U.S. Navy Deploying New Measures to Counter Russian Cruise Missile Threat

Paul N. Schwartz

Today, the United States remains the only country with commitments that are truly global. Not only does the United States guarantee the security of its many allies around the world, it also acts as the ultimate protector of the global commons, especially the world’s airspace and the sea lines of communication over which most of world trade travels. In order to meet these commitments, the United States relies heavily on its ability to rapidly project and sustain military power throughout the world in responding to developing threats. This capability relies in turn on the ability of U.S. maritime forces, especially the navy and air force, to successfully obtain and maintain access to theaters of operation. For several decades, America’s ability to gain access to such theaters has gone virtually uncontested, but that situation is now changing. As noted in the Department of Defense’s (DOD) Joint Operational Access Concept, its latest official strategy document for addressing the challenge, “unopposed operational access will be much less likely in the future, as potential enemies, exploiting weapons and other systems that are increasingly effective against an advancing enemy, will resource and adopt anti-access strategies against U.S. forces.”1 Chief among the weapon systems that such enemies will seek to exploit are antiship missiles, which directly threaten the very naval vessels and commercial shipping fleets that the United States is so dependent on to project force overseas.

The Antiship Missile Challenge

Today, both China and Russia in particular are making use of advanced sensors, information technology, and precision weaponry to increasingly place U.S. maritime forces at risk. Nowhere is this more evident than in Beijing’s and Moscow’s relentless pursuit of advanced missile systems, an area where both are making real progress. In fact, in 2013, according to then-Under Secretary of the Navy Robert Work, “our enemies are now at a point of parity in guided missiles,” although he noted that they still have a ways to go in matching U.S. networked system capabilities.2

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The emergence of increasingly sophisticated antiship cruise missiles (ASCMs) since the end of the Cold War is an especially worrisome development. The most sophisticated ASCMs achieve supersonic speeds, are long-range, highly maneuverable, difficult to detect, and very accurate. Moreover, they are versatile, and can be launched from a variety of platforms, including shore-based missile batteries, manned and unmanned aircraft, and various surface and subsurface naval vessels. They are designed to penetrate the most sophisticated air defense systems, often making them suitable for use even when control of the air is lacking. Most importantly, they have a proven track record of striking important naval targets, dating back to the Falklands conflict in the early 1980s. Although cruise missile strikes were not always used effectively during that conflict, Argentine forces did successfully employ a French-made Exocet ASCM to disable the British destroyer HMS *Sheffield*, and another was used to sink a container ship. A few years later, during the Iran-Iraq War, an Iraqi Exocet caused severe damage to the guided missile frigate USS *Stark*. Since that time, there have been other successful ASCM strikes as well. While these events took place many years ago, since then, cruise missile technology has advanced rapidly, prompting many observers to expect these weapons to remain quite effective in future conflicts.

For over 50 years, Russia has remained the world’s leading producer of advanced ASCMs. Russia began developing sophisticated ASCMs during the early Cold War era because it lacked the conventional naval forces needed to symmetrically counter the U.S. Navy, especially its powerful carrier task forces. Lacking a large surface fleet, Moscow realized that ASCMs gave it an asymmetric means to keep U.S. carriers away from the Soviet mainland, preventing them from mounting large-scale air strikes. With this objective in mind, throughout the Cold War, the Soviets developed a “large array of large, fast, highly lethal and sophisticated ASCMs.” Soviet doctrine at least since the 1970s envisioned using long-range land-based maritime aircraft bearing supersonic air-launched cruise missiles to unleash mass salvo attacks against carrier task forces at range. Fortunately, the Cold War ended before these capabilities and concepts could be tested, and during the economic turmoil that followed the Soviet collapse, most Russian ASCM projects were shelved. Yet progress soon resumed on a limited number of ASCM models, driven primarily by Russia’s desperate need for export revenues to sustain its defense industry.

