as non-hostile based on its flight profile and lack of emissions. Despite being known to challenge Rogers on other occasions, Carlson did not attempt to stop Rogers. Rogers held fire until the aircraft broke 10 miles and then ordered its destruction. There were no survivors. Despite maritime tradition that holds a captain responsible for all actions of his ship, Captain Rogers was exonerated of blame by the resulting investigation that focused blame on operator errors.

Whether or not Captain Rogers hoped to provoke a fight is known only to him. The resulting board of inquiry found his actions compliant with his orders at the time. His actions may have unnecessarily provoked the engagement but were nonetheless within the established ROE. When the shooting started, Rogers acted from the best information available to him, which (erroneously) identified the aircraft as hostile. Tensions were certainly higher than usual because of the concurrent surface action and undoubtedly affected the outcome.

Flexible orders place more responsibility and decisions on the captain's shoulders. He must make the best decisions he can based on the information available to him at the time. Given the increased room for error, however, captains should carefully consider the possible ramifications of provoking an engagement.

> **WAR LESSON 6.4**
>
> The more flexible the ROE and the more liberty granted the captain, the more room the captain has to make mistakes.



IMPLEMENTATION OF ROE

Given the aforementioned functions of ROE, it is now important to understand some of the specifics of the doctrine and evaluate the impact of this guidance on the mission. First and foremost, one must understand the fact that departure from the stated ROE sometimes means that one will not achieve the stated victory conditions. In *Harpoon II*, departure from the ROE may mean losing the game. In the real world, ROE violation can devastate a career or cause loss of life. Second, regardless of the stated ROE, defense of the ship remains paramount, and one can always act in self-defense. Third, the vast majority of the real-world provisions that situationally alter the ROE have been simplified in *Harpoon II* to preclude players having to memorize long segments of rules and special conditions. The basic Warning and Weapons conditions remain, however. These are summarized as follows:

Warning White: Hostile action is possible but unlikely

Warning Yellow: Hostile action is probable

Warning Red: Hostile action is imminent

Weapons Tight: Fire in self-defense only

Weapons Free: Engage hostile contacts at will

The two segments that summarize the doctrine can be combined in any fashion. Warning Red, Weapons Tight, for example, means that one can expect hostile action but cannot be proactive, only reactive, in dealing with the threat. If this seems constraining, it should, because it reflects the actual limitations faced by naval officers in day-to-day operations, as opposed to a wargamer's approach of shooting first and asking questions later. To ultimately achieve the stated victory conditions, therefore, you must understand your obligation under the ROE and consider the impact of this influence on every decision. In subsequent sections, the player gains an appreciation for other similar constraints that, in the aggregate, raise one's appreciation for the complexity of modern naval warfare.

SUMMARY

The road to victory is paved with proper planning. To begin the planning process, it is important to classify the mission type, specify the objectives, estimate acceptable losses, evaluate ROE restrictions, and examine the forces provided to complete the mission. Armed with this knowledge, it is easier to determine specific mission-planning steps, such as formation assignments, movement orders, and emissions-control policy, the details of which are addressed in other chapters.

Leaders attempt to control combat scope through ROE, but they still depend on the individual battlefield commanders to interpret the rules, exercise their own judgment under the rules, and ensure that their forces are ready to engage enemies within the bounds of ROE. In *Harpoon II*, you are responsible for the interpretation and enforcement of ROE.

SECTION 3

GOING INTO HARM'S WAY

In Chapter 4, you were introduced to the concept that the primary "weapons" of sea control were actually sensors. In this chapter, you are given additional detail about the use of your sensor suites, which fall collectively under the heading of *electronic warfare* (*EW*). Following this, each of the other primary warfare areas, AAW, ASuW, and ASW, is examined in detail. To practice effective sea control, you must be proficient in each area. You should also keep in mind that your knowledge of the basic warfare triad can be employed in a campaign of sea denial as well. The principles remain the same — only the focus of the execution changes. The chapter concludes with a *Harpoon II* scenario that illustrates the sea-control concepts presented so far.

THE ELECTRONIC BATTLEFIELD

Any serious student of military history can point out countless examples of how technological improvements have driven changes in tactics. Throughout it all, however, the commander's prime objective of delivering

Facing page: Sea Control means keeping the enemy at arms length. Here a Vulcan Phalanx Close in Weapons System (CIWS) knocks down a cruise missile. U.S. Naval Institute Archives

firepower in support of the mission has remained unchanged. Furthermore, to accomplish this objective, the commander must still locate the enemy, track, and target him. The effort to do so involves all methods of surveillance, from visual sighting to electronic intercept of emissions, and it is known collectively as scouting. *Scouting* involves the gathering of data, active and passive, from all friendly forces for use by the tactical commander. The degree of effectiveness of scouting is a function of the area covered per unit of time. Command and control functions, for the purpose of this discussion, are those that allow you, as the commander, to correlate scouting information on enemy-force strength and disposition and disseminate that information to your own forces for exploitation in a battle plan.

> **WAR LESSON 7.1**
>
> The commander who finds the enemy first and gets off an effective attack (while precluding the opponent from doing the same) ultimately succeeds. The electronic battlefield, therefore, which was once referred to as the battle of the airwaves, holds the key to victory.

As technological improvements have driven the envelope of engagement from the visual horizon out to 600nm, the scouting problem has been complicated exponentially. Why? Simply because of the increased area that must be covered for the commander to feel safe that any units within striking distance have been discovered. Also, because of the increasing lethality of weaponry, the Battle of the First Salvo is a realistic consideration.

The Electronic Warfare Triad

Electronic warfare (EW) is composed of three distinct subsets: electronic support measures (ESM), electronic countermeasures (ECM), and electronic counter-countermeasures (ECCM). All legs of the triad are modeled in *Harpoon II*, but the commander has varying degrees of control over each portion. ESM affords the greatest degree of user-specified doctrine; ECM, a lesser degree of selectability; and ECCM efforts are modeled almost exclusively within the algorithms that control combat resolution. It is assumed that forces employ all ECCM capabilities they possess, so the results of these efforts are displayed automatically without user intervention.

ESM

ESM involves the passive reception of enemy electromagnetic emissions. By processing these emissions against a database of known emissions and comparing the frequency, pulse repetition rate, and other details too extensive to cover here, modern ESM suites such as the SLQ-32 are capable of identifying the class of emitter that produced the transmissions. Some emitters are unique to a single class of ship, aircraft, or submarine, which means that as soon as that emitter is received, the commander can classify the threat exactly. Most emitters, however, are carried on numerous platforms. A single emission, therefore, may produce only a list of possibilities about the originating platform. When this occurs, prudent commanders must assume the worst possible case of all the potential threats.

Subsequent emissions of other radar types from the same bearing may allow you to narrow the list of possible threats, by excluding those platforms that do not have both emitter types, but formations of many vessels may still make this evaluation unreliable. Indeed, it is possible for foresighted commanders to radiate emitters on two separate ships in proximity that can lead the enemy to believe that a third, stronger vessel is present.

A unit that radiates and is subsequently classified by the enemy is not necessarily targeted or even located with any

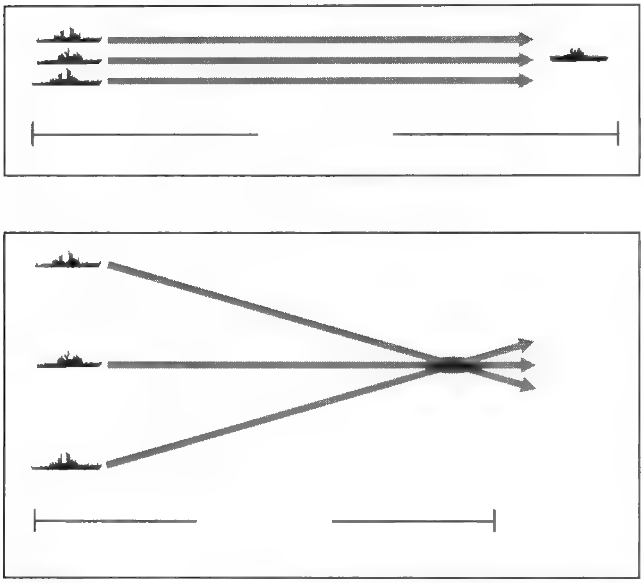


Figure 7.1. The greater the geographic separation of detecting units, the more accurate the ESM cross fix.

degree of certainty. If a single unit in the force receives the transmission, a line of bearing to the source is generated. If multiple units in the force receive the intercept, they may correlate their bearings to define an ellipse known as the *area of probability,* within which the radiating unit is located. This technique is known as *passive cross-fixing.* The greater the physical separation between the units coordinating for the passive cross-fix, the greater their bearing separation and the more accurate and narrow the area of probability.

Given the potentially deadly effect of a passive, over-the-horizon missile attack, in which the first warning is illumination by missile-seeker heads in their terminal phase of flight, one might reasonably question whether it is ever worthwhile to radiate and risk this possibility. The answer is yes, but radiating must be done when it is tactically advisable to do so, and must be avoided when it is not. Because the battlefield is a dynamic environment, the situations that dictate changes in emission posture are also fluid. A thorough understanding of subsequent sections in this chapter, therefore, is essential to success in *Harpoon II.*

Detectability versus Survivability

The manner in which commanders promulgate who may radiate, and under what circumstances, is known as the EMCON posture. EMCON stands for emissions control, which is a significant moniker in and of itself. The tactical commander, even in periods of unrestricted emissions, must consider the impact of that decision in terms of the targeting data provided any potential adversary. In the U.S. Navy, EMCON posture is typically generalized in operations orders as follows:

WAR LESSON 7.2

For ESM efforts to be effective, the enemy must cooperate by radiating their emitters.

EMCON A: No emissions

EMCON B: Limited emissions, no unique emissions

EMCON C: Unrestricted emissions

It is important to understand, however, that different components of a force may be in different EMCON conditions. Consider a CVBG, for example, that wants to remain untargeted but wants a good surface picture out to 250nm. The task force commander may opt to keep the surface units of the task force in EMCON Alpha while launching an E-2C to conduct an active surface search. If the E-2C is detected by enemy forces, its presence denotes that a carrier is somewhere within the area of operations, but the enemy is denied specific targeting data on the location of the carrier as long as the E-2C is not radiating on the deck or in close proximity to its parent. Alternately, in

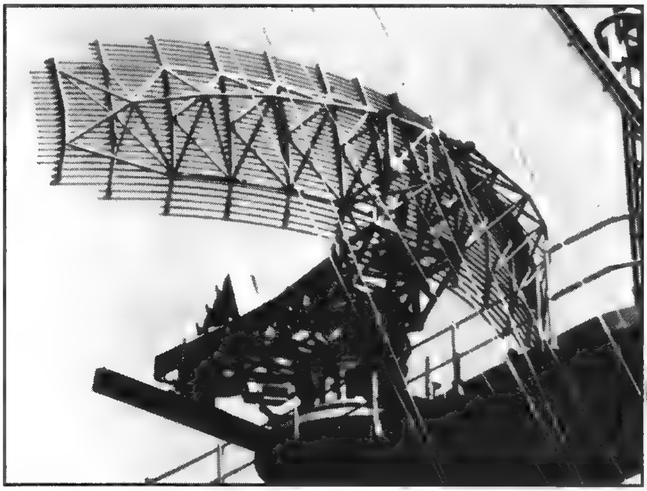


Figure 7-2. When you radiate shipboard sensors like this SPS-49 air search radar, you must remember that the enemy can counter-detect it at over twice the range you can receive an active return.

EMCON Bravo, the commander may elect to have specific units of the force radiate intermittently, to allow for a quick assessment of the active sensor picture while minimizing the amount of locating and targeting data afforded the enemy.

These examples illustrate the differentiation between the quality of information obtained through ESM. The quality of an ESM fix is directly related to the separation of the detecting units, as denoted in the earlier diagram, and the duration of the enemy emissions. The longer the enemy complies by radiating, the higher-quality fix one can obtain. The following classifications generally are applied to ESM fixes:

Detected: The unit has emitted long enough that its presence is known, but it cannot be attacked with any significant degree of certainty.

Tracking: The unit has emitted long enough for opposing forces to establish an area of probability and possible course and speed. Attack is possible but with a reduced degree of success due to uncertainty.

Targeted: The unit's position, course, and speed are known. Detecting units have the capability to attack at will.

Given that the sword has two edges, commanders must realize that the enemy seeks to target them in the same manner as they attempt. Determination of an active or passive posture falls, therefore, to other considerations.

Inferiority versus Superiority

Consider the earlier example of an inferior versus a superior force. In that discussion, it was determined that a superior naval force should mass to provide mutual defensive support and that an inferior force should disperse, both to divide the offensive capability of the opponent and to increase survivability of the remaining assets until firing position is achieved. Examining that model in terms of EMCON posture might lead one to conclude that the logical choice would be for the superior force to radiate without restriction and the inferior force to favor stealth and surprise.

Taking the place of the superior-force commander, hereafter referred to as Orange, one's defenses are massed, but they are effective only if any incoming enemy raid is detected. This means that the defensive posture adopted by a close formation is effective only if one surrenders the initiative to the enemy by radiating without restriction. If one elects to do so, the dispersed adversary (which we call Blue) has a geographical separation that makes passive cross-fixing very effective, and he may conduct a coordinated first strike that Orange must be strong enough to absorb. Conversely, if Blue is denied targeting data because Orange remains in a strict EMCON Alpha configuration, he may be forced to conduct an active search, which can lead to defeat in detail of his dispersed assets by Orange's massing of force.

Here lies the tactical dilemma faced by all naval commanders. The struggle to obtain a targeting solution must be weighed against the enemy's capability to do the same. The answer lies in the commander's estimate of whether he has already been detected. As the superior-force commander, if one has reason to believe that his force is undetected and, more importantly, untargeted by the enemy, then he should continue to pursue offensive operations against the enemy without hesitation. If however, one is reasonably certain that his position is known, a shift to active emissions is necessary to increase survivability.

The common manner of referring to this line of thinking is *risk management.* In the preceding example, if Orange seeks to remain passive for a period to close the battle space with Blue's forces, he is taking a calculated risk that Blue will not find him and attack first. If successful, Orange gains the dual advantage of selecting the time and place of his attack and surprise. If Orange is a more cautious type, he radiates from the outset to minimize the risk to his forces, but, by doing so, surrenders the tactical advantage to Blue.

ECM

Electronic countermeasures (ECM) involve all techniques designed to deny the enemy specific targeting data. Viewed from a broader perspective, they are tactics designed to complicate enemy command and control functions. Some of these techniques are actually mechanical, such as chaff and SOIDs, but they nonetheless are classified within this subset of warfare. There are offensive and defensive employments of ECM, and the fluent tactical commander must understand the role of each one.

Offensive ECM involves the use of jamming in support of strike operations to preclude the enemy from determining the composition of the strike and targeting specific elements with counter-battery fire. In *Harpoon II*, when air strikes are escorted by ECM-capable assets, you will receive a very strong ESM cut on the jammer and a jamming icon next to the track. This complicates targeting of the missile-equipped strike aircraft until the jamming platform is destroyed. Furthermore, a savvy tactical opponent strikes from several directions, complicating the AAW effort with jamming decoy groups and chaff corridors, whose employment is discussed in detail in the sections on AAW and strike warfare. The *Harpoon II* commander can employ ECM in strike planning and must counter the opponent's use of ECM to survive.

Defensive ECM includes the employment of blip-enhance, chaff, SOIDs, and electronic manipulation of radar returns to terminal homers. *Blip enhance* is a selectable tactic employed by properly equipped helicopters to produce the equivalent radar signature of an aircraft carrier for missile terminal seeker heads. Similarly, chaff and SOIDs are employed to provide larger, more attractive targets to missile seekers than their real-world counterparts. Eliminating a missile through any of these countermeasures is termed a *soft kill*, as opposed to a hard kill in the form of a traditional intercept.

Chaff canisters contain thousands of thin, metal strips that are exploded into a cloud after deployment from the firing ship. These strips fall slowly to the ocean, drifting with the wind and expanding as they do to provide a large, reflective radar signature to active missile-seeker heads. Chaff may be employed as either a deceptive or seductive countermeasure. To act as a deception, it must be deployed before the launch of the in-bound missile group so that more targets appear than actually exist.

WAR LESSON 7.3

Soft kills of in-bound missiles by way of ECM are even more desirable than hard kills because they do not require expenditure of finite resources (AAW defensive rounds, for example). You should not depend on them exclusively, however, because they are not 100 percent effective. Rather, use them to complement other aspects of your layered defense plan.

After missiles have been launched, however, chaff clouds may exist only to seduce missile-seeker heads away from their eventual target. *Soids*, which are floating flares, are effective only in the terminal phase of missiles with infrared signature seeker heads. In *Harpoon II*, the employment of chaff, soids, and manipulative seduction techniques are automatic functions that reduce the effectiveness of in-bound missile groups.

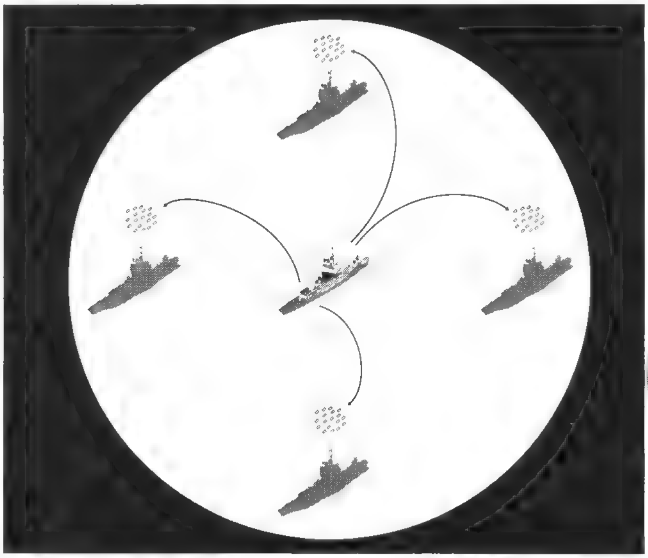


Figure 7-3. Deceptive Chaff complicates the enemy's ability to accurately target individual ships.

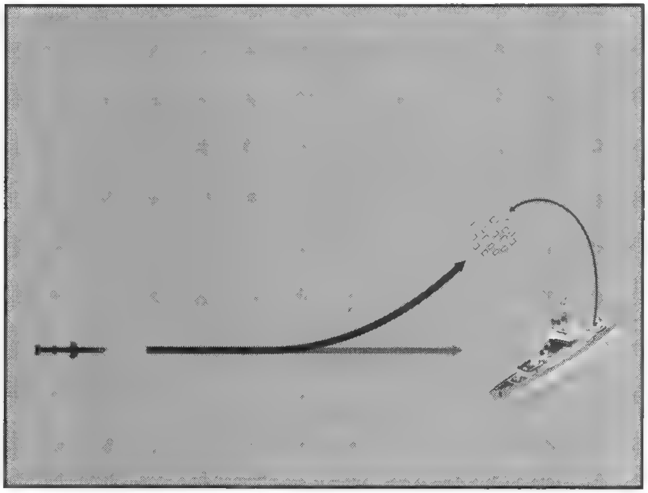


Figure 7-4. Seductive Chaff attempts to cause the missile to break track on the ship in the terminal phase of homing by presenting a larger and more attractive radar return.

ECCM

Electronic counter-countermeasures (ECCM) involve all efforts and techniques to retain command and control despite enemy jamming and other ECM tactics designed to deny it. In the real world, these techniques include raising the power of friendly emitters to "burn through" jamming and other, more innovative approaches that fall outside the realm of this discussion. In *Harpoon II*, it is assumed that all possible ECCM efforts are utilized and that the players display is updated over time accordingly.

Command & Control

Communications transmissions are also electromagnetic emissions that are subject to detection and exploitation by the enemy. Again, however, some types of transmissions are more detectable than others. Data links, which are used extensively by U.S. forces, can be omnidirectional or line-of-sight transmissions. The latter are hard to detect unless an enemy unit is between the transmitting and receiving unit. In *Harpoon II*, data links are modeled as connecting webs of lines between the units in contact. Only one unit, such as the E-2C used in an earlier example, may be radiating and therefore targetable by the enemy, but all units connected to the web are capable of using the targeting data provided by the link for any subsequent attack.

Satellite communications, because they are also directional in nature, are difficult to intercept. Traditional radio frequencies, such as UHF, VHF, and HF, are progressively more susceptible to intercept, and HF transmissions have been localized from thousands of miles away. The prudent commander must therefore balance the need to disseminate targeting data to his forces with the corresponding intelligence he reveals to the enemy by his method of doing so.

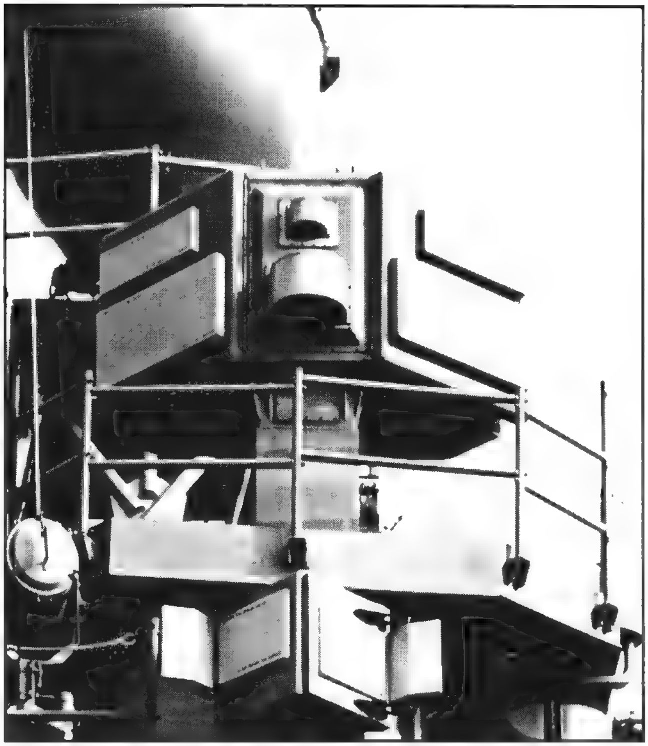


Figure 7-5. Most U.S. shipboard ESM efforts are managed by the SLQ-32 topside array

Electronic Warfare Summary

To deliver firepower, the commander must detect, track, and target enemy forces that are either the objective of the mission or that complicate the achievement of that objective. After being targeted through proper scouting, the commander must have effective command and control to disseminate that information to units of his force that prosecute the attack. To accomplish these objectives at an appropriate level of risk to his forces, the commander must constantly weigh the impact of his decisions regarding emissions policy.

WAR LESSON 7.4

Remember, the battle of the airwaves can hold the key to victory.

ANTI-AIR WARFARE

AAW posture should be a constant concern of the naval commander because a missile threat can materialize from all contact types: surface, subsurface, or air. Furthermore, with anti-surface missile speeds ranging from subsonic (in the case of sea skimmers such as TASM), to Mach 4 (such as the HARM), an AAW threat may present a window of engageability measured in seconds. If the commander has not invested the forethought and planning to be in position to take advantage of the period of vulnerability, the missile strikes home and additional actions, even the destruction of the launch platform, are academic.

In determining the AAW force posture, the commander must remember, whenever possible, the tactical axiom to "shoot the archer, not the arrow." If ROE and other constraints allow, it is always better to engage the firing platform before it reaches its launch point, thereby killing many missiles with a single attack instead of attempting to deal with groups of multiple in-bound missiles. Although this is the optimum case, it is not always attainable. The prudent commander therefore balances the effort and resources committed to the outer air battle just described with those necessary to provide cohesive mutual support in the inner air battle.

WAR LESSON 7.5

Shoot the Archer, not the Arrow.

To provide the most applicable situation in which to illustrate the conduct of inner and outer air battles, we must return to our earlier comparisons of the inferior and superior force. In the case of an inferior force, which has adopted dispersal as the best tactic, AAW defense is a single-unit or small-group proposition. In essence, it is every man for himself, and the best chance for survival in the face of enemy air superiority is to avoid detection in the first place. Conversely, remember that superior forces favor concentration and massing for mutual defense, which fits the more complicated model of integrated AAW at sea. For the remainder of this section, therefore, the case of the superior force commander is assumed.

AAW Weapon Basics

Before examining the flow of events that occur in the outer and inner air battle, the commander must become fluent in the technical constraints that govern the employment of surface-to-air missile systems (SAMs). The majority of the world's SAMs employ semi-active homing for in-flight guidance and course corrections. Semi-active homers require the firing platform to actively illuminate the target throughout the intercept with a missile fire control director. The number of directors a ship possesses governs the number of intercepts that may be simultaneously prosecuted. As a rule, therefore, director-assignment commands are more limiting than launcher cyclic rates in evaluating engagement potential. If the guiding radar shuts down for any reason, such as attempting to avoid an in-bound HARM or being struck by the same, then all defensive missiles in flight self-destruct.

The exception to the aforementioned limitations is the Aegis fire-control suite employed by Ticonderoga and Arleigh Burke-class ships. The SPY-1 radar system employs phased-array and time-sharing technology to allow simultaneous tracking and targeting of hundreds of contacts, but can only guide a maximum of 12 intercepts at a time. This means that the Aegis platform suffers none of the delays

Figure 7-6. Standard Missile firing from the forward Vertical Launch System of the Aegis Cruiser, USS San Jacinto (CG-68).

associated in switching between targets and may capably manage 12 missiles in a 360-degree area of coverage at any moment. Furthermore, as an intercept is completed, if other targets remain, the system can automatically and instantaneously put another missile in the air from the vertical launch system to refill the engagement cue.

Also, because the SM2-MR possesses an inertial mode, if the guiding radar shuts down for any reason, all missiles in flight continue on their last course update until intercept occurs or fuel is expended. Maneuvering aircraft can, as a rule, escape this "death gasp," but missiles generally still are intercepted provided the SAM was not in its initial phase of flight. Given these statistics, it is not surprising to see why Aegis is referred to as "the guardian of the fleet."

Airborne Early Warning

The first consideration for proper AAW management is airborne early warning. If one cannot see them coming outside their launch points, then the outer air battle is already lost and the commander is forced to play catch-up in the inner screen. The premier platform for AEW is the E-3 AWACs, but it is constrained by being only a land-based asset. If they are available, use these air frames to the maximum extent possible. If not, E-2 Hawkeyes are the weapon of choice to keep savvy CVBG commanders appraised of the air threat. A well-positioned E-2 eliminates altogether the need for the CVBG to use active emissions, thereby confounding the enemy's targeting efforts. He knows that you are in the area because E-2s don't materialize out of thin air, but he cannot localize you well enough to attack without resorting to methods other than ESM.

To employ one of these AEW assets, they should be stationed in a racetrack loiter pattern to cover the area of interest. In the case of a rapidly transiting CVBG, for example, this might be 100nm ahead on PIM. Also, because there are a limited number of these valuable aircraft and they are very vulnerable to enemy intercept, it is always prudent to also provide one or two fighters as flankers to support the AEW platform.

> **WAR LESSON 7.6**
>
> Proper employment of airborne early warning aircraft is critical not only to getting off the initial salvo, but also to have the maximum response time to counter enemy salvos.

The Outer Air Battle

The primary player in the outer air battle is the fighter/interceptor aircraft on a combat air patrol (CAP) mission. CAP may originate from a CVBG or a land base. Furthermore, CAPs may protect their unit of origination or any other unit. CAP assets that are stationed to protect units other than their home base are known as long-range combat air patrol (LORCAP) assets.

The proper positioning of either CAP or LORCAP is on either side of the expected threat axis at about 160 to 180nm from the unit or group of units to be protected. Use the loiter command to prolong their time on-station and reduce the amount of relief CAP that must be launched. From this vantage point, the CAP assets usually are in position to engage incoming groups with AA missiles, which destroy portions of strike elements and may cause others to jettison their ordnance to increase maneuverability and survivability. The pilot's dictum is that it is far better to flee and fight another day than to press forward with a suicidal or non-decisive attack. When this latter case occurs, it equates to a "mission kill" even if the CAP does not succeed in eliminating any of the in-bound aircraft.

Players must watch these engagements closely and dispatch relief CAP to the units on-station as soon as they occur so that follow-up waves of attack aircraft are met with full weapons loads. After in-bound aircraft have penetrated the outer defenses, the player may have a second opportunity to engage them with CAP in Ready 5 status (in the case of short-shooters such as Maverick-equipped aircraft), but the bulk of them become the responsibility of formation AAW assets.

The Inner Air Battle

In this area, the player has a little latitude tactically. Within the main body, shooters should be positioned in such a way that they can provide a layered defense and overlapping coverage to protect the high-value unit (HVU), which is usually the CV, LPH, LCC, support ship, or merchant group. Each class of AAW ship usually has several methods of defeating in-bound aircraft or missiles, including either long- or medium-range missile systems, point defense systems such as Phalanx (which are effective only against missiles targeted at their own ship, due to Doppler restrictions), and electronic countermeasures, which provide a soft kill on missiles by luring them away from their actual targets to explode harmlessly (except for nukes) over the ocean.

To protect the HVU, the optimum position for the firing platform is directly between the HVU and the in-bound missile group. The reason for this constraint relates to the probability of kill (Pk) for the missile to be employed as a factor of the aspect of engagement. Although the ship is plotted with a circle denoting the maximum effective range of the AAW weapons system, when viewed with Pk in mind, the circle becomes an ellipse. The highest percentage shot is against a directly in-bound missile. As one nears the tangent or closest point of approach of a missile flying past the ship, regardless of how far inside the nominal range of the AAW missile system is, the Pk drops to less than 20 percent, as a rule. The reason is that the relative motion of the intercept is at peak speed, and most AAW missiles cannot do course-trajectory changes fast enough to complete the intercept for a crossing shot as just described.

As the missile continues in-bound to other ships in the formation, if it is a slow enough target, such as a sea skimmer,

Figures 7-7a & 7-7b. Given the low probability of kill against crossing shots, there is a substantial difference between theoretical weapons range and the actual engagement envelope.

and the firing unit is either a picket or a member of the outer screen some 20 miles distant from the main body, it may obtain an opportunity for one more attack. These tail chase engagements have a slightly higher Pk than crossing shots do, but they are still below acceptable standards.

Given the aforementioned Pk considerations, main body positioning of AAW assets becomes even more critical. A good rule of thumb is to place Aegis-equipped ships in close proximity to the HVU while placing lesser shooters (DDGs and FFGs) in sectors between 16,000 and 24,000 yards from the main body on either side of the threat axis. In groups of sufficient size, in which an outer screen is employed as well, AAW assets should be spaced one sector width farther away from the threat axis than inner screen units at 18-24nm from formation center. This distance allows for the aforementioned interspersing with ASW units of the outer screen and also affords a greater degree of protection for AAW attacks that are somewhat off the main threat axis. Naturally, the more reliably one is able to predict the axis of attack, the more effective one's units are in the subsequent inner air battle.

Special Tactics: The Role of the AAW Picket Ship

More sophisticated tactics involve the use of AAW picket ships in either a missile trap or silent SAM configuration. When the tactical situation dictates that main body assets must adopt an active emission posture (when their detection and localization is assured to enemy forces), positioning one or two cruisers 100 to 150nm from the main body on the threat axis in total emission silence is ideal. In this configuration, the cruiser (or cruisers) can act as a missile trap, going active with their air search radar only when the incoming raid has been detected by other means and is within their engagement envelope. The hazard to this tactic is that, after these assets go active and are detected, they lack mutual defensive support and become vulnerable to individual attack.

Calculating Defensive Staying Power

Occasionally, it is beneficial for the force commander to calculate the defensive power of a unit against missile attack, particularly when making stationing decisions. In the real world, this calculation can become a cumbersome exercise in number-crunching against each possible missile threat. In *Harpoon II*, the player need not be as exacting. A reasonably accurate yet simple-to-obtain method of obtaining these figures follows.

Take each ship of the force and examine its AAW weapons systems. Assign numeric values to the following attributes based on factors listed in the *Harpoon II* database:

A = The maximum number of intercepts per engagement cycle

B = The number of engagement cycles based on maximum range

C = The base Pk value of the missile system

D = The effective number of engagements

Manipulation of these variables yields this equation:

A X B X C = D

Assign B a value of 1 for short-range shooters (25nm or less), 1.5 for medium shooters (30 to 45nm), and 2.5 for long-range shooters, such as the SM2 ER used in an earlier example. Continuing that example here, let's assign a value of 4 to variable A, to reflect the number of directors, and a base Pk of 80 percent to the missile. By entering these numbers, you arrive at the following value:

4 X 2.5 X .8 = 8

You have determined that an SM2 ER unit should be capable of engaging eight in-bound targets with its missile system alone. As a rule of thumb, if the unit is the subject of the attack, 1 may be added to D for the presence of a point defense system (such as Phalanx), one may be added for chaff, and 1 may be added if the unit has defensive ECM capability such as that provided by the SLQ-32. A Leahy or Belknap class, if optimally positioned, could therefore increase force defensive posture by eight kills, yet have a higher saturation value of 11 in defending against its own ship attack. Beyond that, any surviving missiles strike their target.

AAW gun systems are discounted for all classes when considering missiles because the level of depression required to engage and the constraints related to proximity fuzing make such employment a low Pk proposition. Their effectiveness is higher against manned aircraft, if the latter are cooperative enough to fly within the relatively short zone of engagement.

Finally, the commander must understand that these estimates assume early detection of the threat, so that the first engagement occurs at the maximum effective range of the SAM system. When the enemy succeeds in compressing the battle space by using one or more of the tactics discussed throughout this book, reaction time and the maximum number of AAW engagements are reduced considerably.

AAW Summary

The AAW commander must constantly update the threat axis to reflect the most reliable intelligence available. In formation considerations, invest the time necessary to actually analyze the capability of your own force units. Balance resources between the outer and inner air battles, but strive to shoot the archer, not the arrow, whenever possible. Finally, station assets relative to the threat axis with Pk-biased weapons envelopes in mind. This strategy increases one's chances of living up to the Aegis motto "If it flies, it dies."

ANTI-SURFACE WARFARE

ASuW is slightly more difficult than AAW because one must invest more time establishing hostile intent and refining the over-the-horizon targeting solution. Several factors must be considered when one is contemplating an ASuW strike, including target composition, delivery platforms, which ordnance package best accomplishes the job, and timing. Because surface units begin with a limited number of ASuW weapons, it is generally advisable to husband these resources if air groups are available to prosecute the attack.

