

# Anti-shipping missiles for RAN - requirement or desire?

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RGM-84L Harpoon Block II

In April 2011 the Indonesian Navy performed its first publicly disclosed test launch of a Russian supplied NPO Mashinostroyeniya P-800 3K55/Kh-61 Oniks/Yakhont or SS-N-26 Stallion supersonic sea-skimming Anti-Ship Cruise Missile (ASCM), destroying the intended target at ~150 nautical miles. Indonesia is not renowned as a leading naval power in the region, and at best is a late adopter of advanced weapons. What the Indonesian trial demonstrates is that in surface actions the Royal Australian Navy is badly outgunned by regional navies, with a growing capability gap.

The ADF is wholly reliant on variants of the Boeing RGM/UGM/AGM-84 Harpoon ASCM launched from aircraft, surface combatants and submarines. With over 7,000 rounds built, the Harpoon is a very mature, reliable and robust weapon. The RAN recently introduced the RGM/UGM-84L Harpoon Block II variant, with GPS/inertial midcourse guidance to permit operation in congested littorals, and attacks on coastal land targets.

The limitations of the Harpoon reflect its 1970s design origins, as the missile is subsonic, and outtraged by larger Russian and Chinese weapons, which have proliferated globally but especially across Asia. The greater range of many of the missiles operated by regional navies provides them with a 'first shot' opportunity, detection permitting – and the supersonic capabilities of many of these missiles result in much shorter flight times and better survivability against terminal defences, compared to the subsonic Harpoon. Many are also equipped with advanced multi-mode seekers, designed to compare radar tracking outputs with passive anti-radiation sensor outputs, to defeat countermeasures, be they jammers or chaff cartridges.

In a head-to-head shootout between two SAGs (Surface Action Groups) using over the horizon targeting by onboard helicopters, the SAG launching longer ranging supersonic missiles has a decisive advantage, in extremis being able to lob ASCMs from outside the reach of its opponent.

## ASSESSING A 'RAINBOW THREAT' ENVIRONMENT

During the 1990s the US Air Force coined the term 'Rainbow Threat' to describe environments where a diverse range of opposing weapons were likely to be encountered, sourced from a wide range of manufacturers in a globalised high technology arms market. This was identified as a major force structure planning challenge, compared to the Cold War era, as arbitrary potential opponents could be armed with arbitrary mixes of weapons, ranging from indigenously built local designs, reverse engineered Soviet and Western weapons, and weapons of US, EU, Israeli, Russian and Chinese origin. Capability development and planning must then account for the full range of possibilities, along with unknowns such as local operator tactics and technical improvements or modifications to imported systems.

Fifteen years later the 'Rainbow Threat' environment is more diverse, and the technical sophistication of the most advanced weapons deployed well beyond that observed after the Cold War.

Australia's domestic defence debate remains wholly disconnected from this material reality. The recurring argument heard from a number of commentators, including some in the Canberra Defence community, is along the lines of "We have no need to plan around defeating Russian or Chinese weapons since it is very unlikely that the ADF will have to fight Russia or China."

This argument is demonstrably little more than an excuse to evade having to confront the reality that the regional capability baseline has advanced enormously since 1991, while Australia has at best struggled to maintain absolute capabilities, let alone advance capabilities to remain competitive against the region. Regional capabilities today are more diverse than ever before, and with China ramping up its efforts to export advanced weapons it will in coming years rival Russia as a major supplier across the globe. Whether the ADF is fighting in the region or on the global stage it cannot escape the reality that proliferation of sophisticated weapons is global.

In 2006, during Israel's incursion into Lebanon, the Hezbollah seriously damaged an Israeli Saar 5 class missile boat using an ASCM launched off the back of a truck. The missile was believed to be a Chinese built C-802/YJ-82, supplied to Iran, and then provided by the Iranian government to the Hezbollah. The weapon is technologically comparable to the earlier Harpoon and Exocet variants.

Conventional wisdom is that 'insurgents are not smart enough to maintain and operate sophisticated modern weapons'. Unfortunately, that view reflects the era of analogue technology during the Cold War, not the digital age of the 21st Century. Modern high technology weapons have digital guidance systems with digital built-in-test and digital fire control sensors. Large numbers of engineers and scientists with PhDs may be required to design and build such weapons, but not to operate them in combat.