One of the most important of these Russian ASCMs is the P-800 Oniks missile (the export version is known as the Yakhont). The Oniks remains one of the world’s premier ASCMs. It can be launched from a variety of platforms, including ships, submarines, aircraft, and coastal defense

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batteries such as the Bastion.\textsuperscript{7} The latter was recently installed in Crimea to extend Russian control over the Black Sea.\textsuperscript{8} The Oniks has an effective range of up to 300 kilometers, and can reach supersonic speeds of up to Mach 2.5, making it one of the fastest ASCMs in the world. During the terminal phase of its flight, it dips to a sea-skimming altitude of just 5 to 15 meters above sea level, making it difficult to detect before it strikes the target. The distance at which it descends to a sea-skimming altitude can be programmed to make it more difficult to counter depending on circumstances.\textsuperscript{9} It employs an active radar seeker, enabling it to hit targets at extended range once its onboard radar system acquires the target. Moreover, it employs a variety of countermeasures designed to defeat jamming, spoofing, and deception operations by electronic warfare systems. The Oniks is designed to be especially effective when fired in salvos, in which case the missiles are reportedly able to communicate with one another while in flight to share tracking information and to allocate targets.\textsuperscript{10}

**How Do U.S. Cruise Missile Defense Systems Stack Up?**

Since 2000, the U.S. Navy has made substantial progress in upgrading its cruise missile defense systems to meet the challenge presented by advanced Russian ASCMs like the Oniks. In that year, a report issued by the Government Accountability Office gave relatively low marks to the Navy regarding the capabilities of its ship self-defense systems. The report found that “most ships continue to have only limited capabilities against cruise missile threats.”\textsuperscript{11} Nor did the report’s authors express high confidence that the situation was likely to change any time soon, noting that “none of the improvements the Navy plans to make in the future would provide any ship class a high level of self-defense capability against far-term threats.”\textsuperscript{12}

While this report was limited to an evaluation of ship self-defense systems (as opposed to layered area defense systems provided by adding aircraft to the mix), there were other significant problems with the Navy’s cruise missile defense programs at that time. The chief problem was that the Navy’s ability to detect, target, and intercept incoming cruise missiles at over-the-horizon (OTH) ranges remained limited. One of the key principles of defending against stealthy, high-speed cruise missiles like the Oniks is early detection.\textsuperscript{13} Detection at the greatest possible range affords the opportunity to take multiple shots at the incoming missile before it reaches its target, thereby greatly increasing the probability of killing it. Because of the curvature of the earth, a ship-based radar system cannot readily detect a low-flying cruise missile until it crosses the horizon and enters the radar’s line of sight. With supersonic missiles like the Oniks, however,

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\textsuperscript{9} Kopp, “Soviet-Russian Cruise Missiles.”


\textsuperscript{12} Ibid.

\textsuperscript{13} Dennis M. Gormley, Dealing with the Threat of Cruise Missiles (Hoboken: Taylor and Francis, 2013), 59–60.
waiting until then to engage the target leaves little time for the ship’s defensive systems to effectively react before the missile strikes.

Of course, the Navy has long been using airborne radar systems, like the E-2 Hawkeye, to expand its defensive coverage area. Because of their greater perspective, airborne radars on high-flying aircraft like the E-2 can detect incoming missiles at much greater range. Once the incoming missile is detected, the E-2 can cue (i.e., relay) information to both in-flight aircraft capable of intercepting it as well as ships that lie in its flight path. This capability has long enabled the Navy to mount a defense in depth against incoming cruise missiles. Aircraft equipped with look-down/ shoot-down radar flying in the outer perimeter constitute the first line of defense. Any missiles that leak through that outer defense zone could then be targeted by ship-borne missile defense systems located in the inner zone.

Despite the increased coverage provided by a layered defense system, this approach suffers from shortcomings. First, maintaining an area defense system requires a relatively large number of in-flight aircraft to remain on station at all times, which is not only costly, but greatly increases the wear and tear on pilots and equipment. Second, even with extended coverage, patrolling aircraft cannot be everywhere at the same time. So even when a target is spotted by an E-2, the closest interceptor still has to rapidly close to within striking distance of the incoming missile in order for its onboard radar system to acquire the target and to engage it with its own antimissile defense systems. Likewise, ship-borne missile defense systems covering the inner defensive zone, such as the Aegis combat system, have until recently been unable to engage incoming cruise missiles until they have already penetrated the outer defense zone. Because ship-based missiles like the Standard Missile-2 (SM-2) require ship-borne radar systems to provide the necessary guidance, they could only operate within the radar’s line of sight. Thus, even with a layered defense system, ship-borne missile defense systems still could not engage an incoming cruise missile at OTH ranges.

