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RESEARCH REPORT

HARPOON EMPLOYMENT IN NAVAL ANTISURFACE WARFARE (ASUW)

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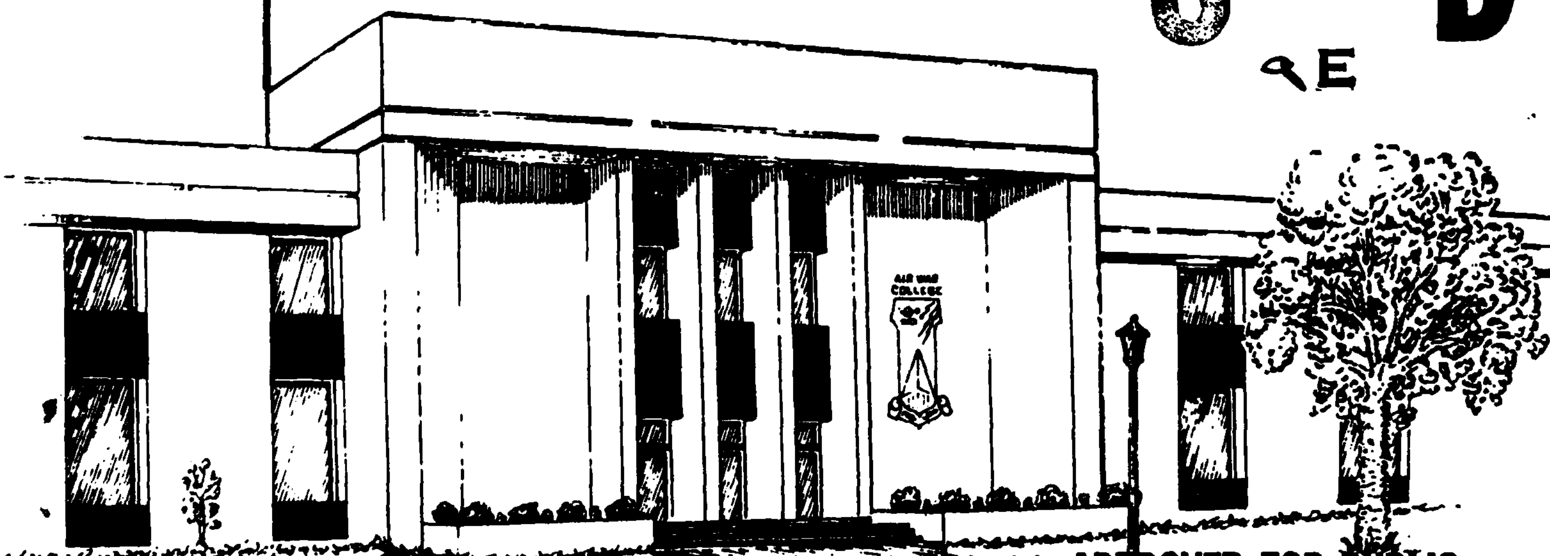

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by

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Research Advisor: Colonel William P. Moore

MAXWELL AIR FORCE BASE, ALABAMA

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AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

TITLE: Harpoon Employment in Naval Antisurface Warfare (ASUW)

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Current Soviet naval doctrine encompasses a strong "blue water" surface navy to project sea power to lines of communication throughout the world. As a result, the Soviet Navy is dramatically increasing its size and threat capability. To counter this threat, a hunter-killer team of the P-3C Orion and the B-52G Stratofortress with Harpoon anti-ship missiles could be used in an offensive role to relieve the pressure on U.S. Navy carrier battle groups.

This paper develops this concept in detail by first discussing historical perspectives of the airborne anti-ship missile in the Falklands War and the USS Stark incident. Then, the current Soviet and U.S. force structure in the Pacific and the operating characteristics of the P-3C and B-52G will be discussed. Detailed techniques of employment, including discussions of emission control and atmospheric ducting along with suggested future improvements are also covered.

BIOGRAPHICAL SKETCH

Lieutenant Colonel Frederick E. Grosick (MBA, Indiana University) is a Senior Pilot with over 2900 hours flying time. His operational flying experience is in the F-4 and B-52H aircraft. He served as both a Transportation and Avionics Maintenance Squadron Commander. Colonel Grosick also completed staff tours with the Joint Strategic Target Planning Staff and the Joint Staff. He first became involved with the Harpoon missile while overseeing the B-52/Harpoon avionics modifications as Commander, 43 Avionics Maintenance Squadron, Andersen AFB, Guam. He is a graduate of Air Command and Staff College and Air War College, class of 1988.

Commander Patrick L. Massey is a Naval Flight Officer who spent his career in the P-3 maritime patrol community. He flew as Mission Commander in the P-3 Orion at Barbers Point, Hawaii, and Moffett Field, California, where he deployed to several countries in the Western Pacific theater, including the Republic of the Philippines, Japan, and Adak, Alaska. In addition to frontline operational experience, he held various operational and staff positions in the patrol community, including COMPATWING ONE at Cubi Pt., Republic of the Philippines, and COMPATWING TEN at Moffett Field, where he was directly involved in command and control of the operational maritime squadrons. Prior to attending Air War College, he served as Operations Officer, Patrol Squadron Nine, Moffett Field, California.

Lieutenant Colonel Mark W. Petersen (M.S., University of Southern California) is a Senior Pilot with over 3800 hours flying time. He entered the Air Force as a Weather Officer and graduated from Undergraduate Pilot Training in 1973. He has mainly been assigned to operational flying duties in the B-52G, except for one staff tour at SAC Headquarters. He developed his interest in Harpoon employment as the Operations Officer, 60 Bombardment Squadron, Andersen AFB, Guam, and as Commander, 69 Bombardment Squadron, Loring AFB, Maine. He is a graduate of Air Command and Staff College, class of 1984, and Air War College, class of 1988.

CHAPTER I

INTRODUCTION

In January, 1986, Admiral James D. Watkins declared that the United States maritime warfighting strategy consisted of three phases: forward deployment for deterrence or, if necessary, transition to war; seizing the initiative as far forward as possible (including destruction of all Soviet forces); and carrying the fight to the enemy in his home waters. (45:17) If U.S. naval strategy is to project force throughout the world and protect the sea lanes in time of war, what are the threats this force will encounter and can it accomplish its mission without sustaining unacceptable losses?

In testimony before the House Appropriations Committee in April 1987, Admiral Ronald J. Hays, Commander-in-Chief, U.S. Pacific Command, stated modernization was needed for a technical edge against the Soviet military. Two Soviet weapon systems he viewed as primary threats in his discussion were the submarine threat and the growing number of long-range bombers in the Soviet inventory. (18:136)

There would appear to be a contradiction in thinking by the two individuals above. If the desire by the Navy is to "carry the fight to the enemy," but a viable major threat to the U.S. Naval forces is Soviet long-range bombers, how can the United States afford to fight in Soviet bastions? Although the

Navy carrier battle groups have devised a highly effective "umbrella defense" against airborne attack through use of sophisticated air-defense weapon systems, substantial damage could be sustained through "leaks" in the defense. In addition, can U.S. Navy surface action groups (SAGs) which operate independently from carrier forces survive attack from a massive Soviet bomber force without air protection afforded by the carrier?

In World War I, the majority of sea battles were fought ship against ship using the big guns. In each of the famous battles, the victors out positioned and/or surprised their opponent and attempted to inflict as much damage on the foe until surrender was acclaimed. As a result of military lessons learned from the war, the military leadership viewed the battleship as an ultimate weapon.

In preparation for World War II, Hitler's strategy was that of building large battleships to destroy the Allied fleet. Due to failure of these huge battle cruisers to accomplish their task early in the war, Hitler discontinued his efforts and concentrated on minimal air power and the stealth of the U-boat in his attempt to control the seas. Although his attempts failed to crush the Allied fleet, the minimal number of submarines (fifty-seven U-boats at the beginning of the war) proved to be one of the most feared weapon systems of the war. (2:76)

Additionally, during World War II, the aircraft carrier had come of age, and its ability to project power at will to all parts of the globe was recognized for its value by the United States. The great battles of the Pacific between the United States and Japanese naval forces demonstrated the destructive capability that air power, launched from a ship's deck, could provide.

As a result of lessons learned in World War II, the aircraft carrier and the submarine have maintained a predominant role in the U.S. Navy's inventory. Today's aircraft carriers are the largest, fastest, and most destructive-capable ships on the oceans of the world. They possess the means to project power to all parts of the world in a relative short steaming time and to deliver air power where needed in increasing severity as her weapon systems continuously improve. The carrier battle group with her escorts of destroyers, frigates, and cruisers can defeat any armada in the world and project air power to land and sea targets with deadly accuracy.

The question is: have we lost sight of what history has told us? Have continual improvements in enemy capabilities to defeat the weapon systems of the past been ignored? In World War I, the machine gun proved that frontal assaults were outdated. In World War II, the battleship was proven not to be indestructable.

Today, the Navy is building aircraft carriers and the required accompanying ships while failing to respond to the composition and purposes of naval forces being built by the Soviet Union. In a recent article concerning Soviet expansion in the Pacific, Captain Jack V. Roome, USN, a member of the U.S. Defense Intelligence Agency, stated that the Soviet military was expanding in the Pacific area as part of a determined effort to promote the USSR as a world dominant force. This included the deployment of the Backfire bomber into both Soviet Air Forces and the Pacific Ocean Fleet Air Force, dramatically increasing strategic and maritime strike capabilities. (38:12)

The purpose of U.S. carrier battle groups is to project power and defend the sea lanes of communication (SLOCs) through destruction of enemy surface and subsurface combatants. In truth, the carrier does have the capability to do just that. The Soviet surface forces are no match for those of the United States in an open ocean confrontation. Where U.S. naval force strategy falls short is not considering all aspects of Soviet forces. In addition to building a "blue water" Navy, the Soviets have developed an air force with the capability to carry the naval battle to the carrier battle group through use of the Backfire and other aircraft with air-to-surface missile capability. If U.S. forces position within the combat radius of these land-based aircraft in an attempt to destroy Soviet surface forces, a massive Soviet air attack could cause significant damage to U.S. surface forces. The airborne anti-surface capability was clearly demonstrated in World War

II, the Falklands War, and the Stark incident in the Persian Gulf.

This paper will look at the air-to-surface missile capability in naval anti-surface warfare during the Falklands War and the Persian Gulf and compare these to current U.S. Harpoon missile employment. In addition, the paper will discuss possible future applications including an alternative offensive "tactical package" force structure and strategy to combat enemy surface forces in areas where a threat from an airborne anti-surface threat exists.

CHAPTER II

FALKLANDS WAR

Remarkably enough, the origin of anti-ship missiles can be traced to the German Luftwaffe during World War II. On 14 September 1943, German Dornier bombers used SD 400 gliding bombs to attack the Italian fleet, that was trying to sail to Allied ports after the Italian surrender. Combining destructive power and accurate guidance, the bombs were responsible for sinking the cruiser Roma and heavily damaging the cruiser Italia. (41:49) Although it was considered another of Germany's "secret weapons," Allied strategists paid little attention to this first "air-to-sea" missile.