## ANTI SHIP CRUISE MISSILE CAPABILITIES

The most lethal and capable ASCMs operated globally, but especially across Asia, are weapons of Russian origin. Nearly all of these designs may have their origins in the late Cold War period but since then have evolved, primarily as a result of modern digital technology insertion in their guidance and control systems. There is a deep dichotomy between the Western approach to the design of ASCMs and the Russian approach. This dichotomy developed through the 1960s and has persisted, with the adoption of the Harpoon and Exocet families as defacto standards across Western and Western aligned navies during the 1970s. Chinese built missiles reflect this dichotomy implicitly, with the Russian or Western origins of product families determining their configuration.

The Russian bias toward large supersonic ASCMs reflects the fundamentally different force structure philosophy of the Soviet Navy, which was in most respects modelled on the 1940s German Kriegsmarine. Like the Kriegsmarine, its central purpose was denial of the North Atlantic, rather than the sea control and 'blue water' maritime superiority roles of NATO navies, especially the US Navy. Controlling the maritime environment drove Western navies toward increasingly large aircraft carriers, with air wings equipped for blue water ASW, ASuW and maritime air superiority. A Cold War era CVBG, supported by subsurface (SSN) escorts, was designed to kill any opposing submarines or surface combatants, and do so at a distance. The primary weapon for killing opposing surface combatants was the air wing, equipped with a diverse mix of fighter and strike aircraft, the latter armed by the late 1960s with a range of smart munitions.

The Harpoon and Exocet, available in surface, subsurface and air launch configurations, were developed for this style of warfare. Compact and affordable, they could be launched in numbers to saturate opposing defences. While a single Harpoon or Exocet lacked the killing power to destroy or seriously damage a larger capital vessel, the collateral blast damage would be sufficient to cripple shipboard radar systems, thus disabling the target's defensive capability. Aircraft armed with television or laser guided bombs of up to 1,000 lb weight would then be employed to finish off the target.

In Western navies, the ASCM was built primarily to provide smaller surface combatants with a self-defence capability against opposing surface combatants, and permitting aircraft to attack opposing surface assets from outside AAW coverage.



SS-N-26 Yakhont.

The Soviet Navy did not deploy a CV capable of embarking competitive fighter/strike assets until the late 1980s. It did deploy a large fleet of attack submarines, initially diesel-electric and later nuclear, large numbers of cruisers and heavy destroyers, and a very large fleet of jet bombers dedicated to ASuW. While the composition of the force structure changed between the 1950s and 1991, the philosophical approach did not.

The ASCM was quickly adopted as the principal 'equaliser' in surface combat. The first genuinely effective Soviet ASCM was the P-15 Termit or SS-N-2 Styx, produced and exported in vast quantities, arming fast missile boats, corvettes, frigates, and destroyers, as well as coastal batteries. Variants or derivatives of the Styx remain in production in China and Iran.

In 1967 Egyptian missile boats sunk the Israeli destroyer Eilat with four Styx rounds. In 1971, the Indian Navy sunk and damaged several Pakistani vessels using Styx equipped fast missile boats, these numbering two destroyers, an oiler, a minesweeper and a transport. The ASCM had arrived as a primary weapon. The Styx was soon followed into service by the air launched KSR-2/ KSR-11 or AS-5 Kelt, built around a similar liquid rocket engine, active radar seeker and warhead design.

While the Styx and Kelt with 1,000 lb class shaped charge warheads could do serious damage to a capital warship, they lacked the killing power the Soviet admirals sought. The result of this agenda were two missiles that remain in use today, and set the pattern for all subsequent designs. These were the 4 tonne turbojet powered P-5/4K48 / P-6/4K44/ P-35/4K88 or SS-N-3 / SSC-1 Sepal/Shaddock family of surface launched ASCMs, and the enormous 6 tonne air launched liquid rocket powered Mach 3.5 Kh-22 Burya (Storm), or AS-4 Kitchen. Both missiles flew arcing high altitude supersonic trajectories, diving on their targets to initiate 2,000 lb class shaped charge warheads. The proximity fused warhead would burn through deck or side armour plate, and the remaining supersonic mass of the missile and unburned propellant would enter the target through the hole cut by the shaped charge jet. The target's damage control teams would have to deal with concurrent structural damage, blast damage and fires. The Kitchen remains in use today, while most of the Shaddocks were progressively replaced by evolved derivatives, specifically the P-500 Bazalt or SS-N-12 Sandbox, and P-1000 / 3M70 Vulkan or SS-N-12 Mod 2 Sandbox, both with cruise speeds in excess of Mach 2. The Sandbox was fitted with internal ECM to jam the X-band radars carried by the target.

Western navies responded by developing a range of improved SAM systems, culminating in the SPY-1 Aegis, intended to stop saturation attacks by diving supersonic ASCMs.