Due to the Navy’s deployment of new systems over the last several years, however, OTH engagement capabilities have improved substantially. Such systems include the ship-based Aegis Combat System, the Cooperative Engagement Capability (CEC) system, the Standard Missile-6 (SM-6), and associated radar systems. Collectively, the component systems constitute elements of the new Naval Integrated Fire Control-Counter Air (NIFC-CA) “system of systems.” The first of the new component systems to be deployed was the CEC. With CEC, radar systems and sensors distributed across a variety of aerial and naval platforms can now be networked together to provide for sharing of radar surveillance and tracking data. Through CEC, each platform now receives an integrated picture of the entire battlespace, and consequently no longer has to rely on its own limited perspective. Thus CEC provides the first essential step toward enhanced OTH targeting, locational awareness, and tracking of enemy targets beyond the horizon.

Even with CEC, however, OTH targeting continued to suffer from other limitations. Locating and tracking the target is only half the battle; it also has to be successfully engaged and destroyed at OTH ranges as well (a concept known as “engage on remote”). Until recently, the Navy’s ability to do so was limited by the semi-active radar seekers on board ship-launched missiles, such as the SM-2. Such missiles depend upon ship-borne radar systems to properly illuminate the target (here, the incoming ASCM) so that the missile can home in on the reflected radar signal. But ship-borne illuminators can only do this once the cruise missile has come within its radar’s line of sight. Therefore, despite early detection, a low-flying cruise missile could still approach uncomfortably close to a targeted ship before it could be engaged by the SM-2. 16 Until this problem was solved, the capability to intercept cruise missiles at OTH ranges would remain limited.

To remedy this problem, the Navy developed the new SM-6. Unlike the SM-2, the SM-6 is equipped with an active radar seeker. Using active radar, the SM-6 can acquire and track the target itself once it has flown to within radar range of the incoming cruise missile. Consequently, with active radar, the SM-6 no longer depends on ship-borne radar systems to illuminate the target. While the SM-6 must still be guided to within range of the targeted missile before its onboard radar can take over, this can be accomplished “by using networked fire control data such as that provided by the Navy’s [CEC].” 17 With CEC, the ship that launched the missile continues to communicate with the SM-6 during its midcourse phase to provide updated guidance information until the SM-6’s active radar system can take over. 18 In July 2014, an SM-6 using this approach successfully intercepted a “cruise missile target . . . at near the missile’s maximum range.” 19 Thus, the SM-6, with its extended range and active radar capability, provides the final piece needed to conduct successful OTH engagement of incoming cruise missiles, currently at ranges of up to 130 nautical miles.

Conclusion

While the Navy’s new capabilities represent tremendous progress in countering advanced ASCMs, it is not yet clear how well they will perform against the most sophisticated Russian ASCMs. In addition to the Oniks, the Russians have also deployed the highly capable Klub missile. Supplementing its versatility, range, and low profile, the Klub also has the unique ability of first approaching its target at subsonic speed, and then accelerating rapidly to speeds of up to Mach 3.0 as it makes a final sprint to the target.

The United States and its allies would likely encounter such missiles in theaters other than just Crimea. In a future conflict involving Russia, for example, ASCMs could conceivably be used in

17 Ibid.
the Baltic Sea, in the Arctic, and off Russia’s Pacific Coast. Moreover, the Russians have exported sophisticated ASCMs to other countries, including China, Syria, Indonesia, and possibly Venezuela, among others. Thus, the United States may find itself targeted by Russian ASCMs in a variety of other theaters as well. Nor do Russian ASCMs constitute the exclusive threat. Many other states, including China and Iran, are developing sophisticated antiship missiles of their own. Some of these, such as China’s new Dong-Feng 21D antiship ballistic missile, will pose unique challenges for NIFC-CA, especially when used in conjunction with traditional ASCMs.

Moreover, Russian doctrine today, as during the Cold War, likely still calls for undertaking sustained, mass-salvo attacks from multiple directions against U.S. naval battle groups, in the hopes of overwhelming U.S. missile defense systems, no matter how capable they may be at countering small numbers of incoming cruise missiles. China has clearly adopted a similar approach. Finally, new Russian cruise missile programs threaten to reverse some of the gains made by the United States in deploying OTH technology. For example, new Russian missiles will be stealthier (making them harder to detect at long range) and faster (eroding some of the gains in reaction time achieved through OTH capabilities). Thus, the Navy will not have much respite before it has to address a whole new set of ASCM challenges. In fact, the Navy is already working on new measures to counter further advances in cruise missile technology, including use of satellites and aerostats (tethered balloons) to enhance detection and tracking capabilities, and use of electromagnetic railguns and high-energy lasers to improve intercept capabilities.

Paul N. Schwartz is a nonresident senior associate with the Russia and Eurasia Program at the Center for Strategic and International Studies in Washington, D.C.

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