After the war, Western navies saw no need for the development of a missile, since they could utilize naval gunnery and carrier-based aircraft for power projection at sea. The Soviet Union, however, lacked carriers and began development of the first anti-ship cruise missiles in the early 1960's to develop her own power projection capability. (34:9) The Western powers did not think much of these strange new weapons until they were jolted into reality when a Soviet-built guided missile was used by the Egyptians to sink the Israeli destroyer Elath during the 1967 Arab-Israeli War. This was the first time in history that a ship had been sunk by a guided missile. The missiles used were four Styx surface-to-surface missiles, launched from two Soviet-built Komar class PT boats. (43:5) The crude, but effective Styx weighs 5,500 pounds with an 837-pound warhead and has a top speed of .9 Mach and a range of 20-25 miles, using a rocket-boosted turbo-jet engine. (32:26) The missile's flight path is high altitude with a low-attack phase and uses an active radar homing guidance system. Skeptics pointed to the fact that the Elath was built in Great Britain and had questionable damage-limiting features and no attack warning. Nevertheless, the U. S. Navy quickly set about equipping the fleet with the Sea Sparrow anti-ship missile to counter the cruise missile threat. (34:12) The West had learned an important lesson from the Elath sinking and subsequently developed two very capable anti-ship missiles of its own: the French-built Exocet, and the American-built Harpoon. Not until 1982 would the truly amazing capabilities and superiority of the air-launched anti-ship missile be recognized, when it was first used in a minor conflict in the remote southern portion of the South Atlantic--the Falklands War between Great Britain and Argentina.

The Falklands War in the spring of 1982 will be remembered for the first combat use of air-launched anti-ship missiles. The first sinking in history of a ship by such a missile occurred on 4 May 1982 when two French-built Dassault-Bregnet Super Etendard fighters of the Argentine Navy attacked the British destroyer HMS Sheffield with a pair of Aerospatiale Exocet missiles. The fighters, each carrying one missile under the right wing and a 2,000-pound external tank under the left wing for balance, launched from their base in southern Argentina and flew between 100-200 feet above the sea at 480 knots toward the British task force. They were vectored to the general target area by an Argentine P-2 Neptune reconnaissance aircraft. (25:22) Approaching from the south, the two fighters climbed to 500 feet altitude for target acquisition at approximately 25 miles from the British ships. (12:15) Detecting two targets on their radar, one medium-sized and one large, the pilots fed the range and azimuth information into their missiles and launched a single missile at each target at 23 miles. (12:15) The HMS Sheffield, about 15 miles from the British carriers, was acting as an air defense picket ship with a load of medium-range Sea Dart missiles. (14:13) The carrier Invincible detected the Super Etendards on radar when they climbed to 500 feet and notified the Sheffield of the attacking aircraft in the area. The two missiles headed directly toward the Sheffield at 600 miles per hour, using an inertial navigation computer for heading and a radar altimeter to maintain an amazingly low altitude of 8-10 feet above the water. Approximately six miles from the target, the missile's homing radar turned on for final target lineup. (25:22) Captain Sam Salt, commanding officer of the Sheffield, was the first to see the approaching missiles. Later, he was to say that nothing could have prevented the missile from hitting the ship: "We had only time to say 'take cover', and the missile exploded." (41:49) One missile missed but the other struck the Sheffield amidships and penetrated to the operations room before its 350-pound warhead detonated. All main systems on the ship were disabled, and its fire-fighting water main ruptured. The missile's remaining solid propellant continued burning, filling the damaged compartments with smoke and making the surrounding aluminum bulkhead glow white-hot. (14:13) The ship was abandoned four hours after the attack and eventually sank a week later while in tow. The fact that a $660,000 missile had destroyed a $47-million British destroyer caused many naval strategists to doubt the future combat effectiveness of large surface fleets.

The Sheffield attack was followed three weeks later by a similar attack on the British container ship, Atlantic Conveyor. In this attack, both Argentine Super Etendards detected one large target surrounded by numerous smaller ones and launched their missiles at the maximum range of 30 miles against the large target, believing it to be one of the British carriers. (12:15) The missiles both scored hits, and the ship subsequently sank. However, the British account of this attack stated that the two Exocets were targeted against the carrier HMS Invincible but were diverted by an extensive chaff barrage and active electronic countermeasures toward the Atlantic Conveyor. (7:18) The French and Argentines both disagreed with this assessment.

The Exocet Missile

The Exocet missile is 15.5 feet long, weighs 1441 pounds, and has a maximum range of 27-27.8 nautical miles. It can be launched at altitudes between 300 feet to 33,000 feet and has a maximum speed of Mach .93. (12:16) Flying at 8-10 feet above the surface, it uses a combination of inertial navigation guidance with an active radar seeker to achieve terminal target lock-on. (12:16)

Tactics

The Argentine Navy had just recently received the first five of 12 Super Etendard fighters and only had five Exocet missiles in their inventory when the war began. Consequently, they were very judicious in exposing these precious assets and getting maximum benefit from their five missiles.

Without clear air superiority by either side, the Argentines used both their Boeing 707 transport and P-2 Neptune patrol aircraft for long-range reconnaissance and command and control. During all of the Exocet attacks, the P-2 Neptune vectored the Super Etendard fighters to the general area of the British ships. With their greatest threat being antiaircraft missiles, such as Sea Dart, and artillery on the ships, the Super Etendards flew almost the entire ship-attack mission below 300 feet altitude. Given the Argentine's very limited air refueling capability and the Super Etendard's 400-mile combat radius, they were severely limited in flying this exclusively low-altitude attack profile. With no electronic countermeasures equipment, they could not jam the British shipborne radars. Therefore, they could only turn and run after being detected during their target acquisition maneuvers at 500 feet altitude.

Lessons Learned

The most important lesson for the B-52 from the Argentine attacks on the British task force is the complete success achieved by the hunter-killer team of the P-2 Neptune and the Super Etendard fighters. Today, the hunter-killer team of the Navy P-3 Orion with a B-52G would have greatly improved capabilities because of the B-52G's tremendous endurance, advanced radar on both the P-3 and B-52G, the longer maximum launch range of the Harpoon versus the Exocet, and the extensive electronic countermeasures systems on the B-52G. Also, the importance of surprise and avoiding radar detection prior to missile launch was aptly illustrated in the Falklands War. The lack of a long-range, carrier-based fighter in the British Navy then and the Soviet Navy now bodes well for the success of the P-3/B-52G hunter-killer team against the Soviet fleet.

CHAPTER III

THE PERSIAN GULF

The Persian Gulf area produced more anti-ship missile attacks than any other region to date. These attacks came from airborne as well as land-based platforms. An analysis of the attacks will explore what led to the successful strikes. How can an anti-ship missile penetrate a ship with four lines of defense against air-to-surface and surface-to-surface missiles in a hostile area? (15:41)

USS Stark

In May 1987, the USS Stark, a guided missile frigate, sailed into the Persian Gulf, where more than 200 vessels had been attacked in the past three years. Early in the day of 17 May, Iraqi jets fired missiles into a Cypriot tanker leaving it dead in the water. (28:37) That evening, the Stark's tactical action officer, who was in charge of the ship's combat systems, was tracking an Iraqi Mirage F-1 fighter for more than an hour. The F-1 had been flying a southeasterly course from Iraq, when it made a left turn to fly an east northeasterly course toward the Stark. (1:26) Initially, the Stark's early warning receiver detected the Iraqi jet's Cyrano IV radar when the fighter was 27 nautical miles from the ship, about four minutes before the first missile struck. (1:28) As the fighter approached the ship, the audio control on the electronic warfare system was switched on so the signal from the Iraqi jet's fire-control radar could be heard in the control room over a loudspeaker. Three minutes after detecting the Iraqi jet's radar, the sensor operators heard the intermittent low hum of the jet's scanning search mode transform into a steady, high pitch indicative of the targeting mode, showing the fighter had locked-on to the Stark. (1:26)

With this signal, the ship's chaff launchers were "unsafed." These launchers consisted of three pairs of mortar-sized tubes, canted at fixed angles, to shoot clouds of thin metallic strips to confuse incoming radar-guided missiles. In concert with this, the tactical action officer activated the automatic radar-directed Phalanx gatling gun, which is the ship's last-ditch defense against incoming missiles. In addition, the Stark radioed a warning on the international military air distress channel to the fighter, but no response was received. (1:26)

After launch, an Exocet missile typically maneuvers down in various stages to a final altitude within two or three meters above the ocean's surface, which it senses by using a radio altimeter and inertial guidance platform. Since the missile travels at just under the speed of sound, a launch at 20 miles gives a warning time of about two minutes. During the final stage of its flight, the missile is guided by its own terminal radar, which is normally programmed to turn on at an adjustable preset distance from the target, reported to vary from three to ten kilometers. Its frequency is also preset within a limited range. (1:28)

Human eyes detected the Stark's incoming missile first, even though the ship possessed a panoply of electrotechnical sensors. A seaman, on port lookout duty, saw a bright flash in the distance, followed by a small blue dot bobbing erratically on the horizon. As it raced toward the ship, it grew into a blue fireball. The blue flame was recognized as an inbound missile only moments before impact. The Exocet penetrated the ship's hull about six feet above the water on the port side and shot through the crew's quarters to the starboard side of the hull. Fortunately, the missile did not detonate. (1:26)

Approximately 25 seconds later a second missile struck the Stark and immediately exploded near the hole where the first one had pierced the ship. The ensuing fire became so intense it melted parts of the ship's aluminum superstructure. Nearly all means of communication were cut and smoke filled the ship's compartments. Radiation of heat through the metal ship caused spontaneous blazes in new locations. (1:26)

As the heavily damaged Stark made its way to Bahrain, the ship's chaff launchers remained fully stuffed on the top deck. Also, the Phalanx gun at the ship's stern was still full of ammunition rounds. Not a shot had been fired in defense. An inquiry later stated, "the state of battle readiness and response to the evolving threat was determined to be unsatisfactory." (1:26) What can be learned, if anything, from the unfortunate attack on the USS Stark?

Lessons Learned

The ultimate goal for a Harpoon-striking B-52 is to have its Harpoon missile strike its target without enemy defenses being employed against the incoming missile. Compared to the Mirage F-1 fighter, the B-52 would appear as large as a barn on an enemy's radar scope. When matched against the new B-1 bomber, the B-52's reflectivity is multiplied by a factor of 100. It is difficult to imagine that a B-52 under radar contact can lull an enemy's ship into complacency. The USS Stark fell prey to one of the principles of war, surprise, and was caught off guard. The Iraqi F-1 aircraft, however, was not a surprise for it was detected and identified by the U.S. airborne warning and control system (AWACS) surveillance aircraft as the fighter left Basra and headed southeast towards the Stark. (28:38) During this period, the Stark was participating in a two-way computer data exchange with two other ships, the Coontz and the Lasalle, and the U.S. Air Force AWACS aircraft. Information on airborne contacts, such as geographical position, course speed, altitude and assumed or confirmed identity, was automatically relayed to each unit participating. (39:1164) This means two hours or 350 miles of early warning was provided about the Iraqi jet's presence. Apparently, the Stark's SPS-40 air warning radar detected the Iraqi aircraft at about 200 miles. (28:38) The Mirage's actions, on the other hand, took the ship by total surprise.

Perhaps one of the biggest threats to the B-52 would be an adversary's AWACS. This would allow relatively easy detection of the B-52 against a homogenous background and enable the enemy to deploy fighters at the incoming B-52. The scenario could result in either the B-52 being shot down or terminating the Harpoon attack before the launch point. With this in mind, employment of the B-52 in a Harpoon attack scenario should be in an area void of enemy AWACS-type aircraft.