Not any air group constitutes an appropriate strike, however. Proper strike planning requires the player to consider the enemy's defenses and the amount of ordnance that must be delivered to achieve the objective of the strike. Weapon types must be matched to target types, but, more importantly, the strike aircraft must be given a reasonable chance of reaching their launch points.

In the preceding section, you viewed an ASuW strike from the receiving end, with the goal of destroying that strike before it could prove decisive. In this section, we reverse roles and capitalize on this newfound AAW expertise to exploit it for our own purposes. The *Harpoon II* commander learns how to evaluate enemy defenses and develop a plan to overwhelm them in support of the ASuW mission area, first through air assets and then with surface ships.

Over the Horizon Targeting

Because enemy surface task forces are mobile, the first step to prosecuting them is to find them and target them. Some guidance has already been provided on passive cross-fixing, which is a form of OTH targeting, in the section on electronic warfare. This section is designed to supplement that information, therefore, by discussing the role of ship-based helicopters in OTH targeting.

As a stand-alone search platform without any initial locating information on the enemy force, the helicopter has limited effectiveness. Armed with even a single ESM cut on a platform of interest, however, the helicopter can begin a line of bearing search to attempt to acquire that target. If the helicopter flies out the line of bearing to its maximum radius and doesn't discover anything, then it was not a wasted journey. At least the tactical commander has good reason to assume that the enemy platform is beyond that maximum range.

Helicopters are best employed, however, when a rough area of probability has been obtained on the enemy force, such as when they are radiating intermittently. In this instance, the helicopter approaches the area of probability from off-axis, so as not to provide the enemy a line of bearing to its launch platform if it is discovered. After the pilot estimates that he could be above the radar horizon of the enemy group if they radiate, he must slow down and reduce elevation.

For the duration of the approach, the helicopter should fly low and slow under 50 feet to make detection difficult. Air search radar usually has a feature, known as MTI, that requires a certain degree of movement from the target before it is identified as other than clutter. Helicopters can often use their slow speed and small radar and visual cross-sections to remain undetected, even when they're within-sight of the formation being targeted and while maintaining a directional data link back to the parent platform. If these same helicopters are also ASuW-missile-capable, such as the British Lynx, then the commander may also use them to conduct the first pulse of his strike package from their undetected position at short range. Indeed, such tactics proved devastating to the Iraqi navy during Operation Desert Storm, which has prompted considerable open debate by policymakers in other brown-water navies.

Alternatively, the helicopter may conduct a search tactic known as *jumping jacks*. From the standard search profile of 150 feet at cruising speed, the helicopter pops up to between 500 and 1,000 feet, does a visual scan and a couple of quick radar sweeps if nothing is spotted, and then dives down to the deck again. The process is repeated about every 7 to 9nm during the search at the pilot's discretion. This puts the helicopter at greater risk, but increases the scouting area swept per unit time.

Evaluating Enemy Defenses

Commensurate with the effort to refine the targeting solution for the conduct of an ASuW strike, the commander must also classify the composition of the enemy force to the best of his ability. The more accurate this assessment, which is based on the correlation of sensor and bearing information as explained in the section on electronic warfare, the more correctly the commander may determine the defensive power of the formation to be targeted.

When one or more asset types is possible, the prudent commander always assumes the worst-case scenario. Applying this logic to all the discrete platforms that have been detected, the commander comes up with a composite picture of the enemy force. Using the *Harpoon II* database and the formula presented to calculate is own ship's AAW capability, the commander can reliably estimate the required saturation level for the intelligence composite he has developed. Armed with this knowledge, the commander may begin strike planning in earnest. One note of caution

WAR LESSON 7.7

Always assume the worst case scenario when estimating enemy defenses based on incomplete targeting data.

must be mentioned, however: The saturation estimates are only as accurate as the classifications of the target types. It is possible to either overestimate, which wastes precious weapons, or underestimate, which endangers the strike elements themselves.

The ASuW Strike Group

After the target has been classified and targeted, the commander must have a strike package ready to assign to the threat. We have already noted that it is best to conduct ASuW strikes with air assets whenever possible. Therefore, let us consider a strike against an enemy CVBG, to illustrate one possible composition and approach. First, the player should launch from four to eight fighters in two groups on patrol missions in the area one would expect to encounter enemy CAP. You cannot launch them on strike missions because their ordnance does not match the target type. Immediately following this, the commander should launch all ARM- or HARM-capable aircraft to engage any air search radar that goes active in the target group. If these units succeed in blinding the enemy, the remainder of the groups have a milk run. Follow this with the main body of the strike force, employing stand-off and guided munitions.

Concurrent with the fighter sweep but as a discrete group, the commander may

WAR LESSON 7.8

Iron bombs should be reserved strictly to mop up critically wounded ships after the main attack or, in the case of limited air resources, as weapons of last resort.

also commit electronics support aircraft, such as the EA-6B, which increases the survivability of the strike as a whole. If several types of strike aircraft will be used, each should be launched as a separate group, to complicate the enemy's AAW effort and maximize the chances of the strike achieving its objective.

Ship-to-Ship ASuW

When air assets are unavailable to prosecute the target, surface forces must consider other factors to maximize their attacks. Of utmost concern is ensuring that one has a refined, complete targeting solution before committing the limited assets in the magazine. Furthermore, one must be certain of the composition of the target group. Do you know they are hostile? Will the number of weapons you are about to employ ensure saturation, based on the intelligence you have at that point? If the answer to either of these questions is no, then hold off on the attack. If you are certain that conditions are right to proceed, then the next steps are to establish salvo size, the timeline, and the axis of the attack.

Assume that the Pk of your missile is 80 percent and that the target vessel is capable of firing three AAW missiles with their own Pk of 60 percent in the time that your missiles are in the envelope. In the case of a single target vessel, this means that a salvo of four missiles is likely to have two survive to

Figure 7-8. Achieving Saturation of Enemy AAW defenses ensures that a scene like this will be the last thing he ever sees.

enter the terminal phase of guidance. Within the terminal phase, either point defense systems or the ECM suite is capable of killing both, but the likely event is that at least one will survive, having an 80 percent base chance of hitting the target.

Although this illustration seems reasonable and simple to understand, the problem is grossly more complicated when one is targeting a formation of ships. In this instance, the overlapping air defenses complement one another, and the player must commit many scarce ASuW missiles to ensure a modicum of success. When this is the case, the best alternative is to try to coordinate at least two different ASuW attacks from different bearings with a simultaneous time on top of the target. This is not easy to accomplish, but players who do so are rewarded with appropriate results.

The timeline can be calculated by using the method delineated in Chapter 9. As noted there, when you're coordinating multiple firing platforms, the objective should be to obtain simultaneous time on top to saturate the enemy defenses. In considering the axis of attack, firing straight down the bearing to the target may be the fastest method of getting ordnance on the target, but it also allows the enemy to shoot a bearing-only attack down the reciprocal course of the in-bound missiles after he detects them. This exercise, known as a "quick shot," is an exercise practiced routinely by surface ships. It is rarely a conclusive attack, but if fired down the correct bearing (if the original shooters did not fire off-axis, for example), it can force the enemy ships to bring up the AAW radar. This would allow surviving members of the original target group to quickly counterattack with any remaining ASuW missiles.

Composition and Employment of SAGs

If enemy forces have equivalent launch ranges for ASuW weapons, then prudent players dispatch a surface action group (SAG) rather than endanger their HVU. SAGs are good for taking the battle to the enemy. As a rule, they can transit faster than the battle group and prosecute the attack quicker. The player must ensure, however, that SAG composition is both adequate to accomplish the mission and to defend itself against potential threats.

A strong SAG should be capable of posing a viable threat to a CVBG. To do so, it should include at least four medium-range ASuW shooters, one long-range AAW shooter, one medium-range AAW shooter and, if an ASW threat is present, a couple of helo-equipped platforms to counter the subs and provide OTH targeting services. Towed array assets are not important because SAG transit speeds render this sensor useless. This description means four ships of proper capability, not a total of eight, because each ship class is multimission capable. Two- and three-ship SAGs may also be used against smaller groups or less capable ships with a corresponding expectation of success.

The optimum formation for a SAG is a scouting line abreast with 10 to 12nm spacing between units. This distance allows for maximum swept coverage of the scouted area, covert communications via flag-hoist and semaphore relay, as well as optimum separation for passive cross-fixing, as described in the section on electronic warfare. Also, when the target group has been located and classified, this formation provides an inherent multiple axis to the ensuing missile attack.

ASuW Summary

Effective ASuW requires mastery of passive cross-fixing and other over-the-horizon targeting techniques. After forces have been detected, classified, and targeted, the commander must conduct a detailed estimate of the required salvo size to achieve saturation. Finally, in the prosecution of the attack, make every effort to conceal the origination point of the attack to avoid counterattack.

ANTI-SUBMARINE WARFARE

Because of their inherent capability for stealth and surprise, submarines are the most deadly adversary faced by modern naval commanders. Until recently, the bulk of U.S. ASW doctrine focused on countering the Soviet submarine threat, dashing out of the Norwegian Sea and the G.I.U.K. gap to interdict sea lines of communication (SLOC) supporting a ground war in Europe. With the dissolution of the Soviet Union, this possibility has virtually evaporated. In its place, however, looms a broader, potentially more devastating threat.

With the loss of an obvious challenger for open-ocean supremacy and a political climate emphasizing budget reduction, the U.S. maritime structure is being whittled at incessantly. Furthermore, the naval hierarchy is shifting mission emphasis away from strategic control of the oceans to support of joint operations in littoral conflicts. In this capacity, the Blue-water-turned-Brown-Navy is viewed as a method of quick power projection ashore, via air and missile strikes as well as amphibious ground forces. As astute naval commanders are aware, however, for power-projection operations to be undertaken with an acceptable degree of risk, sea control of the objective area must first be obtained. Here lurks the new danger.

The CIS is strapped for cash, and its most readily available export commodity is hardware from the once-mighty military machine. Although their arms-sales efforts have already extended to all platform types short of nuclear weapons, here we focus exclusively on their support of submarine proliferation. Most notable among current negotiations is Iran's purchase of several Kilo submarines. These boats represent the most advanced diesel electric technology in the world, which gives them a very quiet snorkel signature. One doesn't have to be a military analyst to appreciate how the presence of these type of platforms would complicate naval operations in any future Gulf conflict. There is also a possibility that Libya, Syria, and Algeria, all of whom already operate Soviet submarine designs, may obtain additional boats.

By adding these developments to the fact that shallow-water ASW is the most difficult to conduct, one develops an appreciation for how the changing maritime strategy places additional emphasis on this warfare area. In the remainder of this section, commanders can find detailed briefings on the impact of oceanographic conditions on tactics, area-versus-local ASW, assessment of one's own force capabilities, and other topics of vital importance to battlefield survival.

The Environment

Sound propagation in the ocean is affected by temperature, pressure, and salinity. Of these, temperature is the dominant characteristic. The ocean temperature varies with depth, but there is usually an isothermal layer somewhere between 100 and 300 feet, where the temperature is relatively constant. The location of this area, known as the *layer depth,* is tactically significant for several reasons. Without getting into the physics of the model, players need to understand only that sound emanating from a source below the layer tends to remain trapped beneath the layer and likewise for that originating above the layer. It is not an impenetrable

> **WAR LESSON 7.9**
>
> When sufficient depth exists in the area of operations, submarine assets are the least detectable at the deep or very deep settings.

barrier — there is some leakage, particularly with very high-decibel sound sources such as high-speed cavitation (the speed at which bubbles produced around the propeller collapse noisily in the wake) and active sonar transmissions — but the general rule of thumb is that a receiver must be within the same medium to detect a sound source. In reality, layer depth varies, and the best depth for a submarine to hide is layer depth plus 200 feet. In *Harpoon II*, layer depth is modeled as a constant at the barrier between shallow and deep settings.

ASW Summary

Commanders must constantly assess whether their sonar emissions policy should be active or passive based on the tactical situation. To understand the basics behind specific cases that are explored later in this section, it is important to illustrate first the influence of the layer in a generic encounter between surface-ship Blue and submarine Orange. In the first case, Blue is operating at five knots, towing a passive sonar array (SURTASS) above the layer. Orange is also operating at five knots below the layer. Notice that the sound waves emitting from both platforms are so minimal that only those in a direct path to the layer penetrate, while the bulk of the sound is reflected or refracted on either side of the layer. Those that do penetrate directly through the layer form a narrow cone of sound. In this case, for either Blue or Orange to become aware of one another, they must physically pass through the direct path cone, which means that they would be virtually on top of one another if it occurred at all, and detection would be simultaneous.

In our second example, Blue is towing a passive sonar array below the layer, and all other conditions remain the same. Note that Blue would now be able to receive the bulk of the sound waves emitted by Orange, which means that he would detect Orange at a considerably farther range while remaining undetected himself. The actual range at which this detection would occur is a function of the total decibel strength emitted by Orange operating at this speed, which varies by type and class of submarine.

In the third case, Blue is attempting an active search by using a hull-mounted sonar, and Orange remains below the layer. Active sonar transmissions are so powerful that they literally boil the water surrounding the transducer, which makes them counter- detectable at ten times their effective range or more. Blue is considered to have surrendered the initiative to any subsurface threat within 100nm, therefore, because its transmissions act like a giant homing beacon. We ignore the lack of reasoning behind this decision for now and address only its effectiveness in the layer model we have established.

Notice that the bulk of Blue's active transmission curves at the layer boundary and is reflected back toward the surface, leaving a portion to penetrate the layer as a direct path ray. This direct path ray is capable of detecting Orange if it is foolish enough to stumble into it, but such detection would typically be limited to the 3,000- to 5,000-yard range. The remainder of Blue's transmission arcs back to the surface and reflects downward again. The area of reflection is known as the *annulus*, and any contacts detected there are known as *convergence zone* (CZ) contacts. Surface ships can also be detected as they pass through the CZ annulus. When conditions are correct, two or more CZs are possible with a spacing of 15 to 20nm between them, in restricted water such as the Mediterranean. In open ocean the spacing between CZs can be as much as 30 nm. *Harpoon II* does not model active CZ propogation, only passive CZs.

Consider now another case, in which Blue possesses a variable-depth sonar (VDS) in conjunction with his towed array. By lowering the combination of active and passive capability into the same medium as Orange, Blue can listen for Orange as before, but as soon as he feels that Orange is within striking distance, he may selectively go active for one or two transmissions from the VDS and obtain an immediate targeting solution on Orange. The range at which a return echo is strong enough to provide this solution is again variable, depending on the type of sonar, the aspect of the target, the presence or absence of anaerobic coatings, and numerous other factors. While listening below the layer as noted earlier, the hull-mounted sonar is capable of passive or active operations above the layer. This is the optimum configuration to conduct blue-water ASW for surface ships that are properly equipped.

Shallow-Water Operations

It has been alluded to in this chapter that shallow-water operations are the most difficult to conduct. It is now important to explain why this is the case. In the examples just presented, you may have noted that, as a rule, passive-detection ranges far exceed active ranges. When active contact is held, both parties are usually within striking distance of one another. Naturally, the commander prefers to extend his battle space and engage the enemy before he gets within striking distance. Passive operations are therefore the norm in most cases. Shallow-water operations are the exception to this rule.

Although biological noise sources are present throughout the ocean and are frequent sources of false contacts (whale flatulence sounds like ballast tanks being blown, for example), the highest concentration of biological activity is in shallow water. Furthermore, wave and tidal action, the influx of rivers and estuaries, and other natural phenomena combine to make passive ASW virtually impossible for either side, although sub sonar operators are a little more adept at sorting out the background noise than are their surface counterparts.

The second factor to consider is that shallow waters have a minimal thermal gradient and none of the aforementioned layer affects. Therefore, both surface and subsurface units are always in the same medium. Although no sub commander would use active transmissions to search for contacts, preferring the periscope instead, surface task forces are virtually mandated to use active sonar whenever a shallow-water submarine threat exists. Again, this is done with forethought to counter-detection ranges, but the task force commander obviously has some other reason to sacrifice strategic mobility and operate close ashore, so he must assume that he is already detected, if not targeted. Given that, the logical choice is to adopt the best defensive posture for the force and hope that his surface search radar picks up any periscopes of lurkers setting up a shot. What we have not explored up to this point, however, are the measures he may have taken to minimize that threat during his transit to the area of operations.

Joint ASW

Each component of the ASW triad has strengths and weaknesses that must be clearly understood for proper tactical use. Of the three, submarines are the most effective at finding and killing other submarines. The root of their strength lies in operating in the same medium, but it extends beyond that. Because of these nuances of employment and the fact that SSNs best accomplish this mission area as solo players, the use of SSNs as hunter-killers is discussed in Chapter 8, in the section "Commanding a Submarine." Here, we focus on the interplay of surface and air assets attempting to detect, localize, and target rogue submarines in a concept of layered defense. These phases of an engagement are analogous to the aforementioned qualities of passive cross-fixes, and an understanding of their meaning is critical to subsequent discussion:

Detected: Regardless of the source of data (active or passive), the commander has reason to believe that the presence of a submarine is possible. (Possub) or probable (Probsub).

Localized: The submarine contact has been localized to a small enough area of probability to allow attack with a reduced chance of success.

Targeted: The bearing and range to the target, in addition to the target's aspect, course, and speed, are known with sufficient certainty to attack with a high expectation of success.

WAR LESSON 7-10

For a theater-level ASW campaign to be successful, the commander must correctly employ all available ASW assets — surface, air, and subsurface.

Area ASW

Area ASW has several applications, but the specific platforms and tactics used to conduct it remain constant throughout the range of applications. The platforms of choice are maritime patrol aircraft (MPA), such as the P-3 Orion, and SURTASS-equipped surface ships, because each possesses endurance and potency, in terms of weapons load. SSNs also do, but again, their use is explored later. Of the two, SURTASS assets cover a greater area but require more time to do so; MPA assets cover more area per unit of time, providing a quicker search of a smaller area. A less-than-optimum choice for area ASW is CV-based aircraft because they have limited endurance and barely adequate weapons and sonobuoy loads. Finally, a new employment of area search involves active dipping by SH-60F helicopters 100nm in advance of the task force.

What is area ASW? It is the coordination of search efforts in advance of the main force on specific areas of ocean that hold tactical significance. The objective of area ASW is to detect and localize any submarines within the area, as a minimum, and to destroy the same if the tactical situation and rules of engagement allow. Within the concept of layered defense, area ASW provides the first opportunity for a commander to attrite enemy submarines.

Examples of area ASW are the sanitization of chokepoints, such as straits and narrows, by a SURTASS-equipped ship operating 30 to 50nm ahead of a task force on PIM. Also, a task force that is required to transit at high speed (which makes them invulnerable to subs closing behind the force but much more vulnerable to subs ahead and to the side of PIM) may use barrier patrols of MPA assets 150nm in advance of the force and on either side for the duration of the transit.

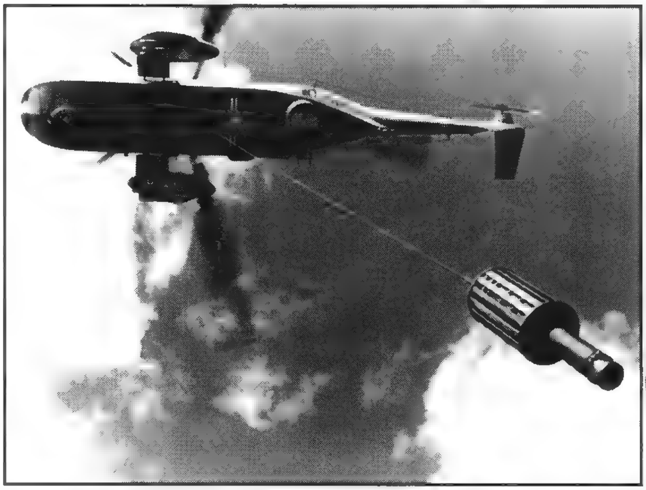


Figure 7-9. Helicopters equipped with dipping sonar are deadly ASW hunters, but only after they have been given localizing data from other platforms.

Local ASW

After submarines have penetrated the concerted effort of area players, their next obstacle to overcome is the outer screen. As discussed briefly in the section on unit positioning, outer screen assets should consist of ASW and AAW platforms, to allow for mutual defense in conjunction with their picket duties. Assets of the outer screen should, with the exclusion of the aforementioned shallow-water case, be passive and conduct search operations above and below the layer.

Because of their separation from the main force, (12 to 24nm with a skew toward the latter), any contacts generated by units of the outer screen generally pose an immediate threat only to those units, and not to the main body. Cruise-missile-equipped submarines are the exception to this rule, but one may not be able to classify the contact as such, and if the main body is in strict EMCON Alpha, it is likely that the submarine does not have an adequate targeting solution to fire anyway. Regardless, a prudent commander turns the main body away from the contact while the screen units attempt to prosecute it.

With at least two ships holding passive contact, the targeting solution should come rapidly enough to conduct an urgent attack with a stand-off weapon such as an ASROC. If the contact is out of range for such an attack, a helicopter should be launched from Ready 5 status to conduct the attack. If the passive contact is held by only one ship on the screen, the player may opt to close to attempt contact, but one must be constantly aware of diversionary tactics. Again, the better solution is to launch

WAR LESSON 7-11

In the conduct of area ASW in *Harpoon II*, the commander may specify the area of interest for the MPA asset to prosecute by laying out a rectangle on the mission plotter.

available helo assets to attempt to localize the contact sufficiently for targeting.

Alternately, if the passive contact is of sufficient strength that the on-scene commander believes that the submarine is within his active envelope, he may elect to go active with the sonar and conduct an immediate over-the-side shot. Whether this attack is effective or not, and it generally is one of the least effective methods, it does succeed in putting the submarine on the defensive, which buys the commander time for a more thorough follow-up attack.

This tactic is also the tactic of choice when a submarine is fortunate enough to penetrate to the inner screen. Because it has already achieved firing position on the HVU of the force, any and all efforts must be made to distract that submarine from effecting the attack. Time is of the essence in getting weapons in the water, even if they are not accurately targeted. Concurrent with these attacks, the commander must execute all appropriate torpedo-evasion maneuvers based on his knowledge of the loadout carried by the class of submarine contacted.

Task Force Defensive Tactics

The scenario of a prowling submarine inside the boundaries of a formation is the nightmare of every task force commander. There has evolved a body of doctrine, therefore, that may be selectively employed by the *Harpoon II* commander to complicate enemy efforts to achieve this position. Obviously, all the considerations relative to EMCON posture and counter-targeting still apply, but the commander may also decide to invoke a zigzag plan. Zigzags originated a number of years ago, and although they are ineffective against modern variants of acoustic and wake homing torpedoes, they are still beneficial against the majority of the Third World inventory,

> **WAR LESSON 7-12**
>
> Frequent course and speed changes complicate the targeting efforts of enemy submarines.

which are straight runners similar to their WWII counterparts.

Zigzags are effective because they make it difficult for the submarine commander to pinpoint the course and speed of the targeted formation, which introduces an error into his spread of torpedoes. *Harpoon II* does not include any preset zigzag plans, but the user can easily create them by way of the navigational plotter. By zooming down to a smaller area when inputting waypoints, users can plot numerous waypoints on either side of a base leg between the starting point and the destination. If the timeline does not require a base speed over ground between the two points in excess of 10 to 12 knots, it is relatively easy to conduct the diagonal legs of the transit below cavitation speed.

ASW Summary

Submarines pose the greatest sustained threat in the multi-threat environment. Commanders must consider their ASW posture as an integral part of all mission planning. To successfully prosecute submarines, one must have an understanding of the tactical elements of the environment in which they operate and use every ASW asset at hand to counter their inherent advantages of stealth and surprise.

AN EXAMPLE OF EFFECTIVE SEA CONTROL

Inchon again best illustrates the need for effective sea control in support of power-projection operations. At problem start, North Korean forces (DPRK) have overrun a large portion of South Korea (ROK). The 2nd Battalion of the U.S. Army is under siege in Seoul. A Marine Expeditionary Force (MEF) must be landed at Inchon to relieve the siege. The MEF is embarked on three amphibious assault ships escorted by an Aegis cruiser and several smaller combatants. Indigenous air support includes a squadron of AV-8 Harriers, embarked on the *Essex*, and several helicopters. This force is being preceded into the area of operations by a small contingent of ROK warships.

DPRK forces consist of four diesel submarines that pose the greatest threat to U.S. mission accomplishment, several small patrol boats whose only impact is to support passive ESM cross-fixing, and a number of shore batteries including SAMs and Silkworm missile sites. In a straight toe-to-toe engagement, the DPRK could never be expected to win. This is not the case, however, because the victory conditions specify that the DPRK needs to destroy only one escort ship or inflict 5 percent damage on one of the three amphibious ships in order to win. This is an appropriate reflection of real-world constraints.

The sinking of a U.S. combatant would constitute a political victory because it would precipitate popular pressure at home to withdraw from the contested area, just as was the case in Beirut and, more recently, in Somalia. Damaging one of the amphibious assault ships would constitute a military victory because it precludes the MEF from landing as a cohesive unit and making its full impact felt in the land battle.

These victory conditions make sea control the number-one priority of the U.S. commander. Before landings can occur in support of power projection ashore, the entire amphibious area of operations must be secured. Furthermore, no afloat units of the force can be damaged or destroyed in accomplishing that objective. In other words, you must win — but only at *no* cost!

Inchon Again, 0500, 6 August 94

TF-1 *heading 019 at 10 knots, 34.38 x 125.5*

D006 *heading 320 at 15 knots, 35.53 X 126.10 (Computer Controlled)*

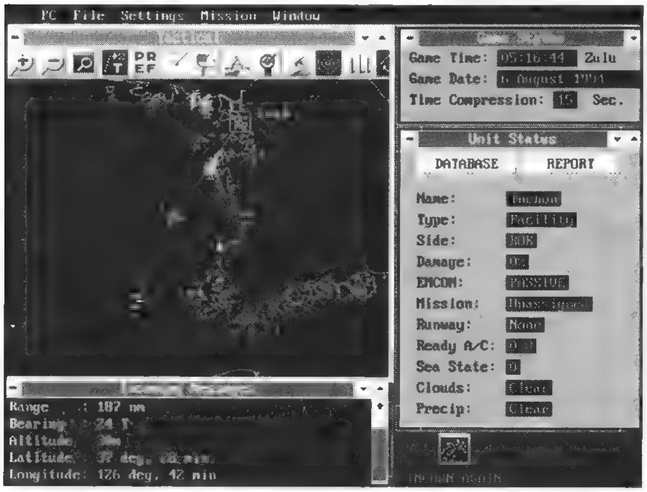


Figure 7-10. Initial dispositions of U.S. & Allied Forces

Figure 7-11. While keeping TF1 in passive EMCON, launch air assets in active emissions posture for scouting

05:12

TF1 *visual detects medium air contact, designate A015 bearing 342 at 21 nm.*

05:13

TF1 *goes active, jamming.*

05:14

TF1 *goes passive.*

05:20

TF1 *launches A098 Sea King, heading 357.*

05:21

TF1 *launches AG08 (3 Sea Harriers) heading 107.*

05:26

AG08 *visual detects large surface contact, designate P045 bearing 38 at 10 nm.*

05:29

AG08 *drops 2 Rockeye cluster bombs on P045. P045 destroyed. AG08 heading 352*

05:40

AG08 *Goes active.*

05:41

AG08 *goes passive,* TF1 *Ahead to 18 knots.*

05:43

AG08 *returning to base.*

05:58

AG09 *(2 Sea Kings) launches from* TF1, *heading* 345.

06:10

AG10 *(3 Sea Harriers) launches from* TF1, *heading* 000.

06:16

AG10 *goes active,* AG10 *radar detects large surface contact, designate* S023 *bearing* 017 *at* 87 *nm.*

06:18

AG10 *radar detects med. surface contact, designate* S024 *bearing* 18 *at* 78 *nm.*

06:20

AG10 *radar detects med. surface contact, designate* S025 *bearing* 347 *at* 86 *nm.*

Figure 7-12. First enemy surface unit is detected and subsequently destroyed by Rockeye cluster munitions

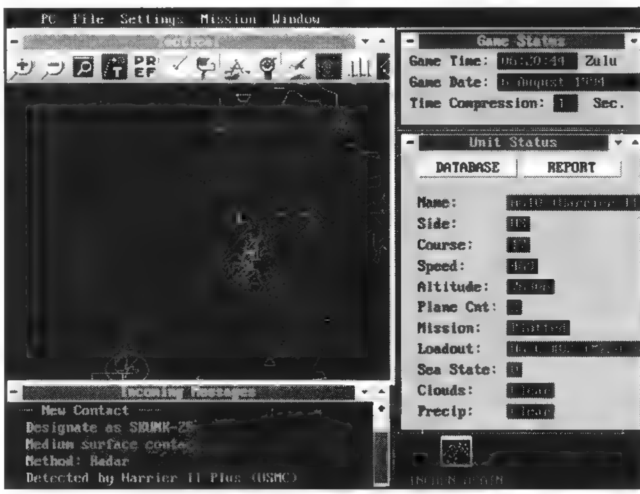


Figure 7-13. Continuing north, the Harriers will pick up the other DPRK ESM picket ships

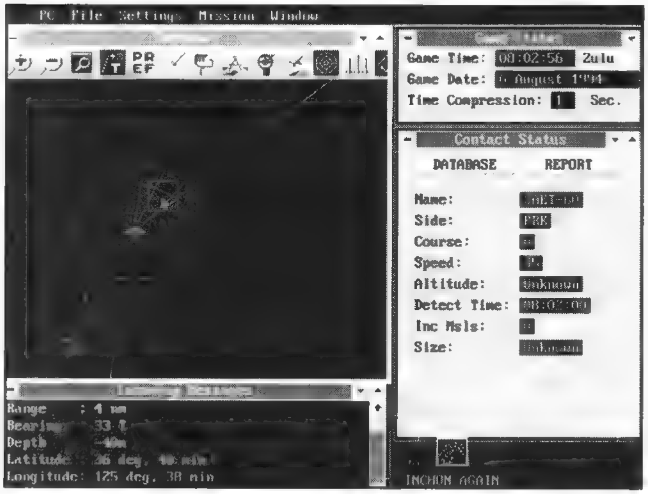


Figure 7-14. Computer controlled ROK screening forces are fired upon by an unseen submarine

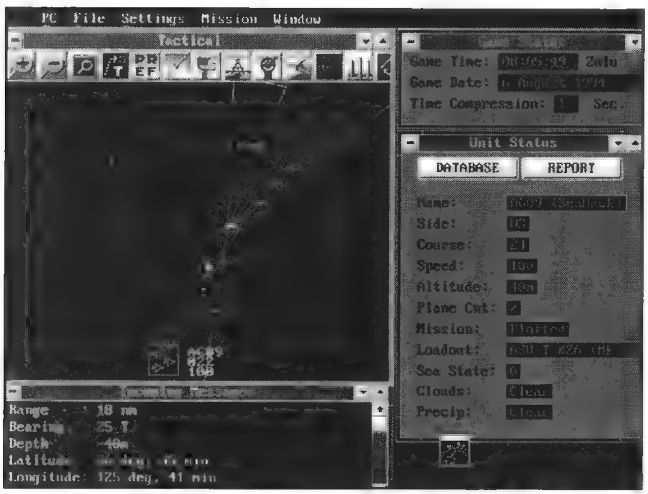


Figure 7-15. The DPRK Romeo class SS is detected and localized

06:27

AG10 *visual contact with S023, Hostile. Designate P005. AG10 on requested intercept.*

06:28

P005 *sinking, on fire.*

06:30

AG10 *on requested intercept of S024. Hostile. Designate P003.*

06:31

P003 *sinking, on fire.*

06:32

AG10 *radar detects 2 incoming vampires, bearing 340.*

07:36

AG10 *bingo fuel, returning to base.*

08:00

TF1 Antietam *passive sonar detects very large torpedo contact bearing 188.*

08:01

D006 *passive sonar detects unknown torpedo contact.*

08:01:30

AG09 *heading 009*

08:04

D006 *passive sonar detects small sub contact, designate G041 bearing 25 at 18 nm.*

08:07

D006 *passive determines G041 is hostile. Designate S002 Romeo*

08:11

A118 Ocean Hawk *on requested intercept of S002.*

08:13

D006 *launches W119 Asroc*

08:14

W119 *destroys S002*

08:16

A118 Ocean Hawk *heading 352.*

08:36

Contact lost with S025. AG09 *bingo fuel, returning to base.* TF1 Iowa *launches W120 Tomahawk at F070 Sam bearing 26 at 75 nm. ETA 07:00*

08:43

W120 *destroys F070*

Figure 7-16. Although the U.S. player dispatches an Oceanhawk to assist the ROK group, they complete the prosecution with a well placed ASROC shot

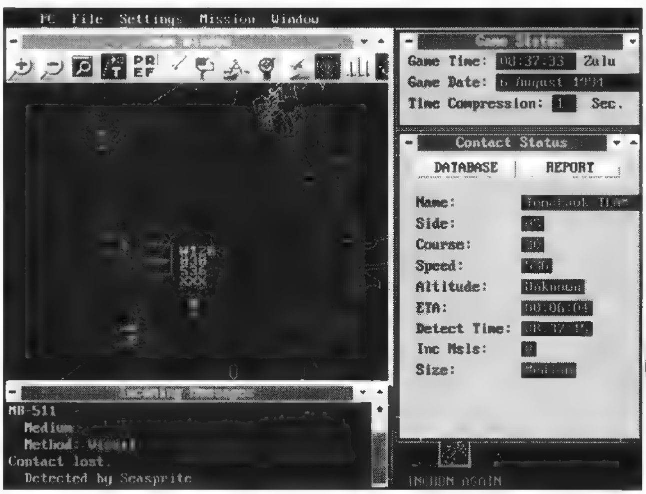


Figure 7-17. The Iowa begins reduction of shore defensive sites using TLAM

Figure 7-18. Nothing equates to the pinpoint accuracy and penetrating power of Tomahawk

08:45

TF1 Iowa *launches W121 Tomahawk at F071 Sam bearing 30 at 76 nm. ETA 07:30*

08:54

W121 *destroys F071.*

09:13

A119 *bingo fuel, returning to base*

10:04

TF1 Iowa *launches W139 Tomahawk at F072 Sam Battalion ETA 10:00*

10:12

TF1 Spruance *launches W140 tomahawk at F075 Sam Battalion, bearing 007 at 111 nm. ETA 11:00*

10:14

W139 *destroys F072*

10:24

W140 *destroys F075*

10:37

TF1 Iowa *launches W141 Tomahawk at F076 HQ (SA-2 Regiment) bearing 008 at 112 nm. ETA 11:00*

10:49

W141 *Destroys F076*

10:52

TF1 *launches W142 Tomahawk at F073 Sam bearing 012 at 91 nm. ETA 09:00*

10:53

TF1 Spruance *launches W143 at F074 Sam bearing 011 at 97 nm. ETA 09:00*

11:01

W142 *destroys F073*

11:03

W143 *destroys F074*

11:38

TF1 *goes active*

12:30

TF1 Iowa *fires 3 406mm/50AP shells at F071. F071 destroyed.*

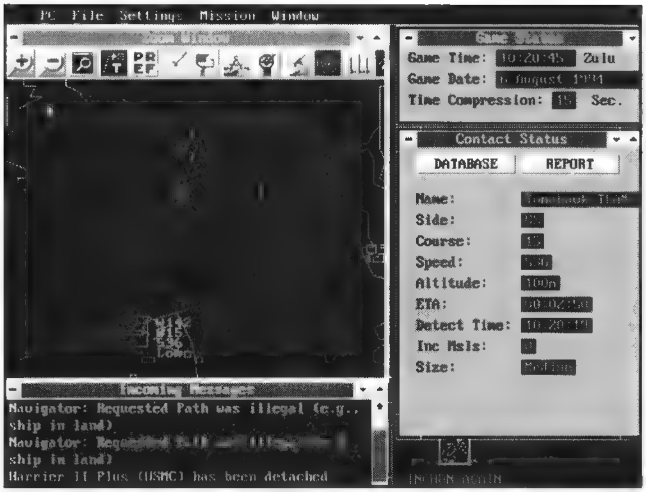


Figure 7-19. TF1 continues to attrite enemy defenses using passive launch techniques to avoid counter-battery fire

Figure 7-20. ROK screening forces eliminate the northern surface threat

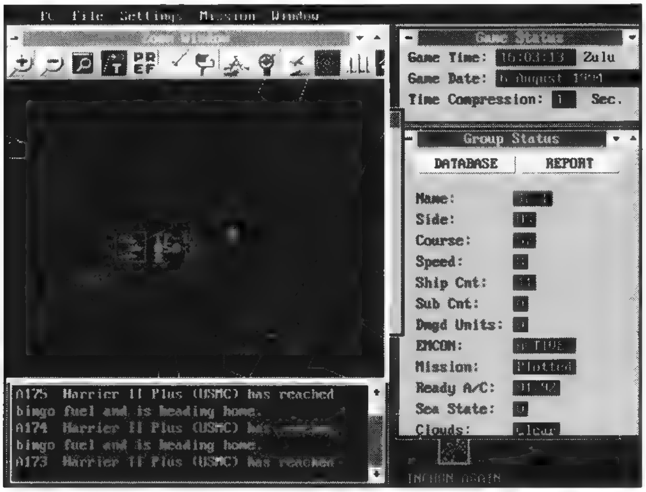


Figure 7-21. The U.S. MEF proceeding to the final objective unscathed

13:00

D006 *fires 3 SM1MR missiles at S025 MB-513. S025 destroyed*

15:00

TF1 *makes objective at target 1 unopposed*

17:00

TF1 *makes objective at Target 2 unopposed*

Scenario end

Analysis of the Mission

The U.S. commander succeeds by keeping the MEF in passive EMCON to avoid targeting by DPRK assets. Concurrently, indigenous air assets are utilized to scout DPRK positions for passive attack by TLAMs. Because of time constraints to reach the AOA, the MEF commander cannot afford to use zigzag plans to confuse enemy submarines. Instead, ASW screening units such as the *Spruance* alternately sprint and drift in advance of the main body to scout for submarines. Concurrent with these local ASW efforts, helicopters are utilized to leap-frog along PIM with their dipping sonars to try to pick up potential leakers.