The second generation of Soviet supersonic ASCMs are the direct forerunners of current designs, and evolved from the need to provide a subsurface launched sea skimming supersonic capability. This reflected the reality that early Soviet Echo SSGNs and Juliet SSGs were just as vulnerable to air attack when surfaced to launch and guide their Shaddocks, as Soviet cruisers were. This imperative led to the development of the 7 tonne launch weight 300 nautical mile range Mach 2.5 turbojet powered P-700 / 3K45 Granit or SS-N-19 Shipwreck, carried by Oscar SSGNs, the Kirov CG and the Kuznetsov CV classes. It remains in use by the Russian Navy, but has never been exported.



SS-N-22 Sunburn.



SS-N-27 Sizzler.

AGM-158 JASSM.



Supersonic LRASM-B.

The Granit was the template for the P-800 3K55/ Kh-61 Oniks/Yakhont or SS-N-26 Stallion, being exported globally, and has been supplied to China and Indonesia. India has licenced the Yakhont as the PJ-10 Brahmos A/S, for surface combatants, submarines, coastal batteries, with the air launched variant about to enter flight test.

The three tonne launch weight Yakhont is a supersonic ramjet sea skimmer, with a top speed between Mach 2 – 2.5, and a range of up to 160 NMI. It carries a 500 lb class penetrating warhead. The dual mode seeker incorporates active radar homing and passive anti-radiation homing capabilities.

The principal competitor to the Yakhont is the Raduga P-270 / 3M80/3M82/Kh-41 Moskit E/E1/ MVE or SS-N-22 Sunburn, the primary weapon carried by Chinese and Russian Sovremenniy class DGGs, a Russian equivalent to the DDG-51. The four tonne launch weight Sunburn cruises at Mach 2.2 – 3 depending on altitude, and is credited with a range of up to 130 NMI. Like the Yakhont, the Sunburn is fitted with active radar homing and passive anti-radiation homing capabilities, and is powered by a ramjet engine.

The third Russian weapon to achieve post Cold War export success is the Novator P-900 / 3M54E/AE/ E1/AE1 / 3M14E/AE Klub/Kalibr or SS-N-27 Sizzler family of ASCMs and LACMs, available in ship, submarines, coastal battery, containerised and air launched configurations. This weapon has been exported to China and India, and is available for most recent variants of the Kilo SSK.

The Sizzler is a turbojet powered derivative of the strategic S-10 / 3M-10 / RK-55 Granat or SS-N-21 Sampson, the Soviet 'Tomahawski', making it in turn an analogue to the US Navy's 1980s RGM/ UGM-109 Tomahawk Anti-Ship Missile (TASM), equipped with a Harpoon derived seeker. While the TASM warstock was rebuilt into LACMs and expended in combat, the Russians further evolved the Sizzler.

The baseline 3M54E1 weapon is a direct TASM equivalent, subsonic sea-skimming with a range of 160 NMI, making it a 'bigger Harpoon'.

The improved 3M54E weapon is quite different, with the forward section replaced by a rocket propelled sea skimming Mach 2.9 kill stage, equipped with an active radar seeker. This variant cruises on turbojet propulsion until the target is acquired, upon which the 'cruise airframe' is jettisoned and the rocket propelled kill stage attacks the target. The variant has a cited range of 120 NMI.

With ranges between 120 and 160 NMI, and endgame speeds between Mach 2 and 2.9, the current Russian ASCM offerings are the regional benchmark to beat in surface warfare. The planned Chinese YJ-12 is modelled on the Moskit/Yakhont. The ADF's options in procuring Military Off the Shelf ASCMs to supplement or replace the Harpoon are not particularly broad at this time, unless Russian ASCMs are to be acquired, which is politically unimaginable and would create other difficulties, such as the weapon capabilities being intimately understood by potential opponents.

An ASCM derivative of the stealthy air launched AGM-158 JASSM-ER would provide the required range and midcourse survivability, but being subsonic it would be vulnerable to endgame defences, and development would be required

to adapt it for deck launch or VLS tubes. Such a design is under development as the Long Range Anti-Ship Missile or LRASM-A, for air launch applications.

The US Navy's high altitude supersonic ramjet powered Long Range Anti-Ship Missile or LRASM-B is the best long term candidate, but the ambitious IOC of 2013 is unlikely to be met, assuming the program survives the current budgetary holocaust in Washington. This program builds in part on research performed under the turbojet RATTLS (Revolutionary Approach To Time Critical Long Range Strike) program, and the weapon is conceptually not unlike a 'stealthy Sunburn'.

Whatever future ASCMs might be acquired for the RAN, for the foreseeable future Australia's surface fleet will be outgunned in surface action scenarios.



RATTLS demonstrator.