It is interesting to note in the attack against the Stark that the first detection of actual missile launch was by the human eye, as the seaman lookout detected a bright flash. Enroute the missile could be seen as a blue flame traveling towards the ship. Since the attack took place after sunset, the darkness allowed visual detection of the Exocet. A better time of day should be selected for launching a Harpoon missile, such as during daylight hours from sunrise to sunset. Due to the small size and profile of the missile, it is extremely difficult to detect visually, except for a visible flame such as occurred during the evening hours with the Stark. One of our authors, Lieutenant Colonel Mark Petersen, was onboard the first, live B-52 operational test and evaluation launch of the Harpoon missile at Loring AFB, Maine. Three pilots on that flight had great difficulty picking up the white missile after launch against the sea below. Only through watching the chase aircraft were they able to see the missile, and then it appeared as a small, white speck racing across the ocean. A different missile color would have made detection even more difficult.

The B-52G is capable of carrying 12 Harpoon missiles externally under the wings. The intent is to saturate the enemy defenses with Harpoon missiles to ensure a successful strike. In the Stark attack, the two missiles struck approximately 25 seconds apart. If the Stark's defenses had been enabled, there is a good likelihood both missiles could have been destroyed. However, if both missiles had arrived simultaneously, the targeting factor for the Stark's defenses would have been increased measurably. Currently for the B-52G, the launch interval between employed Harpoon missiles is just under 30 seconds. In order to effectively complicate the enemy's defensive actions, this interval must be reduced significantly and hopefully to less than five seconds.

An important characteristic of a single anti-ship missile is its destructive capacity. The anti-ship missile possesses an obvious cost advantage for the attacker by exchanging a few anti-ship missiles worth hundreds of thousands of dollars each for a high-value target worth hundreds of million dollars. (44:53) Even though the Stark was struck by two missiles, only one detonated. Studies have been performed to determine the number of anti-ship missiles necessary to kill (sink) a particular type of ship. However, in light of our limited supply of Harpoon missiles, it does not appear prudent to attack ships with a must-kill capability. Instead, employment strategy should center around disabling a ship such as what happened in the Stark strike. This will put a ship out of commission for months and possibly render the ship ineffective for the remaining conflict.

The devastating effect from a sole missile can be seen in the Stark attack. The ensuing fire that the missile ignited became so intense that it melted portions of the Stark's aluminum superstructure. The radiation of heat through the metal ship caused spontaneous blazes in new locations. The Stark was saved by crewmen who acted quickly to flood the forward missile compartments to prevent an explosion. The close proximity of other United States warships and a private firefighting tugboat was a primary factor in salvaging the ship. Some 20 hours elapsed before on-station personnel were able to extinguish the fire. Except for hand-held emergency radios, routine means of communication, such as phones, intercom and radios, were cut off. (1:26) Our task for employing the Harpoon missile centers around doing the most with the least. With our existing limited resources, every launched missile must have a high percentage chance of hitting its target. We cannot afford to use missiles unnecessarily or in an inefficient employment mode.

CHAPTER IV

MEMORANDUM OF AGREEMENT

The U.S. Air Force and Navy agreed in the Key West Agreement of 1948 to the concept of use of Air Force assets in collateral duties to support the Navy's primary sea control mission. Although several attempts were made by the two services to coordinate and cooperate since that time, little success was realized due to individual agendas and specific concerns of the respective branches of service.

World realities of the early 1970s forced the two services to reevaluate their positions and again seek common cause in their endeavors. Specifically, the U.S. military witnessed a severe reduction in U.S. Naval forces, while the Soviet Union commenced a great expansion of its surface, subsurface, and Soviet naval aviation forces. In 1975, the USAF/USN Collateral Functions Agreement was signed which stated that Air Force resources will be trained for tasks (a) which will complement and supplement sea control operations, and (b) which encompass an inherent, existing Air Force capability. (5:42) In response to the agreement, Air Force B-52 assets were used in two exercises to evaluate their effectiveness in the sea role of enemy ship surveillance. The exercises were determined to be successful and later in that year, an attempt by the Air Force and then Defense Secretary James R. Schlesinger was made to coordinate purchase and development of a launch capability for Harpoons on existing B-52 aircraft.

Although this plan failed, interest in this new use of the aging B-52 continued.

In 1981, the Air Staff requested a study on the potential use of the B-52 in a maritime role, and in 1982, the Secretary of Defense approved the Air Force's conclusion that the aircraft was well suited for the role as an anti-ship weapon system. The sinking of the HMS Sheffield by airborne missile attack in the Falklands War reinforced the Air Force's study by demonstrating the capability of air-to-surface weapon systems against a surface target.

In March 1983, the B-52 completed test launchings on the Pacific Missile Range in California and in May 1984, three B-52Gs were Harpoon certified. By June 1985, the Air Force successfully completed necessary training and certification requirements to designate two B-52 squadrons (30 aircraft) as fully operational for Harpoon employment. (5:41)

Today, successful exercises conducted with the B-52 and ISAR-equipped P-3s have demonstrated the capability to project a lethal airborne force against surface ships in the theater. Although incompatibility with the two systems has caused problems in the past, both services are currently addressing these problems and are progressing toward development of a truly joint task force. But are there problems yet to be resolved? Only through a joint Air Force/Navy dedicated effort to formulate and agree to an established role for the B-52/P-3 hunter-killer force can a viable role be created.

CHAPTER V

STRATEGY CONSIDERATIONS

As stated in the introduction, the United States' naval strategy is to project force against the Soviet forces by taking the fight to the enemy. In taking the fight to the enemy, three questions must be asked. Where will the enemy be located, what type of forces will be encountered, and what U.S. weapon systems are most effective against the enemy? The first two questions are unknown, and therefore contingencies must be planned for possibilities. The third question must be answered based on the force structure available and capabilities of the weapon platforms assigned. These are all hard questions that must be addressed in order to be ready if the time comes to face the Soviet threat. This section will address these questions and attempt to provide reasoning for choices and conclusions reached.

Where are Soviet forces going to fight?

The buildup of Soviet forces into a "blue water" Navy, the continuing development of their first overseas base at Cam Ranh Bay, Vietnam, and their increased political influence in numerous parts of the world demonstrate possible Soviet intent to adjust their earlier strategies of coastal defense in the Soviet home waters. Although past Soviet force structure stressed defensive weapon platforms, recent Soviet efforts at conventional aircraft carrier construction demonstrate the capability for a more offensive posture. But should this, in itself, cause the U.S. Navy to reassess its strategy for a possible confrontation? The answer is a "qualified yes."

The Brezhnev, the Soviet's large deck carrier, was launched in 1985. It is a 65,000 ton vessel, 984 feet long with an estimated maximum speed in excess of 32 knots. She is designed to carry some 60-70 fixed-wing aircraft, including the SU-27 Flanker and MIG-29 Fulcrum. (8:40) At present, it has not been outfitted with an aviation wing and will probably not be operational for some time. In addition, the Soviets have no experience at conventional launch capability from a carrier and will have to learn this difficult task prior to their carrier being an operational threat to U.S. forces. The currently operational Kiev with its V/STOL Yak-36 Forger is not considered a severe threat by U.S. forces due to the Forger's lack of combat radius and minimum weapon load. Even with the two Soviet conventional carriers operational, the majority of Soviet surface forces consist of older ships with limited weapon standoff range. (Table 5-1)

Although consideration must be given to what type of forces will be developed for the future, consideration must also be given to what time element is involved for new construction, what economic restraints are being imposed on the Soviet military, and what they are building now. The Soviet naval forces that have made significant strides in the past few years are their submarine and Soviet Naval Aviation (SNA) forces. New construction, quieting programs, and advance metallurgy applications made their submarine fleet a highly dangerous arm of their Navy. Additionally, the Soviets introduced increasing numbers of the Backfire bomber with sophisticated air-to-surface missiles to the growing SNA bomber force. Both the submarine and SNA forces provide required substance and depth to the Soviet Navy. (Tables 5-2, 5-3, and 5-4 provide Soviet surface, submarine and anti-ship air assets in the Soviet naval inventory. Tables 5-5 and 5-6 list Soviet forces in the Pacific theater.)

In consideration of the above, the question of where the Soviets will fight is dependent on their strength. Although the submarine force is capable of independent action and can venture into the open oceans and SLOCs with minimal threat from U.S. surface forces, Soviet surface ships have little inherent capability to attack U.S. forces without support. This support must come from either the submarine force or the air coverage provided by the SNA. This limits the Soviet surface forces from operating far from support bases such as Cam Ranh Bay or home water ports such as Petropavlovsk or Vladivostok. There is much documentation to support this premise.

In an article written for the Armed Forces magazine, Wing Commander A. F. Nicholas, MBE, RAF chronicles the development and current buildup of the Soviet Pacific Fleet. He describes Soviet peacetime and wartime objectives based on their political, as well as defensive needs. Nicholas states that peacetime objectives include:

> In the support of state policy, the Pacific Fleet will continue to maintain an autonomous squadron of warships, submarines and auxiliaries in the Indian Ocean...deployment of one or two destroyers/frigates to Cam Ranh Bay to serve as area guardships and shadowing of U.S. Navy's Third and Seventh Fleet forces...and to react to a situation in Southeast Asia that the Soviets would wish to exploit.

In the outbreak of hostilities, Commander Nicholas suggests that Soviet objectives would change. He believes the Soviet Pacific Fleet will remain near home waters. He states the Soviet wartime objectives as:

> With a 6,000 mile-long coastline, the support of land forces and the protection of local sea lines of communication across the Seas of Japan and Okhotsk must figure high on the fleet's priority list...the problems facing the (Soviet) fleet on an East-West confrontation would be complex enough, but they could be further compounded by Chinese and/or Japanese involvement. (33:309)

In the Rusi Journal for Defense Studies, Jan S. Bremmer debates the possibilities of the strategy involving Soviet SSBN bastions in the Soviet Navy. This strategy states that Soviet SSBN forces would remain in homewaters as a "strategic war reserve." Bremmer states that if the proposed strategy is correct, then a role of the Soviet surface fleet is to protect this submarine force from Western attack:

> Once it was accepted that the Soviets had moved from an anti- to a pro-SSBN strategy, the implication for the roles and missions of the Soviet Fleet generally was obvious: ships and aircraft once assigned against U.S. strategic submarines would now be committed to defending the Soviet Union's SSBN sanctuaries. (4:21)

Finally, the Office of Naval Intelligence reported in the Naval Review Proceedings in 1987 that:

> Soviet naval exercises in waters close to the Soviet mainland may reflect, among other things, the following:
>
> * Economic constraints.
>
> * Increased emphasis on the Navy's role in close-in, combined-arms operations.
>
> * A possible intention to develop more flexible employment options for naval forces and to increase their combat readiness to counter the U.S. maritime strategy's deployment of forces near Soviet territory and SSBN operating areas at the outset of hostilities. (35:102)

The article further states the reason for close-in Soviet operations:

> Fleet air defense for ships operating beyond the range of land-based tactical air is one of the Soviet Navy's

greatest weaknesses. Overcoming this weakness is a high priority, because it affects both the combat stability of the strategic offensive force and the ability to defend the homeland from air and seaborne attack. (35:103)

What is the Soviet threat?