Utilize the Harriers in an air-to-air mode to shoot down the DPRK Beagle-class reconnaissance aircraft, after which the enemy's targeting efforts are further degraded. If you can avoid the submarines, the remainder of the mission is a simple exercise in scouting, ASuW, and strike warfare.

8

Sea Denial

In Chapter 4, you learned that the premiere players in a campaign of sea denial were mines and submarines. Here, each of these weapons systems is examined in a little more detail so that you can properly implement them in your battle plans.

MINE WARFARE

> *Damn the torpedoes, full speed ahead.*
>
> — Admiral David Farragut
>
> *Minesweeping seems to acquire sex appeal once every 25 years. The intervening hiatus is quite a hurdle to overcome.*
>
> — Admiral Issac Kidd

Admiral Farragut's famous battle cry, issued at Mobile Bay in 1864, is perhaps the most quoted utterance of a naval commander in history. What most people don't know, however, is that the lead ship of his attack, the *Tecumseh,* struck a mine (known then as torpedoes) and sunk moments later. Admiral Kidd's statement, though much less famous, strikes closer to

Facing page: USS Mobile Bay CG53 conducting standard missile shot in the Gulf of Mexico during her commissioning shakedown cruise. U.S. Naval Institute Archives

the truth about mine warfare. It was spoken in reference to the difficulties experienced by U.S. forces clearing Hanoi Harbor at the end of the Vietnam War. The fact that these operations were difficult, even in peacetime, is significant. The root of this difficulty is that mine warfare is the most underfunded of all the mission areas.

Mines have proven a deadly adversary in virtually every naval conflict since their inception, yet their impact is forgotten in every ensuing period of peace. The reason for this anomaly in naval tactical thought constitutes a study in itself. As a *Harpoon II* commander, one has to remember only that the last three U.S. Navy ships to sustain battle damage did so from inexpensive mines: the USS *Samuel B. Roberts* (FFG-58), the USS *Tripoli* (LPH-10), and the USS *Princeton* (CG-59).

Mine Types

The initial design employed at the Battle of Mobile Bay, a moored mine with a contact fuse, is still in use today. Mine technology has progressed at an exponentially higher rate, however, than the ability to counter this threat. Although the capabilities vary nationally, today's spectrum of mines include floating mines, magnetic mines, pressure mines, acoustic mines, electrode potential mines, and combinations thereof.

Pressure mines lie on the ocean floor and detect the pressure wave generated by a ship's hull moving through the water, detonating when peak pressure is reached. To confound efforts to sweep them, they may also be equipped with counters, which allow several ships (hopefully MCM vessels) before hitting the preset number and detonating. *Acoustic mines* can be programmed to look for a particular sound signature, such as that of an aircraft carrier, before they detonate. *Captor mines* are encapsulated torpedoes that pounce on passing submarines. Combinations of two or more of these methods of detonation may be employed to defeat mine countermeasures. Also, mines may be disguised with anechoic coatings to reduce their sonar signature, as in submarine hulls, or even disguised as discarded refuse.

Areas of Employment

Although mines may be employed anywhere, they are obviously most effective when used in an area likely to be entered by the enemy. Furthermore, because the anticipated degree of success is a factor of field density, the more closely the area can be defined, the more effective the field is. In discussing these areas, you must remember that mine warfare may be either offensive or defensive in nature.

Offensive mine warfare involves mining the harbors and bays surrounding enemy areas of egress to bottle up their fleet or make it undesirable for third-party countries to conduct trade via the seas. In essence, this is an extension of the naval blockade; the most recent example of its employment was the 1983 disruption of commerce in the Red Sea due to mine-laying by the Libyan ship *Ghat*. Its efforts would have been more successful had it remained undetected.

Defensive mining operations are designed to complicate the approach of enemy forces to the homeland. The best areas in which to establish defensive minefields are narrow straits and channels through which the enemy must pass and in in-shore waters that are vulnerable to amphibious assault. The most recent use of defensive minefields was the Iraqi mining of Kuwaiti territorial waters, which complicated Coalition efforts to place a

> **WAR LESSON 8.1**
>
> The premiere platform for offensive minelaying in the world, and in *Harpoon II*, is the SSN.

Marine amphibious force ashore. Indeed, the mine-sweeping effort mounted to counter that threat, which involved the combined assets of the free world, took months after the end of the war to complete.

Mine Countermeasures

Although warships have used degaussing systems to reduce their magnetic signature, this type of protection has never been economically feasible for non-combatant ships, such as merchants and auxiliaries. Furthermore, no reliable system of countermeasure has been developed for pressure mines, and only a moderately reliable one has been developed for acoustic mines. The task of a commander faced with a viable mine threat is therefore a difficult one indeed.

Navies employ a number of MCM ship types, and U.S. forces also field a mine-sweeping variant of the CH-53 helicopter. Each type of MCM platform carries different types of gear to sweep for each specific type of mine. Changing gear is a time-consuming process that adds to the MCM timeline, so the greater the reliability of one's intelligence as the mine type employed, the shorter the time required to conduct a sweep. Furthermore, the more sweeps that may be made of the suspected area, the greater chance that all the mines have been found. Finally, as each mine is found, it must be individually disarmed or detonated, which is also time-intensive.

Without attempting to equate numbers and types to time on-station for effective MCM, the *Harpoon II* commander must understand the following truth of mine warfare: Mine-clearance efforts require precise coordination and an inordinate amount of time to accomplish, and the commander must devote an excessive amount of resources and attention to their completion, an effort that otherwise would have been directed at the nation laying the mines. Also, from the standpoint of the mine-layer, the enemy's battle timeline has been disrupted severely at little risk to one's own forces.

MINE WARFARE SUMMARY

The optimum countermeasure is to prevent or reduce the extent of mine-laying operations from the beginning. This is not always possible, and one must accept that the suspected presence of even a few mines can require the mustering of considerable MCM force to preclude the commander from having to keep the threat in the front of his mind for all subsequent tactical planning. Because MCM resources are limited, an inferior foe who succeeds in low-cost mining has achieved a major tactical advantage by restricting the strategic mobility of the superior force.

COMMANDING SUBMARINES

> *The* San Luis *was at sea, and at times in the area of the British force, for an estimated 36 days. The threat from the Argentine submarine was a continuous concern for the British task force commander, and numerous attacks were made against suspected submarine contacts, with a large number of ASW weapons being expended. In any event,* San Luis *survived all British ASW efforts.*
>
> — From the briefing prepared for the Secretary of the Navy, the South Atlantic Conflict Lessons Learned

> **WAR LESSON 8.2**
>
> A single unlocated submarine can complicate the battle plans of the adversary considerably.

What the *Harpoon II* commander should garnish from this observation on the Falklands War is not only that ASW is difficult, which should already be understood, but that a single unlocated submarine can complicate considerably the battle plans of the adversary. Also, similar to mine warfare, the suspicion of the threat is sufficient enough to force the commander to commit large numbers of resources to eradicating it, resources that would otherwise be available to support his primary mission.

So far, the focus of this book has been on countering the submarine threat to one's own force. In this section, we reverse tack and become the threat. By learning the optimum employment of submarines from a commander's perspective, one not only possesses a potent new force multiplier but also gains additional insight into how enemies

Out of Sight, but not Out of Mind

attempt to use this platform to their advantage.

The first major leap of faith required of those who muster subs on the battlefield is that they cannot be micromanaged to the degree that other forces permit. Although earlier releases of Harpoon allowed the commander to issue orders to submarines whenever the mood struck, this is inconsistent with real-world constraints. For submarines to be in constant communications, they would have to remain at periscope depth all the time with their communications mast raised. Naturally, such a posture would eliminate virtually all the tactical advantage they possess.

Whenever submarines are in communication, the commander has the opportunity to alter their ROE, mission tasking, and movement orders. In between periods of communications, no additional interaction is allowed the commander.

Generally, the period between communications should be once every six to eight hours except in special circumstances, which are contact- or mission-specific. If the sub were on a reconnaissance mission, for example, he would communicate the presence of new contacts as soon as it was deemed tactically safe to do so without risking detection. On a hunter-killer mission under Warning Red, Weapons Free, he might miss a scheduled reporting period while stalking a surface task force or enemy submarine. After prosecuting the attack, the commander reestablishes contact and reports the results of his attack, again when he has determined that he may do so without risking detection.

This brings up some interesting uncertainties for the task force commander. When a submarine has failed to make its scheduled reporting period, it can mean a number of things. The worst-case scenario is that it has been detected and sunk in the interim, but only time will tell whether that is true. The sub might have experienced a communications failure because of battle damage or mechanical breakdown, or it might be conducting an attack or escaping from the scene of the crime, at which point it will make contact later. The most important thing to understand is that the commander does not know for certain until the battle is over; the only indication is the loss of contact. After the scenario ends, the tote board of casualties is updated to reflect actual losses of friendly submarines.

> **WAR LESSON 8.3**
>
> Because the special sonar transmission used to call SSNDS assets to the surface is recognizable to the enemy, it is sometimes beneficial for a commander without an SSNDS asset to radiate it anyway, which makes any enemy subs in the area think another sub is present. This tactic currently is not enabled, but keep it in mind should the opportunity arise to use it in the future.

The Special Case: SSNDS

In some instances, a commander has a submarine in direct support of a task force (SSNDS). This asset is usually stationed in a distant sector on the Formation Editor as an ASW barrier patrol. Because of special communications gear contained in the active sonar suites of surface ships, submarines operating directly with the battle group may be alerted to come to communications depth at any time. Again, if the submarine skipper is not in contact with an enemy sub (which would now be alerted to the presence, if not the precise location, of the friendly), he comes to periscope depth for communication. There is a delay based on the actual time it takes to change depths, but after the sub is there, the commander may alter ROE, mission tasking, and movement orders as mentioned. Here's one other tactical tip before moving on.

Submarine Missions

Excluding SSNDS, most missions assigned to submarines reflect their capability to operate independently and respect their capability to strike effectively without a great deal of additional guidance. A prudent commander, therefore, considers the need for stealth and surprise and capitalizes on the strengths of submarines in mission planning without placing them in unwarranted risk.

Before the commencement of hostilities, submarines are the platform of choice to conduct reconnaissance of enemy strength and disposition, as well as to conduct offensive operations such as the mining of enemy sortie routes. From this inshore position, these same submarines can act as linebackers for their minefields, conducting follow-up attacks on enemy assets attempting to transit the area. Also, if these same submarines are missile-equipped, they can either conduct preemptive strikes on enemy airfields or ports or lie in wait to strike in conjunction with air elements of the main task force.

Additionally, when the enemy has limited ASW capability, as is the case with many of the littoral nations, a submarine may be positioned close ashore with its periscope raised to report the movements of enemy air groups coming off-shore against the main force. This is a new method of passive airborne early warning that has been used with success by Sixth Fleet assets in the Mediterranean. Also as a scout, submarines can provide ESM cross-fixes and visual surface searches from their area of operations. The latter can be critical in monitoring traffic through such congested areas as straits and narrows, and identifying contacts of interest to preclude fire on neutrals. Finally, submarines are also capable of performing BDA when used in conjunction with other forces in a joint attack.

With hostilities in progress, submarines may be used in their traditional role of hunter-killers. Submarines are the most effective platforms for locating and destroying enemy submarines, so they should be considered for all area ASW plans. Do not discount the diesel boat in this equation either. The *Batfish* located and destroyed three of four Japanese submarines operating around the Philippines in as many days in WWII.

WAR LESSON 8.4

Modern diesel boats are much more capable than their predecessors and are a match for the most capable SSN's if handled properly.

As hunter-killers, submarines may also seek and destroy enemy warships or cripple the war effort of the adversary by pursuing a *guerre de course.* A commerce war on merchants and auxiliaries is a great fear of western nations because these assets are in much shorter supply than they were during WWII, when Nazi U-boats almost succeeded in breaking the Allied back in the North Atlantic.

> *If we would have had more U-boats, we would have won the war!*
>
> — Admiral Doenitz

Sea denial is the conduct of any and all operations designed specifically to restrict or deny free use of the sea to the enemy. The historical roots of the sea-denial mission are the conduct of naval blockades and the *guerre de course,* or commerce war. Employed by virtually every maritime power in the world at one point or another in their history, the naval blockade precludes the enemy's use of the sea at the point of origin.

Traditionally, squadrons of fast, capable warships were positioned outside the ports of the offending nation to engage and destroy any shipping that emerged. Often, the mere threat of such massing of power was sufficient to keep enemy fleets bottled up in port. Such was the case with the *Kriegsmarine* during World War II. It was so intimidated by British naval forces that it allowed itself to be destroyed by air power without ever venturing out of Scapa Flow to break the blockade.

Modern submarines are much more effective than their surface counterparts at imposing a blockade. Given the presence of surface search radar coverage of inland waters, blockading ships would be detected and engaged with the massed firepower of land-based air assets. *Seawolf,* however, can lurk off-shore indefinitely, striking at will those assets that attempt to run her blockade. Conversely, she could conduct initial strikes and then proceed to other missions, confident in the knowledge that the enemy will waste a tremendous amount of time and effort searching for her long after she has gone. Furthermore, the enemy's inability to find and destroy the source of the attack will do nothing to alleviate its doubts about sending other ships into those waters. In essence, your sub can accomplish two missions at a time.

World War II provides a salient example of the second component of sea denial as well: commerce raiding. The German U-boat campaign in the North Atlantic was a classic attempt to pursue a strategy of sea denial. The German High Command sought to buy itself time to consolidate its position in Europe by interrupting Allied sea lines of communication (SLOC). Its efforts certainly prolonged the war and came dangerously close to precluding an Allied invasion effort altogether. Fortunately, technological advances in the developing field of sonar allowed the Allies to counter the U-boat threat with an effective campaign of sea control and an unprecedented ship-building effort.

Today, the impact of a sea-denial campaign one-tenth the size of Germany's effort would be ten times as decisive in execution. The reasons behind this exponential increase are simple to understand. First, industrialized nations are much more dependent on imports, such as oil, than they were 50 years ago. Second, it is much more economical for shipping lines to carry bulk cargoes like this on a single, huge supertanker than 20 or 30 smaller-capacity ships. Third, the consolidation of the merchant fleet into fewer, larger ships has resulted in a general decline in the ship-building industry. The direct result of this development is a general inability of all nations to replace merchant assets that would be lost to a campaign of sea denial at a rate that would preclude that campaign from having a decisive effect.

During the same 50-year period, quantum leaps have been accomplished in the field of submarine and weapons design. Early WWII torpedoes were notoriously unreliable. Even after the incorporation of mercury switches to arm the warheads, far too many targets escaped an attack with nothing more than a dent below the water line. Furthermore, there are dozens of cases in which four or more torpedo hits were necessary to finish crippled ships.

Figure 8-1. Early WWII Torpedoes were notoriously unreliable

MK-48 ADCAPs suffer no such limitations. They are virtually 100 percent reliable in combat. Furthermore, because they are designed to explode under the keel of the intended target, creating a huge pressure bubble that lifts the ship out of the water and snaps it in two at the keel, most ships are destroyed with a single shot. The largest enemy ships you will encounter, the *Kiev* and the *Kirov*, require two or three ADCAPs to finish them off.

Concurrent with the increased lethality of weapons, sub-silencing technology has continued to outstrip the capability to detect these denizens of the deep. Each platform, therefore, is more survivable. When you combine that with the fact that fewer weapons are necessary for each target and that fewer targets must be destroyed to cripple an entire nation's war effort, you begin to see the big picture.

ASuW

You have two primary methods of prosecuting surface contacts. You may maneuver into firing range to engage with torpedoes or you may elect to stand off and attack them with missiles. The former option is the most favorable of the two in most instances. The reasoning behind this conclusion follows.

In terms of effectiveness per weapon expended, the MK-48 ADCAP will outperform either the Harpoon or Tomahawk cruise missile. The reason for this has nothing to do with the quality of those weapons, as both are proven ship-killers. What makes the difference is the surface ship's capability to defend itself against missiles and its inability to do the same against torpedoes.

Conducting a Torpedo Attack

The delivery of torpedoes is the classic role of the submarine and your most effective method of engaging the enemy — both surface and subsurface. In setting up a torpedo attack, you must consider the angle of approach, the optimum firing range, the best type of attack mode with which to program the torpedo, and your escape and evasion plan after the shot.

The angle of your approach may be preordained by the position of the contacts when you detect them. If they are high-speed contacts, your first shots should be taken from within a 120-degree arc centered on their bow, if at all possible. Load four ADCAPs and target the leading ships of the formation in succession and fire. Your torpedoes

Figure 8-2. Use a slow methodical approach when setting up a torpedo shot.

should be set to a depth below that of the thermal layer, in such a way that the intended targets remain unaware of them until the last possible instant. The ADCAPs swim out to the target area at 30 knots following the commands they receive via the guidance cable. When they are within 1,000 yards of their targets, they pop up through the layer, lock onto their contacts, and kick up speed to 55 knots for the terminal homing run.

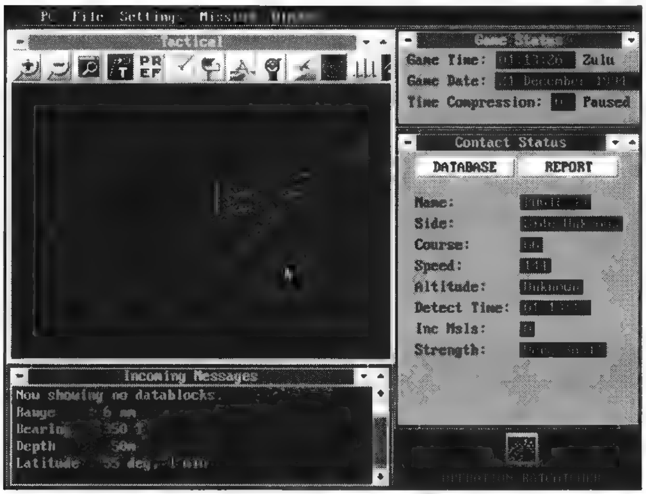


Figure 8-3. Always fire a multiple torpedo salvo, as opposed to a single shot. This increases your chances of totally incapacitating the target.

The targeted ships have no place to run or hide. Furthermore, if your attack has been properly conducted, they also still have no targeting data on your submarine. This situation should allow sufficient time for follow-up attacks at their beams (classic side shots) if they continue along their present course after the initial salvo. Failing this, quartering shots (directed at the 120-degree arc centered on their stern) may also be effective, though you have only a short window of opportunity in which to conduct these attacks before the formation gets out of range.

Remember that, even at the high-speed setting of 55 knots, a target going away from you at 30 knots experiences a torpedo closure rate of only 25 knots. The torpedo, therefore, would take 12 minutes to close a 5-mile gap from the point of firing, as opposed to a little more than 3 minutes for a bow shot taken at the same range. Twelve minutes can be an eternity in combat, particularly when you cannot maneuver if you want to maintain the torpedo's guidance link.

> **WAR LESSON 8.6**
>
> Approach slow moving convoys from astern, hiding in their baffles until you attain firing position.

For slower-moving formations that don't contain towed array or VDS units, the optimum angle of approach is from astern, in their baffles. Although destroyer escorts occasionally reverse course to clear the baffles, just as you should do periodically, the periods between these occurrences should allow you sufficient time to maneuver into position two to three miles astern of the trailing ship.

After you have attained this position, match your speed with the convoy's and load all four tubes with ADCAPs. Target the rearmost ships in the formation in turn, designating one torpedo to each one. When all four fish are in the water and swimming toward their targets, prepare a follow-up salvo. Target four other ships in the formation and launch the second salvo as soon as the first torpedo from your initial salvo strikes home.

Because the other torpedoes in the first salvo should be close enough to their targets to have acquired them actively with their seeker heads, you may now begin evasive maneuvers without worrying about the guidance cables being severed. Set a heading 120 degrees off your current course in either direction, preferably to the side away from the strongest escorts. Go to Flank speed and dive to the deep or very deep setting. When you have reached escape depth, slow to one-quarter speed, change course 90 degrees, and put a noisemaker in the water. Continue on this heading no less than five minutes and then change course back toward the initial point of attack (provided that no escorts are directly on that path), and come to "best depth." Mop up the escorts at will or leave them to wallow in their own confusion.

Figure 8-4. Noisemakers, like the one's depicted on the left side of this screen, increase a submarine's chances of survival during post-attack escape and evasion maneuvering.

Chokepoint Warfare

The easiest place in which to conduct ASuW is in a geographic chokepoint, a strait or narrow between two bodies of land through which the majority of the world's ocean-going traffic must pass. Because every navy in the world is aware of this, they also usually send submarines or ASW ships into these areas in advance of the main body to sanitize the corridor. Because these waters are also shallow, ASW prosecutions are difficult. There are leakers, subs that escape the initial search and lie in wait for the high-value units, aircraft carriers, amphibious ships, and critical convoys.

While in command of a submarine, you experience this situation from both sides, as the hunter and the hunted. The greatest threat you face in each case is diesel submarines. They are extremely quiet while operating on batteries and can use the high ambient noise in a shallow-water strait to their advantage.

The Modern Diesel Boat

Though some analysts would point to Germany's Type 209 diesel boat as an example of modern technology, this quiet warrior still requires six hours of snorkel time to charge. The Russian Kilo design, on the other hand, is capable of going without snorkeling for as many as two to three days at a two-to-three knot patrol speed. It is a much more capable adversary or threat, therefore, depending on which side of the fence one is sitting on.

Despite the capability of the diesel boat to be a devastating threat, U.S. analysts discount their effectiveness in the hands of Third World crews because of a lack of training. Whether these assumptions would prove out in the real world remains to be seen, but the *Harpoon II* commander can learn from the reasoning behind this assumption and employ the antithesis to make his diesel forces stronger.

The presumptions that exist are that these crews will expose their masts much more than necessary because they do not know how to conduct a passive plot correctly. Furthermore, there is a great deal of skepticism that they are capable of making a deep, submerged approach on batteries, which is the most advantageous tactic because of a constant need to refine their position estimates in relation to the target. It is also assumed that diesels resting on the bottom would snorkel at least once a day to preserve the amount of battery power they would need to escape after an attack. This line of reasoning reflects a dangerous tactical arrogance. Whether or not these potential adversaries are currently capable, they can become so in short order under the right circumstances. The prudent commander therefore can never discount this threat on the presumption that it will be improperly employed.

Busting the Bastions

A more classic use of submarines is to hunt Soviet SSBNs deep in their "safe" areas, known as *bastions*. Given the extremely long range of Soviet ICBMs, their SSBNs can perform their strategic nuclear mission without ever venturing out of "home" waters. The only reason they would ever have to do so, in fact, would be to shorten the flight time of their missiles.

As such, they have established heavily guarded patrol zones in the Sea of Okhotsk, the Barents Sea, the Kara Gulf, and even under the polar ice cap. The approach routes to these areas are heavily patrolled by ASW ships and aircraft. The areas themselves certainly contain a number of ASW mines and one or more Soviet SSNs, generally Akulas, guarding the SSBN. This layered defense makes these types of missions the most perilous you will face while in command of submarines.

When you are tasked to proceed to the bastions and eliminate one or more SSBNs, your overriding tactical concern is to *remain completely undetected until you have initiated the attack*. Under no circumstances should any ASW surface ships or enemy SSNs in the area be engaged before attacking the SSBN. Failure to follow this guidance results in the primary target slipping away without being engaged and the concentration of all other forces in the area on your submarine. The latter condition will occur anyway, making your escape and evasion very difficult, but to risk your own destruction without accomplishing the primary objective would be foolish.

Enter the bastion area at a maximum speed of four knots, with the towed array deployed. Both SSBN and any SSNs that accompany her will be at their quietest mode, so they will not be easily detected. Your goal is to obtain a sonar track on the SSBN while avoiding the SSN. If you hold contact on the SSN as well, try to position yourself on the other side of the SSBN from the SSN, in such a way that your sound signature is at least partially masked. This situation is hardest to achieve when you're operating in the polar region,

WAR LESSON 8.7

Patience is the watch word when stalking a SSBN.

where the ambient noise generated by ice floes and other naturally occurring sounds make any detection difficult.

When you obtain a targeting solution on the SSBN, exclusive of any SSNs, load and fire two ADCAPs at the SSBN. Ignore the guidance cables, immediately order Flank speed, and change course away from the SSBN. Dive as deeply as you can in this process.

After two minutes more change course from 45 to 90 degrees. Continue for two more minutes on this heading, loading two more ADCAPs while you do so. At the end of that time, order all stop and do a 180-degree turn to clear your baffles. If any SSN guardians are pursuing you, they will be going to fast to have noticed that you stopped, and they will put a great deal of noise of their own in the water. You should be able to immediately classify them. Shoot first and ask questions later.

With the SSNs dispatched, it is now important that you evaluate the effectiveness of your initial attack on the SSBN. Although a single torpedo is almost always capable of killing an SSN, the dual titanium hulls of the large SSBNs, such as the Typhoon, often prove more resilient. If it is not dead, it certainly has sustained hull damage and is probably struggling to survive. The damage you inflicted in the first round will increase its flow noise considerably, making it much easier to detect the second time around. Take your time, start the hunt over, and finish it off.

If SSN contact is held before your initial attack on the SSBN, the only major change to your tactics is to load four ADCAPs at the beginning, versus two. Fire two ADCAPs each at the SSBN and SSN, and then begin the evasive sequence as just delineated. The remainder of the plan requires no revision.

SUBMARINE SUMMARY

The commander of submarine units who uses them properly, with forethought and patience, possesses a powerful force multiplier. Furthermore, in the correct tactical placement, submarines can contribute to all the warfare mission areas, including Strike, AAW, and EW, not just ASW and ASuW, as was true in the past.

9 Power Projection

Military might within one's own territory does not indicate the capability to effectively deploy that might away from home. A nation may be virtually unconquerable through a well-organized, -equipped, and -trained defense network, but may have only limited capability to deploy that power outside its borders. The capability to reach out and "touch" someone is called *power projection.*

PUNITIVE STRIKES

Power projection contains a variety of missions, the most recognizable being the "punitive strike." When one nation ignores treaties or international law, executes actions that threaten another nation, or supports activities counterproductive to international stability (such as terrorism), another nation, or group of nations, may respond militarily. Such a strike demonstrates that the offended parties no longer tolerate the offender's actions and that they have sufficient military might to *stop* the offender.

Facing page: Prior to the introduction of aircraft and over the horizon missiles, naval gunnery enforced the power projection mission. Author's collection

Libya, 1987

In 1987, when the U.S. attacked Libya in retaliation for the terrorist bombing of a German discotheque, the U.S. Navy and U.S. Air Force executed a classic power-projection punitive strike. This mission demonstrated that the U.S. considered Libyan actions unacceptable, wanted Libya to cease and desist, and could force Libyan compliance militarily. Despite being on the far side of the planet, the U.S. revealed just how far its military fist could reach. Similarly, the 1988 U.S. attack on Iranian offshore oil platforms in the Persian Gulf and the subsequent sinking of several Iranian warships also illustrated how much the U.S. would tolerate and how far it could reach.

Iraq, 1991

The 1991 Gulf War also boils down to a show of force. Politics behind the war were complex, involving dismantlement of Iraqi strategic weapons programs, Kuwaiti liberation, and protection of Saudi Arabia. Despite news media reports, the Gulf War was not fought over oil or oil supply lines. By forming a coalition, President Bush sent a signal to Iraq that the United States (and the world in general) would not remain idle while an aggressive, imperialistic regime threatened terrorist attacks with mass-destruction weapons against anyone opposing its military expansionism.

About a year before Iraq invaded Kuwait, *Aviation Week & Space Technology* reported that Iraq had placed a satellite in orbit using indigenous rocket technology. This type of rocket technology, coupled with Iraq's chemical and nuclear weapons programs, immediately placed most of the world within Iraqi reach. Although a single ICBM could not defeat an enemy like the United States or Soviet Union, a single nuclear detonation would make a giant Iraqi show of force, boost Iraqi morale, and generate fear throughout the world. Stopping any such Iraqi power projection before it happened clearly predominated in the minds of coalition planners, evidenced by the heavy air attacks on all strategic weapons sites during the war and the continued presence of weapons inspectors years after the war ended.

The protection of oil supplies, although undoubtedly a major concern, was probably less critical to President Bush than making the appropriate power projections. In the Gulf War, Bush demonstrated his foreign-policy skills by forming the coalition, strengthening the world's resolve against unstable dictatorships by leading the coalition into battle, and building the U.S.' significant military advantage by routing Iraqi forces. Critics state that the war failed because Saddam Hussein remained in power; however, Saddam Hussein rarely appears on the 6 o'clock news anymore, making brash threats against the "Great Satan." Hussein may remain in control of his nation, but his ability to project power outside his borders is virtually non-existent as a result of the Gulf War. In this sense, the Gulf War was a successful U.S. punitive power projection.

Bosnia, 1994

In early 1994, as the war in Bosnia continued, NATO, for the first time in its 50-year history, executed a combat operation. In an attempt to punish Serbian forces for violating a U.N.-sanctioned cease-fire, U.S. aircraft bombed several Serbian positions. The Serbs, however, were undaunted. With years of ethnic hatred pushing them and victory luring them, the Serbs ignored the NATO attack (which had less-than-impressive results anyway). A few days later, the Serbs bloodied NATO's nose by executing *their own* punitive strike against NATO. Serbian forces downed a British Sea Harrier that was performing reconnaissance. NATO air ops ceased immediately and the war continued.

This example shows the *worst possible* approach to power projection. For a power-projection mission to succeed, it must impress the recipient. The NATO attacks utterly failed to impress Serb forces, and, worse, NATO's cessation after the loss of a single jet resulted in a surprising reversal. The Serb counterattack, especially because it was preceded by warnings, was a punitive power projection in every sense; the Serbs demonstrated what their tolerances were and how far their reach extended. NATO's lack of response indicates that the Serb power projection was successful.

SHOW OF FORCE

Another popular form of power projection, the *show of force* (also known as *gunboat diplomacy*) traces its roots to the origin of naval warfare. Whereas a punitive strike is akin to spanking a misbehaving child, a show of force equates to waving your fist at the child to scare or impress him *before* he misbehaves.

John Paul Jones earned quite a reputation for his numerous and successful attacks along the British coast during the American Revolutionary War. Because of the lengthy communications delay across the Atlantic, Jones' operations could hardly be coordinated with North American operations. The fledgling United States had no real desire nor any significant means to wage an offensive war against England. Thus, Jones' offensive operations appear more significant as power projections demonstrating the resolve of the Americans than as offensive attacks against England.