In developing strategic doctrine and the required force structure to defeat the Soviet threat, one must consider the size of the theater and the enemy assets in the tactical theater. The Pacific theater is enormous in size. Geographically, it is the largest of the U.S. commands including 100 million square miles (52 percent of the earth's surface.) It stretches from the west coast of the Americas to the east coast of Africa and from the Arctic to the Antarctic. (16:7)

In the Pacific theater, the Soviet presence has significantly expanded in recent years. The Pacific fleet is the largest of the Soviet Union's four fleets and comprises more than thirty percent of the total Soviet Navy ships and submarines. This fleet possesses 84 major combatants, including two of the four Kiev class aircraft carriers. In addition, there are 130 submarines currently assigned, including 25 of 62 ballistic missile units, and one-third of Soviet Naval Aviation forces, including the new TU-26 Backfire and the older TU-16 Badger anti-ship strike aircraft. (Table 5-7) (17:35)

As of March 1985, the United States maintained a Pacific fleet of some 94 surface warships. Although the U.S. surface force is balanced with the Atlantic fleet's compliment of 101 ships, there is a large disparity in submarine forces. The Pacific fleet has only five nuclear ballistic missile carrying submarines (SSBNs) and 39 nuclear attack submarines (SSNs), while the Atlantic fleet is composed of 31 SSBNs and 56 SSNs. In addition to surface and subsurface forces, each U.S. fleet maintains 13 squadrons of land-based P-3C anti-submarine maritime reconnaissance aircraft. (36:56) These P-3C squadrons, in addition to S-3 Vikings ASW squadrons onboard the carriers, are assigned dual tasking for the fleet. This tasking includes anti-submarine warfare (ASW) prosecution of Soviet submarines and anti-shipping missions against Soviet surface units.

Which U.S. weapons are most effective?

As stated previously, the U.S. Pacific Fleet surface ships are superior in numbers and capabilities to their Soviet counterparts. However, the disparity in subsurface assets and the threat of the land-based airborne anti-ship capability of the Soviets is significant. In view of the above, a synergistic mix of U.S. forces must be fielded to accentuate the positive capabilities of the U.S. fleet, while lessening the impact of the enemy's strengths.

In determining which weapons systems would be most effective against the Soviet surface fleet, each component of the U.S. naval force must be considered. Although the U.S. surface fleet with its combined surface, subsurface, and air power has significant advantages over the Soviet surface fleet in an open ocean scenario, if the Soviet fleet remains in home waters at the outset of hostilities, increased firepower of the Soviet SNA and coastal submarine defenses becomes a serious disadvantage to U.S. ships within the combat radius of these weapons.

U.S. submarine force capability to destroy the Soviet surface fleet is significant. Although the U.S. Pacific submarine force is small by comparison to Soviet submarine forces, this component of the U.S. Navy is an extremely lethal element. The problem that arises is there are too many targets in too large of an area. If the Soviets order their submarine force to sea for coastal defense and SLOC intervention, the U.S. submarine force would be extremely busy in three roles. These roles would include: locating and destroying enemy submarines, protecting the U.S. surface fleet from Soviet submarine attack, and finally, destroying enemy surface units. Although this U.S. force could accomplish its mission over time, the desire for a fast response to Soviet aggression would not be realized.

A third alternative for attacking Soviet surface units is carrier-based aviation. In World War II, carrier aircraft proved their worth in attacking enemy surface ships. The primary disadvantage of this premise is again, the requirement for the carrier to enter within combat range of the Soviet SNA. Even in providing refueling for these aircraft, the carrier could be put in jeopardy.

Although use of carrier aviation or submarines to defeat enemy surface forces are viable solutions, an alternative is available which can provide significant destructive power against Soviet units while allowing U.S. naval assets to be used more effectively. This U.S. force is highly mobile, quick reactive, and can provide substantial firepower against enemy targets in an all weather, high threat environment. Finally, this force is comprised of "off-the-shelf" weapon platforms in the current inventory. This hunter/killer force is comprised of the Air Force's B-52G, the ISAR-equipped Navy P-3C aircraft, and the Harpoon missile system. Why this combination? These assets have tactical capabilities that compliment each other in their respective tactical roles. To have a better understanding of this, an evaluation of each unit is presented.

P-3C Orion

The Navy P-3 Orion is a long-range, all weather aircraft with a combat radius of approximately 2100 miles. Although designed primarily as a submarine hunter, the aircraft is also designed as a surface surveillance platform with radar ranges of over 150 nautical miles. The communications suite has dual HF and UHF capability in either a secure or unsecure mode and an unsecure VHF radio. The onboard navigation suite has dual INS in concert with an Omega navigation system which provides precision navigation accuracy. The aircraft has the capability to carry 84 sonobouys and eight MK-46 torpedoes for its anti-submarine mission. As part of the P-3's anti-shipping role, it is designed to carry six AGM-84 Harpoon missiles on the wings for external launch. The P-3's most significant asset is the recent introduction of the new APS-137 inverse synthetic aperture radar (ISAR) which was designed as an upgrade to its current radar. This radar provides a continuous imaging capability through the addition of ISAR processing, which generates true two-dimensional radar images of any selected ship target. (27:140) This state-of-the-art radar allows for significant increased capability in target identification, as shown by Diagram 1 and 2.

The limiting factor for the P-3C aircraft is its inability to provide any type of jamming capability and its less than optimum firepower due to constraints on Harpoon carrying capacity. These shortfalls are mitigated by the marrying of the P-3C with the B-52. The B-52's weapon load capacity of 12 Harpoon missiles externally and the ability to carry eight additional missiles internally with the addition of a common strategic rotary launcher provides the firepower needed against all ships in the current Soviet inventory. (Table 5-8)

B-52G Stratofortress

The Boeing B-52 Stratofortress is a large eight-engine aircraft built in the late 1950s as a long-range, high-altitude nuclear bomber. A series of avionics, structural, and flight control modifications over the years provided the aircraft with an excellent low-altitude penetration capability. With a crew of six, the aircraft has a combat radius of over 3900 miles that can be extended by air refueling. Its maximum speed of 390 knots at low altitude gives the B-52 an impressive high-speed dash capability for such a large aircraft. Currently, there are two squadrons of B-52s (30 aircraft) modified to carry the Harpoon missile. Each aircraft can carry a maximum of 12 missiles (six missiles on each of two external pylons.) The B-52's communications capability consists of two UHF radios and one HF radio. One UHF is secure capable and the other can use the Air Force Satellite Communications System (AFSATCOM), giving it a truly worldwide communications capability. The aircraft has a dual INS navigation system tied into its advanced digital search radar and weapons delivery system, that was installed over the last five years into all B-52 aircraft. Also enhancing the B-52's maritime surveillance capabilities is the electro-optical viewing system (EVS), consisting of a low-light television camera and a forward-looking infrared sensor, both mounted under the nose of the aircraft.

For self-defense, the aircraft has four tail-mounted 50-caliber machine guns and an impressive, state-of-the-art array of electronic countermeasures (ECM) equipment. It has both receivers and jammers for all land-based, shipborne, and airborne early-warning, fire control, and intercept radars. It also carries a large amount of chaff for radar deception and flares to counter heat-seeking missiles.

The B-52 is ideally suited for the hunter-killer role due to its extremely large combat radius, high-speed dash, air refueling, large weapons carrying capacity, and ECM capabilities. These advantages more than offset its high operating cost and large radar return presented to the enemy.

AGM-84 Harpoon Missile

The AGM-84 Harpoon missile was developed by the McDonnell Douglas Aerospace Company under contract to the U.S. Navy. The missile is an all-weather anti-ship weapon which can be launched by several aircraft models including: the P-3 Orion, A-6E Intruder, B-52G Stratofortress, S-3 Viking, and the Nimrod. The missile provides its own guidance after initial computer input by the launch aircraft through use of an attitude reference system and digital computer. It was specifically designed for optimum target acquisition over water and penetration of surface ship defenses by maintaining minimum sea-skimming altitude enroute to its target. Once the missile arrives in the designated search area of the target, the system's active seeker locks-on to the target and maintains its seeker until impact. The warhead is a conventional 500 pound high-explosive blast type that is set to detonate after penetration of the ship's hull. There are currently four variations of the missile providing various options. These variations are:

AGM-84A Initial production model which uses a terminal pop-up maneuver.

AGM-84B Eliminated the pop-up to allow for low-altitude defense penetration.

AGM-84C Improved AGM-84A with pop-up mode.

AGM-84D Current production model. Increased range, waypoints, and selectable terminal maneuvering. (22:870)

Although small in relative terms to other anti-ship missiles, the capability of the missile proved itself in both test and evaluation and real world engagements. In March 1983, the U.S. Air Force conducted three successful live firings of the Harpoon missile on the Navy's Pacific Missile Test Range. (5:43) The Navy completed several successful tests with the missile aboard surface, subsurface and airborne platforms since introduction of the missile in 1977. Strategic Air Command pursued an active operational test and evaluation of the missile and successfully completed live launches at Loring AFB, Maine, and Andersen AFB, Guam. Recently, a single Harpoon missile fired by a Navy A-6 in the Gulf of Sidra critically damaged a Lybian-owned Soviet Nanuchka class missile corvette. The damage sustained in the attack aptly demonstrated the Harpoon's destructive capability as an air-launched anti-ship missile.

The One-Two-Three Punch

In the previous section, the brief discussions of the

P-3, the B-52, and the Harpoon missile system were presented to describe the basis for a highly lethal combat force consisting of current off-the-shelf weapon systems. This combat force could be the vanguard for destructive action against the Soviet surface fleet without placing U.S. surface and subsurface forces in jeopardy.

Although each of the weapon systems has limited capabilities they do provide respective attributes for a synergistic approach as a hunter-killer weapon system to the problem. The P-3 is incapable of carrying the needed number of weapons to target. Although it can successfully attack a single target with sufficient force for successful mission accomplishment, if multiple targets are encountered, the P-3 will have to be assisted by two additional P-3 aircraft for every B-52 not on the mission. In the case of a large grouping of targets, several P-3s would be required which could severely degrade the mission.

In addition, P-3 assets will be scarce in the theater due to its primary mission of anti-submarine warfare and protection of the battle group. The primary benefit of the P-3, as stated earlier, is the ability to detect and classify surface ships at a substantial standoff distance. This ability precludes mission termination due to surface-to-air missile threats of most Soviet ships.

Except for sea surveillance, the B-52 has had little need for broad ocean area search and identification in the past. The range of the B-52 radar is inadequate for its anti-shipping role. Also, the radar does not have the capability to classify surface ships. The B-52's contribution to the force is its ability to carry substantial numbers of missiles and its extended combat radius. This is extremely important, especially if the another platform cannot launch combat missions from a nearby country. Presently, the B-52G can carry 12 Harpoon missiles externally under its wings. With the addition of a common strategic rotary launcher and eight Harpoon missiles internally, the B-52G would be capable of carrying 20 Harpoons equalling a force of ten A-6 aircraft. This massive firepower can provide the destructive force needed to destroy the biggest and most heavily defended ship of the Soviet Navy.

Finally, the Harpoon missile has minimal range capability which does not allow for overt attacks against the enemy having extended surface-to-air defensive missile (SA-N-6) capabilities. It does have three attributes that make it an impressive partner to this triad. Its 500 pound warhead with delayed reaction detonation gives it an outstanding destructive capability. The sea-skim trajectory and optional terminal maneuvering makes it a very difficult target to defend against. Lastly, its shoot-and-forget capabilities allow the launch platform to depart the area immediately after launch, increasing the survivability of the strike aircraft.

TABLE 5-1A

SOVIET ANTI-SHIP MISSILES

SURFACE SHIP LAUNCHED

MISSILE	WARHEAD	SPEED	RANGE	SHIPS
SS-N-2A STYX	837 LBS	HIGH	20NM	OSA,MATKA,
SS-N-2B	same	SUB-SONIC	29NM	TARANTIL
SS-N-2C	same	same	45NM	KASHIN,KILDIN
SS-N-3A SHADDOCK	2,200 LBS	HIGH	250NM	ECHO II SSGN
SS-N-3B	OR	SUB-SONIC	250NM	KYNDA CG,
SS-N-3C	NUC YIELD	same	400NM	KRESTA CG
SS-N-7	1,100 LBS OR NUC YIELD	MACH 0.95	30NM	CHARLIE I SSGN
SS-N-9 SIREN	1,100 LBS OR NUC YIELD	MACH 0.9	60NM	CHARLIE II/III SSGN
SS-N-12 SANDBOX	2,200 LBS OR NUC YIELD	MACH 2.5	300NM	KIEV CV,KLAVA CG, ECHO II SSGN
SS-N-14 SILEX	UNK	UNK	30NM	KARA,KIROV, KRESTA II, UDALOY
SS-N-19	UNK	UNK	300NM	KIROV,OSCAR
SS-NX-22	HE or NUC YIELD	UNK	60NM	SOVREMENNY, TARANTUL II

Source: Jane's Publishing Company Limited, London, England. Jane's Aircraft of the World, 1987.

TABLE 5-1B

AIRCRAFT LAUNCHED

MISSILE	WARHEAD	SPEED	RANGE	AIRCRAFT
AS-2 KIPPER	1,100 LBS	MACH 0.9	100NM	BADGER C/G
AS-4 KITCHEN	1,100 LBS or NUC YIELD	MACH 2.7-3.5	150-250NM	BACKFIRE B, BEAR, BLINDER
AS-5 KELT	1,100 LBS	MACH 0.9	100NM	BADGER C/G
AS-6 KINGFISH	1,100 LBS or NUC YIELD	MACH 2.7	150-250NM	BADGER C/G
AS-11 (replacement for AS-4)	CONV/NUC YIELD	MACH 3.5	500NM	UNK

(NOTE: This list contains only those missiles currently in the Soviet inventory with sufficient destructive capability and range to be of threat to U.S. naval surface forces.)

Source: Munro, Neil, "Soviet Antiship Missiles", International Combat Arms, July 1987.

TABLE 5-2

SOVIET NAVY SURFACE COMBATANTS

CARRIERS	6
KIEV	4
MOSKVA	2
CRUISERS	37
KIROV CGN	2
SLAVA CG	2
KARA CG	7
KRESTA II CG	10
KRESTAI CG	4
KYNDA CG	4
SERDLOV CL	8
DESTROYERS (DDG/DD)	63
SOVREMENNY	7
KASHIN MOD	6
KILDEN MOD	3
UDALOY	8
KASHIN	13
KANIN	6
KOTLIN	6
SKORY	5
KILDIN	1
ESCORTS	168
TOTAL	274

Source: "The Military Balance", The International Institute for Strategic Studies, August 1987.

TABLE 5-3

SOVIET NAVY SUBMARINE FORCES

SSBN	76
CRUISE MISSILE SUBS	67
SSGN (NUCLEAR)	51
SSG (DIESEL)	16
ATTACK	200
SSN (NUCLEAR)	76
SS (DIESEL)	124
OTHER ROLES	86
COMMS	4
RESEARCH	4
RESCUE	2
TRAINING	4
RESERVE	72
TOTAL	436

Source: The Military Balance, The International Institute for Strategic Studies, August 1987.

TABLE 5-4

SOVIET NAVAL AVIATION

BOMBERS		390
	TU-26 BACKFIRE	130
	TU-16 BADGER	230
	TU-22 BLINDER	30
FGA		195
	YAK-38 FORGER	100
	SU-17 FITTER	75
	SU-24 FENCER	20
ASW AIRCRAFT		219
	TU-142 BEAR	65
	IL-38 MAY	59
	BE-12 MAIL	95
	HELICOPTERS	295
	MI-14 HAZE	100
	KA-25 HORMONE	115
	KA-27 HELIX	80
MR/ECM AIRCRAFT		180
	TU-16 BADGER	105
	TU-22 BLINDER	10
	TU-95 BEARS	50
	AN-12 CUB	15
	HELICOPTERS	25
	KA-25 HORMONE	25

Source: The Military Balance, The International Institute for Strategic Studies, August 1987.

TABLE 5-5

MAJOR NAVAL UNITS OF THE SOVIET PACIFIC FLEET

TYPE	NUMBER	CLASS	SIZE (TONNAGE)
AIRCRAFT CARRIER	2	KIEV	38,000
BATTLECRUISER	1	KIROV	23,500
CRUISERS	4	KARA CLG	10,500
	3	KRESTA II CLG	7,600
	2	KRESTA I CLG	7,500
	2	KYNDA CLG	5,700
	1	SVERDLOV CLCP	17,200
	1	SVERDLOV CCL	17,200
DESTROYER	1	SOVREMENNY DDG	7,850
	1	UDALOY DDG	8,300
	4	KASHIN DDG	4,900
	3	KANIN DDG	4,450
	2	SAM-KOTLIN DDG	3,850
	4	MOD-KOTLIN DDG	3,750
FRIGATES	2	KRIVAK 3 FFG	3,800
	5	KRIVAK 2 FFG	3,800
	6	KRIVAK 1 FFG	3,800
SUBMARINE FORCES	26	SSGN/SSG	
	50	SSN/SS	

Source: Nicholas, A. F., Wing Commander, RAF (Ret), "The Fifty-Year Development of the Soviet Pacific Fleet", Armed Forces, January 1986.

TABLE 5-6

AIRCRAFT OF THE SOVIET PACIFIC FLEET

BOMBERS			TANKERS	
TU-26 BACKFIRE		1 REGIMENT	TU-16A BADGERS	15
TU-16 BADGER		3 REGIMENTS		
	TOTAL	110 AIRCRAFT		
RECONNAISSANCE			ANTI-SUBMARINE WARFARE	
TU-95 BEAR			TU-142 BEAR	
TU-16 BADGER F			IL-38 MAY	
TU-16 BADGER H/J/K			BE-13 MAIL	
	TOTAL	60 AIRCRAFT	TOTAL	170
FIGHTER/GROUND ATTACK			HELICOPTERS	
YAK-38 FORGER			ASW	90
SU-17 FITTER			EW/MISC	20
	TOTAL	70 AIRCRAFT	TOTAL	110

Source: Nicholas, A. F., Wing Commander, RAF (Ret), "The Fifty-Year Development of the Soviet Pacific Fleet", Armed Forces, January 1986

TABLE 5-7
SOVIET NAVAL AVIATION (SNA)
AIRCRAFT

TYPE	DESCRIPTION
TUPOLEV TU-26 BACKFIRE-C	Out of the 250 Backfires in the Soviet inventory, 100 are estimated to be in the SNA. The primary armament of one AS-4 Kitchen in the center fuselage, or two Kitchen missiles on each wing. Maximum unrefueled combat radius of 2,160NM with a level speed at high altitude of MACH 2.0. Service ceiling unknown. Estimates are that the SNA will eventually replace the Badger-C and Blinder-B aircraft with the Backfire-C in the anti-ship role once production of 400 Backfires is completed for the SNA.
TUPOLEV TU-16 BADGER-C	In 1986 there were approx 240 attack aircraft of this model in Soviet Naval Aviation (SNA). This version is equipped to carry the AS-2 Kipper and the AS-6 Kingfish anti-ship missiles. Maximum range for the aircraft is 3,885NM. Maximum level speed is 535 kts with a service ceiling of 40,350 ft.
TUPOLEV TU-22 Blinder-B	There are currently approximately 35 TU-22 Blinder-Bs in the SNA that have the capability to carry a single AS-4. In addition, there are 20 Blinders in the SNA inventory used for reconnaissance purposes. The Maximum unrefueled combat radius for the aircraft is 1,565NM. Maximum level speed is MACH 1.4 with a service ceiling of 60,000FT.

Janes Aircraft of the World,1987.

TABLE 5-8
ESTIMATED ANTISHIP MISSILE REQUIREMENTS

CLASS of SHIP	YEAR DEL to FLEET	LENGTH of SHIP	WARHEADS to DISABLE	ANTI-MISSILE DEFENSE	PRICE of ADMISSION
RIGA	1952	300	1	NA	1
PETYA	1962	265	1	MG	2
SKORY	1950	395	2	SG	2
KOTLIN	1955	420	2	2SG	2
KILDIN	(1975)	415	2	2MG,2SG	3
SAM KOTLIN	(1966)	420	2	MS,2SG	3
KANIN	(1963)	455	2-3	MS,SG	3
KYNDA	1962	465	2-3	MS,2MG	3
KASHIN	1962	470	2-3	2MS,2MG	3
KASHIN	(1975)	480	3	2MS,2MG,2GA	6
KRESTA I	1966	510	3	2MS,2MG	4
MOSKVA	1967	625	4	2MS,2MG,(TS)	6
KRESTA II	1969	520	3	2MS,2MG,2GA	7
KRIVAK	1970	410	2	2SS,MG,(TS)	5
SVERDLOV CC	(1972)	690	5	SS,4GA	8
KARA	1972	570	4	2MS,2SS,2MG 2GA,(TS)	10
KIEV	1975	900	7	2MS,2SS,2MG 4GA,(TS)	15
KIROV	1980	755	5-6	2MS,2SS,MG, 4GA,(TS)	12

CODE:

DESIGNATOR	WEAPON SYSTEM
SG	SHORT-RANGE GUN
MG	MED-RANGE GUN
SS	SHORT-RANGE SURFACE-TO-AIR MISSILE
MS	MED-RANGE SURFACE-TO-AIR MISSILE
GA	30 MILLIMETER GATLING GUN
X	NUMBERS PRECEDING DESIGNATOR INDICATE NUMBER OF SYSTEMS
TS	INDICATES TOP SAIL RADAR INSTALLED FOR IMPROVED TARGET ACQUISITION
(YEAR)	DATE IS GIVEN IN PARENTHESIS WHEN A CLASS OF SHIP HAS UNDERGONE CONVERSION OR A MAJOR MODIFICATION

Information compiled from: Cruise Missiles- Technology, Strategy, Politics, The Brookings Institution, Washington, D.C., 1981.