Likewise, Commodore Matthew Calbraith Perry's 1852 trade-negotiation mission to Japan perfectly illustrates gunboat diplomacy. Oliver Hazard Perry's younger brother, Perry performed an impressive demonstration of warship firepower that "convinced" the Tokugawa shogun to openly trade with the U.S. The U.S. demonstrated its ability to force relations with Japan without employing that force.

The "Great White Fleet" of 1907 is another example of a peaceful show of force. President Theodore Roosevelt, determined to illustrate U.S. dominance of the western hemisphere and its "right" to intervene in any dispute therein, ordered a significant task force of battleships (The Great White Fleet) to circumnavigate the planet and display American naval might. The fleet never entered combat, but nonetheless is recorded as an impressive display.

POWER PROJECTION AND HARPOON II

Although both offensive and peaceful power-projection missions exist in the real world, *Harpoon II* focuses exclusively on combat-oriented scenarios. It is, after all, a combat-oriented simulation, and peaceful circumnavigations would generally be boring. Only offensive power-projection missions exist in the *Harpoon II* world. Our discussion of power projection focuses on three missions: "Okinawa," "A Fight to the Death," and "Assault on Zion."

Keep in mind, power projections generally contain a projector (the side making the demonstration) and a recipient (the side receiving the display). The missions listed in the preceding paragraph fit this category, with the U.S. on the "projecting" side. Discussion is limited to the projecting forces.

A FIGHT TO THE DEATH

European unity is collapsing and Russia's military expanding. It's 1995, and the U.S. Navy, crippled by budget cuts, stands alone against the Red fleet. Protecting the captured airbase at Keflavik, the Russian carrier *Admiral Kusnetsov* patrols the Icelandic coast. To oppose the Russian aggression, the U.S. sends a carrier battlegroup (CVBG) centered on the *Nimitz* to engage and destroy the *Kusnetsov* group. The *Nimitz,* with her aircraft complement halved by budgetary cuts, is a mere shadow of her former self.

Within this scenario, we examine these concepts:

1. Missile-to-hit requirements
2. Missile targeting
3. Navigation and threat zones
4. The Mission Editor
5. Basic air operations

Mission Analysis

This mission consists of both a punitive strike and a show of force. The punitive strike retaliates for Keflavik's capture, and the offensive mission itself demonstrates that despite the budgetary ax, the U.S. Navy is prepared to face the Russian fleet.

Successfully completing this mission means destroying several key Russian warships (the *Admiral Kusnetsov* and a Kirov-class cruiser) in addition to preparing Keflavik for recapture. Failure probably means the loss of the *Nimitz,* a loss the U.S. can ill afford, as well as failing to impress the

Russian navy. The Russians must be convinced that the U.S. means business; only then do red forces consider stopping their advance.

CIS Order of Battle

The following configuration contains excellent ASuW and air-defense capabilities. The Su-27 and MiG-29, although less capable at strike missions than its blue counterparts, provides excellent air cover for the fleet- and land-based bombers.

NAS Keflavik (very large aircraft)
  Intel indicates: Tu-16G, Tu-95D, Tu-26C
KUG1
  CG *Slava*
  CG *Nikolayev*
  CG *Udaloy*
  DDG *Admiral Levchenko*
  FFG *Krivak II*
  DDG *Otchayannyy*
  BCGN *Admiral Ushakov*
  CV *Admiral Kusnetsov*
    Intel indicates: Ka-25, Ka-27, MiG-29, Su-33

U.S. Order of Battle

The following *Nimitz* has less than half the typical fixed-wing loadout, with reduced numbers of fighters, strike aircraft, multi-role aircraft, and no fixed-wing ASW assets. This configuration leaves only 10 aircraft for air defense and 20 multi-role aircraft, compared to a typical aircraft carrier complement of 20 F-14s for air defense, 20 A-6 Intruders for strike missions, and 20 multi-role F/A-18s. Lack of ASW assets leaves the group ill-suited against submarine threats.

SSN *Toledo*
- 2 BGM-109C TASM
- 3 BGM-109C TLAM
- 4 BGM-109D TLAM

BG *November*

CV *Nimitz*
- 10 F-14 Tomcat
- 20 F/A-18 Hornet
- 3 E-2C Hawkeye
- 2 EA-6B Prowler

CGN *Texas*
- 2 BGM-109B TASM
- 2 BGM-109C TLAM
- 2 BGM-109D TLAM
- 8 RGM-84A Harpoon

CG *Ticonderoga*
- 8 RGM-84A Harpoon

DDG *Barry*
- 4 BGM-109B TASM
- 4 BGM-109C TLAM
- 2 BGM-109D TLAM
- 8 RGM-84A Harpoon

DDG *Kidd*
- 8 RGM-84A Harpoon

DD *Spruance*
- 31 BGM-109B TASM
- 11 BGM-109C TLAM
- 12 BGM-109D TLAM
- 8 RGM-84A Harpoon

FFG *Ingraham*
- 4 RGM-84C Harpoon

Forming Battle Strategy

Mission orders indicate that the battlegroup should proceed toward Keflavik, executing air and missile attacks against it and the Russian *surface action group* (*SAG*) as though the *Nimitz* had sufficient assets to handle both targets simultaneously. The scenario description also implies that the balance of power favors the U.S. Although the offensive strike potential of a full-fledged CVBG may exceed that of its Russian counterparts, the watered-down *Nimitz* in this scenario significantly reduces this advantage.

The blue fleet faces two problems:

- Insufficient attack resources to overcome Russian missile defenses
- Insufficient missile defenses to overcome a consolidated Russian attack

Insufficient Attack Resources

The blue fleet has 37 Tomahawk anti-ship missiles (TASM) available (not counting 2 on-board the *Toledo*) and 44 shorter-range RGM-84 Harpoon missiles. The TASM is an excellent long-range ASuW weapon, but must penetrate the enemy air defenses. For decades, the Soviet navy's greatest foe was the U.S. aircraft carrier and its missile-armed aircraft. The Soviets accordingly designed warships with heavy air defenses to counter this threat, consisting of *surface-to-air missile* (*SAM*) systems and *close-in weapon systems* (*CIWS*). CIWS, or point defenses, consist of guns firing as many as 3,000 rounds per minute, putting a potentially impenetrable barrier of lead between the ship and in-bound missiles. An attack of 37 TASMs, although representing incredible destructive potential, has little chance of surviving the red task force's defensive SAMs and CIWS.

Missile-to-Hit Ratios

In multiple test firings within *Harpoon II*, all 37 missiles were shot down every time. Test firings tried both spreading the volley across all enemy ships and focusing on a single vessel. In all cases, all missiles were destroyed. Furthermore, the red SAG demonstrated a willingness to fire on Tomahawk land-attack missiles (TLAM) passing near them. Test firings with 39 TLAMs (all TLAMs carried by the battlegroup) directed over the enemy fleet as a decoy followed by 37 TASMs resulted in disaster: All 76 missiles were downed without a single missile striking a target.

Test runs also showed that 20 F/A-18s armed with a maximum of 40 missiles (either AGM-84 Harpoon or AGM-88 HARM) met the same fate. Coordinated air/ship tactics fielding 77 missiles supported by ECM and air-launched decoys were repeatedly shot down without striking a single target.

To understand these results, you must analyze the air-defense capabilities of individual units. Test firings pitting Harpoon-armed aircraft against a single, unescorted warship indicates that a modern AAW-capable warship requires 20 missiles to score two hits, or a 20:2 *missile-to-hit* (MTH) ratio. *MTH ratio* is the number of missiles required to result in the specified number of hits on a given target. Repeated test firings show that a single, well-armed AAW ship can easily defeat 18 in-bound Harpoon missiles. Typically, SAMs intercepted two-thirds of the in-bound missiles, and point defenses claimed 3 to 5 missiles, or in a 20-missile attack, 14 fell to SAMs and 4 fell to point defenses, leaving only 2 to strike the target.

You can see from this analysis that even though the 20:2 MTH ratio can be reduced mathematically to 10:1, such reduction is tactically invalid. Air-defense systems do not work "proportionately" and allow some minute percentage of missiles to penetrate. Rather, SAMs and CIWS point defenses are designed to intercept a given number of in-bound missiles. Although you do not know the design number's values, you can see from the 20:2 MTH ratio that typical SAM systems easily intercept as many as 14 missiles and that CIWS easily down 4. Given these capabilities, a 10-missile volley has almost no chance of success; the SAM defenses alone could intercept all in-bound missiles before they came near CIWS range. Naturally, the MTH ratio drops against less capable AAW ships. A 10:1 MTH ratio appears reasonable for older AAW ships, and 5:1 for other warships.

The *Aggregate MTH* (AMTH) ratio, or the missile-to-hit ratio for an entire battlegroup, is the sum of each component ship's MTH. If two ships with a 20:2 MTH accompany two ships with a 10:1 MTH, the AMTH ratio is 2 X 20:2 + 2 X 10:1, or 60:6. Based on the individual performance of each ship, you can assume that 60 missiles are required to hit each ship at least once. As the number of ships in the task force increases, so does the AMTH.

WAR LESSON 9.1

Assume that 20 missiles are required for any to hit a well-armed AAW ship, and 10 to hit less capable warships. The higher the MTH ratio, the harder that target is to hit; the lower the MTH ratio, the easier that target is to hit.

Unfortunately, there is no concrete method to determine 100 percent accurate AMTH or MTH values. MTH ratios are subjective measurements based on estimated performance on the unit in question. If intelligence or assumptions about the unit are faulty, the resulting MTH ratios also are incorrect. Use the specified 10:1 and 20:2 MTH values as a base estimation for missile requirements, but understand the inaccuracies that are built in.

Estimates place the red SAU's AMTH ratio at roughly 120, meaning that blue force missile attacks less than 120 missiles are unlikely to penetrate red forces aggregate air defenses. Because of the reduced number of aircraft and escorts, blue forces, coordinating all available are unable to amass such a barrage. Coordinating all available TLAMs as decoys and all available TASMs and F/A-18s, blue can muster only 116 missiles, which could possibly be successful, but leaves no TLAMs left for a Keflavik attack. This number increases to 160 if the battlegroup closes within the ship-launched Harpoon missile's range of 60nm, but places the group at a severe counterattack risk. At that range, the red task force will almost certainly detect and fire on the blue group.

It is obvious, therefore, that blue forces are unable to simply slug it out with red and rely on brute force to win the day. Blue forces must fight *smarter,* rather than harder, than red to win. You'll soon see how blue can accomplish this task.

Insufficient Defenses

MTH ratios can be examined defensively as well as offensively. The blue force's defense technology may well be superior to the red force's, but it simply cannot withstand a full-blown onslaught of anti-ship missiles fired from the red SAG. Technologically superior or not, MTH ratios explained previously favor the red forces. Repeated experiments in which both sides exchanged missile volleys resulted in all blue missiles downed for no red losses, while blue forces generally lost a cruiser and at least a destroyer or frigate. These types of losses bring blue forces dangerously close to mission failure.

Why are blue forces at a disadvantage when the individual ships have similar MTH capabilities? Because the red task force is significantly larger than the blue CVBG, with a higher percentage of strong AAW ships than blue. Estimates place red's AMTH at approximately 120, with blue's AMTH nearer to 70. Blue cannot quite muster 120 missiles in a single attack, even when coordinating a complex attack utilizing all available resources. Such an attack, unless executed perfectly, most likely will be detected in time for red forces to maneuver picket ships to protect their carrier. Based on intelligence reports, the red battlegroup can muster approximately 60 missiles without coordinating multiple groups, and probably well over 100 when coordinating land-based bombers from Keflavik with the red task force. At close range, red can muster nearly 150 anti-ship missiles.

The lack of aircraft reduces blue's defensive abilities also. With only eight F-14s available for combat air patrol (CAP), enemy-patrol aircraft from Keflavik and scout helicopters from the SAG have greater potential for finding the CVBG. The F/A-18s can be used for CAP duties as well, but they further limit blue's striking ability. Compounding the problem, both groups begin the scenario roughly 150nm apart. This distance is closer than the CVBG should be used, but the lack of tanker aircraft means no in-flight refueling, which means that all aircraft must operate within range of the carrier. Move the carrier back to a safer distance and you move the F/A-18s out of range of the target.

WAR LESSON 9.2

Red can generate an overwhelming attack; blue cannot.

It is critical, therefore, that red forces never locate the CVBG. If the CVBG is located, a red missile attack will devastate it. Even a "bearing only" contact, a situation in which red forces know which direction the CVBG lies but not how far away, is unacceptable. The Russian task force occasionally fires a small number of missiles on a bearing-only profile toward the CVBG. If these missiles make it past the CAP fighters, the CVBG escorts must activate radar and engage the in-bound missiles. After the CVBG radar "lights up," red forces have an exact fix on it and follow up the bearing-only attack with a giant missile barrage.

To keep the carrier hidden, practice tight EMCOM, or emission control, and never take the carrier closer than 100nm from the red fleet. Make sure that aircraft do not activate their radar when within 30nm of the carrier except in absolute emergencies. *Harpoon II* handles air operations rather poorly, and players must generally micromanage sensor operation to ensure proper EMCOM near the carrier.

Defining a CAP Mission

The Mission Editor handles air operations reasonably well. With the Mission Editor, units (aircraft or otherwise) are given a task (such as AAW patrol) and an area in which to execute that task. The Mission Editor then stations assigned units according to the *one-third rule,* or one-third of the assigned units on-station, two-thirds in reserve. If six aircraft are assigned to a AAW patrol, for example, the Mission Editor launches two. When those reach bingo fuel or Winchester weapons, the Mission Editor recalls them and launches two more. This technique keeps the patrol zone constantly occupied and relief aircraft always ready. You investigate how to use the Mission Editor below.

Figure 9-1. Opening position

Initial Aircraft Deployment

The reconnaissance satellite photograph in Figure 9-1 shows that the red fleet normally begins the scenario at 81nm, bearing 225 degrees southwest of Keflavik, 65nm, bearing 37 degrees from the *Toledo,* and 200nm, bearing 32 degrees from the *Nimitz* battlegroup.

Figure 9-2. CAP mission reference points

Before starting the scenario, use the intelligence provided in Figure 9-1 and create CAP and AEW patrols. Use this time, while the game is still paused, to define patrols and create a defense. A real-world captain would never have brought his task force so close to the enemy without a screen of combat and radar aircraft on-station. Because the scenario begins with no aircraft in the air, it is reasonable to deploy forces while the game is paused.

Creating Missions

The Mission Editor, despite potential quirks, works reasonably well for such tasks as AEW and CAP patrols. Begin by making the seven reference points shown in Figure 9-2. Please note that newly created reference points are named REF. They must be renamed by using the Rename Reference Point hot key to appear as shown in Figure 9-3.

Figure 9-3. Defining a BARCAP patrol zone

Note that the three AEW reference points are tucked safely behind the CAP reference points. When the CAP and AEW missions are created, the AEW patrols are protected by the CAP fighters. Also note how far the CAP reference points are from the red fleet. Do not place the CAP mission too close to the enemy or they will find themselves subject to continuous SAM attacks. Generally, the fighters must stay at least 40nm from any ship or risk significant SAM attacks.

Select the four forward reference points, as shown in Figure 9-3, and then select "create mission" from the mission pull-down menu. Although the random names assigned by default sound realistic, most players find that renaming missions to something more relevant helps manage them. For example, BARCAP Alpha serves nicely. Select Patrol AAW, Intermittent emissions, and Edit Now, and then press OK. Your screen should now resemble Figure 9-4.

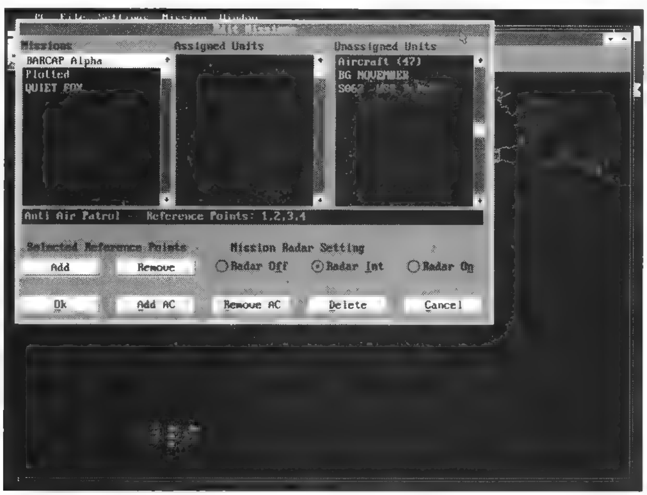


Figure 9-4. Adding aircraft to a mission

Highlight the desired mission, as shown in Figure 9-4, and then press Add AC. After the standard Air Ops menu appears, scroll down and assign the group of eight F-14D Tomcats. *Do not assign the separate group of two Tomcats.* These should be held in reserve for emergency intercepts. Press Continue and notice that (8) Aircraft have been added to the middle window. Press OK and return to the scenario. The Mission Editor launches these aircraft when the game clock is started.

Now repeat the procedure for an AEW patrol with E-2C

Hawkeyes. Set the Delay Time to five minutes. This amount allows the CAP aircraft to launch before the E-2C, keeping it safe from any prowling enemy fighters. Add all three E-2Cs and return to the scenario. The AEW patrol should be positioned as far as possible from the carrier, but safely behind the CAP fighters. The E-2C has no defensive capability and makes a juicy target for an enemy pilot. The enemy understands how important the E-2C's electronic eyes are and jumps at the opportunity to destroy one. Again, try assigning only two of the three E-2Cs to the mission, saving the third one for an emergency. Because an E-2C's on-station time exceeds four hours and the turnaround time is only 30 minutes, the Mission Editor should have no problems keeping one on-station at all times with only two aircraft assigned to the mission.

Do not worry about assigning too many units to a mission. Even if the Mission Editor malfunctions, any unit can be removed from an assignment at any time through the Edit Mission menu item and then selecting Remove Aircraft. A list of aircraft assigned to the mission is displayed. Simply click on the desired aircraft. If the selected aircraft is airborne, it loses all orders and must be manually assigned new orders. Non-airborne aircraft become "unassigned" and can immediately be redeployed by using the Air Ops button.

Figure 9-5. Use the three "back" reference points for the AEW patrol

Mission Editor Quirks: Straying Fighters

Notice the box in Figures 9-2 through 9-4 between the CAP mission and the enemy fleet. This is an air threat navigation zone. Navigation zones define areas that should be "off limits" to a particular type of unit. In this case, no friendly fighters move into the defined threat zone. Why create the threat zone? Fighters on CAP missions aggressively investigate positively identified hostile contacts near the patrol zone, leaving the zone as necessary.

Based on the avionics available, each fighter has an *identification range*, or the range at which unknown aircraft can be positively identified. Most fighters have a 30nm-to-40nm identification range; the F-14, using the TCS television system, has a nearly 60nm identification range. Subsequently, fighters often leave the patrol zone to intercept targets identified at maximum identification range. Straying into hostile territory (especially a Tomcat penetrating 60nm) begs an enemy response, generally a host of SAMs. To prevent the CAP from straying too far from the assigned station, therefore, use an air-threat navigation zone to "fence" in the fighters. If an aircraft needs to violate the threat zone, order it to ignore the threat zone or delete the threat zone altogether. See Chapter 1 for details on creating, editing, and deleting threat zones.

WAR LESSON 9.3

Use threat zones to keep aircraft out of trouble.

Mission Editor Quirks: Weapons Free

Aircraft or any other unit assigned to a mission ignore the Weapons Tight/Weapons Free menu option. Mission-assigned aircraft always fire weapons at their own discretion, even with Weapons Tight selected. Players can still manually order mission-assigned aircraft to fire weapons at any time, but they cannot prevent mission-assigned aircraft from automatically launching weapons during execution of the mission.

Positioning the Toledo

After completing the initial air patrols, you now turn your focus to the only submarine included in this scenario, the Los Angeles-class *Toledo*. The *Toledo* is arguably the most effective weapon blue has in this scenario. Whereas red forces can intercept an inordinate number of in-bound missiles, they have no similar defense against submarine-launched torpedoes, except destroying the sub before it achieves a firing solution.

The *Kusnetsov* group has sufficient ASW resources in two *Udaloys*, a *Krivak II*, and numerous ASW helicopters to hold the *Toledo* at bay. You see that, alone, the CVBG cannot overpower the red SAG, and that, alone, the *Toledo* faces grave risks approaching the target. The secret therefore lies in effective team tactics between the *Toledo* and the CVBG to outsmart Russian forces.

Assigning the Toledo

First and foremost, assign the *Toledo* a mission *before starting the scenario.* Failure to do so causes the *Toledo* to immediately fire its TLAMs at Keflavik Unfortunately, the red SAG always begins the scenario between *Toledo* and Keflavik and simply shoots down the incoming missiles. Worse, it gives the *Kusnetsov* group a bearing contact on the *Toledo.* Fortunately, if the *Toledo* is assigned a mission before the game begins, it stealthily drops beneath the waves and proceeds with its mission in deadly silence.

The *Kusnetsov* group patrols back and forth between blue's position and Keflavik's. Create four reference points

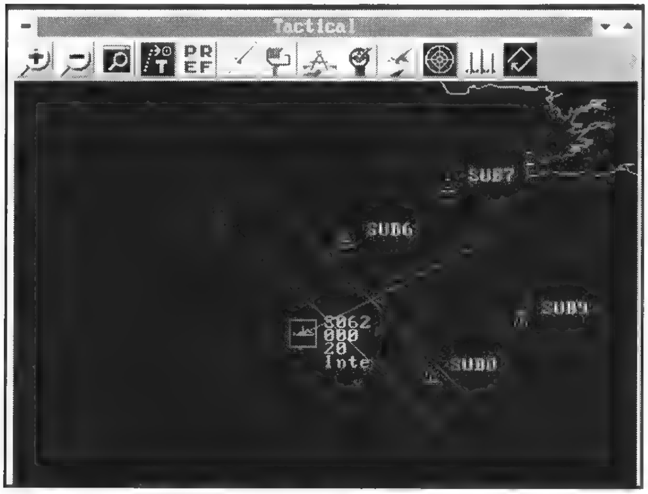


Figure 9-6. Assign the Toledo an ASuW mission

as shown in Figure 9-6, and then create an Patrol ASuW mission with only the *Toledo.* She then works the specified zone, stalking the Russian task force.

Teamwork

As stated, the *Toledo* cannot attack the *Kusnetsov* group alone. Now the teamwork begins. Use the *Nimitz*' Phoenix-armed F-14s to destroy Russian helicopters at long range. The Phoenix seems quite reliable against helicopter contacts at long range, thereby minimizing the risk to the Tomcats. Above all else, be patient. Submarine attacks are notoriously slow, and it can take hours for the *Toledo* to work itself into attack position. After the game starts, the *Toledo* dives and, as usual, you lose contact with it. After it's submerged, you receive no reports from it nor can you give it any additional orders. For the next few hours, you must remain patient and diligent. Do not allow any ASW helicopter to live and keep recon planes within range of the Russians.

Unless you began the game with the -w parameter (see Chapter 1), you may receive no indication when the *Toledo* initiates its attack. The CVBG might hear torpedoes during the attack, but don't count on it. Keep watch on enemy ships with your Hawkeyes. If one or more suddenly reduces speed to 0 knots, it has probably been hit. Carefully note the difference between zero speed and "sinking." *Zero speed* simply means that the ship cannot move; it does not mean that its defenses and missiles are also inoperational. One *Udaloy* in this mission was struck by two torpedoes and sat dead in the water for hours. Nearly six hours later, with the rest of its group long gone, it apparently completed sufficient repairs and got underway at 4kts toward Keflavik. Remember that "dead in the water" does not equal "dead."

The *Kusnetsov* generally leaves cripples behind and proceeds on its mission. As the *Toledo* sinks and cripples a few ships, the stragglers are left to fend for themselves and the AMTH ratio for the *Kusnetsov* group drops. Hence the earlier statement: The *Toledo* is the great equalizer in this scenario.

WAR LESSON 9.4

At the advanced level of difficulty you cannot micromanage a submarine unless you make it your flagship. Otherwise, you lose contact when the sub dives. If you make the sub the flagship, however, you lose contact with all surface assets when it dives. *Harpoon II* handles submarine operations significantly better than it handles air operations. When the sub resurfaces, the U.S. ships will probably be in flames. Therefore, let the computer control the submarine. The submarine surfaces and resumes contact after a few hours if it finds no targets.

Patience Is a Virtue

The carrier, in its reduced capacity, should act primarily as air cover for the *Toledo* until the submarine manages to split the *Kusnetsov* group and reduce AMTH requirements. Accordingly, the *Nimitz* battlegroup should hold its TASM missiles in reserve until they have a reasonable chance for success. The *Nimitz* should arm most, if not all, of its F/A-18s with air-to-air weapons. Assign them to CAP missions alongside the F-14s.

Despite orders to proceed to Keflavik, the *Nimitz* should pull back and hide from land-based Bear-D search aircraft. Ship's safety is your primary concern, and there is sufficient opportunity to assault Keflavik later. The *Nimitz* doesn't have enough aircraft on board for a reasonable strike, and TLAMs cannot be launched at Keflavik until the *Kusnetsov* group has moved out of the way and won't try to shoot them down. Maneuver patiently and wait for good shot opportunities.

Killing Keflavik

After three hours, possibly sooner, the *Kusnetsov* group should have moved south and left a clear path to Keflavik. After the line of sight between the blue CVBG and Keflavik is clear, launch the TLAM attack. Create a zoom window around Keflavik and set the window to display units rather than groups. Position the window so that the CVBG is visible at the same time in a separate window. This technique allows targeting of specific units at Keflavik If the entire group is attacked, the computer resolves how many TLAMs should be used against each unit, which may or may not coincide with your goals. Stopping enemy maritime search aircraft is the highest priority, so a player is best served by handling the attack manually and *ensuring* that the search patrols will cease.

WAR LESSON 9.5

The Russians have brute force, but time is on the side of the U.S. The scenario generally takes 18 or more hours of game time.

TLAM Types

The blue battlegroup carries three types of TLAMs: the TLAM-N with a nuclear warhead, the TLAM-C with a 454Kg warhead, and the TLAM-D with a submunition warhead. Because nuclear release is not granted in this scenario, discussion focuses on the TLAM-C and TLAM-D.

The TLAM-C's single, large warhead is best suited for large, reinforced structures, and the TLAM-D's submunition, or cluster bomb, warhead works better for softer targets.

Executing the Attack

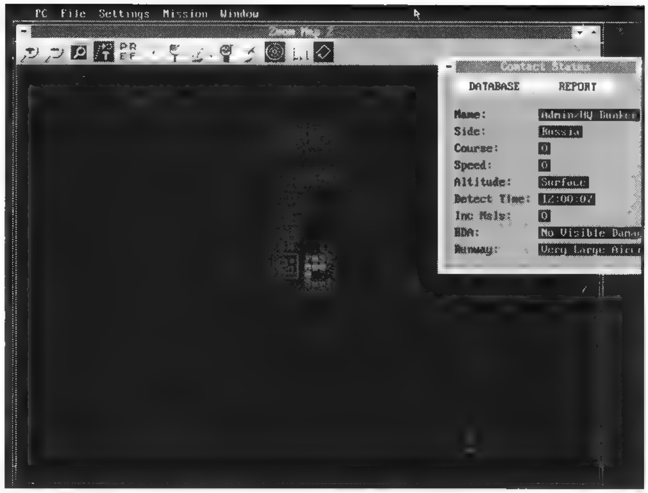


Figure 9-7. A detailed view of Keflavik

As shown in Figure 9-7, Keflavik contains three runways, three large hangar complexes with a total of 12 hangars, a fuel tank farm, a control tower, an HQ bunker, an SA-10 SAM battery, an SA-12 SAM battery, and an SA-13 SAM battery. Which ones should be hit? If the blue CVBG is carefully executed, it can destroy the entire base. Is that the best plan? Probably not.

You must examine why blue is attacking Keflavik to stop enemy air patrols. How do you stop air patrols? Destroy all the runways, destroy all the fuel, or destroy all the aircraft. Keflavik's strategic position means that it will probably be needed as a forward air-base for U.S. forces later in the war; therefore, the theater commander probably wants the runways left intact. That means hitting the hangars and, just to be safe, the tank farm as well.

Diversionary Attack

Most of the Russian helicopters in the real world are less effective at night, but *Harpoon II* ignores these platform restrictions. Keeping the premise of thinking like a real world tactician, however, we will construct our strategy based on reality. The Ka-25 Hormone lacks sufficient avionics to use its dipping sonar at night. Only the Ka-27 Helix operates equally as effective night or day. If CAP forces can destroy most Helix ASW helicopters, the red

> **WAR LESSON 9.6**
>
> Disable enemy airbases by destroying hangars first, followed by fuel tank farms, and, last, the runways. Also, SAM sites generally have 5:1 MTH ratios.

force loses most of its nighttime ASW capability, leaving the door open for the *Toledo.*

It should get dark around 1800 hours Zulu time. Around 2300 hours, prepare an anti-ship airstrike. Reconfigure the aircraft as follows:

16	F/A-18s	SO #08 (Two Harpoon missiles)
4	F/A-18s	SEAD-M LR #03 (Two AGM-88 Harms)
2	EA-6B	SEAD-M #02 (ECM gear + 1 Harm)

Keep the F-14s active on barrier CAP and watch the enemy SAG closely. If ships suddenly make erratic course changes and the *Kusnetsov* turns away from the rest of the group, rest assured that the *Toledo* is attacking. Escort ships peel off to prosecute the submarine, leaving the *Kusnetsov* with less-than-adequate coverage. If the *Nimitz* is ready to launch aircraft at the first sign of confusion, its aircraft can likely strike before the red battlegroup reforms.

In the worst case, *Nimitz* aircraft are too slow, but the *Toledo* should manage to sink one ship and probably disable another. The Hornets can finish off a burning cripple or begin to pick apart the remaining escorts. After *Toledo* reduces red's AMTH ratio, blue can move in and pound the survivors.

> **WAR LESSON 9.7**
>
> If the enemy task force makes sudden, erratic formation changes for no apparent reason, a submarine is probably attacking.

Debrief

Following this plan should result in victory with no blue losses, although part of Keflavik may remain operational and some remnants of the *Kusnetsov* group still afloat. This plan illustrates power projection: Despite being outnumbered and outgunned, superior technology and coordinated tactics reduce a major Russian task force to scrap, forcing Russian military planners to look at Washington in a different light.

If you did not succeed, however, let's consider potential reasons in this section.

First, the *Toledo* was sunk or otherwise failed to perform its ASuW role. Assuming that the ASuW mission was correctly planned and the *Toledo* patrol zone correctly encompassed the *Kusnetsov* group, there are two possible reasons for this failure. First, the battlegroup may have provided inadequate air cover, allowing Helix and Hormone helicopters to hold off or sink the *Toledo.* In this case, try keeping more Phoenix-armed F-14s on-station. The F-14s use the Phoenix at long range to kill these helicopters. When an F-14 fires all of its Phoenix, do not wait for the Mission Editor to eventually bring the F-14 back to base. Manually order the F-14 back and launch a fresh F-14 right away.

Figure 9-8. The dreaded indication of mission failure

Second, the *Kusnetsov* group may have executed a random patrol pattern that differed from the satellite photo in Figure 9-9. Depending on which options *Kusnetsov* was given at mission creation, it may pull a surprise and evade the *Toledo.* There's really only two things to do about this: Save the mission early, watch where the Russians go, and then restart and replan accordingly, or keep the *Toledo* surfaced (and at considerable risk) until the Russian movements are known. Otherwise, see the next category.

Third, the *Toledo* may have just have had bad luck. Sometimes this happens. The die take a bad roll and the *Toledo* is detected too early, its weapons miss, or its patrol pattern allows the bad guys to elude it. Despite all the planning and training in the world, units operating out of communication with each other may still fall victim to bad luck. Try the mission again.

OKINAWA

Inevitably, Japan's economic dominance led to imperialistic designs. No longer satisfied within its own borders, Japan desires dominance throughout the Pacific Rim. It is a feasible goal given the size and state of other Pacific militaries, with only one substantial problem: the United States. With economic superiority boosting its confidence, Japan prepares to challenge the U.S. Japan knows that it cannot outfight the U.S., but it can muster a good fight as long as its forces stay close to home and land-based aircraft. Japan therefore pressures the U.S. to withdraw from Okinawa and then blockades the island. Fueled by overconfidence, Japan believes that it can inflict heavy U.S. casualties, causing the U.S. to lose interest and simply withdraw.

The U.S., however, is not about to back down. The U.S. prepares its own show of force, illustrating just how small the Japanese navy really is. One SAG centered on the cruiser *Shiloh* and one CVBG, containing the carrier *Abraham Lincoln* escort supply ships toward Okinawa.

Mission Analysis

Japan deploys its best assets for its sea-denial mission. The newest, most powerful ships and submarines Japan owns, supported by formidable land-based air assets, block the path to Okinawa. Arguably operating within its own "backyard," a naval blockade typically construes an act of war. The U.S. must either concede Okinawa or impress its abilities on Japanese minds.

Unlike "A Fight to the Death," this mission features a full-strength carrier battlegroup as well as an independent SAG and three submarines. Both sides have approximately an equal number of combatants, but the U.S. CVBG enjoys a significant firepower advantage.

Within this scenario, we examine these concepts:

1. Blue water-carrier ops
2. Combined air attacks
3. Facing simultaneous ASuW, ASW, and AAW threats

Plotting a Course

To win, blue must deliver one, preferably both, Algol-class transports within 4nm of the Naha reference point. Three enemy SAUs, at least four enemy submarines, and numerous attack and reconnaissance aircraft stand between blue forces and the destination.

Figure 9-9 shows the latest available intelligence, revealing enemy fleet movements, sans submarines.