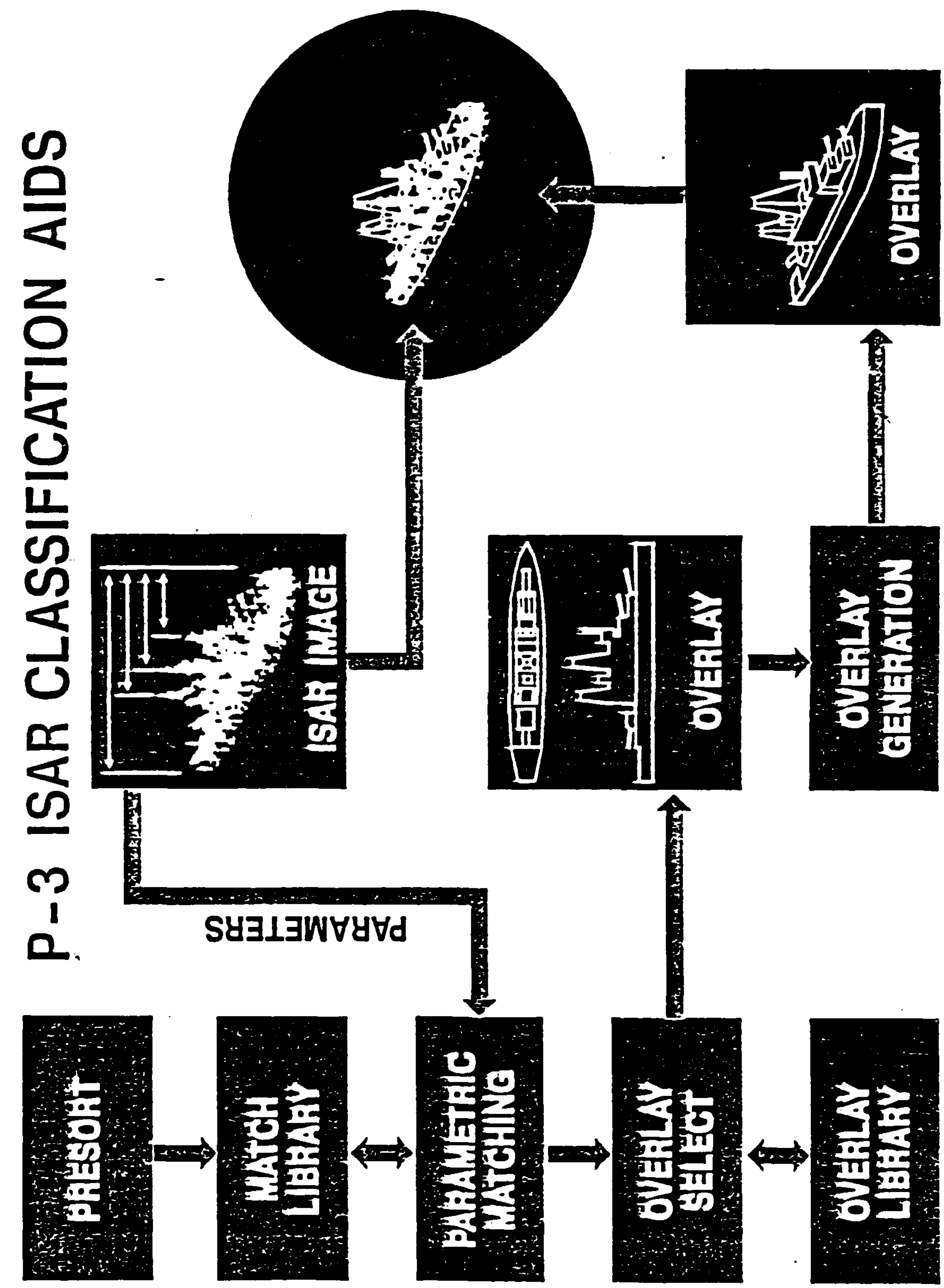
P-3 ISAR CLASSIFICATION AIDS
PRESORT
MATCH LIBRARY
PARAMETRIC MATCHING
OVERLAY SELECT
OVERLAY LIBRARY
PARAMETERS
ISAR IMAGE
OVERLAY
OVERLAY GENERATION
OVERLAY

Diagram 1

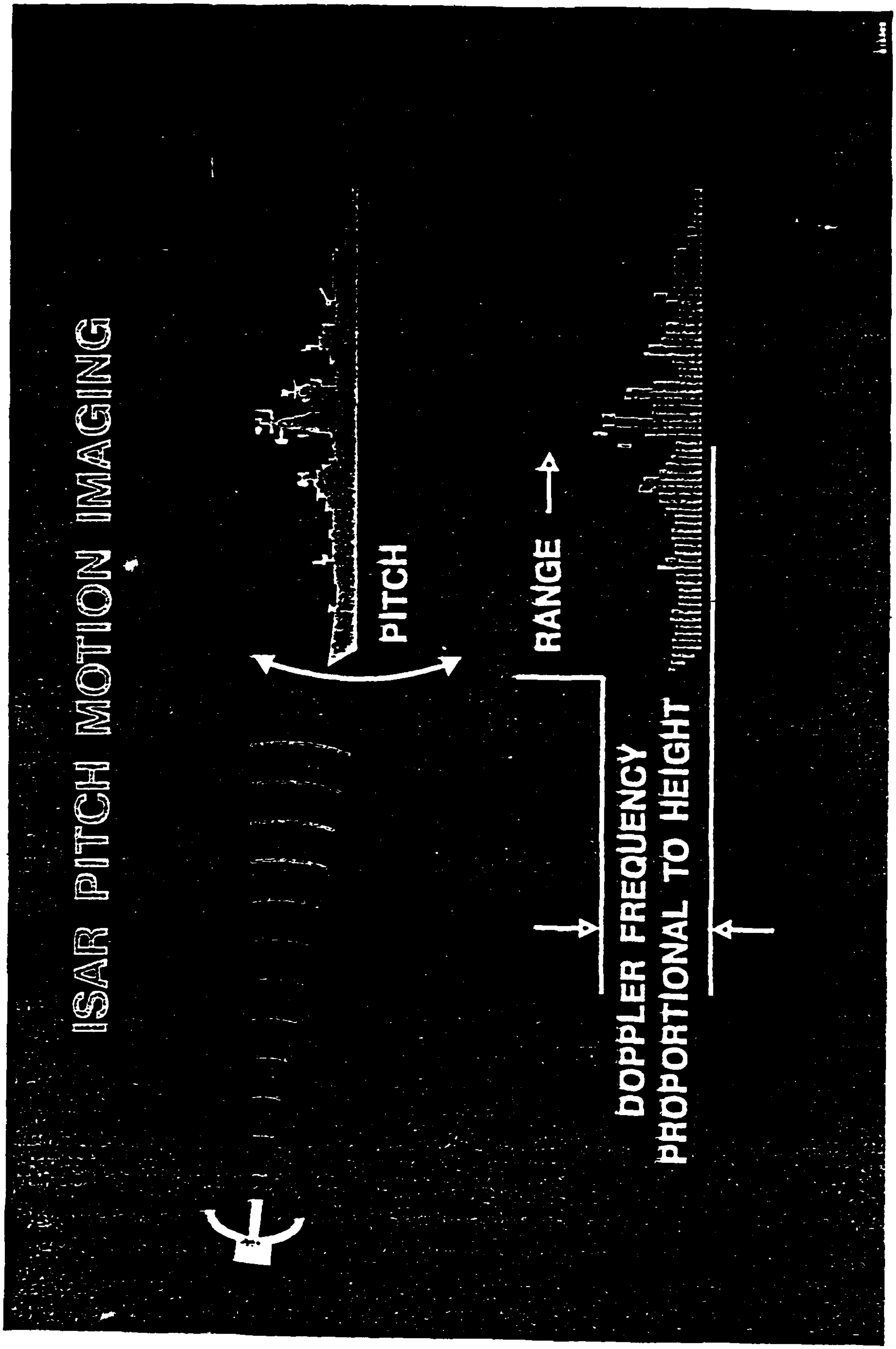
ISAR PITCH MOTION IMAGING
PITCH
RANGE
DOPPLER FREQUENCY
PROPORTIONAL TO HEIGHT

Diagram 2

CHAPTER VI

ANTI-SHIP MISSILE DEFENSES

Defenses against anti-ship missiles like the Harpoon and Exocet have been varied in both principle and effectiveness. In the Falklands War, the British hurriedly devised tactics to protect against Exocet missile attacks. Initially, barrages of chaff clouds were deployed whenever any air attack took place. Since only two destroyers carried the Sea Wolf anti-missile missile system, an ingenious tactic was used to protect the carriers. A helicopter with a noise jammer would be deployed between a missile and the carrier. When the missile shifted to home-on-jam mode, it would follow the helicopter that would gradually move away from the ship. This worked fine as long as the helicopter increased altitude to avoid the sea-skimming missile. (25:22)

Today, a modern fleet's defense against sea-skimming anti-ship missiles must be layered. Long-range defenses are provided by carrier-based fighters, which hopefully would destroy the enemy launch aircraft. Medium-range defense consists of surface-to-air missiles like the U.S. Standard and British Sea Dart with ranges of 20-40 nautical miles. The second-generation Standard possesses roughly twice the range capability of the original model. (4:46) The close-range defense today is covered by a combination of short-range missiles and rapid-fire guns. The U.S. and NATO navies use the improved version of the Sea Sparrow missile, a modified Sparrow air-to-air missile, and the British Sea Wolf missile. Currently under development is the multinational Rolling Airframe Missile, a small but extremely effective point defense missile. It incorporates the motor, warhead, and proximity fuze from the Sidewinder air-to-air missile and the infrared seeker from the Army's Stinger missile. (4:49) The two other primary close-in weapons systems are the U.S. Phalanx and the Netherlands Goalkeeper. The Phalanx is a 20-mm Gatling gun, which fires 3000 rounds per minute out to an effective range of 600 yards. The Goalkeeper is a 30-mm radar-controlled Gatling gun which fires 4200 rounds per minute out to 1200 yards. (4:50) The main drawbacks of these systems are their limited ammunition storage capacity and inability to counter steep-diving targets. The Soviet Union has also deployed a Gatling system consisting of radar-controlled twin 30-mm guns each firing 3000 rounds per minute. (30:47)

CHAPTER VII

EMCON

To successfully strike an enemy's ship involves not only having a capable weapon and launch platform but the appropriate tactics for delivering that weapon. A vital part of those tactics is the procedure the crew uses in reaching the launch point. Since surprise is such a critical element of any attack, the crew must develop procedures to maximize their anonymity. One portion of this involves controlling external emissions to not alert the enemy of your presence or whereabouts.

Maintaining control of external emissions from an aircraft is contrary to how we're initially trained to fly, communicate, and fight. Today, the aircrew must not only be intimately familiar with all aspects of their mission but be able to anticipate their fellow cell mates actions. With detailed mission planning and discussing various contingencies, crews can fly entire missions together without talking to one another over the radios. This is very difficult in a large aircraft, when you are not flying in a wingtip position to see the other crew's visual signals.

Radio silence on the day of the mission begins during the preflight. Here, ground runners are needed to deliver messages from the control tower and wing senior staff to the cockpit. Messages, such as the crews air traffic control clearance with appropriate IFF code, must be carried to the crews. Prearranged times such as starting engines and start taxiing can be precoordinated with the control tower. Once the crew starts taxiing, light signals from the control tower will inform them of their clearance for takeoff. These actions all funnel into good operations security procedures. In flight, especially over United States airspace, radio silence must continue to the maximum extent possible.

Precoordination with the air route traffic control centers enables the bomber/tanker cell to fly on a prearranged flight path and altitude with only safety-of-flight information transmitted to the aircrews. Air refueling under radio silence is very straight forward, as visual signals from the tanker's rotating beacons and aerial refueling boom position tell the bomber pilot of the tanker's air refueling status. Unfortunately, total energy emission-out status cannot be maintained 100 percent of the time.

At different points in the mission, the B-52's navigational system requires geographical updates to maintain desired accuracy for its weapons. Prior to takeoff, a ground alignment of about one hour will stabilize the inertial navigational system (INS). This ground alignment also means fewer in-flight updates to the INS is necessary. In flight, the radar set should not be operated continuously for upgrading the system's accuracy. Instead, as an update comes along the route of flight, the radar navigator will go to operate, identify the radar fix point, and incorporate it into the system. It is important to update the system just prior to coast out, as it will likely be several hours before the next update is taken. This procedure will minimize radar emissions to enhance the B-52's chances for surprising the enemy or at least keep the aircraft from being detected later in the mission.