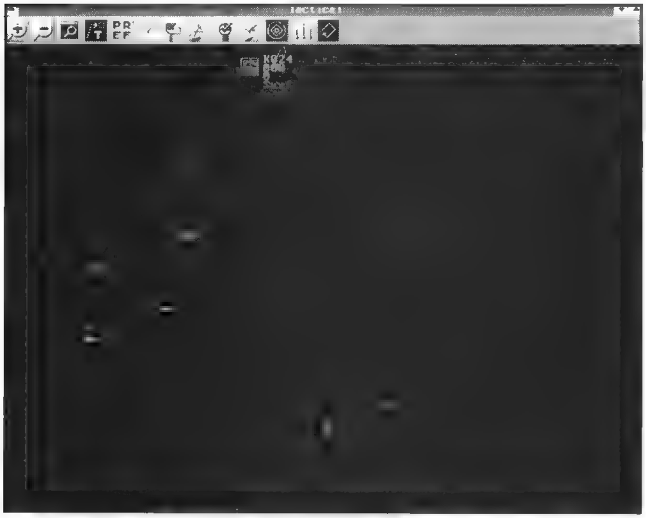


Figure 9-9. Check the strategic level map frequently to keep the big picture

Blue must first decide how to approach Okinawa. Enemy forces hold stations all along the island, and aircraft from the Japanese base, Kamiyaku, can reach at least as far south as Naha. Blue has significant air power, though, and therefore has many options. You can't determine "the best strategy" because there is no single "best" method. As you analyze blue's projection capabilities, you see that blue has, like a comic-book superhero, a set of "powers" or "abilities" at its disposal. Blue's strategy depends on how well the battle commander knows and employs these abilities.

As usual, the commander's first concern is the ship's safety. Although blue most likely can run the blockade anywhere, it faces the highest enemy concentrations the farther north it goes. Blue begins the scenario far to the south and has little reason to move northward. Arcing northwesterly from the starting position expedites the journey and minimizes exposure to Japanese fire.

Submarine Assets

> **WAR LESSON 9.8**
>
> Keep blue forces to the south, minimizing red's opportunities to fire on them.

As usual, each blue submarine should be given a mission and left alone. The subs dive, deftly execute the assigned task, and notify the flagship when it's all over. The hard decision is, what mission do you assign to a submarine you may not hear from again for 24 hours? Tactical situations can change drastically in an entire day, but the submarine maintains its original mission blissfully unaware of surface exigencies. Whatever mission you give the sub now had better be applicable for a few days or else the submarine becomes a wasted resource.

Enemy submarines are the greatest threat to blue forces in this scenario. Surface ships present a significant risk, but they can be dealt with, for the most part, with aircraft. The bulk of blue submarine forces should be used to sanitize areas of hostile subs before the carrier passes through.

> **WAR LESSON 9.9**
>
> Japanese subs pose the greatest risk to blue forces.

Note that most, *not all*, of the blue forces should provide ASW patrols. In Figure 9-9, notice the starting position of blue's three subs. The *Santa Fe* and the *San Juan* are relatively close to the surface ships, and the *La Jolla* is far to the north. Assigning the *La Jolla* to ASW operations makes little sense; any enemy sub that far north presents little threat to the blue SAUs. By the time any submarine that far north moves into firing position, the mission will be long over. True, killing any such submarines makes egress after delivering supplies safer, but a safe route home means little if the blue ships are destroyed on ingress. Attacking surface ships far to the north makes *La Jolla* more immediately useful and relieves pressure from the CVBG's northern flank.

The *San Juan* is positioned significantly north of the carrier battlegroup, too far north for an effective screen ahead of the carrier, but perfectly positioned to guard the carrier's northern flank. Japanese submarines in the vicinity of the *San Juan* could potentially move within attack range during the length of the scenario. *San Juan*, therefore, is most valuable as an ASW screen north of the carrier. There are ships

> **WAR LESSON 9.10**
>
> Aircraft assigned ASW missions through the Mission Editor automatically assume that any detected submarine is hostile and attack it. Aircraft performing plotted or unassigned sonobuoy/dipping sonar patrols through the Formation Editor do not attack an unidentified submarine unless manually ordered to intercept it.

in that area as well, but the carrier can find and kill these vessels easier than it can find submarines in that area.

Santa Fe is the wild card. It lies almost directly where the carrier needs to go. It is perfectly positioned to sanitize the area ahead of the carrier, with one problem: The carrier cannot assign any ASW missions in that area. If the carrier does, those ASW assets assigned through the Mission Editor will detect and attack the *Santa Fe*, assuming that it's hostile. Aircraft assigned sonobuoy patrols through the Formation Editor will probably detect the *Santa Fe*, but will not attack unless ordered to do so.

Figure 9-10. Suggested courses and patrol zones

Figure 9-10 shows the suggested courses and patrol zones for the various units. The reference points labeled Nor indicate the northern sub, or *La Jolla*'s ASuW patrol zone; reference points labeled Cen indicate the central sub, or the *San Juan*'s ASW patrol zone; and the reference points labeled Sou indicate the southern sub, or *Santa Fe*'s ASW patrol zone. Notice that the CVBG moves southward around the *Santa Fe*'s patrol zone to avoid possible blue-on-blue engagements.

ASW Patrols and Automatic Threat Zones

Because any unit assigned an ASW mission automatically engage any submarine they detect, it is obviously a bad idea to have a friendly submarine on patrol in the same area. To make life a little easier, *Harpoon II* automatically creates a submarine threat zone overlapping the ASW mission zone as soon as the ASW mission is assigned. That way, friendly submarines cannot maneuver into a region being ASW-patrolled.

This concept brings up two issues:

- How do you assign a submarine to an ASW mission if the mission immediately excludes friendly submarines?
- What if you create an ASW mission that a friendly submarine is already inside of?

Remember that navigation zones have type attributes and that units by default honor all possible relevant navigational zone types. Also remember that any unit can be ordered to ignore one or more navigation zone types. Therefore, simply order the submarine you want to perform an ASW mission to ignore submarine threat zones and then create the mission and assign the sub to it.

From here on out, let the submarines work their patrol zones. They will surface and resume contact every third patrol leg. In the interim, rest assured that they *will* actively seek out and engage the enemy.

WAR LESSON 9.11

It is imperative that ASW mission zones be carefully chosen to avoid areas with friendly submarine activity.

Defensive Formation

After the submarines begin their patrols, your thoughts turn to protecting blue ships from enemy forces. Before a CVBG can deploy its incredible might, it must prepare adequate defenses. A well-defended carrier is notoriously hard to kill.

Submarine Threats

Intelligence reports indicate that four hostile submarines are believed to be operating in the area. In this scenario, enemy submarines pose a much greater threat than do surface ships or aircraft. Surface ships and aircraft are readily detectable by carrier-based reconnaissance assets. Submarines are much more difficult to find, and you can't fight what you can't see.

Even if you cannot see the enemy submarines, most likely it can see you or, more accurately, hear you. A sudden barrage of hostile torpedoes at close range will most definitely ruin your day. In this scenario, the Lincoln has four types of submarine defenses:

- Long-range ASW aircraft
- Short-range ASW aircraft
- Carrier escort ships
- The *Shiloh* group

WAR LESSON 9.12

Units on missions, including submerged submarines, use the same aggressive artificial intelligence as computer-controlled enemy units, although they do not fire until they have positively identified the target as hostile.

Long-Range ASW Aircraft

The Lincoln has six S-3 Viking anti-submarine aircraft. The Vikings typically carry four torpedoes, two Harpoons, a substantial number of sonobuoys, and a Magnetic Anomaly Detection (MAD) system.

The Viking patrols the outer edge of the formation, dropping long rows of sonobuoys and then loitering above them for as long as six hours. If a submarine is detected, *Harpoon II* artificial intelligence immediately assumes that it is hostile and prosecutes it.

WAR LESSON 9.13

You can't fight what you can't see.

Initially, by using the Formation Editor, position the Vikings approximately 100nm from the carrier in patrol zones that surround the entire battlegroup. The submarine threat axis lies along the group's direction of travel because a submarine behind the group cannot keep up without revealing itself. At the beginning of the scenario, though, an enemy submarine can be anywhere — just behind the convoy, off to one flank, or directly ahead. Until the convoy has cruised long enough to eliminate the rear and rear-flanking threats, the Vikings should diligently monitor all fronts.

Figure 9-11. Create a wall of ASW aircraft through the Formation Editor

After the battlegroup cruises a few hours, reposition the Vikings mostly ahead and along the forward flanks. Prudent commanders probably keep at least one Viking patrolling behind the battlegroup, "just in case." This tactic also provides an increased margin of safety should the CVBG have to reverse course at some point.

Short-Range Aircraft

The helicopter forms the backbone of ASW for most surface vessels. Helicopters often operate 50 or 60nm from their host vessel while carrying torpedoes or depth charges, as well as a host of sensors including dipping sonars, sonobuoys, and MAD systems. Helicopters have lesser range than the aforementioned S-3 Vikings and carry fewer weapons, but nonetheless make highly effective submarine killers.

The U.S. Navy operates several ASW helicopters. The older Seasprite remains effective, but it lacks the capabilities of newer designs. The two variants on the UH-60 Blackhawk — the Seahawk and the Oceanhawk — form the core of U.S. ASW helicopter forces. All three (Seasprite, Seahawk, and Oceanhawk) serve the fleet well, although the more modern Oceanhawk possesses the most overall capabilities.

Despite the best Viking screen, an enemy submarine sometimes still penetrates within the carrier battlegroup. Perhaps the scenario started with the submarine inside the Viking's patrol; perhaps the submarine slipped between Vikings; perhaps it simply lay stationary and silent, letting the carrier come to it. Whatever the reason, the carrier cannot ignore the possibility of a submarine being the proverbial wolf in its seagoing fold.

Like the Vikings, you initially spread the helicopters around the formation. As time passes and the risk of rear attack is reduced, redeploy the helicopters along the forward edge and forward flanks of the battlegroup, keeping one or two on patrol inside the formation between the ships to watch for infiltrators.

Carrier Escort Ships

No carrier ever embarks without escort vessels. Although fighter aircraft receive more public attention, strike aircraft are the reason for the carrier's existence. A carrier with a nothing-but-defensive aircraft circling overhead has no power-projection capability. The carrier's airwing must be free to strike enemy forces, so the carrier needs escort ships for self-protection.

The navy packs ASW ships full of complex sonar equipment designed to detect even the faintest submarine sounds. Despite the best equipment available, the noise generated from the carrier and other escorts easily masks faint submarine sounds. Therefore, ASW escorts, such as the John Young (a Spruance-class destroyer in this scenario), should be stationed along the ASW threat axis relatively far from other ships.

Placing ASW escorts far from AAW escorts leaves them potentially vulnerable to air and missile attacks. The greater the threat of enemy airstrikes and missile attacks, the closer the ASW platforms should be stationed to AAW escorts. This scenario presents little of this type of threat to the blue forces. The Japanese ships carry only the relatively short-range (compared to the carrier's weapons) Harpoon, and the Japanese land-based strike aircraft do not have the range to engage the blue fleet far to the south. The *John Young* should be reasonably safe operating 25 miles ahead of the carrier.

The Shiloh Group

Battlegroup LIMA, the *Shiloh*'s group, is a miniature version of the CVBG with short-range ASW aircraft (helicopters) and ASW escort ships. These assets should be deployed as described earlier, by using the Formation Editor. BG-LIMA, though, can also be one of the carrier's ASW assets.

WAR LESSON 9.14

Assign the screening force a zig-zagging, sprint-drift pattern ahead of the CVBG. Use high-speed runs to stay ahead of the carrier, and then drift quietly to listen for submarines.

The *Shiloh* group, when positioned ahead of the carrier along a similar course, acts as a submarine screen. Theoretically, its ASW resources should detect and prosecute any submarines before the carrier arrives. Also theoretically, any enemy submarines ahead of the carrier will detect the *Shiloh* group and engage it, thereby revealing its position, with the carrier safely several miles away. Of course, theories sometimes fail. A preceding screening group may occasionally miss a submarine, but the trailing CVBG is safer with this type of screen than it is without it.

Friendly Fire

Remember that any unit assigned an ASW mission will fire on any submarine it detects. The unit has no way of knowing whether the submarine is hostile, so it assumes that all submarines are hostile. When the carrier group closes near where the *Santa Fe* and *San Jose* are operating, be very careful with ASW patrols. If either submarine completes its patrol and surfaces, redeploy it out of the way. If one or both remain on-station and out of contact, carefully plot a course around the submarines' patrol zones.

Air Threats

Blue forces face two types of air threats: missiles launched from Japanese surface ships and missiles launched from aircraft. The best defense against enemy missiles always has been and always will be

- Stay out of sight.
- Stay out of range.
- Possess a high AMTH ratio.

Stay Out of Sight

> **WAR LESSON 9.15**
>
> The less the enemy knows about your position, the safer you are.

Applicable in most any combat situation, the less the enemy knows about your position, the safer you are. The enemy has to know at least approximately where blue is before it can attack. Staying hidden means safety from attack. You see in this section that keeping something as large as an aircraft carrier battlegroup hidden requires *air superiority*, or dominance of the sky.

Stay Out of Range

It doesn't matter how many missiles the enemy has if none of them can reach you. If Japan finds the carrier, it still has to deliver weapons on it. Air superiority plays a significant role here also.

Possess a High AMTH Ratio

Essentially, you "buy" security. The more platforms bought and deployed, the bigger the enemy has to be to overcome it. Usually, the impetus behind most arms races equates to "the guy with the most guns wins." Economic concerns may not support such activities, but a large, "flashy" military is essential for show-of-force power projections.

Air Defense Through Air Superiority

Why is air superiority so important? Because of an aircraft's reconnaissance and strike potential. Both Japan and the United States have highly capable E-2 Hawkeyes in this scenario. A single Hawkeye can monitor the entire Okinawa theater single-handedly. Both side possess the capability to find the other side almost instantaneously. Remember that the first defense against air attack requires remaining hidden.

> **WAR LESSON 9.16**
>
> *Air superiority* is the ability to use the skies for your own purposes with impunity while denying the enemy the same.

The side with air superiority denies the other effective use of such assets. Air superiority ensures the first air defense rule while denying the enemy the same luxury.

The second air-defense technique suggests remaining outside enemy weapons envelopes. This means that you must locate the enemy and identify him to know what weapons he has and how far they reach. Air superiority allows use of recon assets and ensures the second air-defense rule while denying the enemy that luxury also.

Third, although defense budgets may preclude increasing the size of the battlegroup with additional AAW assets, fighters have significant capabilities to intercept cruise missiles. A wave of fighters probably cannot stop all in-bound anti-ship missiles, but they can kill a few. Aircraft therefore must be included in AMTH calculations for the battlegroup because they effectively increase AMTH requirements. Also consider the fighter's ability to kill in-bound bombers and strike aircraft before they can launch their missiles. Forcing an enemy to launch twice as many bombers in order to simply penetrate the fighter CAP effectively doubles the number of missiles it must field to score a hit, which by definition increases AMTH requirements.

Having air superiority, by definition, means significantly reducing the number of enemy fighter aircraft and therefore allowing easier access for one's own strike aircraft. Air superiority therefore effectively increases friendly AMTH ratios while simultaneously reducing enemy AMTH requirements.

You see from this discussion that air superiority is essential for the battlegroup, but is not its primary goal. Air superiority is a method by which larger goals, such as air defense, are accomplished. Fighters usually receive significantly more fame and glory than do their ground-attacking counterparts, but never lose sight of the real purpose of aircraft: to find the enemy on the ground and destroy him. Fighters developed from a need to protect bombers, and a carrier deploys fighters not usually as the primary mission but as a necessary component for deploying ground-attack aircraft.

WAR LESSON 9.17

Always remember that bombers are the carrier's primary weapon; fighters exist only to support them. Obtain air superiority before launching massive strikes or prepare for heavy losses.

Coordinated Air Operations

This discussion leads us to the topic of coordinated air operations. No matter how you decide to approach Naha, most of your battles with Japan consist of coordinated air operations. Coordinate air operations quickly become complex and are best explained by example. We therefore illustrate coordinated air operations by stepping through the first few hours of the scenario. The battle plan executed here is by no means the only way to approach the mission, but is designed to teach the components of air warfare. Some steps may not be necessary given the scope of this scenario, but nonetheless illustrate integral concepts of air warfare. The following discussion examines a complete air operation, teaching you what you need to know to create and wage your own subsequent air campaigns.

Step 1: CAP On-Station

Before launching any aircraft anywhere, assign a CAP station that usually consists of two fighters. Although two fighters do not constitute a significant CAP, there are three good reasons to start the CAP small.

First, don't overcommit CAP assets until the threat axis is established with a reasonable degree of certainty. You can reasonably assume that all airborne threats come from Kamiyaku airbase, but other surprises may be waiting out there. Most scenarios do not have such a clear-cut air threat. Be prepared to "scout around" a little before committing significant numbers of fighters.

Figure 9-12. Positioning the first CAP sorties

Second, the Mission Editor works better when all aircraft of a specific type are assigned at the same time, and it works best when aircraft are all assigned when the mission is created. The Mission Editor sometimes has problems consolidating units of the same time added to a mission at different times, and it subsequently violates the one-third rule. For example, if two F-14s are assigned when the mission is created and seven more are created later, the one-third rule should try to keep three F-14s on-station at all times. Unfortunately, it sometimes mishandles the consolidation and launches all nine aircraft at a time.

Adding airborne and landed aircraft simultaneously can also confuse the Mission Editor. It is best to add all aircraft, such as the nine F-14s in the preceding above, at one time when all nine are on-board the carrier.

Third, it is unlikely that the enemy will know your position at the beginning of the scenario. It takes him a few minutes to get his aircraft on-station, and there almost always is sufficient time to launch additional CAP fighters after detecting the enemy aircraft. There is no need to rush getting aircraft airborne for the first 10 or 15 minutes of the scenario.

Step 2: AEW On-Station

After a few fighters are up and 40 or 50 miles from the carrier, activate their radar if they have not already done so. Watch for enemy aircraft for a few minutes. If the area near the carrier looks clear, launch an E-2C Hawkeye. The Hawkeyes are the electronic eyes and ears of the fleet. The Hawkeye's AN/APS-145 radar has a 350nm search range, covering an area over 500,000 square miles and detecting both ships and aircraft. A single Hawkeye stationed on an anticipated threat axis 100nm to 200nm from the carrier provides ample detection and warning of approaching enemies.

Figure 9-13. As always, position AEW patrols behind fighters

Because the Hawkeye is vital to obtaining and maintaining air superiority, one should be kept on-station at all times, usually by creating an AEW patrol mission and assigning two Hawkeyes to it. The Hawkeye can remain on-station five to six hours, depending on the range from the carrier, but it requires only 30 minutes turnaround time between missions. Therefore, two E-2Cs are sufficient to keep one on-station at all times.

The Hawkeye has no significant armament and depends completely on other units for protection. *Never allow an E-2C to operate without a screen of fighters along all anticipated threat axes between it and the anticipated threat.* Losing an E-2C makes the blue fleet devastatingly blind until a replacement can be fielded.

WAR LESSON 9.18

Never operate an AEW aircraft of any kind, land-based or carrier-based, without fighter protection between it and the enemy.

Step 3: Deploy Full BARCAP

After the E-2C has been on-station for 15 or 20 minutes, blue should have a good picture of the theater and threat axes. Using the procedures defined earlier in this chapter, in the "A Fight to the Death" scenario, create barrier CAPs, or BARCAPs, along all air threat axes with air-threat navigation zones to keep fighters from straying too far from the assigned areas. Assign a reasonable number of F-14s, at least six, to each BARCAP. Assigning six should keep at least two on-station at all times. High-risk threat axes should generally have four fighters on-station at all times.

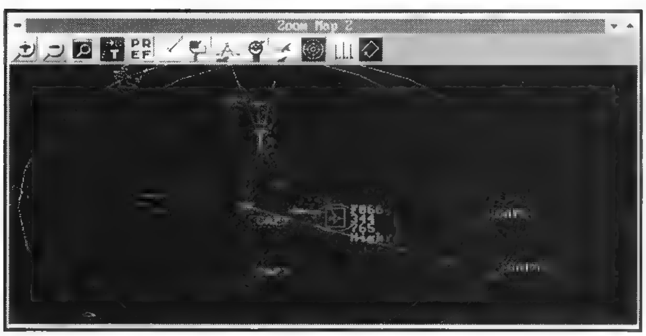


Figure 9-14. Deploy full BARCAPs along the "front lines" of the air war

Never assign all available fighters to BARCAP missions, though. BARCAPs are the outer perimeter of your region of air superiority, or, in other words, *the front lines of the air war.* Some fighters must always be present on the front to prevent enemy penetrations, but as with all other fronts, friendly fighters should be pushing forward, driving the enemy back and securing more airspace. This concept requires additional fighters for penetration missions into enemy-controlled or contested airspace. Remember that while you are building air superiority, the enemy is doing the same. Always keep a few fighters in reserve to intercept enemy AEW patrols, helicopters, etc.

Step 4: Tanker Orbits

Most fixed-wing aircraft have unrefueled at least a 200nm unrefueled combat radius, and some have much greater ranges. Unrefueled combat radius is the range the aircraft can fly from the carrier, engage in combat, and make it back home without requiring additional fuel. Most aircraft can substitute external fuel tanks for part of its normal weapons loadout, giving it significantly longer ranges at the expense of armament.

Sometimes, though, on-board fuel is not sufficient. Perhaps the target lies 500nm away or no E-2Cs are ready to relieve the one currently on-station or an aircraft got lost and has insufficient fuel to get home. Occasionally, *Harpoon II* glitches cause an aircraft to do strange, unpredictable, gas-guzzling maneuvers, reducing its fuel load below bingo. *Bingo fuel* is the amount the aircraft needs in order to get home and land with only five minutes of fuel left in its tanks.

Harpoon II includes for these conditions a resource the original Harpoon sorely lacked: in-flight refueling. Several aircraft, such as the A-6 Intruder, can carry multiple fuel tanks in place of weapons. More importantly, they also can carry a "buddy store" to allow refuelling of other aircraft. A fuel-hungry fighter can stop by the local "filling station" and top off its tanks on the way home. Click on the desired aircraft, press the Air Ops button, and then double-click on the tanker.

Air-to-air refueling in *Harpoon II* has some quirks:

- The tanker aircraft must be loitering. If the tanker is not loitering, the recipient aircraft ignores the order to refuel.
- Tankers transfer fuel at a fixed rate and always completely fill the recipient's tanks. If the tanker has insufficient fuel to completely fuel the recipient, the recipient ignores the order to refuel, *even if it is dangerously low on fuel.*
- Tankers can be launched in groups, and entire aircraft groups can be sent to the tanker or tanker group at one time. But, as in the second entry in this list, if the tanker does not have enough fuel for the entire recipient group, the entire recipient group ignores the order to refuel.
- Once in a great while, something goes wrong with the tanker logic. On these rare occasions, the tanker aircraft physically freezes on the map window and any aircraft ordered to refuel get confused. Recipients simply fly in circles around the tanker, ignoring all orders to move, return to base, or intercept enemies. If this happens, zoom the map in until you can draw an air-threat navigation zone around the tanker aircraft without including the "confused" recipients. The automatic navigator kicks in, trying to resolve the path through the new navigation zone, and seems to "wake" the confused units, including the tanker. For safety, immediately order the revived units back to base before something else goes wrong.

Always remember that the tanker aircraft burns the same fuel supply it shares with the recipients. As the tanker pumps gas and the recipient's endurance increases, the tanker's endurance decreases. Tankers seem to be reasonably intelligent, though, and do not transfer fuel it if jeopardizes their own bingo fuel requirement.

Large tankers, like the KC-10 or KC-135, can refuel many fighter-size aircraft. Smaller tankers, like the A-6 (usually referred to as a KA-6 when it's performing the tanker role), have significantly lower fuel supplies. Coupled with the logic of "transfer fuel until the recipient can't take anymore," a single KA-6 is usually good for only one, perhaps two, fighter-size recipients. A more realistic scheme allows the user to specify how much fuel to transfer to the recipient.

Figure 9-15. Building a gas station: Like AEW patrols, keep a wall of fighters between tankers and enemies

Because a tanker must be loitering before the recipient will refuel, tanker orbits can only partially be automated. Create a separate mission and assign tanker aircraft to it. When fresh tankers launch, let them arrive on-station and then manually change their speed to loiter. When recipients no longer obey refuel commands, reset the tanker's speed and order it to return to base.

> **WAR LESSON 9.19**
>
> A single KA-6 can refuel only one or two fighter-size aircraft, and only a single recipient at a time. Larger aircraft, like the KC-135, can refuel multiple fighter-size and bomber-size aircraft simultaneously.

Step 5: Additional Recon Flights

By this time, the Hawkeye should have a good read on the theater and at least bearing-only contacts on enemy surface units. The Hawkeye probably has an exact fix on most every surface ship and base in the theater, but probably has not positively identified them all. Now you need a recon mission.

As described in Chapter 1, "recon ship" missions dispatch assigned units, usually air units, from the mission patrol zone to "check up on" contacts all over the theater. Recon ship missions resemble a game of tag. The defined patrol zone is "base." Aircraft assigned recon missions expect "base" to be a haven protected from all enemy fire. Aircraft in "base" are assigned ship contacts to investigate. Contacts are assigned to whichever available aircraft can get to that contact fastest. The aircraft leaves the "base" patrol zone and approaches the contact until it obtains a positive fix and identification on ("tags") the contact. The aircraft then runs back to the base patrol zone and hangs out for a while. After the contact ages awhile, the aircraft again leaves base and "retags" it. The aircraft continues to leave base and tag the contact until the contact no longer exists or the aircraft is removed from the mission. Through this process, the aircraft effectively shadows the contact throughout the theater.

Figure 9-16. Setting up a "safe zone" for ship reconnaissance

Full-realism players must also consider communications networks with recon missions. When you're using full realism, information from the patrol aircraft is not relayed to the rest of the fleet if its communications are broken. Just a reminder: *Make sure that recon aircraft have active data links.*

Step 6: Strike Launch

Next, wait for hostile units to appear and then prepare an appropriate response. In-bound bombers? If the BARCAP cannot handle them, launch additional interceptors. Recon aircraft detect hostile ships? Prepare an ASuW strike. Sonobuoy detect a submarine near the CVBG? Deploy ASW assets. Enemy airbase launching too many nosy patrol aircraft? Launch an airstrike. The point is that only now, after you have secured the airspace around the carrier, developed a reasonable view of the theater, and established the various threat axes, should you attempt an airstrike. Doing otherwise invites disaster.

> **WAR LESSON 9.20**
>
> Recon aircraft expect their patrol zone to be threat-free and spend significant time loitering there. The patrol zone is actually a "loiter zone" to the assigned units. Be sure to keep it well protected.

Executing the Strike

Unfortunately, launching a successful strike is not as simple as it may sound. A successful strike demands coordination of large numbers of aircraft, ships, bases, and weapons. Simply sending 24 A-6s off to attack Kamiyaku results in most of them being shot down without doing any noticeable damage. This section discusses streamlining the mission-planning process, minimizing the number of fatal planning errors, and maximizing strike impact by illustrating one such strike in this Okinawa scenario.

> ***Example:*** Recon and BARCAP assets are on-station, and three enemy task forces are identified, consistent with satellite photograph (see Figure 9-1). The best course to Naha lies to the south, so you begin hostilities by executing a large-scale airstrike on the southernmost group of warships.

Know the Target

Before launching any strike against any target, know what you are about to go up against. Never launch a strike if the target's current, exact whereabouts are not known. Never send a strike package out to roam around and search for its target. If you do not know where the target is, you do not know exactly how big it is, how strong it is, or what other hostile units may be lurking nearby. In war, the side with surprises up its sleeve usually wins.

Always obtain an exact identification through recon missions before launching a strike, especially against ships. Land bases are pretty easily identified and mapped, but ships require more thorough identification procedures. Why acquire a positive ID when there may be little or no doubt that the unit is hostile? Recall the golden lesson from Chapter 2: *Always know your enemy.* If the target is identified only as a "medium-size ship," does that mean a medium-size AEGIS-equipped AAW ship or a lightly AAW-armed ASW platform? The former case presents a much higher MTH ratio and greater risk to in-bound

> **WAR LESSON 9.21**
>
> You cannot choose the right weapons and aircraft for the attack until you know everything about the intended target.

aircraft, and the latter case offers easier MTH requirements and requires fewer attack platforms, releasing aircraft for other missions. Unless you know who you are about to flght, you have no idea how much offensive firepower you need nor how much defensive firepower you are about to face.

> ***To continue the example:*** An E-2C on-station north of CVBG continues to track the southern group, but has yet to positively identify them as hostile. You must therefore launch a recon mission and gather more intelligence. Add three reference points in a triangle pattern as the perimeter for a recon mission's loiter zone, as indicated in Figure 9-16. Create a "recon ship" mission and assign one S-3 Viking to it. If no Vikings are available, assign an A-6 or an F/A-18.

Choose the Right Tools

Matching the right tools with the job at hand is the most important part of strike planning. No matter how precisely timed the attack, no matter how well executed, no matter how coordinated, if the ordnance delivered is ineffective against the target, it was all for naught.

First, do you need tanker support or can the strike aircraft get there under their own power? Having a few tankers around anyway to account for the inevitable mistakes, mishaps, and computer glitches can never hurt as long as mission-critical aircraft are not reassigned to the tanker role. If tankers are needed, do you have enough? If a KC-135 or two is available, probably. If the strike depends on KA-6s, it becomes doubtful. With the approximately 1:1 KA-6-to-recipient logic, the A-6 strike force is halved if full tanker support is necessary.

In this case, ask the question "Does this target really need to be hit?" If the target lies that far from the airbase or carrier, does it really pose an immediate threat or can it be left alone? Can other resources, such as Tomahawk TLAMs, be used instead? Remember that in the real-world every bullet, missile, aircraft, and drop of fuel costs money. Every attack, successful or not, costs hundreds of thousands of dollars, easily extending into millions. If two enemy destroyers are lazily meandering around coastal waters 300nm north of the ops zone, do they really need to be sunk, except to bolster the captain's ego?

Second, what type of defensive countermeasures are available and needed? Are EA-6Bs or other ECM-capable aircraft available? Jamming works reasonably well, but announces to anyone listening that something is happening. Listeners cannot determine where or what is happening, but they know that *something* is going on. Generally, the benefits of jamming enemy radar far outweigh the potential disadvantages, especially if they're carefully managed to avoid early revelation of the strike package.

Similarly, the ADM-141 Tactical Air Launched Decoy (TALD) is one of the most effective countermeasures available in *Harpoon II*, but every aircraft carrying TALDs is one less aircraft carrying weapons. TALDs, when used appropriately, greatly enhance strike potential and aircraft safety. Therefore, TALDs should be included in some capacity in every strike in which enemy resistance and air defenses are anticipated. The question is, *how many TALDs are really needed?* An F/A-18 can carry as many as 8, and an A-6 can carry as many as 26. Is one A-6 sufficient? In some cases, yes; in others, no. Later, when we discuss how to use TALDs in combat, you learn how to make the judgment: How many TALDs are enough?

Anti-radiation missiles, like the AGM-88 HARM, are the ultimate countermeasure. Not merely a blindfold or a decoy, the HARM literally pokes the enemy's eyes out by homing in on enemy radar emissions and destroying the radar source. An enemy must activate his radar, literally open his eyes, to engage in-bound aircraft and missiles. Doing so leaves him open to anti-radiation attack. It places him in quite a dilemma: Keep his eyes shut to protect them but potentially lose them when the ship is sunk, or open his eyes to see what is happening and be permanently blinded? As long as there are enough aircraft available, it never hurts to have a few equipped with HARMs. Firing a few when the enemy first activates radar makes him think twice about using such a powerful tool.

Third, determine what ordnance the target requires. Long-range Harpoon missiles are great against enemy ships, but what about attacks on land bases? Hardened bunkers? Runways? As stated in Chapter 2, you must know your weapons and capabilities as well as those of your enemy. The bottom line is, *don't send aircraft off to attack a target with the wrong weapons.*

After choosing the correct weapon, the number of said weapons required to destroy the target must be determined. Now the great quandary begins: "I need 20 aircraft carrying Harpoons, eight carrying TALDs, two with ECM, eight with HARMs, and a couple of tankers for good measure but I've got only 24 aircraft available!"

This is what command is all about: making the hard decisions. Combat demands almost always exceed available resources, so compromises must be made. Tankers are a nice insurance policy against unforeseen mishaps, but if not mandated by the mission, reallocate them to a strike role. Of course, if something goes wrong, a waypoint is moved in error, the program glitches, etc., one or more aircraft may be lost. Such is life. Are eight TALD-carrying aircraft really necessary? Can four do the job? If so, reassign four of them to carry ordnance. Of course, one or more may be shot down because one of the deleted TALDs was not available to deceive an enemy SAM. Again, such is life.

Strike planning comes down to allocating resources, taking *reasonable* risks, and sticking by the decisions. The key word is "reasonable." By fully understanding the enemy's strengths and weaknesses compared to your own, you can make informed decisions and "cut corners" only where it minimizes overall risk. Information may well be the greatest weapon a strike planner has.

Fourth, who has control of the skies? Does the strike need escort fighters? This scenario makes an excellent example. With the BARCAP in place, blue has air superiority everywhere south of Naha. An airstrike against the southernmost surface group scarcely requires fighter cover. The northernmost group, though, operates north of blue's BARCAP in contested, or possibly enemy-controlled, airspace in range of Kamiyaku-based fighters. Strikes that far north almost definitely require fighter escorts and target CAP, also called TARCAP.

> ***To continue the example:*** Estimating conservatively, the targeted task force has an approximate AMTH of 60:6. You have 10 F/A-18A, 20 F/A-18C, 14 A-6E, and 4 EA-6B. Blue has air superiority in this region, so no additional fighter cover is necessary. Arming all 30 F/A-18s with loadout SO#08 gives them 2 Harpoons each, plus 4 air-to-air missiles in case air security is compromised, for a total of 60 Harpoons. The Japanese ships are well-equipped, so anti-radiation missiles are in order. Arm 8 A-6Es with loadout SEAD-M #01, giving them 4 HARM missiles each, or a group total of 32 HARMs. The enemy rations radar use

to evade HARMs. If it shuts down radar, the HARMs will likely miss, so you need decoys available. Arm the remaining 4 A-6Es with loadout SEAD-D #01, giving each aircraft 26 TALDs. You have a sufficient number of HARM missiles, so load 2 EA-6Bs with loadout ECM #01, giving each aircraft 4 ALQ-99 ECM pods. The target is well within range, so tanker support is unnecessary.