Through conscientious use of EMCON, the B-52 will be a more lethal weapon system due to its ability to surprise the enemy, despite its huge size. The chances of a successful attack will be enhanced and allow our precious assets to be used another day and in a different manner.

CHAPTER VIII

ATMOSPHERIC DUCTING

Normally, when planning a B-52 mission, every opportunity will be made to route the aircraft around enemy defenses or through mountainous terrain for terrain masking to prevent detection by those defenses. However, for a striking B-52 over open ocean areas, there is no terrain to hide behind. To remain undetected, the B-52 must not only maintain complete emission-out status on exterior energy-producing equipment but stay outside of enemy radar line-of-sight range. Here, the earth's curvature serves as the B-52's mountain. The distance from the enemy's radar is dependent upon the aircraft's altitude. Consequently, the lower the B-52's altitude, the closer it can fly undetected to its target.

The solution is not always that easy. Flying at a lower altitude may not be the wisest option. This is because refraction may bend the radar energy around the earth's curvature much as if the radar energy was trapped in a duct next to the earth's surface. We know light can be refracted, and that it encompasses only a small portion of the electromagnetic spectrum. It follows that peculiar refraction effects should occur in other parts of the electromagnetic spectrum as well. Pre-World War II tales of VHF radio transmissions reaching abnormally long distances (in excess of 2000 miles) are explained in terms of the refraction of the waves by elevated tropospheric layers. Early VHF radar observations in 1944 depicted the coast of Arabia from the Strait of Hormuz up through the Persian Gulf in detail on a radar located near Bombay, India over 1700 miles away. (24:12)

Refraction

Refractive effects are the property of a medium to refract or bend an electromagnetic wave as it passes through the medium. Radio reflectivity, N, may be determined empirically at any altitude from a knowledge of the atmospheric pressure, P, the temperature, T, and the partial pressure of water vapor, e, by the equation, $N = 77.6P/T + 3.73 \times 10^{5} e/T^{2}$, where P and e are in millibars and T is in Kelvin. In the standard atmosphere, temperature, pressure, and partial pressure of water vapor diminish with height in a manner that causes the index of refraction and radio refractivity to diminish with height. (24:13)

At colder temperatures, the contribution of water vapor to refractivity is small because the saturated vapor pressure is small. Cooler air simply does not have the capability of absorbing water vapor as warmer air does. However, at higher temperatures, humidity plays an increasingly important role in refraction. (24:13)

The condition of the atmospere for electromagnetic propagation purposes can be assessed by examining the vertical profile of refractivity. The basic values of temperature, pressure, and relative humidity can be derived from radiosonde measurements. In our everyday perception of height, range, and distance, one finds that normal propagation means that electromagnetic rays launched horizontally will bend slightly downward toward the earth's surface with a ray curvature about twice that of the earth's radius. As previously stated in a standard atmosphere, temperature and humidity decrease with height, thereby causing refractivity, N, to decrease with height. The behavior of an electromagnetic wave propagating horizontal to the earth's surface is such that it will refract or bend toward the region of higher refractivity. (24:13)

Anomalous refraction is grouped into three major categories. Relative to normal propagation paths, subrefraction is the bending upward of rays, superrefraction is the bending downward of rays, and trapping is the severe bending downward of rays with a curvature much less than the earth's curvature. In the case of trapping, rays may be guided by the earth's surface or by other layers of grossly different indexes of refraction. (24:14)

This modified refractivity, M, can be defined as $M = N + h/r$, where h is the height above the earth's surface at which M is derived, and r is the earth's radius. M includes both atmospheric refraction and effects of the earth's spherical curvature. Consequently, when the vertical gradient or first derivative of M (shown by dM) is taken, and dM is zero at a given height, the path of an energy ray launched horizontally is a circular arc parallel to the earth's surface. If the derivative, dM, is negative, the ray will bend greater than the earth's curvature. When M decreases with height, a trapping layer is formed in which an electromagnetic wave can be refracted towards the earth's surface, thus forming a duct. (24:14)

Ducting

Ducting is the concentration of radar waves in the lowest part of the troposphere in regions characterized by rapid vertical changes in air temperature and/or humidity. Three common duct types are shown in Figure 8 with straight-line segment modified refractivity (M) profiles. The evaporation duct is typified by a negative derivative, dM, value which is adjacent to the surface. The height of the duct, D, is given by the vertical position of the M-profile inflection point, where dM changes from a negative value to a positive value. Electromagnetic waves launched inside the duct with the ray directions within a few degrees of parallel with the duct boundaries will be trapped. Precisely how small these shallow grazing angles need to be for trapping to occur is dependent on the wavelength of the radiation, the vertical dimension of the duct, and the strength of the duct as gauged by the dM gradient. (24:14)

The evaporation duct in Figure 8a is found regularly over relatively warm bodies of water such as the Gulf Stream in the Atlantic Ocean. It is generally caused by a temperature inversion near the surface and is accentuated by the intense relative humidity near the surface caused by water evaporation.

Over land surfaces, a duct, also with the profile of Figure 8a, can be formed in situations when an intense layer of low-lying humidity is found over a surface that is cooling more rapidly than the surrounding air, such as ground fog. This type of duct can also be found over land surfaces when the relative humidity is low, but there is a daytime temperature inversion over a locally cool surface caused by increased air temperature from heat reradiated from surrounding surfaces. This situation exists over a gray concrete runway surrounded by black asphalt. In this situation, it is better to call it a surface duct rather than an evaporation duct, even though both ducts are shown by Figure 8a. (24:15)

An elevated duct is identified from a profile that contains an inflection point above the surface, accompanied by a modified refractivity value that is larger than the surface M value. Elevated ducts are caused primarily by temperature inversions aloft. These inversions can be caused by the intrusion of hot air into the region or by the sinking or subsidence of air under high pressure centers. A faster than normal decrease in humidity with height usually accompanies these elevated inversions. The thickness of the elevated duct is shown in Figure 8b. Electromagnetic rays launched at shallow angles into the vertical region of negative dM will be trapped. Rays launched into the vertical region, where dM is positive, will be trapped only if they are horizontal.

Nonhorizontal rays launched within this region will escape. (24:15)

A surface-based elevated duct is present when the modified refractivity, M, value at the surface is lower than that at the lower inflection point, but not as low as that at the upper inflection point of a negative dM region. The height of the surface-based elevated duct is shown in Figure 8c. The reasoning for trapping of electromagnetic waves in the surface-based elevated duct is identical to that of the elevated duct. (24:15)

The transition zone between two differing air masses creates a trapping layer for ducts to form. Over the ocean, there often exists a cool, moist, maritime air mass from the surface up to about 1000 feet. The air mass above this can be much warmer and drier than the marine air. It creates a transition region in which the air warms up and dries out rapidly with increasing altitude. The warming and drying of the air causes the modified refractivity, M, to decrease with height, thus forming a trapping layer. With relatively small changes in strength or vertical location of the trapping layer, a surface-based elevated duct can become an elevated duct and vice versa. (37:2)

These ducts prove a real problem to the striking B-52 which wants to remain undetected. The height and strength of the evaporation duct vary from one geographical location to another. Also, seasonal and diurnal influences present at each locale regularly change the duct character. The evaporation duct height over the Persian Gulf can be expected to be greater than that over the North Atlantic. Evaporation ducts are normally below 500 feet. Since a radar antenna on a ship is likely to operate at an elevation that is within the duct, the striking B-52 should stay at least 500 feet above the ocean's surface. Surface-based elevated ducts commonly extend up to 1000 feet and may go up to 3000 feet. (24:22) If these ducts are anticipated, the B-52 should compromise on an absolute altitude of about 1000 feet.

The presence of a surface-based elevated or evaporation duct can greatly enhance returns from sea clutter. Sea clutter, if stronger than the target return, can mask air targets and make it difficult to impossible to detect a target. However, this is entirely dependent on the strength of the duct and the roughness of the sea surface. Since we have no data on the sea state necessary to accomplish this, we recommend for avoiding detection the best position is to remain above the duct, where less enemy radar energy exists for the detection of targets.

Operationally, it is difficult to accurately predict the existence and location of these ducts. The U.S. Navy has more experience than the U.S. Air Force in forecasting ducting. In-flight assistance can be obtained through the Navy's P-3 which is capable of taking temperature measurements and identifying the presence of an inversion. This information could be passed randomly to the striking B-52s, and they would then fly at an absolute altitude placing the aircraft above the inversion layer.

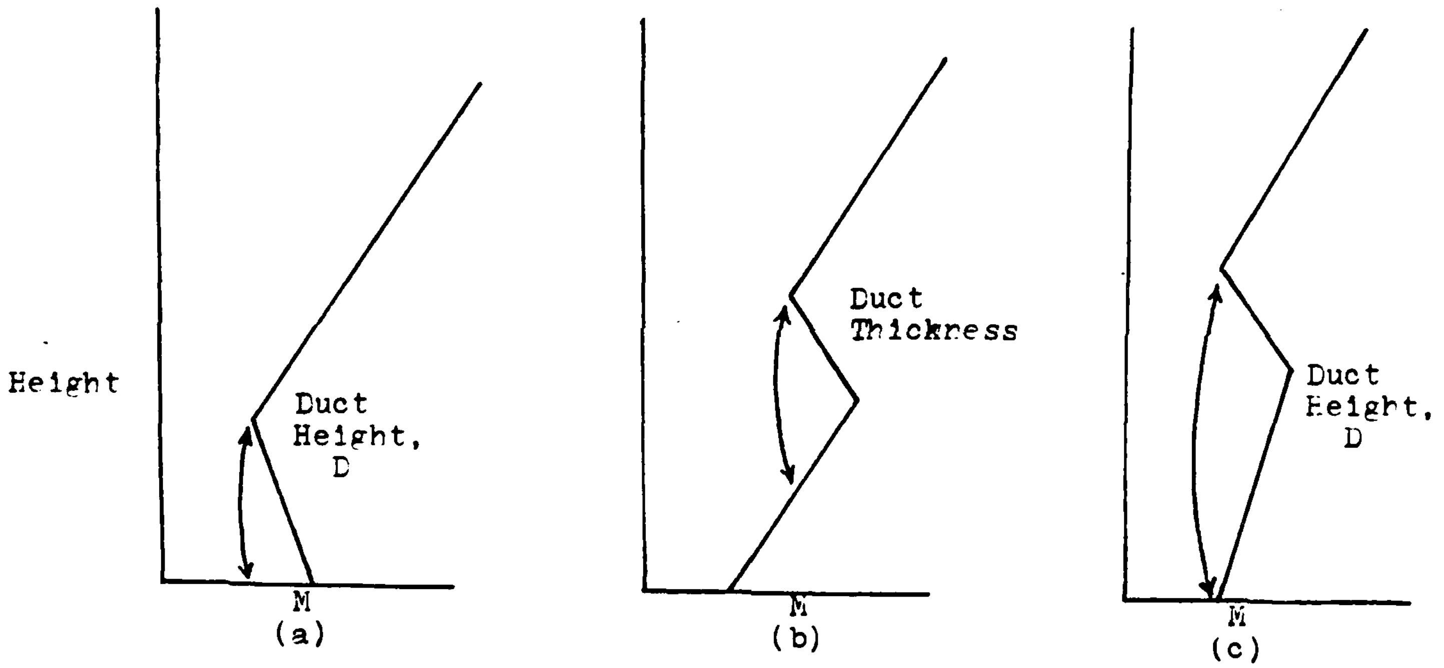

Figure 8 - Stylized vertical profiles of modified refractivity, M, identifying the presence of the (a) evaporation duct, (b) elevated duct, and (c) surface-based elevated duct. (24:15)

CHAPTER IX

MODIFICATIONS

As enemy defenses improve and become more sophisticated, our employment becomes more difficult. We must constantly strive to improve our techniques, procedures, and equipment. This chapter will look at some of those modifications we are capable of making to enhance our chances of a successful strike.