This example is beginning to show blue's overwhelming superiority in this scenario. Without making any significant sacrifices, the attack force carries 60 anti-ship missiles and 32 anti-radiation missiles and equals the estimated enemy AMTH ratio. Additionally, you have ECM and TALD support, which you later will see causes a significant reduction in enemy AMTH requirements.

Plot Courses

How the strike package approaches the target partially determines how many aircraft will come back home again. The sooner the enemy knows a strike is coming, the longer it has to prepare for it, so both stealth on ingress and surprise are paramount. Attacking from multiple directions may confuse some targets, but may also degrade the strike. Most ships have multiple radar facing multiple directions, each with some number of *fire-control slots,* meaning the number of targets each radar can simultaneously track. If all aircraft attack from a single angle, they may overwhelm the air defenses on that

> **WAR LESSON 9.22**
>
> Deception plays a major role in combat, and surprise attacks work best, but always try to concentrate firepower to overwhelm air defenses guarding the attack direction.

side, but if they split the attack from multiple directions the respective air defenses may easily track and destroy all inbound missiles. The best advice is to approach the target from multiple angles to confuse the enemy, but attack from a single side. The enemy may redeploy a battlegroup in anticipation of an attack from the south, leaving it open to attack from the real direction: the north.

A critical real-world concern that is absent in *Harpoon II* is avoiding blue-on-blue, or friendly-fire, air engagements. Allies shooting each other account for a significant portion of combat losses in every war of the 20th century. Splitting forces tends to disrupt communications, leading to confusion and, ultimately, mistakes. Except for submarines, *Harpoon II* units rarely lose communications with the flagship, therefore eliminating most friendly-fire conditions. The real world is not so fortunate.

Most weapons require a specific flight profile of speed and altitude for launch, known as *launch parameters*. Computer-controlled aircraft know these parameters and account for them automatically, but you may unexpectedly encounter them in the heat of combat during a manual attack. It is best to edit each aircraft's or airgroup's final waypoint to ensure that they arrive at the proper speed and altitude for the attack.

> ***To continue the example:*** There seems to be no reason to complicate the ingress. The target is relatively close, so a quick strike seems in order. The target warships have reasonable air-defense capabilities, so the strike force should concentrate firepower from a single direction. The aircraft launch and follow the courses shown in Figure 9-17, therefore, arriving from the west and spread slightly from north to

south. The separation makes control of individual groups easier, but is not significant in terms of concentrating firepower.

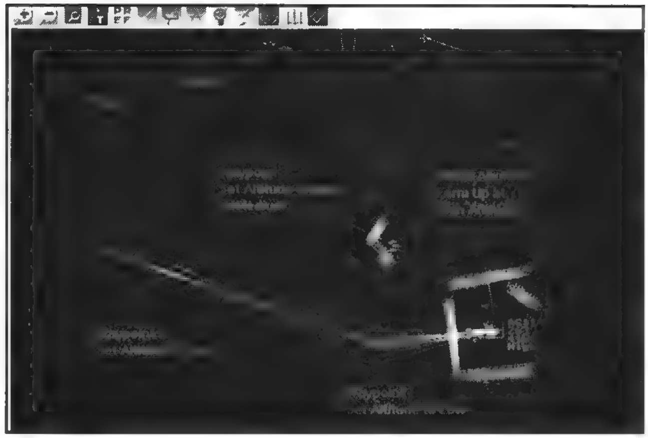


Figure 9-17. Plotting ingress routes

Harpoon missiles require medium or low altitudes for launch, and HARM missiles requiremediumorhigh alti-tudes. For maximum effect, TALDs must be launched from high altitudes. For simplicity's sake, edit all airgroups' final waypoint so that they arrive at medium altitude except for the TALD-carrying aircraft, which should arrive at high altitude. Order all airgroups to loiter at their final waypoint. You do not want the aircraft to initiate any attacks until you have examined possible attack methods, which are discussed shortly.

Effecting the Attack

As the aircraft approach, deception aircraft must begin masking their arrival. ECM should not be activated too soon because its active emissions gleefully announce its presence, but it must be activated in time to hide the incoming strike aircraft. If the enemy's radar is off, do not activate ECM; if his radar is off, he cannot see the incoming strike anyway, so there is little need to announce the attack by using ECM. If his radar is already active and the strike aircraft are within its operational range, activate ECM immediately. Better to let the enemy guess about an incoming strike than to positively know about it. After the attack begins, activate all ECM gear and leave it on until all friendly aircraft have departed.

TALDs: The Great Secret

ADM-141 Tactical Air Launched Decoys (TALDs) are possibly the most useful yet least documented *Harpoon II* component. TALDs are small gliders launched from other aircraft. The TALD's shape, however, presents a relatively giant radar cross-section (RCS). In other words, the small, gliding TALD looks like a fighter or attack aircraft on enemy radar screens. TALDs have three purposes:

- Encourage enemies to activate radar.
- Overwhelm enemy radar.
- Deceive enemy missiles.

> **WAR LESSON 9.23**
>
> Radars can track only a limited number of targets at a time. Of those targets, the radar is limited further by the number of fire control solution spots available. If the radar is overwhelmed by decoys, it might be saturated and unable to engage a separate inbound missile group.

First, waves of TALDs often cause enemies to activate their radar. Some enemies are quite reluctant to turn radar on because they expect to find a host of incoming HARM missiles mere seconds after activation. Therefore, they sit patiently and rely on visual spotting, ESM (or radar detectors), or television and infrared systems to indicate that something is happening out there. Then, when they believe that in-bound missiles are quite likely, they "open their eyes" and take a look around. This reluctance to use radar can be quite annoying when you are waiting to send a volley of HARM missiles toward the emitter. A wave of 10 or 15 TALDs, however, convinces most hostiles that an attack is in progress. They obligingly activate their radar and await the inevitable HARM missiles.

Second, TALDs overwhelm enemy radar. Recall the previous discussion about concentrating firepower to overwhelm radar fire-control slots. TALDs effectively catch and occupy the radar's attention, forcing it to ignore other objects, such as in-bound Harpoon missiles. The computer's defense logic always gives priority to missiles over aircraft. That is, if the computer detects both a missile and an aircraft within SAM range, it *always* fires on the missile first because the missile presents a much more immediate threat. The radar, though, has a limited number of fire-control channels. If the radar has 25 fire-control channels, it can only develop fire-control solutions on 25 targets at one time. If the radar is busy updating solutions on 25 TALDs when a group of missiles arrives, the fire-control system can't prosecute the inbound missiles. Overwhelming enemy radar with TALDs, therefore, decreases the enemy AMTH requirements.

Third, the enemy often fires on TALDs, believing them to be actual hostile aircraft. SAM launchers have a finite rate of fire that cannot be exceeded. A SAM launcher busily shooting down TALDs may be reloading an inactive when a friendly AGM-84 comes knocking on the door.

Using TALDs

TALD endurance, or how long it flies around deceiving enemy radar, is directly proportional to the altitude from which it was launched. The higher it was launched, the longer it lasts. TALDs fly at approximately 400kts. Their speed and RCS make them easily distinguishable from small, fast missiles. The Harpoon is somewhat faster at 570kts, and the HARM is significantly faster at 1,980kts. Therefore, TALDs should be launched 60 to 120 seconds before a spread of missiles, giving them time to catch the radar's

WAR LESSON 9.24

A large barrage of TALDs fired a minute or two before the main missile attack greatly improves the missiles' chances of penetrating enemy air defenses.

attention. Repeated experiments of 20 Harpoons versus a Kongo-class guided missile destroyer in this scenario have shown significant results. Without accompanying TALDs, the destroyer easily commanded a 20:2 MTH ratio. When the missiles were preceded by 26 TALDs, the MTH dropped significantly. Generally, two or less missiles were hit by SAMs and three or less by point defenses. The MTH ratio plummeted to nearly 20:12!

Aircraft on missions casually drop a solitary TALD now and again to confuse any nearby enemy radar. This approach is hardly acceptable for airstrikes, so TALDs must be launched manually. Undocumented, TALDs can be launched only by using a bearing-only attack. Press the Bearing-Only Attack hot key, select a direction to fire, and then select the number of TALDs to launch. TALDs do little maneuvering, and multiple TALDs fired simultaneously glide along "in formation." Therefore, it is recommended that TALDs be fired in small groups, usually two per launch and not exceeding four, along slightly different bearings. Basically, you create an illusion of many pairs of aircraft spreading out and engulfing enemy forces. Firing TALDs from two separate directions toward the same target may confuse or deceive the enemy into expecting an attack from a false direction and therefore repositioning its forces according to that mistaken belief.

> **WAR LESSON 9.25**
>
> TALDs must be manually launched by using the Bearing-Only Attack hot key. TALDs *never* appear on your map when they're launched.

In summary, despite the lack of documentation, TALDs are extremely effective deceptive devices that greatly increase friendly aircraft survival rates and greatly decrease enemy MTH ratios. The authors typically fire more than 300 TALDs in an average scenario.

To continue the example: Knowing the value of deception, position one EA-6B on the north end of the attack force and the other on the south. This technique provides jamming from two directions, making "burn through" more difficult. The TALD is the hero of the day, though. As soon as aircraft arrive on-station, launch about 20 TALDs in groups of two along 10 different bearings toward the enemy fleet. This technique should amply confuse enemy radar screens and cause reluctant radar operators to "light up." HARMs should now be launched at any active radar. Figure 9-18 shows a how the strike zone should appear.

Launching Missiles: Three Methods

After all the jamming and deceiving are in place, the reason for the mission — the main attack — takes place. *Harpoon II*, like the real world, offers multiple ways of accomplishing most every task, including executing an attack. *Harpoon II* supports three methods of delivering weapons, each with specific advantages and disadvantages:

- Manual execution
- Intercepts
- Attack missions

Figure 9-18. A successfully deployed strike force

Manual Execution

"Manual execution" accurately describes the first attack method: The player positions each group and unit and then executes each attack by hand. This method best suits those who believe the old saying, "If you want something done right, you have to do it yourself." With manual attacks, every detail, every nuance of the attack is controlled by the player. This concept offers several advantages. The player is assured that missile launches appropriately trail TALD launches and that missiles are allocated to targets as the player wants them to be. When the group or unit expends all of its ordnance, it automatically returns to base. Manual launches also ensure proper HARM usage. If an aircraft carrying HARMs is ordered to execute one of the automatic attacks listed below, but the target is not emitting any radar, the computer determines that the HARM-carrying aircraft are not appropriate for this task, disband the group, and send all the individual units back to base rather than loiter and wait for a radar source to light up.

With a manual attack, the player is warned that the HARM "is not capable" against the specified target, meaning that the target is not emitting and that there is nothing for the missile to home in on. The player can then cancel the mission, keep the HARM-carrying aircraft in the area, and try the attack again later.

HARMs require careful handling. Never fire a large volley of HARMs at a single radar. If the radar operator shuts down the radar, all the missiles generally miss. The HARM, when it loses an

WAR LESSON 9.26

When you're attacking a radar source that is turned off, the HARM missile is listed as "not capable" against that specific target. Wait for the source to activate the radar and then launch again.

active radar source, continues directly toward the emitter's last known position. That works fine against land-based, fixed SAM sites, but not so well against moving ships. Try firing HARMs in short bursts (targeting each radar with one missile), wait a few seconds, and repeat. By staggering the waves of HARMs, the radar operator must keep turning his radar off or be hit. Either method significantly reduces his effectiveness.

Naturally, such precision comes at a price (being forced to "micromanage" the air battles). Micromanaging eight aircraft is relatively easy; micromanaging 45 or 50 is an entirely different matter. Sometimes manually controlling the entire attack is simply not feasible. Fortunately, the automatic attacks described below can often be mixed with manual attacks.

Interceptions

Interceptions, as the most flexible and most predictable methods, are the best of the automatic attacks. Interceptions rarely pull any "surprises" and suddenly send all the aircraft off the edge of the map or teleport them off to UFOs in geosynchronous orbit above. Interceptions are straightforward: Select the desired targets (either individually or with a "group select," as shown in Figure 9-19), press the Air Ops button, and then select the desired aircraft. If the aircraft are out of range, they request permission to close and engage, and then they move forward, automatically allocate weapons, fire weapons, and then return to base. An interception attack works equally well against hostile ships and hostile aircraft, if the respective interceptors are appropriately armed.

If the interceptor has inappropriate weapons, the aircraft immediately return to base. If the interceptor carries

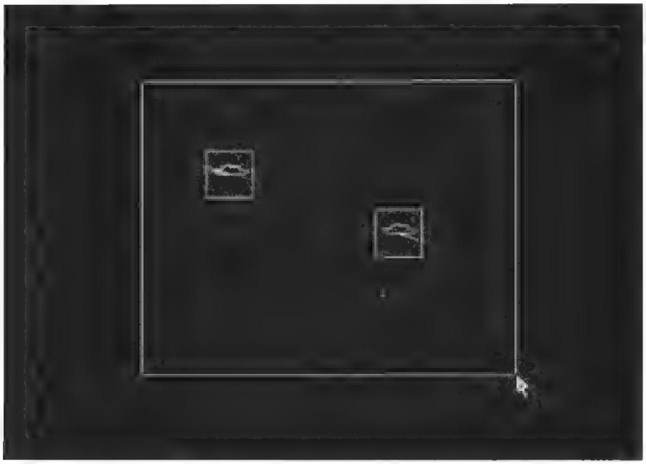


Figure 9-19. Drag-selecting targets

HARMs but the target is not emitting, the computer determines that the weapons are inappropriate and sends the aircraft back to base, as described above under "Manual Attacks." Interception attacks also do not honor groups; that is, any aircraft assigned an interception immediately breaks from its group (if it's part of a group) and proceeds with the attack. Interception attacks cannot be used to launch TALDs; these attacks must always be handled manually.

Mission Attacks

Defining a mission, such as a ship strike mission, constitutes the third automatic attack method. Missions make for easy ingress and egress because the automatic navigator directs aircraft to and from the mission zone. Unfortunately, mission attacks are the least reliable of all attack types, for several reasons. Understand that aircraft assigned to missions use the exact same artificial intelligence and computer-controlled enemies. The computer decides how every detail of the attack should be executed. Despite significant advances in artificial intelligence in recent years, the computer still cannot compete with the human brain in terms of strategy and creativity. Mission

> **WAR LESSON 9.27**
>
> If you change your mind after initiating an interception attack, you will have dozens of individual aircraft to manage rather than a handful of airgroups.

attacks usually lack significant unit coordination, allocate fire based on perceived threat (not your strike goals), and fail to effectively use ECM and TALDs. The one-third rule launches only one-third of the aircraft when the mission is created, so the user must manually launch the aircraft and then assign them to the mission. Mission attacks also misuse HARM missiles, often sending the HARM-equipped aircraft home because no enemy is actively emitting.

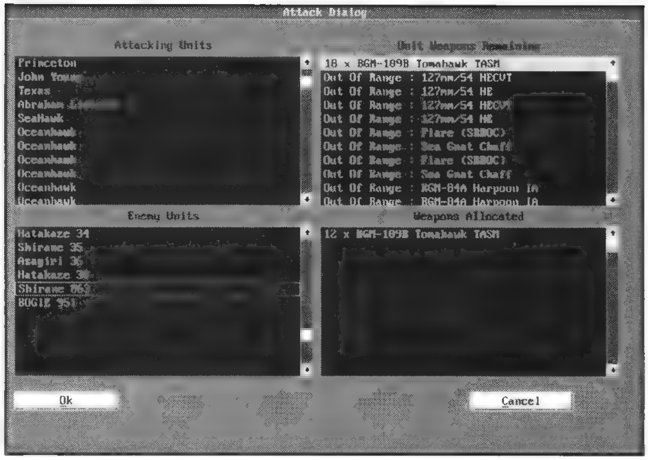


Figure 9-20. A typical group-selected attack

Group Selection

When dozens of units engage each other, especially at close range, it often becomes difficult to select any specific unit during the battle. Selecting a specific ship from an enemy task force or picking out a specific fighter from an amorphous mass of aircraft and missiles is often near impossible. Either by accident or design, airgroups sometimes dissolve, leaving the component aircraft apparently stacked one on top of another and awaiting manual orders to launch dozens of Harpoon missiles at a single target. These cumbersome steps are the single biggest disadvantage to manual attacks. Fortunately, there is something of a solution: *group selection.*

> **WAR LESSON 9.28**
>
> When the combat zone gets crowded, group-select units and use subsequent menus (such as the Attack menu) to sort out the situation.

Group selection refers to selecting more than one unit at a time, evidenced by the white "select" boxes around multiple units simultaneously. Both attacking and targeted units can be group-selected. As explained in Chapter 1, units can be group-selected in two ways: by using the *Shift-select* method or the *drag-select* method. Please refer to Chapter 1 for operational details and differences between the two methods. No matter which method you prefer, both achieve the same result: They increase attack flexibility. First, group-select all potential attacking units, press the Attack button and then group-select all potential targets. Do not worry about selecting "too many" units. When the attack screen appears, as shown in Figure 9-20, you can select exactly which units fire what weapon at which target.

Group-selecting cannot be used to plot courses, but can be used to send multiple aircraft back to base. Group-select the desired units, press the Air Ops button and then select the appropriate airbase or aircraft carrier. All selected aircraft immediately return to base.

> ***To continue the example:*** The Japanese ships usually have their radar inactive when the strike group arrives. First select one of the HARM-equipped groups, press the Attack button, and then drag a box around the entire Japanese group. The Attack menu allows you to select which ship or ships to target. If their radar is off, the HARM is displayed as Not Capable when you designate the target. If they are emitting, fire a burst of HARMs, sending one missile at each radar source. Individual radar is chosen after completing the missile allocation on the Attack menu.

If the ships have their radar off, select the TALD-carrying group of A-6Es and fire 13 groups of two TALDs along slightly different courses toward the Japanese group. These 26 TALDs, or the total carried by one of the four A-6Es, should convince the ships to light up. Keep trying to attack the ships with HARMs at regular intervals. Always group-select the entire Japanese group; maybe only one or two ships out of the group is emitting. Selecting the entire group lets you easily check all four ships from the Attack menu.

After the first couple of HARMs are under way, launch another set of 26 TALDs. Again, launch them in groups of twos along different courses toward the Japanese ships. Wait another 30 to 40 seconds, and then fire 13 more TALDs, each on a different course. Wait another 45 seconds and fire 13 more, each along different courses. These 42, plus the previous 26, plus the in-bound HARMs, should be enough to overwhelm the various radars' limited number of fire-control channels. Because TALDs are slower than most missiles, wait about two minutes after firing the TALDs before launching anti-ship missiles; this gives the TALDs time to occupy the radar operator's attention.

Then group-select all the Harpoon-carrying F/A-18s. If they are near each other, drag a box around them. If not, use the Shift-select method described in Chapter 1. After all F/A-18s are selected, press the Attack button, and then drag-select the entire Japanese group. Firing 10 Harpoons at each ship should be sufficient given the number of TALDs roaming around out there. Firing 15 at each ship almost certainly guarantees 4 sinking ships, but is probably overkill. By firing only 10 at each ship, the total group still has 20 of its 60 Harpoons left for a follow-up attack in case there is a problem.

While the Harpoons are in-bound, keep trying to launch HARM missiles every two or three minutes. If the enemy force launches SAMs at any of the HARM missiles, that means their radar is tracking those HARMs in addition to the TALDs. Immediately launch another barrage of TALDs. The goal is to either destroy enemy radar, force them to shut down completely, or overwhelm them with decoys until the Harpoons arrive.

When any group fires all its weapons, it automatically disbands and sends all component aircraft back to base. If a group does not fire all its weapons, you must manually order them to go home.

BDA

After the attack is completed, the results of the attack must be determined. Which ships were hit? Which ones are damaged? Which ones are sinking? The E-2C says that one ship is stopped, but also says "no visible damage." Did the ship take a critical hit? Is it sinking? Is it affecting repairs? A ship can take *hours* to sink or repair. Just because a ship is stopped is no indication that the ship is seriously crippled. Other systems, like surface-to-air defenses, are probably fully functional during this period. If the damage to engineering can be repaired, the ship eventually gets under way again and heads for the nearest base, usually at slow speed. Missile hits may also cause a fire that, depending on the quality of the crew's damage-control skills, may do little damage or may gut the ship. These things cannot usually be discerned from an E-2C Hawkeye orbiting 200nm away.

Just as prestrike recon missions were required to determine details about the enemy, therefore, post-strike recon is required to determine what has become of him and whether a follow-up attack is necessary. As before, use a "recon ship" mission. If the previous recon ship mission is still active, it will suffice. If not, create a new one. Allow the associated aircraft a couple of hours to perform its mission.

Figure 9-23a. Mission evaluation

To continue the example: One and a half hours after the attack, an S-3 Viking approached the group. The Hawkeye detected two ships sinking and subsequently lost contact with them. The third was reported stopped, and the fourth was still maneuvering at 15 knots toward Naha. As the S-3 approached, it determined that the stopped ship was a Kongo-class vessel, indeed stopped, but with no visible damage. The other ship, a Hatakaze-class, was under way but on fire. The other two ships could not be reacquired and therefore must have sunk already. A follow-up attack was deemed unnecessary at this time, but further recon was in order. Nearly five hours later, the Hatakaze-class was spotted stopped, still on fire, and sinking. The Kongo was still stopped, but still showed no apparent damage. It fired two SM2-MR SAMs at the approach Viking, which subsequently withdrew without being hit. Two hours later, the E-2C Hawkeye spotted the Kongo moving north at 4 knots, presumably toward Kamiyaku base. A follow-up attack is needed, but because of the ship's crippled nature, can be delayed until after other surface threats have been eliminated.

Figure 9-23b. Friendly expenditures

Debrief

There is no reason for U.S. forces to lose this scenario. Japanese airpower is insufficient to penetrate the F-14 patrols and is too small to overcome AMTH ratios of either blue surface group. The Japanese surface ships, although heavily armed with Harpoon missiles, are outclassed by the U.S.' longer-range Tomahawk TASMs and the carrier's attack aircraft. Only the Japanese submarines pose any real danger to U.S. forces, but a standard ASW screen of aircraft and escort ships render this threat impotent as well. U.S. airpower prevents any Japanese unit from closing within range of blue surface ships, and Japanese forces lack sufficient firepower to threaten U.S. surface ships in any event. Unless you totally drop your guard and fail to field an ASW screen and BARCAP, there is no way for the U.S. to lose this scenario.

AN ATTACK ON ZION

Does power projection immediately equate to airpower? Not at all. As indicated by the historical references at the beginning of this chapter, power-projection missions have been around as long as organized militaries have, something that predates the airplane by a few thousand years. The definition of power projection analyzes the intent of the operation, not the tools used in the operation.

As an example, the PLO executes a power projection against Israel in the Assault on Zion scenario. Here, three Osa II-class patrol boats are sent to wreak havoc on Haifa Beach, a tourist facility. Although military targets are nearby, the mission orders specifically state Haifa Beach targets, not Haifa military targets. Three Osa II boats carry a grand total of 12 SS-N-2C Improved Styx missiles, barely adequate to defeat Haifa's single Patriot battery. A successful attack has little military significance. Furthermore, given the proximity of Haifa's military airbase, the three PLO platforms have almost no chance of escaping. The raid is designed to terrorize the Israelis and disrupt their tourism industry.

Figure 9-23c. Enemy expenditures

Scenario Examination

The scenario is short and blunt. The PLO boats will almost certainly die, and the only question is, how many of their missiles will get past Haifa's Patriot battery? Success requires at least three Haifa Beach targets destroyed, so the PLO must carefully plan its attack. First, the scenario is packed with neutral vessels. Oil tankers, merchant ships, and other vessels from Greece, Egypt, and even commercial Israeli ships filter the region, all cruising at a leisurely 10kts. Israeli forces immediately investigate anyone moving significantly faster than this speed. Even though the Osa II ships can make a high-speed run at 38kts, doing so blatantly identifies the PLO ships.

Second, the four missiles carried by each Osa II are not sufficient to slip past the Patriot battery. The three Osa IIs must coordinate their attack and send all 12 missiles together. This takes time, though, to get all three ships in position. They must maneuver carefully and slowly to not raise Israeli suspicions.

Third, and arguably the most important, *maneuver as close as possible to the neutral ships and stay there.* Tests show that when an Osa II maneuvers inside a cluster of merchant ships, especially within 1nm of a merchant ship and especially with multiple merchant ships between the Osa II and enemy forces, the Israeli forces cannot identify which ship launched the missiles. They apparently do not detect the in-bound Styx missiles until only a bearing-only contact on the launching ship can be estimated. The Israeli forces immediately return fire, but have hit neutral merchant ships operating near the responsible PLO ship. In one test run, Israeli forces sank two neutral ships while trying to identify which one fired the Styx missiles.

Debrief

PLO forces must expect to lose all three Osa II ships. Even if the PLO forces can maneuver inside neutrals and hide from Israeli patrol boats, IAF attack aircraft launch from Haifa and prosecute the offenders. With virtually no defensive capabilities, the Osa IIs are destined to die. Assume that this mission is some form of holy suicide attack against a sworn enemy and maneuver accordingly.

CONCLUSION

The concept of power projection is as ancient as the idea of an organized military and as critical to international politics today as it was in the time of the pharaohs, Babylonians, Greeks, and Romans. The modern supercarrier was designed as the ultimate power-projection tool: the capability to field significant firepower around the world regardless of political alliances. Alliances can change, and land-based airfields may suddenly be rendered "off limits." An aircraft carrier knows no such limitations; it's free to roam international waters at will.

Glossary

AA Anti-aircraft

AAM Air to Air Missile

AAW Anti-Air Warfare

Abort To cut short or break off an action, operation or procedure with an aircraft, guided missile or the like, especially because of equipment failure; for example, to abort a mission.

ACE Allied Command Europe

Acoustic Mines Mines that detonate when they detect the sound made by a passing vessel: some can be set to "listen" for only the sounds indicative of certain classes of ships.

Active In naval warfare, any device that transmits a signal. The term is generally applied to sensors, though communications devices are generally active as well.

AEW Airborne Early Warning

Aft Toward the rear of a ship, aircraft or other object.

AIM Air Intercept Missile

AIP Air Independent Propulsion

Ambient Noise The total background noise, measured in decibels. The source level of contacts must be higher than ambient noise to detect them with the passive Sonar suite.

AMRAAM Advanced Medium Range Air to Air Missile

Anechoic Coating A composite material made of rubber and other sound-deadening materials that is applied to submarine hulls and other surfaces (e.g. interior decking) to lessen the effectiveness of active sonar signals.

Angle of Attack The angle at which a body, such as an airfoil or fuselage, meets a flow of air.

Annulus The donut-shaped area that a convergence zone (see below) can search.

Anti-Submarine Warfare The art and science of finding and destroying submarines.

Anti-Surface Warfare The art and science of destroying surface ships and land targets.

ARM Anti-Radiation Missile. These missiles are designed to home in on any enemy's active radar antenna.

ASCM Anti-Ship Cruise Missile

ASM Air to Surface Missile

ASRAAM Advanced Short Range Air to Air Missile

ASROC Anti-Submarine Rocket

ASUW Anti-Surface Warfare (see above)

ASW Anti-Submarine Warfare (see above)

Attitude The position or orientation of an aircraft, either in motion or at rest, as determined by the relationship between its axes and some reference line, plane or other fixed system of axes.

AWACS Airborne Warning and Control System

Axis An imaginary line that passes through a body, about which it rotates or may be assumed to rotate. For example, the horizontal, lateral and longitudinal axes about which an aircraft rotates.

Baffles The area directly astern of a ship or submarine (i.e., where the propellers are) and 30 degrees on either side of that line. The baffles are significant because they represent a blind spot, in which approaching enemies are rarely be heard.

Bare Steerageway The minimum speed necessary to change headings and conn the boat.

Base Course The direction the vessel is really traveling, though it may deviate from the base course via the tactic of zig-zagging.

Battle Space The area and time the commander has to work in, it effects many other factors in a battle, including decisions about formations and deployments, detection and tactics.

BDA Bomb or, more generally, battle damage assessment. An after action process carried out by satellites or aerial reconnaissance aircraft to determine how much damage has been done to the enemy.

Blue Water A synonym for deep water or large bodies of water. A blue-water navy is one whose forces operate far out to sea and in many different parts of the world. The United States Navy is a blue-water navy.

Broadband Noise Sound signals received by the sonar array which contain a great many overlapping frequencies. If you hold a broadband contact, you can detect and track him, but you lack the discrete frequencies necessary to classify the hull type of the contact.

Brown Water A synonym for shallow or coastal waters. A brown-water navy operates close to home - generally in or near its own coastal waters. The Argentinean Navy is one example of a brown-water navy.

CAP Combat Air Patrol

Captor Mines Mines that consist of a sensor array and a torpedo. When the sensor detects a passing vessel, it activates the torpedo, which attacks the vessel. Captor Mines are generally employed in deep water to attack submarines, but they can be used elsewhere as well.

Cavitation At high speeds (the speed varies with the kind of vessel), propellers turn fast enough to form air bubbles. These air bubbles produce noise as they collapse, making the vessel noisier and easier to detect.

CAW Carrier Air Wing

CG Designation for a Guided Missile Cruiser.

Chaff Thin strips of foil or mylar fibers dropped by airplanes or fired by ship-mounted mortars to confuse radar-guided missiles.

CIA Central Intelligence Agency

CINCEUR Commander-In-Chief, European Command

CINCLANT Commander-In-Chief, Atlantic Command

CIS The Commonwealth of Independent States (see below)

CIWS Close-In Weapon System (see below)

Classification Identification of the hull type, or class of a given contact.

CLOS Command to Line-Of-Sight

Close-In Weapon System A small-caliber, extremely high-rate-of-fire, automated weapon system designed to shoot down missiles as they approach a ship. The premier example is the U.S. Navy's Phalanx 20mm Gatling Gun.

COMINT Communications Intelligence

COMSEC Communications Security

Converge Zone (CZ) An area on the surface of the ocean where a sound source reflects at the surface boundary after recurving upward.

CSW Conventional Stand-off Weapon

Datum The term used to refer to the last known locating data of a submarine or other unit once contact has been lost.

Deploy To put forth into the environment in which the equipment or system was designed to operate.

DF Direction finding. A form of passive electromagnetic intelligence gathering that provides a line of bearing to emitting platforms.

DIA Defense Intelligence Agency

Direct Path The portion of a surface ship's active sonar transmission that passes through the thermal layer without recurving upward.

DMZ Demilitarized Zone

DoD Department of Defense

ECCM Electronic Counter-Countermeasures

ECM Electronic Countermeasures, e.g. jamming

EHF Extremely High Frequency

ELINT Electronic Intelligence

ESM Electronic Support Measures

ETA Estimated Time of Arrival

EW Electronic Warfare

FA Soviet Frontal Aviation

Fairing A part or structure that has a smooth, streamlined outer surface designed to cover a non-streamlined object or protrusion.

FCS Fire Control System

FLIR Forward Looking Infrared

Flow Noise Broadband noise created by water passing over or around a ship or submarine hull. The greater the speed at which the unit is travelling, the higher the flow noise. Flow noise not only increases a units own sound signature, it reduces their ability to detect other contacts passively as well with sonar.

GPS Geographical Positioning System

GWS Guided Weapon System

HARM High-speed Anti-Radiation Missile

HE High Explosive

HELO A helicopter

Hercules American built C-130 transport aircraft used by both Britain and Argentina in the Falkland Islands and elsewhere.

HMAS Signifies an Australian Naval craft

HMS Signifies a British Naval craft (United Kingdom)

HUMINT Intelligence gathered by human sources, ie: spies

HVU High Value Unit

Hydrophone Effects The term used to describe the very distinct tonals emitted from a torpedo's propellers.

IFF Identification Friend or Foe. An electronic black box system that sends a coded pulse to friendly radar emitters to preclude inadvertent blue on blue engagements. Civilian airliners also carry a form of IFF hardware.

INS Inertial Navigation System

IR Infrared

JCS Joint Chiefs of Staff

Knots A knot is the abbreviated term that refers to one nautical mile (2000 yards). If you say that a contact is traveling at 20 knots, he is going 20 nm/hr, which is slightly higher than 20 mph.

LAMPS Signifies a United States Navy Light Airborne Multi-Purpose System helicopter.

Launch To release or send forth. For example, to launch aircraft from an aircraft carrier.

LGB Laser Guided Bomb

Lynx Westland armed helicopter carried aboard some British warships.

MFCS Missile Fire Control System

MIF Maritime Interdiction Force, utilized during Desert Shield to intercept Iraqi merchant ships and divert them from their intended ports in Iraq. The force consisted of both Navy and Coast Guard personnel.

MiG Signifies a series of aircraft designed and built by the Soviet corporation, Mikoyan Guerrevich. MiGs are the most widely exported airframes in the world.

Narrowband Noise A sound signal consisting of discrete tonals and harmonics. These frequency lines are used to identify, or classify a contact of interest.

NATO North American Treaty Organization

NORAD North American Air Defense Command

NSA National Security Agency

NSC National Security Council

OJCS Office of the Joint Chiefs of Staff

OTH Over-The-Horizon

PADS Position and Azimuth Determining System

PAVE-PAWS Phased Array radars for SLBM early warning.

PIM Planned intended movement. The course which a ship has plotted to get from one point to another. PIM is used for transits of some distance, not tactical maneuvering.

Ping To send out an active sonar pulse, or transmission.

Puma Anglo-French designed medium lift helicopter used by the Argentineans in the Falklands.

Radar A device that uses reflected radio waves for the detection of objects.

REC Reconnaissance

RF Radio Frequency

RFA Royal Fleet Auxiliary, signifies a British Support Ship

RORSAT A radar satellite that sweeps designated portions of the ocean and dumps its locating data to intelligence gathering agencies.

RWR Radar Warning Receiver. In its most basic form, this is the cockpit warning light that tells a pilot he is being illuminated by a tracking radar or that a missile has locked onto his airframe.

SACEUR Supreme Allied Commander, Europe

SACLANT Supreme Allied Commander, Atlantic

SAM Surface-to-Air Missile

Screws A slang term which refers to propellers.

Seacat Short range SAM carried aboard some of the British ships during the Falklands.

Sea Dart Long range, high altitude SAM also carried by the British during the Falklands.

Sea King British, Westland built naval helicopter, capable of carrying 20 men or acting in an ASW role with its sonar suite.

Sea Slug 28 mile range SAM carried by some British warships during the Falklands. It is now obsolete.

Sea Wolf Short range, point defense SAM system similar to Navy Sea Sparrow Basic Point Defense Missile System (BPDMS).

Self Noise The baseline noise generated by own ship. Self noise is a factor of machinery noise, flow noise and cavitation. High self noise levels make detection of other targets more difficult.

Shadow Zone The area between the direct path ray and the convergence ray or a ship's active sonar transmission. Astute sub skippers can hide in the shadow zone.

Sidewinder AIM9L American built heat seeking air to air missile. When fitted on Harrier VSTOL aircraft, this proved to be the most successful missile of the Falklands War.

SLAM Standoff Land Attack Missile. First used in combat during Operation Desert Shield. As it heads toward its target, a television camera on the nose of the missile allows the controller to see where it is going. It is an important weapon because it can be launched outside the radius that triggers retaliation attacks against the incoming missile and because it can remain undetected until it is too late.

SLAR Side looking airborne radar

SLOC A sea lane line of communication. SLOC refers to the critical ocean shipping lanes, through which most of the world's commerce travels.

SM Standard Missile

Sonar A hydrophone array which can detect targets passively, based on their radiated noise, or actively by bouncing strong pulses of sound energy off their hulls and interpreting the returns.

SOSUS Sound Surveillance System that is deployed permanently on the ocean bottom along likely submarine transit routes.

SS Signifies a diesel powered attack submarine

SSM Surface-to-Surface Missile

SSBN Signifies a nuclear powered ballistic missile submarine

SSGN Signifies a nuclear powered guided missile submarine

SSN Signifies a nuclear powered attack submarine

SSNDS The acronym for a submarine operating in direct support of other units.

SUBROC Submarine launched Rocket

SURTASS Surveillance Towed Array Sensor System

TACTAS Tactical Towed Array Sonar

TAOC Tactical Air Operations Center

TAS Target Acquisition System

TFR Terrain Following Radar, such as that utilized in the land attack variant of the Tomahawk cruise missile.

Thermal Layer (or just Layer) A layer of water of relatively constant temperature that is bounded by another layer of a different temperature. Thermal layers are formed naturally in the interaction of the sun, wind, waves, tides and currents. The tactical significance of thermal layers is that they reflect or refract sound waves, based on the angle of incidence and the sound frequency.

Threshold of Detection The combination of self noise and ambient noise. Contacts of interest must have source levels higher than this figure to detect them.

Transmission Loss The decibel amount of a sound wave that is lost, or attenuated through spreading, absorption and scattering.

USS Signifies a United States naval craft

VLA Vertical Launch ASROC (anti-submarine rocket)

VLS Vertical Launch System

VTOL/VSTOL Vertical or short take off and landing. Harrier jump jets are the most common model of this type of aircraft.

Wake The turbulant area a ship creates after passing through the water.

Wakehomer Slang for a torpedo variant that is designed to follow a ship's wake.

WP Warsaw Pact

Appendix A

As much an art as a science, platform analysis and comparison is by any definition a complex procedure that often borders on mysticism. Unless two platforms conform to identical mission specifications and taskings, no objective comparison can be performed. Saying that Platform A is better than Platform B holds meaning only if Platform A and Platform B are intended for an identical mission. More accurately, individual aspects of the two platforms should be compared against various mission profiles. This process reveals the relative merits of each platform and indicates which one best fills the needs at hand without making subjective judgment calls.

The tables in this appendix present, in an extremely simplified manner, the relative strengths and weaknesses of most naval combatants in the areas of ASW (Anti-Submarine Warfare), ASuW (Anti-Surface Warfare), AAW (Anti-Air Warfare), and Air Defense:

1. **ASW:** How well does this platform combat submarines?
2. **ASuW:** How well does this platform combat surface ships?
3. **AAW:** How well does this platform combat aircraft?
4. **Air Defense:** How well can this platform protect itself from missile attacks or airstrikes?

Air Defense varies significantly from AAW. AAW refers to the ability to deny the enemy the luxury of air operations by seeking out and engaging enemy aircraft. Air Defense indicates the platform's ability to protect itself from air attack, whether that is an aircraft at close range or vollies of inbound missiles.

Each category is quality-rated as poor, fair, good, vgood (very good), or excellent. Each rating is usually followed by a slash mark (/) and a note about that type of combat. Usually, the primary weapon for that category is listed, but other notes, such as "radar" and "no helo" are also given. Because ASW considers sensor quality, noise output, and weapons system, no individual weapon is listed for submarines in the ASW category.

Some codes are shown in this list:

1. **AC:** Fixed Wing Aircraft
2. **VTOL:** Vertical Takeoff and Landing Aircraft
3. **Helo:** Helicopters
4. **No Helo:** No helicopters available
5. **TASM:** Tomahawk Anti-Ship Missiles
6. **Harpoon:** Harpoon Anti-Ship Missiles
7. **76mm:** 76mm (3-inch) guns
8. **SAM:** Surface-to-Air Missiles
9. **CIWS:** Close In Weapon System, such as the 20mm Vulcan Phalanx
10. **AEGIS:** AEGIS Air Control System
11. **Torpedo:** Torpedoes used for this type of combat
12. **RBU:** Anti-Submarine Rocket

The tables are far from comprehensive. Generally, only submarines and frigate-sized or larger surface ships are listed. Coastal patrol vessels, corvettes, hydrafoils, and other light vessels are not listed. Navies composed of Soviet designs, such as Libya, are not listed here; see the appropriate class in the "Soviet" section.

WAR LESSON A.1

Do not use the tables in this appendix to compare ships across fleets. Instead, use them to determine the relative merits of platforms within a single navy when you form task forces. Use these tables to quickly determine which of the available ships is best suited for the various roles facing the task force.

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense

People's Republic of China

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
SSBN	Xia	22	fair	poor	none	none
SSN	Han	25	fair	fair	none	none
SSG	Modified Romeo	13	good	good/ Eagle Strike	none	none
SS	Ming	18	good	good	none	none
SS	Ex-Soviet Romeo	13	poor	fair	none	none
SS	Ex-Soviet Whiskey	14	fair	fair	none	poor
DDG	Luda	32	fair/helo	good/HY-2	none	poor
DDG	Gordy	32	poor/ depth charge	good/HY-2	none	poor
FFG	Chengdu	28	poor/ depth charge	good/HY-2	none	poor
FFG	Jianghu	26	poor/RBU	good/HY-2	none	fair
FFG	Jiangdong	26	poor/RBU	fair/100mm	none	fair
FF	Jiangnan	28	poor/RBU	fair/100mm	none	poor

France

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
SSBN	Le Triomphant	25	fair	fair	none	none
SSBN	L' Inflexible	25	fair	fair	none	none
SSBN	Le Redoutable	25	fair	poor	none	none
SSN	Rubis	25	good	good/ Exocet SM39	none	none
SS	Agosta	20	good	good/ Exocet SM39	none	none

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense

France (cont.)

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
SS	Daphne	16	fair	fair	none	none
CVN	Charles De Gaulle	27	poor	vgood/AC	vgood/AC	vgood/AC
CV	Clemenceau	32	poor	good/AC	fair/AC	good/AC
CG	Colbert	31.5	none	good/ Exocet MM38	good/ Masurca	fair
DDG	Georges Leygues	30	good/helo	good/ Exocet MM40	poor/ Crotale	fair
DDG	Cassard	29.5	fair	good/ Exocet MM40	good/ SM-1MR	fair
DDG	Suffren	34	fair	fair/ Exocet MM38	good/ Masurca	fair
DDG	Tourville	32	good/helo	fair/ Exocet MM38	poor/ Crotale	fair
DDG	Type T 53	32	fair	fair/ Exocet MM38	good/ radar	fair
DDG	Type 65	27	fair/no helo	good/ Exocet MM40	none	fair
FFG	La Fayette	25	poor	good/ Exocet MM40	poor/ Crotale	fair
FFG	Floreal	20	none	good/ Exocet MM40	none	fair
FFG	D'Estienne D'Orves	23	good	good/ Exocet MM40	none	fair
FFG	Commandant Riviere	25	fair/no helo	fair/ Exocet MM38	none	poor

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense

Germany

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
SS	Type 206	17	good	good	none	none
SS	Type 205	17	fair	fair	none	none
DDG	Type 103B (ex-Charles Adams)	32	fair/no helo	vgood/ Harpoon	good/ SM-1MR	fair
DDG	Type 101A (Hamburg)	34	fair/no helo	good/ Exocet MM38	none	poor
FFG	Type 122 (Bremen)	30	good/helo	vgood/ Harpoon	poor/ Sea Sparrow	fair
FFG	Type 123 (Deutschland)	29	vgood/helo	good/ Exocet MM38	poor/ Sea Sparrow	fair
FF	Rostock	27	poor	fair/76mm	none	fair

Greece

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
SS	Glavkos	21.5	good	vgood/ Harpoon	none	none
SS	Ex-US Guppy	15	fair	fair	none	none
DD	Ex-US Allen M Summer	34	fair	fair	none	fair
DDG	Ex- US Gearing	32.5	fair	vgood/ Harpoon	good/ radar	fair
DD	Ex US Fletcher	32	good	fair/127mm	none	fair
FFG	Ydra	31	good	vgood/ Harpoon	poor/ Sea Sparrow	vgood
FFG	Ex Netherlands Kortenaer	30	good	vgood/ Harpoon	poor/ Sea Sparrow	vgood
FF	Ex US Cannon	19.3	fair	fair/76mm	none	fair

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
India						
SS	209	22	vgood	good	none	none
SS	Kilo	17	vgood	good	poor/ SA-N-8	fair
SS	Foxtrot	16	fair	fair	none	none
CV	Ex- British Hermes	28	vgood/helo	vgood/AC	good/AC	good
CV	Ex- British Majestic	24.5	vgood/helo	vgood/AC	good/AC	good
DDG	Kashin II	35	good	good/SS-N-2	fair/ SA-N-1	good
FFG	Godavari	27	good	good/SS-N-2	poor/ SA-N-4	fair
FFG	Leander	27	vgood	good/SS-N-2	poor/ Seacat	fair
FF	Petya II	32	fair	fair/76mm	none	none
FFG	Ex- British Whitby	30	fair	good/SS-N-2	none	none
FF	Ex- British Leopard	24	poor/mortar	fair/114mm	none	fair
Iran						
DDG	Ex- British Battle	31	poor/mortar	fair/114mm	good/ SM-1MR	poor
DDG	Ex US Allen M Sumner	34	good	fair/127mm	good/ SM-1MR	poor
FFG	Vosper Mk 5	39	poor/mortar	fair/Sea Killer	none	fair

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense

Iraq

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
FFG	Lupo	35	good	good/ missile	poor/ Albatross	poor
FF	Yugoslav	26	poor	poor	none	good
Corv.	Assad	37	fair	good/ missile	poor/ Albatross	fair

Italy

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
SS	Improved Sauro	19	vgood	vgood	none	none
SS	Sauro	19	vgood	vgood	none	none
SS	Toti	15	fair	fair	none	none
CV	Giuseppe Garibaldi	30	vgood/helo	good/AC	good/AC	good
CG	Vittorio Veneto	32	fair/no helo	vgood/ Teseo Mk 2	good/ SM-1ER	good
CG	Andrea Doria	31	good/helo	fair/76mm	good/ SM-1ER	fair
DDG	Animoso	31.5	good/helo	vgood/ Teseo Mk 2	good/ SM-1MR	fair
DDG	Audace	34	good/helo	vgood/ Teseo Mk 2	good/ SM-1MR	fair
DDG	Impavido	33	fair/no helo	fair/127mm	good/ SM-1MR	fair
FFG	Lupo	35	good/helo	vgood/ Teseo Mk 2	poor/ Sea Sparrow	good
FFG	Maestrale	32	vgood/helo	vgood/ Teseo Mk 2	poor/ Albatros	good
FF	Alpino	28	good/helo	fair/76mm	none	none

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense

Soviet Navy

Note: "Soviet Navy" refers to former U.S.S.R. as well as its descendant CIS nations.

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
SSBN	Typhoon	27	good	poor/torpedo	none	Unknown
SSBN	Delta IV	24	fair	poor/torpedo	none	none
SSBN	Delta III	24	fair	poor/torpedo	none	none
SSBN	Delta II	24	fair	poor/torpedo	none	none
SSBN	Delta I	25	fair	poor/torpedo	none	none
SSBN	Yankee I/II	26.5	fair	poor/torpedo	none	none
SSGN	Charlie II	24	good	good/SS-N-9	none	none
SSGN	Charlie I	24	good	fair/SS-N-7	none	none
SSGN	Oscar II	30	good	excel/ SS-N-19	none	none
SSGN	Oscar I	28	good	excel/ SS-N-19	none	none
SSGN	Echo II	24	fair	excel/ SS-N-12	none	none
SSG	Juliett	19	fair	excel/ SS-N-12	none	none
SSN	Akula	32	excel	vgood	none	none
SSN	Sierra I/II	34	excel	vgood	none	none
SSN	Alfa	45	vgood	vgood	none	none
SSN	Victor III	30	vgood	vgood	none	none
SSN	Victor II	30	vgood	good	none	none
SSN	Victor I	32	good	good	none	none
SS	Kilo	17	good	fair	none	none

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
Soviet Navy (cont.)						
SS	Tango	16	good	fair	none	none
SS	Golf	13	poor	poor	none	none
SS	Foxtrot	16	fair	fair	none	none
SS	Whiskey	14	poor	poor	none	none
CV	Kuznetsov	32	excel/helo	excel/AC + SS-N-19	excel/AC	excel
CV	Kiev	32	vgood/helo	good/VTOL + SS-N-12	fair/VTOL	vgood
CV	Kiev (mod)	32	vgood/helo	good/VTOL + SS-N-12	good/VTOL + radar	fair
CHG	Moskva	31	vgood/helo	fair/57mm	good/SA-N-3	good
BC	Kirov	30	good/helo	excel/ SS-N-19	vgood/ SA-N-6	fair
CG	Slava	34	fair/RBU	excel/ SS-N-12	vgood/ SA-N-6	good
CG	Kara	32	vgood	fair/76mm	good/ SA-N-3	good
CG	Kresta II	35	vgood	fair/57mm	good/ SA-N-3	vgood
CG	Kresta I	35	fair	vgood/ SS-N-3	fair/ SA-N-1	fair
CG	Kynda	34	fair	vgood/ SS-N-3	fair/ SA-N-1	fair
DDG	Udaloy	30	vgood	fair/100mm	poor/ SA-N-9	good
DDG	Sovremenny	32	fair	good/SS-N-22	fair/SA-N-7	good

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
Soviet Navy (cont.)						
DDG	Kashin	37	good	good/ SS-N-2	fair/ SA-N-1	good
FFG	Krivak I/II	32	vgood	fair/76mm	poor/ SA-N-4	good
FF	Krivak III	32	vgood	fair/76mm	poor/ SA-N-4	good
FFL	Grisha I/II/III	30	good	fair/76mm	poor/ SA-N-4	fair
FFL	Parchim II	28	fair	fair/76mm	poor/ SA-N-5	fair
FF	Riga	30	fair	fair/100mm	none	none
FFL	Petya I/II	32	good	fair/76mm	none	none
FFL	Mirka I/II	32	fair	fair/76mm	none	none
United Kingdom						
SSBN	Vanguard	25	fair	poor	none	none
SSBN	Resolution	25	fair	poor	none	none
SSN	Trafalgar	32	vgood	good/Harpoon	none	none
SSN	Swiftsure	30	good	good/Harpoon	none	none
SSN	Valiant/Churchill	28	good	good/Harpoon	none	none
SSN	W	30	vgood	vgood/Harpoon	none	none
SS	Upholder	20	vgood	vgood/Harpoon	none	none
SS	Oberon	17	good	fair	none	none
CV	Invincible/Illustrious/ Ark Royal	28	vgood/helo	vgood/VTOL	good/ Sea Dart	good

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
United Kingdom (cont.)						
DD	Type 82	30	poor	fair/114mm	good/ Sea Dart	fair
DD	Type 42	29	good	fair/114mm	good/ Sea Dart	good
FFG	Duke	28	good	good /Harpoon	poor/ Seawolf	fair
FFG	Type 22 I/II	30	vgood	fair/ Exocet MM38	poor/ Seawolf	fair
FFG	Type 22 III	30	vgood	good /Harpoon	poor/ Seawolf	good
FFG	Leander Batch 2 T. A.	28	fair/helo	fair/ Exocet MM38	poor/ Seacat	poor
FFG	Leander Batch 2	28	fair/helo	fair/ Exocet MM38	poor/ Seacat	good
FFG	Leander Batch 3A	28	good/helo	fair/ Exocet MM38	poor/ Seawolf	good
FFG	Leander Batch 3B	28	fair/helo	fair/114mm	poor/ Seacat	good
FFG	Amazon	30	good/helo	fair/ Exocet MM38	poor/ Seacat	good
United States of America						
SSBN	Lafayette	25	fair	poor	none	none
SSBN	James Madison	25	fair	poor	none	none
SSBN	Benjamin Franklin	25	fair	poor	none	none
SSBN	Ohio	20+	fair	poor	none	none
SSN	Seawolf	35	excel	excel	none	none

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
United States of America (cont.)						
SSN	Permit	30	good	good	none	none
SSN	Ethan Allen	30	fair	fair	none	none
SSN	Sturgeon	30	good	excel	none	none
SSN	Narwhal	25	fair	excel	none	none
SSN	Los Angeles	32	good	excel	none	none
CV	Midway	30	excel/AC	excel/AC	good/AC	good/AC
CV	Forrestal	33	excel/AC	excel/AC	excel/AC	excel/AC
CV	Kitty Hawk	32	excel/AC	excel/AC	excel/AC	excel/AC
CV	John F Kennedy	32	excel/AC	excel/AC	excel/AC	excel/AC
CV	Enterprise	33	excel/AC	excel/AC	excel/AC	excel/AC
CV	Nimitz	30+	excel/AC	excel/AC	excel/AC	excel/AC
BB	Iowa	35	none	vgood/TASM	none	good
CG	Leahy	32.7	fair/no helo	good /Harpoon	vgood/ SM-2ER	vgood
CG	Belknap	35.5	good/helo	good /Harpoon	vgood/ SM-2ER	vgood
CG	Ticonderoga	30+	good/helo	vgood/TASM	excel/ AEGIS	excel/ AEGIS
CG	Long Beach	30	fair/no helo	vgood/TASM	vgood/ SM2-ER	vgood
CG	Bainbridge	30	fair/no helo	good /Harpoon	vgood/ SM-2ER	vgood
CG	Truxtun	30	fair/no helo	good /Harpoon	vgood/ SM2-ER	vgood

Cat	Class	Speed (kts)	ASW	ASuW	AAW	Air Defense
United States of America (cont.)						
CG	California	30+	fair/no helo	good /Harpoon	good/ SM-1MR	good
CG	Virginia	30+	good/no helo	vgood/TASM	good /SM-1MR	good
DD	Spruance	33	excel/helo	vgood/TASM	poor/ Sea Sparrow	good
DDG	Charles F Adams	30	fair/no helo	good /Harpoon	good/ SM-1MR	good
DDG	Coontz	33	poor/no helo	good /Harpoon	vgood/ SM-2ER	vgood
DDG	Arleigh Burke	30+	fair/no helo	vgood/TASM	good/ SM-2MR	good
DDG	Kidd	33	excel/helo	good /Harpoon	good/ SM-2MR	good
FF	Knox	27	good/helo	good/Harpoon	none	fair
FFG	Oliver Hazard Perry	29	fair/helo	good/Harpoon	good/ SM-1MR	good
LHD	Wasp	23	good/helo	good/VTOL	good/ VTOL	good
LHA	Tarawa	24	good/helo	good/VTOL	good/ VTOL	fair
LPH	Iwo Jima	23	good/helo	fair/VTOL	good/ VTOL	good

Appendix B

The following tables provide a quick comparison of naval weapons, surface-to-surface (SSM), surface-to-air (SAM), and air-to-surface (ASM) used around the world.

Name	Range (miles)	Speed (mach)	Altitude (ft)
Surface-to-Air Missiles			
Crotale	8	2.3	16,405
Masurca	31	3	75,460
Albatros	11.5	2.5	16,405
Sea Cat	3.4	1	3,000
Sea Dart	40.4	3	60,000
Sea Wolf	4.04	2	10,000
SA-N-1 Goa	3.7 - 13.7	2.1	295 - 50,030
SA-N-3 Goblet	3.7 - 34	2.8	295 - 80,380
SA-N-4 Gecko	1 - 7.5	2	165 - 42,650
SA-N-5 Grail	3	1.95	150 - 15,750
SA-N-6 Grumble	3.7 - 34	2.8	295 - 80,380
SA-N-7 Gadfly	3.7 - 13.7	2.1	295 - 50,030
SA-N-9	1 - 7.5	2	165 - 42,650
RIM-2 Terrier	23	3	500 - 80,000
RIM-24 Tartar	20.1	1.8	50 - 70,000
RIM-66A SM-1MR Standard	25	2	50,000
RIM-66B SM-1MR Standard	40	2	62,500

Name	Range (miles)	Speed (mach)	Altitude (ft)

Surface-to-Air Missiles (cont.)

RIM-66C **SM-2MR Standard**	40	2	80,000
RIM-67A SM-1ER Standard	35	2.5	80,000
RIM-67B SM-2ER Standard	75	2.5	100,000
RIM-7M Sea Sparrow	8	3	25 - 50,000

Air-Launched Anti-Ship Missiles

Otomat	37	.9	463
Gabriel	25 - 37	1	33
Kormoran	23	.95	364
AS.12	5	low subsonic	62.6
AS.15TT	10	high subsonic	65.5
Exocet AM.38	23	.93	364
Exocet AM.39	30	.93	364
Sea Eagle	62	.9	441
Sea Skua	12	.9	77
AGM-84 Harpoon	81 - 100	.85	500
Penguin	37	.9	264
AS-2 Kipper	115	1.2	2,205
AS-4 Kitchen	286	3.5	2,205 or 800Kt nuclear
AS-5 Kelt	143	1.2	2,205
AS-6 Kingfish	348	3	2205 or 300Kt nuclear

Name	Range (miles)	Speed (mach)	Altitude (ft)

Surface-Launched Anti-Ship Missiles

Name	Range (miles)	Speed (mach)	Altitude (ft)
Otomat Mk 1	50	.9	463
Otomat Mk 2	100	.9	463
Gabriel	22 - 37	.7 - 1.0	330 - 397
Exocet MM38	23	.9	364
Exocet SM39	27	.9	364
Exocet MM40	40	.9	364
RBS-15	50 - 62	.8	330
RGM-84 Harpoon	80	.85	500
BGM-109 TASM	250	.7	1,000
Penguin	25	.9	264
SS-N-2 Styx	60	.9	1,102
SS-N-3-Shaddock	286	1.4	2,205 or 350kt nuclear
SS-N-7	34	.95	1,102
SS-N-9 Siren	68	.9	1,102
SS-N-12	348	2.5	2,205 or 350Kt nuclear
SS-N-19	348	2.5	2,205 or 350Kt nuclear
SS-N-22	93	2.5	1,102
Eagle Strike	24	?	?
HY-2	50	?	?
Sea Killer	13.5	?	?

Appendix C

Scenarios

1. **Dawn Patrol**

   Russia: PGM Buran, PGM Gram, PGM Smerch

   Norway: FF Goteborg, PT Hugin, PT Jagaren, PT Munin, PT Mode, PT Vidar, PT Mysing

2. **Assault on Zion**

   Israel: PGM Yafo, PGM Reschev, PGM Tarshish

   PLO: PCM OSA II, PCM OSA II, PCM OSA II

3. **White Death**

   Chile: MV Pilato Pardo, FF Candell, DDG Capitan Prat

   Argentina: FF Spiro, FF Espora, DD La Argentina, DD Alimirane Brown

4. **A Naval Border War**

   Ecuador: Three merchant ships, SS Shyri

   Northern Group: FF Presidente Eloy Alfaro, Corv Galapagos, Corv El Oro

   CD group 1: Corv Esmeraldas, PGM Quito, PGM Cuenra, PGM Nueva

   Base: Mach; very large A/C

   Base: Guayaquil; very large A/C

   Peru: SS Casma

   TF01: CL Aguirre, FL Villaricencio, FL Meliton Carvajal, DD Ferre

   TF02: DD Palacios, FL Montero, FL Mariategui

   TF03: PGM De Los Heroes, PGM Larrea, PGM Sanchez Carrion

   Base: Tumb; very large A/C

5. **Operation Ratcatcher**

   Sweden: SS Vastergotland

   TF01: FFL Stockholm, PTM Mjolner

TF02: FFL Sundsvall, FFL Harnosand

TF03: FFL Malmo, PTM Magne

Base: Karlskrona; very large A/C

Base: Solvesborg; very large A/C

Unknown Forces: SS Ula, SS Tumleren, SS Kilo

6. **Inchon Again**

ROK: DD Chung Buk

Base: Inchon; no A/C

PRK: SS P33, SS P33, SS P33, SS P33, H-5 Beagle (airborne), PCM MB-571, PCM MB-513, PCM MB-512, PCM MB-511

Base: Sung Buk; very large A/C

U.S.:

TF01: CG Antietam, DD Spruance, FFL Estocin, CG Vincennes, CVH Wasp, CVH Essex, T-AK Lt. Jack Lummus, CVH Kearsage, CG Thomas S Gates, FFG Taylor

7. **Lightning Bolt**

South Africa:

Base: Ladysmith; very large A/C

Base: Durban; very large A/C

SS Emily Hobhouse, SS Maria Van Riebeeck

TF02: FFL Magnus Malan, FFL Oswald Pirow, FFL Hendrik Mentz

TF03: FFL Kobie Coetzee, FFL Fran Frasmus, FFL Jim Fouche

CIS:

Base: 10,000-foot runway (no other name given); very large A/C

SS Kilo

TF01: CG Kronshtadt, DDG Admiral Tributs, DDG Boyevoy, DDG Otchayanny, DDG simferopol

8. **Break the Blockade**

Britain: SS Trenchant

TF West: FF Jupiter, DD Liverpool, DD Glasgow, FF Brilliant, FF Marlborough

TF North: FF Argonaut, FF Battleaxe, DD Cardiff, FF Brazen, FF Arrow

EEC: SSN Saphir

TF Alpha: DD Jean Bart, DD Lutjens, DD Duguay-Trouin, DD Latouche-Treville

TF Beta: DD De Grasse, DD Molders, DD Cassard

9. **To Protect the Queen**

Britain: SS Unseen, SS Turbulent, SS Triumph

Base: Manchester; very large A/C

TF Royal Fleet: CVHG Invincible, FF Broadsword, DD Manchester, DD Exeter, FF Andromeda, DD Birmingham, FF Battleaxe, FF Sirius

Russia: SSN Akula 1, SSN Akula 2, SSGN Oscar II

TF KPG1: CG Marshal Ustinov, CG Kronshtadt, CV Admiral Kusnetsov, BCGN Admiral Nakhimov, DDG Simferopol, DDG Admiral Levchenko

10. **Okinawa**

Japan: SS Sachishio, SS Mochishio, SS Harushio, SS Natsushio

Base: Kamiyaku; very large A/C

TF01: DDG Yakikaze, DD Hatakaze, DD Yugiri, DD Kurama

TF02: DD Hiei, DD Hamagiri, DD Sawakaze

TF03: DD Shimakaze, DDG Kongo, DD Shirane, DD Tachikaze

U.S.: SSN Santa Fe, SSN San Juan, SSN La Jolla

Base: Naha; no runway

TF BG-LIMA: CG Shiloh, DDG Chandler, DDG John Paul Jones, FFG Ingraham

TF NETG-LIMA: CG Princeton, CGN Texas, DD John Young, T-AK Pollux, CVN Abraham Lincoln, T-AK Algol

11. Malvinas

Argentina: SS Argentina, SS Santa Fe, SS San Luis, FF Spiro, PG Indomita, DD Hercules, FF Gomez Roca, PG Intrepida, DD Sarandi

Base: Port Stanley; very large A/C

TF 04: CV Veinticinco de Mayo, DD La Argentina, DD Hercules

Britain: SSN Tralfagar

TF01: DD Southhampton, LST Sir Galahad, LST Sir Bedivere, DD Glasgow, FF Broadsword, FF Amazon

TF02: CVHG Invincible, FF Argyll, FF Lancaster, DD Birmingham, FF Battleaxe

12. Blood Feud

Taiwan:

Base: T'aipei; very large A/C

TF01: DD Sha Yang, DD Yung Yang, DD Han Yang, DD Fu Yang, FFG Kwang Hua I, DD Lo Yang

PRC:

Base: Quanzhou; very large A/C

TF01: FF Dandong, PCM H6137, PCM H6107, PCM H6187

TF02: FF Chang De, DDG Luhu, DD Xian

TF03: DD Jinan, DD Yinchuan, FF Siping, PCM H6155, PCM H6129

13. Taking of Sakhalin

Japan: SS Harushio, SS Takeshio, SS Setoshiu

Base: Sapporo; very large A/C

TF02: DD Shirane, DD Hatakaze, DD Yukigomo, LST Miura, LST Atgumi, LST Ojika, LST Nemuro, DD Yamagumo, DDG Kongo, DD Isonami

Russia: SS Kilo, SS Oscar I, SS Kilo

Base: Vladivostok; very large A/C

TF08: CG Slava, BCGN Admiral Nakhimov, CG Kronshtadt, DDG Sovremenny, DDG Udaloy

14. Black Sea Fleet

Russia: SS Kilo 44, SS Akula

KUG1: BCGN Admiral Nakhimov, CV Admiral Kusnetsov, DDG Sovremenny, DDG Bezuprechny, DDG Admiral Leuchenko, FFG Neustrashimy

KUG2: LPD Mitrofan Moskalenko, LST Krimsky Komsomolets, LSP Tomsky Kosomolets, DDG Udaloy, DDG Marshal Vasilevsky

Ukraine: SS Tango 12, SSBN Charlie II

Base: Saki; very large A/C

Base: Sevastopol; very large A/C

KUG1: DDG Sderzhanny, PCM Tarantul III, FFG Bressemenny, PCM Tarantul III

15. A Fight to the Death

U.S.: SSN Toledo

BG November: CNG Texas, CG Ticonderoga, DDG Barry, DDG Kidd, FFG Ingraham, CVN Nimitz, DD Spruance

Russia:

Base: NAS Keflavik; very large A/C

KUG1: CG Slava, CG Nikolayev, DDG Udaloy, DDG Admiral Levchenko, FFG Kirov, DDG Otchayannyy, BCGN Admiral Ushakov, CV Admiral Kusntesov

Appendix D

Frequently Asked Questions:

1. Group speed changes
2. Sub Depth
3. 1:1 time with staff messages
4. Group speed to 0
5. Plotted and Unassigned missions
6. Unavailable carrier-based aircraft
7. Minimal loadouts
8. Colored Maps
9. Air-to-air missiles
10. Strike aircraft won't launch
11. Losing contact with units or groups
12. Mission names
13. Cancel Return to Base (RTB)
14. Time compression rates
15. Game pause
16. Losing contact
17. Contact color changes
18. Aircraft mission behavior
19. Intercepting enemy contacts
20. Remove units from mission
21. Aircraft mission list
22. Cancelling a mission
23. Changing mission reference points
24. Patrol aircraft behavior
25. Permanent game and symbol preferences
26. Memory Remaining window

27. Staff Message windows
28. Centering map windows
29. Sea State
30. Ship contacts on land
31. Uncertainty regions
32. Groups break up when attacking
33. SAMs fail to allocate
34. Losing contact with missiles
35. Missiles hitting target
36. Point defenses
37. Electronic Counter-Measures
38. Turning communications off
39. Passive and active sonobuoys
40. Dipping sonars
41. Aircraft loadout types
42. Tanker aircraft
43. ASW threat axis
44. Formation Editor range rings
45. Threat and Detections
46. Reloading mounts
47. Sensor selection
48. Disappearing torpedoes
49. Jumping contacts
50. Aircraft refuse orders
51. Database selection
52. Clearing old contacts
53. Damage to enemy bases
54. Aircraft won't drop bombs
55. Diesel submarines
56. Giving waypoint orders

1. Q: When I give my Task Force a speed order to go at Full Speed or Flank, why does it slow down to 5 knots off and on?

   A: If there are units in the Task Force formation which are off of their designated stations, the whole formation slows down a bit to allow them to get where they are supposed to be. Be patient; the speed will resume when the Task Force AI is satisfied.

2. Q: I told my submarine to go to Deep and he stays at Shallow or Intermediate depth. Why won't he dive where I told him to?

   A: Make a Zoom window around the submarine. Then, click on the PREF button and click on Water Depth. Chances are the water is not deep enough for the sub to dive as deep as you ordered him. Alternatively, turn on the <RANGE/BEARING> toggle, which will display information (including the current depth/height) about every location where you click the mouse. This information will be shown in the Incoming Messages window.

3. Q: Why does the game stay in 1:1 time after clicking on a staff message?

   A: There may be one or more staff message boxes hidden behind your map. After clicking on the one you see, if the time still goes to 1:1, try minimizing all the windows and seeing if there are any open staff message boxes. Closing them all cures the problem. There is a check box in the Staff Message window that should be checked if you desire the game *stay* at 1:1 after you close the message window.

4. Q: Why do my groups suddenly go to 0 speed?

   A: The groups course may have been inadvertently set to 0 or it may have reached its destination. Giving the group a new course should cure the problem.

5. Q: What is the difference between "Plotted" and "Unassigned"?

   A: Any units on the "Plotted" mission belong to you. Your automatic Formation AI will not touch them. Neither will the Mission AI. They are completely yours to operate however you see fit.

Any units that are "Unassigned" have no mission, and may be assigned to any mission (included "Plotted" if you wish control of them). The Formation AI will take unassigned units and use them if needed. The Mission AI will not use "Unassigned" units. It will only use units on a mission that are assigned to that mission.

6. Q: Why are all my carrier-based aircraft unavailable for missions?

   A: When a ship is assigned to a mission, all unassigned aircraft on that ship are also assigned to that mission. When you give the carrier a path, it changes from "Unassigned" to "Plotted." Its aircraft change too. You can either make the aircraft missions first or unassign them using the "Remove Aircraft" function of the mission editor.