Since the B-52 is presently employed with a intelligence-targeting platform, such as the Navy's P-3, NATO AWACS, or the Nimrod, to relay current target position data to the bomber, the enemy will be keenly aware they are an item of interest. The adversary will be on the lookout for any aircraft or missile. The B-52 must be able to launch its Harpoon missile outside of enemy radar coverage. This not only assists in the survivability of the B-52 but keeps the inbound missile course an unknown to the target and reduces reaction time for employing defenses against the incoming missile. The Stark's reduced reaction time was indeed fatal.

If the airborne intelligence-targeting platform for the B-52 could be eliminated, there would be no electronic emissions, and the enemy would likely not be on an increased state of readiness, as was the case with the USS Stark. This may be feasible through use of intelligence-gathering satellites. Here, the surface action group (SAG) or potential target could be tracked by satellite through a ground satellite-tracking facility. On-duty staff would encode the present position and pass these coordinates via AFSATCOM to the striking B-52(s). Also, this requires the B-52 crew to fly the mission with emission-out (EMCON) procedures. Fortunately, the B-52 crews are training to operate in this manner.

The drawback to using a satellite is the lack of continuous observation capability for a given area. Since our satellites maintain an orbit around the earth, an area of interest may come into the satellite's viewing area for a relatively short time period or even not at all. This would greatly restrict the employment of the B-52 to a small time window which may be undesirable for a number of factors, such as the time of day or prevailing weather conditions. The need for a geostationary satellite at a specific latitude over open ocean area would reduce these restrictions immensely and give the U.S. Navy much better real-time intelligence data for tracking the Soviet Navy and employing U.S. Navy forces.

To enhance the penetrability of the B-52, an increased range capability in the Harpoon missile would improve the chances of a successful strike. It would allow the B-52 to launch the missile at a greater distance from the target thereby increasing the probability that the aircraft could remain undetected. If the missile was not launched at its maximum range, the effect of residual fuel once the missile strikes its target can be seen in the Stark attack. Even though the first missile striking the Stark did not detonate, the ensuing fire from the residual fuel would have caused loss of life and substantial ship damage.

If the Stark had been in an increased state of readiness, it is still questionable whether the point defenses would have destroyed the incoming Exocets. An important characteristic of anti-ship missiles is their small radar cross-section (RCS) of about 0.15 square meters. To detect a sea-skimming missile in a clutter environment, the radar's clutter rejection capability must perform superbly. (19:48) The Harpoon missile also flies very low, and when it is in the immediate vicinity of its target, it performs a pop-up maneuver to ensure better detection for the radar homing head. However, this renders the missile more detectable and vulnerable. The U.S. Navy recognized this and requested the manufacturer develop an integral low-altitude trajectory option. The first modified Harpoons entered service in 1983 and are sea-skimming flight all the way through impact. (20:49) The U.S. Air Force needs this same capability in its Harpoon inventory.

There are also additional modifications that need to be investigated for improving penetrability. The anti-ship missile can be altered to simulate a nonoffensive trajectory before turning suddenly upon the target. During the last miles of flight, the missile can also be made capable of performing random and rather sharp turns to baffle the fire-control systems and the computers designed to determine the aim point.

An even greater step towards improved penetrability would be from the advantages offered by high supersonic speed. Perhaps the most effective propulsion would be the ramjet engine that allows Mach 2 speeds over long distances. Simply reducing the enemy's reaction time by whatever means is a tremendous asset in ensuring the missile reaches its target. Also with increased speed, it is easier to turn the kinetic energy into sharp maneuvers, allowing the missile to penetrate enemy defenses unexpectedly. (19:51) However, significant improvements with speed will likely necessitate dramatic changes in the missile's overall size, weight, airframe, control surfaces, and guidance systems. One improvement with the use of existing turbofan propulsion would be to test the feasibility of adding a high thrust booster to be ignited during the terminal stage of flight. (20:52)

As mentioned above, even though significant increases in speed may be desirable, they are not likely to accrue without dramatic changes in existing cruise missile design. In addition, tradeoff between faster speed and the ability to maintain a sea-skimmer approach may have to be made. An appealing option in lieu of increasing speed is to pursue the emerging stealth technologies which reduce the overall reflected radar cross-section of the cruise missile while not actually reducing the missile's physical size. (20:53)

Presently, ships need to be attacked with Harpoon missiles in open ocean areas. This is done not just to remain out of range from enemy AWACS and land-based fighters, but because the Harpoon's seeker is incapable of discerning ships from land mass. This problem occurs only when the land mass comes within the Harpoon's footprint once the seeker is activated. If a truly smart seeker were to be developed, it should be able to distinguish between friendly and hostile shipping and be capable of discerning particular ship classes from one another. (20:52)

CHAPTER X

SCENARIO

The following scenario is presented to describe the sequence of events involving a B-52G/P-3C coordinated operation against a Soviet battle group. The importance of this scenario shows that future battles are not matters solely for the Army, Navy, or Air Force to resolve. Instead, we must exploit our strengths and overcome our weaknesses to soundly defeat the enemy.

At 1355 on 11 April 1995, notification arrived that a Soviet task force departed port and is enroute to out-of-area operations in the South China Sea. Estimates of course and speed place the task force in the southern Sea of Japan by 0300Z the following morning. Both Navy and Air Force crews are alerted and a briefing is provided with an estimated position for onstation of the mission.

At a designated time, the ISAR equipped P-3C departs Cubi Pt., Republic of the Philippines, enroute to its predetermined position to commence a search of the operations area. Shortly thereafter, the P-3C gains contact on six units proceeding in a southeasterly direction and commences classification of the possible targets. The lead radar contact is determined to be a civilian tanker. Approximately six nautical miles behind the first radar contact is a large Soviet combattant with five auxillary units in trail. The P-3C secures its APS-137 (ISARS), descends to minimal altitude, clears the immediate area from which it was radiating to avoid possible interception by enemy fighters, and waits for arrival of the B-52G cell. At a predetermined time, the P-3C deploys two eight-hour sonobuoys (A and B) with predetermined channel settings at a location 150 nm and 80 nm respectfully from the target of interest (TOI).

The B-52G cell from Andersen AFB, Guam, departed the previous evening to arrive onstation as scheduled. Three hundred miles from the predetermined onstation position, the B-52G cell descends to 500 feet and proceeds inbound. At a predetermined onstation time, the B-52 crew monitors their installed on-top-position-indicator (OTPI) and alters heading for the sonobuoy (channel A) deployed by the P-3C. When the B-52 places itself over the deployed sonobuoy (channel A), the P-3C acknowledges the aircraft (B-52) mark-on-top (MOT) of the sonobuoy via acoustic equipment in the P-3C and the B-52 leader reports this mark-on-top (MOT) over the UHF secure radio to the P-3C using a predetermined code word. The P-3C verifies the TOI position and reports to the B-52 leader the target's range and bearing from sonobuoy B. The B-52 crews input the range and bearing into their navigation system and commence the attack run from sonobuoy B. At the release point, the B-52s launch their Harpoons and alter their heading to depart the area, maintaining 500 feet until clear of enemy threat radar.

The above scenario is not difficult and gives much credence to its success during a war situation wnere joint operations means keeping operations as simple as possible to avoid conflicts and do the job. Through use of innovative tactics as the joint P-3C/B-52G hunter-killer operations, we can maintain a viable offensive strategy against Soviet surface combatants.

CHAPTER XI

CONCLUSION

This paper examined employment of the Harpoon missile via the B-52 launch platform. Initially, we explored real-world conflicts that employed anti-ship missiles and derived lessons-learned from those conflicts. Both the Falklands War and the Persian Gulf experienced successful anti-ship missile attacks, and we must use these demonstrated techniques in our employment as well.

We also looked at the feasibility of the B-52/P-3 hunter-killer team. Much remains to done by both services and the Department of Defense to turn that feasibility into a truly effective operational capability. Although Air Force doctrine delineates a maritime interdiction role for the B-52, it is principally defensive in nature and has only been supported by the Navy and Air Force on a small scale. The proposed B-52/P-3 hunter-killer team can operate offensively at great distances from the carrier battle group and would pose a formidable threat to Soviet surface action groups. The Navy and Air Force should jointly develop a new offensive employment strategy to fully utilize the inherent capabilities of the B-52 and P-3 aircraft. More assets have to be committed to the hunter-killer team concept to make it a true threat to the Soviet fleet.

The Air Force and Navy lack sufficient numbers of air-delivered Harpoon missiles necessary for a protracted conventional conflict. Also, the concept requires additional B-52s to be modified for the maritime strike role than the present 30 aircraft. As the B-52s relinquish their nuclear role, the remaining non-ALCM-capable G models should be modified for Harpoon carriage. These aircraft must not be retired but instead retained and permanently "chopped" to CINCPAC and CINCLANT for the hunter-killer role with the P-3 and other conventional operations. Andersen AFB, Guam could easily handle an additional 15 to 20 aircraft than its present squadron. Guam is an ideal location to cover all critical choke points and sea lines of communication in the Pacific theater. Despite its age, the B-52 is still a formidable weapons platform as evidenced by the billions of dollars in defensive systems the Soviets have deployed over the years to counter it. They fear the B-52, even in a maritime surveillance/strike role, thus making it even more effective in this new role.

In addition to more assets, more frequent joint exercises and interface are needed. Until now, joint B-52/P-3 training has occurred in a limited context off the northeast United States coast and occasionally during Busy Brewer deployments to Europe. More extensive exercises, eventually on a larger scale, like SAC's Global Shield, will go a long way to proving the validity of the concept.

An effective communications interface must be found in the form of a compatible secure voice radio in the short term. Modifying the B-52 with a data interface capability with the Navy's target data transfer system in the long run is a needed capability. Also, installation of the On-Top Postion Indicator in all Harpoon capable B-52s is essential. These relatively cheap modifications will pay big dividends in the future. As previously stated, use of an intelligence-targeting satellite to locate the target and of the AFSATCOM to transmit the targeting information to the striking B-52 would allow autonomous operation and achieve complete surprise. These improvements, together with the previously suggested range and speed imrpovements to the missile will present the Soviet fleet with a very real threat to their power projection ability in wartime.

The B-52/P-3 hunter-killer team concept is an extremely economical and sensible way to counter the Soviet maritime threat. It uses the advantages of each aircraft while negating their shortcomings. Full-scale development would show the American people and Congress that they are getting a whole lot of "bang for their bucks" and that the services are actually practicing joint operations, not just preaching them. Also, our limited submarine and carrier-based assets would be relieved of a large part of their anti-surface ship responsibilities and could concentrate on prosecuting the Soviet submarine threat and supporting land combat objectives.

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