7. Q: Why can't I load some aircraft with anything other than "minimal?"

   A: Some aircraft have no adjustable loadouts. These aircraft are generally good for only one type of mission. Examples include and E-2 Hawkeye or a Boeing-747 passenger liner. The "Ready" button will not respond when these aircraft are selected.

8. Q: How can I get my map window to look like the color map displayed on the box?

   A: Use the window preferences tool to turn on the display of land elevations and water depths, then shrink the window size. This works best with large area maps, and, although colorful, isn't really very useful.

9. Q: How come my air-to-air missiles keep missing the target?

   A: The probability of an air-to-air missile hitting the target depends greatly on the geometry of every situation, as well as which kind of missiles and targets are involved. Many factors will increase or degrade the probability of a hit or a miss. A common occurance of this is when a missile is fired at a target that is moving away (an opening shot). The probability of a successful engagement is greatly reduced for long range opening shots. Another common situation occurs when non-dogfight capable missiles such as the AIM-54 Phoenix are employed against nimble fighters. These missiles are designed for shooting down heavily laden, unsuspecting bombers, and as such, don't work very well against most modern fighters.

If you are *really* doubting the validity of the model, you can run Harpoon2 with the "-W" command line parameter. This will show (in the Message Window) all the factors, modifiers, etc, of *every* missile engagement. Keep in mind that this will also ruin part of the fun of playing the game because information not normally available to you will be shown. We call this "cheating".

10. Q: How come my strike mission aircraft will not launch?

A: Strike aircraft do not launch until they have a known hostile contact within engagement range. If you specified a target when you created the mission, the aircraft will wait until that target comes into range. If no target was specified, they will wait until the first appropriate target shows up. Keep in mind that aircraft combat ranges will be much shorter than the optimal ranges shown in the Launch/Ready dialog. This is because combat aircraft conducting strikes must fly faster and sometimes lower to avoid radar and enemy defenses. This consumes fuel at a much higher rate than normal flight.

11. Q: How come I lose contact with my units or groups?

A: Harpoon uses a fairly realistic communications model, and several factors can drop a unit off the network. Some common ones are:

a) The unit is out of range of your comm gear.

b) The unit, either by design or enemy action, is now under water.

c) Your communications gear or their comm gear has been destroyed or turned off.

When the communication net breaks down, you will retain control of those units which are on the same net as your designated flagship. Others will act as their mission dictates. Aircraft which have flown beyond contact range will return home when they run out of path or complete their missions. If an aircraft runs low on fuel it will also return home. Submarines without orders will rise to periscope depth and 'phone home'. Submarines on patrol will periodically do this anyway. When these 'lost' units return to your local network, they will share with you any contact information they current hold. The "Auto Datalink" option (in Difficulty Settings) prevents this modeling and allows you to talk with all of your units, regardless of range or depth. When you play in this mode, if a unit will not talk to you then it is either dying/badly-damaged (eg. no radios), or it's not on your side.

12. Q: How do I edit the mission name list?

A: Once a mission is created and approved (by pressing OK in the Create Mission window), you can't change it. Before that point however, you may type over the suggested mission name with whatever phrase or word you like. The computer will randomly generate mission names for you, drawing on the contents of two text files in your Harpoon2 directory. These files are MISSADJ.TXT and MISSNOUN.TXT and may be customized using any text editor. MISSADJ.TXT contains the adjectives (the first word) and MISSNOUN.TXT contains the nouns (the second word). These names will be matched randomly; results during development ranged from bland to appalling.

13. Q: How do I cancel an aircraft's Return to Base (RTB) order?

A: Select the aircraft and hit the "Unassign Aircraft" hotkey (the "U" on the IBM PC). After this point, the plane (or air group) is yours. It is moved into the unassigned list and will loiter until given further instructions. If the plane was landing because of fuel considerations ("BINGO") it will still stop and await orders; it's up to you to get it to a tanker or a base before it runs out of fuel.

14. Q: How come the time compression rate is so slow?

A: Performance varies with scenario size. The larger and more complex the scenarios will take more time to process, and should be run at lower time compression, especially on slower machines.

15. Q: How can I pause the game and still have access to game menus?

A: At any difficulty level but full reality (HARD), the pause key will still allow the user access to the entire interface. This can be set at will using the Custom difficulty settings. The "Enforce Realtime" check box, if checked, causes the modal (blocking) pause and will not let you effect the game until you unpause it.

16. Q: How come I lose contact with all of my units?

A: Check to make sure your flagship is on something reasonable. Designating a submarine as the flagship is liable to leave all your other units on their own when you submerge. If there are no units under your control at all, they're all dead. Better luck next time; Select Resign from the File menu and see how you did.

17. Q: Why do contacts change colors?

A: Contact colors indicate two things; your posture towards them and the certainty with which the contact is known.

Posture: Initially, most contacts are unknown, and are displayed as such. If an unknown contact is seen to take hostile action, it will change to the Hostile shape/color, although you still may not really know what side it is on. You may designate an unknown (or a known) contact as Hostile with the <Mark Hostile> hotkey ("H" on the IBM PC), but you ought to have a good reason for suspecting them or you may be cited for a Rules-of-Engagement violation in your evaluation.

Certainty: In the default palette set contacts are brighter if you have an exact location for them. They tend to grow dimmer if there is some uncertainty about their location.

18. Q: How come all of the aircraft I have assigned to a mission do not launch at once?

A: Strike and ferry missions are single events, and all launch together. All other missions are attempting to maintain a steady on-station presence. These missions will try to keep one third of their aircraft in the air at once, replacing them as needed. If you wish to saturate an area immediately, the aircraft can be ordered to launch manually, and will join the mission. Be aware that you are leaving yourself open to shortages down the road.

19. Q: How do I intercept enemy contacts?

A: There are two methods of getting an intercept:

a) Select the interceptors, hit the air-ops button, and select the target. This is very fast, but does not provide much information about ranges or times. There may be other air assets better capable to intercept the target than the one you chose.

b) Select the target (any contact), and hit the air-ops button. This will bring up a dialog listing all air units available, with ranges and loadouts listed. This takes longer, but allows you to pull units out of group CAP or ASW stations pretty fast, and allows a more considered response.

20. Q: How do I remove units or groups from a mission?

A: Aircraft can be removed quickly with the "Unassign Aircraft" hotkey. For all other units, bring up the mission editor dialog, select the mission, and deallocate the units. This also works for aircraft, launched or landed.

21. Q: How do I get a list of aircraft currently assigned to a mission?

A: Select the mission in the mission editor dialog. Aircraft in the air will be in the assigned units column. Landed aircraft can be viewed using the "Remove Aircraft" button in this dialog. This is also a way to change the loadouts of assigned aircraft; it is not necessary to remove them.

22. Q: How do I cancel a mission?

A: Bring up the mission editor and delete the mission. All units on the mission will become "Unassigned." Mission generated launch orders and paths will be deleted for these units, and the units will become unassigned as well.

23. Q: How to I change which reference points an existing mission uses?

A: Select the reference points, then bring up the mission editor. The "Remove" button under "Selected Reference Points" will remove the selected reference points from the list used by the selected mission. The "Add" button does the opposite. This makes some actions a two step process. If you have an anti-ship patrol "MOVING WINDOW" around reference points 1,2,3,4, and you want it to use 3,4,5,9 the following actions are needed.

1) Select reference points 1 and 2.
2) Bring up the mission editor.
3) Select MOVING WINDOW.
4) Hit "Remove", then "Ok" to leave the mission editor.
5) Deselect points 1 and 2. (Don't forget this!)
6) Select points 5 and 9.
7) Bring up the mission editor and select "MOVING WINDOW".
8) Hit "Add", then "Ok" to leave the mission editor.

24. Q: Why do aircraft on an area mission sometimes patrol outside the region defined by the reference points?

A: Aircraft on patrol are fairly curious about unknown contacts. They will wander over and attempt to ID contacts that match their patrol types (eg. Surface patrols look at ships, AAW patrols look at aircraft, etc). This 'closer look' might take them beyond their defined area by a few miles. Known hostile contacts will be attacked by Patrol missions if possible, and avoided (but reported on) by Recon missions.

25. Q: How do I set my permanent game and symbol preferences?

A: Run H2SETUP.EXE to set your preferences. This program makes changes to the HARPOON2.INI file. When loading a scenario, Harpoon II will default to the settings found in the HARPOON2.INI file.

26. Q: Why do I have more memory listed in the Memory Remaining window than I have in actual RAM?

A: Harpoon II uses a virtual memory DOS Extender. This means the theoretical maximum amount of RAM a program can use is limited by the disk space on the drive with the executable. It should be noted that the game does slow down somewhat when virtual memory is actually used, so it is only used when no more real RAM remains.

27. Q: There are too many Staff Message windows. How can I get rid of them?

A: Select Game Preferences from the Settings menu and turn off the more common ones. The messages will still be shown in the "Incoming Messages" window; the only difference is that the Staff Message pop-up windows allowed you to put the game in 1-1 time.

28. Q: How come I can't center my map window?

A: Map windows won't move outside the defined scenario boundaries. If a Map Window is against one or more of the scenario boundaries, it will not move or expand further in that direction. The main map window contains the entire area of the scenario and can't be moved at all.

29. Q: How come Sea State data is shown on land?

A: Sea state data also shows wind speed.

30. Q: Why are ship contacts appearing on land?

A: If the contact is uncertain, it is displayed in the center of the uncertainty region for the contact. This sometimes shows contacts over land, especially for detections that reveal only a relative bearing or direction (eg. "We hear something over that-a-way, but we're not sure how far"). ESM detections commonly do this.

31. Q: What are the lines, expanding circles, and wedges that appear around contacts?

A: These are the uncertainty regions mentioned above. The uncertainty region is created by the accumulated information from the most recent detection cycle, and then it ages when the contact is no longer detected. These concepts are explained very thoroughly in the tutorial section of your manual.

32. Q: How come my group breaks up when I order it to close and attack?

A: The units which are capable of attacking the target are removed from the group and placed on an intercept mission for the contact(s). I don't recommend doing this with your carrier groups.

33. Q: Why do my surface-to-air missiles fail to allocate?

A: The theoretical engagement distance for semi-active missiles is much longer than the engagement distance against low targets. These missiles require direction from radars on the firing platform, and any target over the radar horizon can't be engaged. This will display as "Target not Illuminated". Sometimes you will see a range ring that indicates an optimal engagement range against closing targets. This optimal range is no often realized and you must frequently wait until the geometry is more favorable (ie. the target is closer). The missile will also fail to allocate if the projected intercept point is beyond the range of the missile. This will display as "Out of Range."

34. Q: Why do I lose contact with the missiles I just launched?

A: If the missile does not have a command data link, it must be tracked with a search radar just like everything else. You have to decide if your curiosity about the fate of that Tomahawk is worth giving away your location by turning on a radar. But that's up to you.

35. Q: How come I can't see when my missiles hit their target?

A: For the same reason you don't know what is happening anyplace else you can't see. If you don't have a current visual/IR/passive-sonar track on the target, or a datalink with your missile, you will not know what is going on. You can later fly over the target and perhaps you'll see some visible damage. Perhaps your plane will be shot down instead. But that's a kind of target damage assessment too, now isn't it?

BDA (Bomb Damage Assessment) is always shown for individual land facilities. Make sure you have UNITs showing instead of GROUPs and you will see any relevant damage to facility targets.

36. Q: How do I use point defenses?

A: Point defenses are automatically fired for you. This includes chaff and flares, and point defense deceptive ECM (if you have the appropriate gear). If you do not have the "Weapons Tight" option set, missiles will be engaged by longer ranged SAMs as soon as an intercept is possible.

37. Q: How do I use Electronic Counter-Measures?

A: The ON/OFF switch can be found in the Sensor dialog. This will activate any barrage/noise jamming equipment for the selected platform. This will certainly give away the location of the jamming platform, but may hide other platforms or weapons from detection.

38. Q: Why would I ever want to turn my communications off?

A: Broadcast communications gear can be intercepted by ESM equipment, and may give away your location. Most modern communications gear, when employed properly is hard to detect. This type of datalink is shown in the "Secure datalink" color. Some units aren't capable of using this type of equipment (or have moved beyond its' range) and must now broadcast openly to remain in communications with you. These units have datalinks shown in the "Broadcast datalink" color. Units will always attempt to use secure gear where possible. Turning communications to Active gives the selected unit permission to broadcast (if needed) to stay in communications. Broadcasted communications links only give an ESM cut to listening enemy units. Since most units are capable of secure communications, we recommend you just keep this on for most units. The AI opponent does NOT currently take advantage of communications ESM cuts so there is no penalty.

NOTE: Sonobuoys will self-destruct via sinking if they lose their datalinks with their parent unit. Selecting a buoy and turning off its comm gear is a good way to drop unneeded sonobuoys.

39. Q: What is the difference between a passive and active sonobouy?

A: Passive sonobuoys use passive sonar. Active sonobuoys will give a more positive location on the enemy, but can be easily detected by submarines and tells them how close to being discovered they are. Active sonobuoys are also useful in shallow water, where all passive sonar works poorly.

40. Q: How do I use dipping sonars?

A: If the helicopter is hovering at or below fifty meters, it will deploy dipping sonar. If you tell the unit to use active sonar, it will go active when the sonar deploys.

41. Q: What loadouts should I use for various aircraft missions?

A: This is a style question. Generally speaking, the following holds true:

IB (Iron Bombs) will give you the most destruction per aircraft. The disadvantage of IB loadouts is that you must fly very close to the target. If the target is heavily defended . . .

SO (Standoff) loadouts tend to work on heavily defended ships where the price for a close-in attack with IB may be too high.

PGM (Precision Guided Munitions) require a fairly close attack (though not as bad as IB), but promise a much higher hit ratio.

SEAD (Suppression of Enemy Air Defenses) tends to be either decoys or anti-radar missiles and can help reduce the defenses around a target.

ATA (Air-to-Air) is good for shooting down other planes.

This is by no means an exhaustive list...Many variations on loadouts exists such as LR (long range) loadouts which tend to trade ordnance for extra fuel. This means you can strike targets further away. Read up on how modern aircraft are generally employed and as always, experiment.

42. Q: What types of aircraft can I use as tankers for aerial re-fueling?

A: Obviously, anything with a TANKER loadout will do, as will any loadout containing a buddy-store. Single purpose tankers will not have loadouts, but will be described in the platform display. Common tanker aircraft include the Kc-135, the KC-130, the A-6, and the Tu-16 Badger.

43. Q: Why can't I move the ASW threat axis in the formation editor?

A: The principle ASW threat comes from the PIM (Path of Intended Motion), because a sub in front of your group can wait quietly for you to set the shot up for him. Elsewhere he must make noise to close range. We therefore tie the ASW axis to the group path, as per USN doctrine. If resources permit, ASW units are placed behind the group as well.

44. Q: Why are my range rings in the formation editor showing up as only ones and zeros?

A: The formation editor window is sized to include all of the vessels in the group and all of their stations (even if they're not there yet). The range rings are then placed evenly out from the center. If the group is less than 2 miles across, the described behavior will occur because we round the displayed number down the nearest mile. Don't panic, the rings can be dragged to wherever you want them and the window can be zoomed.

45. Q: What is the difference between a Threat Nav Zone and a Detection Nav Zone?

A: Threat Nav zones are placed around areas where positive danger exists, such as around enemy SAM sites. Detection Nav zones are used for areas where detection is either possible or certain. They operate in the same way, but units can always be told to ignore any of them separately.

46. Q: How do I reload my weapons mounts?

A: Mounts will automatically reload from on-board magazines when completely empty. To change the loaded weapon or reload early, use the reload toolbar button. The dialog works similar to the Weapon Allocation dialog.

47. Q: Even though I select Sonar, Radar, ECM, and Comm Link active, only some of them change?

A: You only keep sensor states for those types of sensors you have. If there are no sonars on the ship, they will always come up "Passive."

48. Q: Why do my missiles/torps turn dark blue and disappear?

A: The missile has gone out of your sensor range.

49. Q: Why does a contact seem to jump from place to place?

A: You are probably getting uncertain contacts from several different detecting units. Not all of these will get hits every cycle, so the contact may be updated differently. This is pretty common when a sub crashes through a sonobuoy line.

50. Q: Why won't my planes follow my orders to go somewhere?

A: When planes are launched as a group, they must form up as a formation before they can go anywhere. This means that all of the planes you launched as a block will wait until they are all airborne before they set off on a path or mission. Generally speaking, planes launched together will form into groups of 4.

If you don't want them to be in a group, break them into single unit launch requests.

It is also possible that the plane is going home, either because it has run low on fuel or ammo, or perhaps has completed the mission it performing. These must be unassigned before they will follow orders.

51. Q: When I select a ship in the game and press DATABASE, it shows me the wrong ship entry.

A: You cannot get DATABASE information on unknown contacts because you do not know what they are yet. If you selected a ship whose exact identity is known, or if you selected one of your own ships, then you will see the database entry for the class of ship to which your selection belongs. For example; If you selected the USS Eisenhower and pressed DATABASE, you would see the entry for the USS Nimitz aircraft carrier because the Eisenhower is a member of this ship class.

52. Q: I have an old contact left behind from a ship I sank with missiles. Since I didn't actually *see* it sink, (but I'm pretty sure it did), how do I get rid of the old contact which is still cluttering up my screen?

A: By selecting the contact and pressing the <DROP TRACK> hotkey (3/PGDN on the IBM PC). If the contact is not really gone, you will see it again as soon as it is redetected.

53. Q: Why does the is the enemy airbase I keep bombing still say. "No Apparent Damage" in the Unit Status window?

A: Many of the bases in the Harpoon II scenarios are groups of facilities. Use the hot key to toggle to unit view to see the individual components that you have been targeting during your attacks. Each individual facility will have a damage level.

54. Q: My planes won't drop bombs or fire air-to-ground missiles, why?

A: There are restrictions on some weapons as to what speed and altitude they can be released from to operate properly. Try using medium altitude and cruise speed.

55. Q: What is the difference between diesel and electric power for diesel submarines?

A: Diesel subs use electric motors with battery power when submerged. The fuel status indicator shows the endurance at the current throttle setting. If you switch from creep to cruise you should see a dramatic drop in the amount of endurance. To charge batteries, you need to go to at least periscope depth to run the diesel engines to charge the batteries. The battery charge process happens automatically when you reach periscope depth as the sub will start using the diesel engines as soon as the snorkle can be deployed. There are two fuel indicators for diesel subs, one shows the endurance at the present speed and the other shows the endurance capability of the batteries.

56. Q: When I set a waypoint order for a unit or group the order is not being executed when the waypoint is reached. Why?

A: Waypoint orders can only be set AFTER the course has been plotted. If you are in navigation mode (pencil cursor) any order you give a waypoint will not be retained as the waypoint does not exist until after you click on the Navigation toolbar button to exit the navigation mode. After the course has been created you can assign waypoint orders.

Appendix E

Manual Errata

Tutorial

P18: Choosing Sides

The tutorial lessons do not provide the user with a choice of sides other than "Good Guys." There is no need to be concerned about choosing the correct side as only "Good Guys" is available for side selection.

P19: Setting Difficulty Level

The Difficulty Levels include the following setting levels:

Easy, Average, Hard, Default, and Custom. The Default setting sets the level to whatever the user has configured in their HARPOON2.INI file. This file is configured using the Harpoon II Set-up (H2SETUP.EXE) program. The Harpoon II Set-up program allows the user to set their permanent hardware, game, and staff options. When loading a scenario to play, the difficulty level will always be set to Default which uses the settings contained in the HARPOON2.INI file unless the user sets the Difficulty Level to one of the other settings for that particular session.

The initial default setting for Harpoon II is Average, not Easy as indicated in the manual text. For the first tutorial you may leave the difficulty setting to Average.

P21: Maximizing and Minimizing Windows

When a map window is maximized by clicking on the up arrow in the upper right corner, it can not be reduced to an icon. The down arrow in the upper right corner of an maximized window does not function. You must return the map window to its variable size by clicking on the double-arrow button before attempting to reduce the window to an icon.

P25: Replace the word “Boundaries” with “Borders.”

The text uses the word “Boundaries” while the Map Preferences box uses the word “Borders” for the display of Ice Packs.

P29: Sensor Ranges

The USS Puller has three passive sonar circles that represent two types of sonar and the convergence zone.

P29: Show Sonobuoys

The Show Sonobuoy selection is not available. Sonobuoys are displayed at all times. After a sonobuoy has expired it will no longer appear on the map.

P31: Creating Zoom Windows

Replace “Zoom Map 2” with “Zoom Map 1.”

P31: Centering the Screen

Note: If you right-click to center the screen at a point near the boundary of the map it will not center. There must be enough map area on all sides for the map to center properly. If you are near the edge of the map and want to center on a point, try zooming in prior to centering.

P34: Unit Status Window

The initial speed of the USS Puller is 5 knots, not zero.

P35: Report The Report window lists the mounts and weapons that are currently in each mount. The number of rounds available, the capacity, and the rate of fire are displayed. For example: 2/6 means that there are two rounds in a mount that can hold up to six rounds (eg. 2 of 6). If the first number is a zero, that mount is currently empty.

P40: Choosing a Symbol Set

The symbols in the legends for both NTDS and Stylized display Hostile, Unknown (or neutral) and Friendly symbols.

P42: Lesson Summary

Select the File pull-down menu to choose Load BattleSet, not the Settings menu.

P43: Show Data Blocks

Make sure that you have selected the Tactical window prior to using the Show Data Blocks hot key. Display Hot Keys will work with selected windows only.

P46: Using the Navigator

Harpoon II's Navigator does not display dotted lines as it evaluated several courses to reach the final destination. This feature was removed following the printing of the manual. A small "N" will still appear in the lower left of the ship or sub symbol when the Navigator is computing a course.

P48: Create a Nav Zone

After you have clicked on the Nav Zone toolbar button and the cursor is a pencil, place the cursor at a point near Reference Point 1, NOT waypoint 1. Start clicking around Reference Point 1 to draw a box around the Reference Point.

Select "Ship Threat A", NOT "Ship Exclusion A." There is no such thing as a Ship Exclusion selection in the Nav Zone dialog box. Substitute "Ship Threat A" for "Ship Exclusion A" on page 49 as well.

P50: Lesson Summary

Select Load BattleSet from the File pull-down menu, not the Settings menu.

P55: Sonar

When changing the USS Puller's speed from Cruise to Creep there will not be a noticeable difference in the passive sonar range circle. The change is noticeable when changing form Flank to Creep. Go ahead and try increasing to Flank and then decreasing to Creep. Return the ship to Cruise after you have noted the change in the sonar range circle.

P57: ESM vs. Active Radar Detection

The contact may not return to an ESM track. It may stay as a solid contact depending upon the range, and aspect to the detecting platform.

P57: ECM

An "X" will NOT appear in the upper right corner of the ship symbol that is using active jammers. The "X" appears on other ships and aircraft that detect jamming from another source.

P59: Weapons Free or Weapons Tight

The Weapons Free and Weapons Tight option is found under the Game Preferences selection under the Settings pull-down menu, NOT the Staff Preferences selection. Substitute "Game Preferences" for "Staff Preferences" on Pages 59, 60, 61, 62, and 64.

P68: Surface Contacts

You may detected a sub contact prior to detecting the surface contacts.

P68: Using Weapons

Select either the Nanuchka or the Kriminsky Komsomolets when attacking with the Harpoon missile.

P69: Close with the Sub Contact

Depending on the range, aspect and depth of the sub contact, you may or may not be able to identify the sub contact. Engage the contact regardless of identification.

P71: Launch Aircraft

Prior to launching the E-3 AWACs aircraft, start the game by selecting Start/Resume from the Settings pull-down menu.

The Report window will not display a list of aircraft currently assigned to the base. Use the Air Ops toolbar button to display the aircraft currently assigned to the base. First, select the base and then click on the Air Ops toolbar button.

P71 & 72: Launch Aircraft, Ready Aircraft

Replace "OK" with "Continue." The "OK" button in the Launch/ Ready Aircraft window has been changed to continue.

P73: Anti-Ship Strikes

When attacking the surface contact, DOUBLE-click on the contact rather than just a single click.

P75: Aerial Refueling

Aerial refueling will not function if the tanker has a plotted course. The tanker must be loitering. When an aircraft joins with the tanker you will see the fuel numbers increase in the Unit Status window. When refueling has be completed a message will appear indicating that the refueled aircraft has no mission.

P79: Create a Mission

The New Mission selection under the Mission pull-down menu should be replaced with Create Mission. Substitute "Create" for "New."

P80: Choose Mission Type

"AAW Patrol" should read as "Patrol AAW."

P81: Edit Now

The Edit Mission selection is found under the Mission pull-down menu, not the Window pull-down menu.

P82: Edit Mission Window

After typing that you wish 2 F-14 aircraft to be assigned to the mission, click on the OK button, not the Launch button. Once you have confirmed that the two F-14s are indeed O/T Mission, click on the Continue button, not the OK button.

P82: Time Delay

The entire paragraph describing the Time Delay feature for missions relates to the Create Mission window, not the Edit Mission window. Time delay can be set when you first create the mission and can not be set or changed from the Edit Mission window.

P83: Create a Strike Mission

Select Create Mission from the Mission pull-down menu, NOT New Mission.

P83: Create a Reconnaissance Mission

Reconnaissance Ship is abbreviated Recon Ship in the Create Mission window.

Reference Section

P91: Pre-set Difficulty Levels

An additional level is included called Default that is always selected when you start a scenario. The Default setting configures your Detection Setting and Staff Handling parameters to the configuration set in the HARPOON2.INI file which is set using the Harpoon II Set-up program (H2SETUP.EXE).

P92: Average

Add Weapon Allocation as one of the Staff Handles settings for Average.

P97: Grayscale Display

The map background for this display option is black with gray coastlines, not the reverse.

P125: Show Sonobuoys

This option is not available. Sonobuoys are displayed in the map windows at all times until the sonobouy expires. Turning off communications with the SENSOR hotkey or toolbar button will also automatically expire the selected sonobuoys.

Manual Addendum

Command Line Switches

The following command line switches are available in Harpoon II:

-? Display command line switches.

-T or -t Skip introduction screens.

-V Display version number of the executable.

-v <mode> Force vesa mode <mode>.Valid modes are 101, 103, 105, and 107.

-a Autosave. Creates a saved game named "auto.sav" every 15 game cycles.

To use a command line switch type HARPOON2 -s (where 's' is the letter of the desired switch).

The -x switch to force XGA2 mode is not implemented.

Tutorial

To ensure that the tutorial functions properly, make sure that you follow directions and set the difficulty level to what is indicated in the tutorial text.

Aerial Re-fueling

Air-to-air refueling will only function if the tanker aircraft is set to loiter. To do this, set the tanker's speed to loiter using the Speed/-Altitude/Depth toolbar button or delete the tanker's current path.

Missions

Units assigned to a mission will not properly execute orders given to them unless you do one of the following:

1) Cancel the Mission

2) Remove the unit from the mission

3) Use the Unassign key ("U" on the IBM PC)

When a unit or group is assigned to a mission all orders to change speed, altitude, or course will not be accepted. The computer controls these units until you release the unit or group from the mission using one of the three options listed above.

Intercepts are missions and can be cancelled or edited as well.

If a Strike mission is out of range it will not launch until the carrier or the target moves closer. Manually launching planes assgined to a mission that is not in range will cause them to return to base (RTB) right away.

Weather Information

The Unit Status window now displays weather conditions for friendly units. If the bottom of the Unit Status window is not fully extended, this information will not be visible. Extend the bottom of the window to view the additional data or press REPORT for a full sized screen display.

Time Compression

Increasing the time compression should only be used when you wish to speed the game up to make first contact, to transit units or groups, or to ready aircraft. Do not use a high time compression at all times when playing Harpoon II. Time compression does not provide a compression rate of the selected rate for every second of real time that passes. Instead, the time compression feature updates the screen to what has happened in the selected compression interval every time the screen updates. Screen update times vary and are dependent upon the speed of your computer, the size of the scenario, and what is taking place in the scenario at any given moment. If you are playing Harpoon II on a slow machine, or if you have multiple aircraft and missiles airborne, the game speed will be affected. Playing with a high time compression rate can prevent you from having enough time to make decisions that could decide the fate of your forces. Use time compression to speed up game events such as transit to an area or the readying of aircraft.

Datablocks

Data blocks are text information displayed next to a unit, group, reference point, or Nav zone. Use the data block hot key to turn on datablocks). Data blocks can be set to display all, display selected, or display none.

Rename Contacts/Reference Points

Contacts or Reference Points can be renamed by selecting them and then using the rename hot key (consult the Harpoon II Command Card).

Clear Contact Hot Key

To remove an old contact from the screen, use the Clear Contact hot key ("3/PGDN" on the IBM PC). This feature can be used to clear old contacts and contacts that are no longer important (such as a sinking ship). This is useful if a target has sunk, but you did not actually see it go down; the old contact will hang around cluttering your display. If the contact is cleared and later reappears, it has been re-acquired by your sensors.

Designate Contact Hostile Hot KeyContacts can be manually designated as hostile using a hot key ("H" on the IBM PC). If an unknown contact is designated hostile it will be attacked by your units. Be careful you do not designate a neutral unit or group.

Unassign Aircraft Hot Key

If an aircraft is returning to base (RTB) or is assigned to a mission, you can unassign it by using a hot key ("U" on the IBM PC). If you use this option you will be responsible for getting the aircraft to a tanker or another base prior to its fuel being expended. This hot key is handy when an intercepting aircraft's mission is canceled because of range or lack of fuel yet you want to assign the aircraft to another intercept or patrol mission.

Nav Zones

In addition to Threat Nav Zones there are also Detection Nav Zones. Both types are identical in nature except for how they are labeled. Use a Detection Nav Zone around something that can detect your units if they enter the area. Use a Threat Nav Zone around something that can fire on your units.

Groups Break on Close to Attack Order

A group that is given a "close to attack" order will break up. Only those units in the group that are capable of attacking and closing with the target will detach. Be careful using the "close to attack" dialog box with groups if you do not want to break-up your groups.

Aircraft Loadout Types

The types of aircraft loadout types is abbreviated in Ready Aircraft window. the following are the types of loadouts:

IB: Iron Bomb (gravity bombs)

PGM: Precision Guided Munitions (B for bomb, M for Missile)

SO: Stand-Off (i.e. Harpoon anti-ship missiles)

SEAD: Suppression of Enemy Air Defense (i.e. Anti-radiation missiles)

ATA: Air To Air (i.e. Phoenix missiles, Sidewinder missiles)

ECM: Electronic Counter-Measures (ALQ-99 jammers)

Tanker: Aerial Refueling

Minimal: Basic Loadout, (ie. gun ammo only, detection equipment only)

Facilities

Bases are made of components called facilities, much the same way that Groups are made from units. Facilities may include communications assets, fuel storage, runways, hangars, command & control bunkers, and many other types. Each individual facility can be targeted in an attack.

Victory Conditions

Victory conditions are checked every 30 minutes of game time. This is done to ensure that the evaluation of the scenario is accurate and reflects events in progress when you reached your victory condition(s). An example might be that you destroyed all enemy ships but there were still enemy missiles in the air at the time you sunk the last enemy ship. The 30 minute delay allows these missiles to reach the end of their flights where they may potentially affect the outcome of the scenario.

Velocity Vectors

The variable lines protruding from unit and group symbols are velocity vectors. This indicate the direction and relative speed of the unit or group. The longer the line, the faster the unit or group's velocity. These lines point in the direction the unit or group is moving.

Damage

The Harpoon II damage system is similiar to that used by the Harpoon miniatures rules (Paper rules game by Game Designers Workshop). Vessels (ships and submarines) have a damage point rating, which represents the ability of the hull to retain integrity despite damage. All impact weapons act by reducing the number of damage points. As damage points are lost, the maximum speed of the vessel is reduced. At 10% of its initial damage points, a vessel is no longer capable of movement under its own power. At 0 damage points, the vessel is no longer afloat and will begin to sink. Sinking may take up to two hours for a ship or surfaced submarine, although an impact by a large enough warhead can sink a ship instantly. The amount of damage a warhead does is generally equal to its weight in kilograms, divided by five. This amount can be further modified by any armor the vessel may have, as explained below.

Example: The Admiral Kustnetsov has around 1100 damage points. It is struck by a Harpoon missile, which has a 227kg warhead. The missile inflicts a base amount of 45 DP on the Kusnetsov, possibly modified by armor. Unless a critical hit results (not terribly likely at such a low warhead to vessel DP ratio), this will not impair the Kusnetsov at all. If the same missile were to strike an Osa class missile boat (with 9 DP), the poor Osa would be broken in two and sunk instantly.

Damage is also represented by critical hits, which model damage to specific systems such as weapons, sensors, and propulsion systems which may damage or destroy the equipment without harming the hull of the vessel. Critical hits can result from normal weapons hits, based on the size of the warhead and the size of the vessel. Certain weapons can also cause critical hits as their primary damage mechanism. Fragmentation warheads, for example, can cause damage to a large number of systems, but the hull of the target is unlikely to be substantially damaged by the fragments.

Damage can be reduced or negated by the presence of armor on a vessel. Armor can be of two types:

General armor reduces the damage a vessel takes from weapons which hit it. Larger warheads and armor-piercing warheads are reduced less than smaller ones. For example, the Iowa's general armor rating is sufficient to shrug off 20mm guns, but still takes substantial damage from large anti-ship missiles and large-caliber (8 inch or larger) AP rounds. Critical hit protection prevents damage to specific systems. For example, The Mk44 Tomtohawk Armored Box Laucher has light armor. This will probably stop fragmentation damage or light guns (25% chance to penetrate), but damage from a 16 inch round will likely penetrate the armor (50% or higher chance to penetrate).

Some critical hits can continue to cause damage (which can cause MORE critical hits, etc.) such as flooding and fires. These hits can be eventually stopped by damage control (which occurs automatically).

Critical hits which do affect a system may destroy the system (or at least damage it such that it cannot be repaired at sea) or merely damage it, in which case it is likely that the crew will be able to repair it (again, this occurs automatically). If repairs at sea are possible, they should occur within 48 hours, unless the system is damaged again before the repairs are complete, in which case the repairs will have to start over.

Note that under this system, it is possible for a ship to be fully operational, except for movement, up to the time it begins to sink. It is also quite possible for a ship to be stripped of weapons and sensors, and still be completely seaworthy.

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