Future air defence needs for the Army

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MIM-104 Patriot PAC-2 Launcher

CHANGING global and regional strategic environments have proliferated guided munitions of all categories. At the upper end are cruise missiles, terminally guided ballistic missiles and artillery rockets along with smart bombs; at the lower end guided artillery and mortar rounds. While the technology to defeat such weapons is mature and available, investment across Western Armies has been weak, reflecting a preoccupation with fighting COunter INsurgency campaigns in the developing world. Australia is no exception, observing an increasing gap between an extant and growing strategic need, against planning commitments and indeed strategic and doctrinal thinking.

At present there seems to be a collision between the material realities of a changing global strategic and technological landscape, and a thought process mired in the realities of a past era. The fragmentation of the air defence role and associated poor levels of investment is a problem endemic across Western nations, and this has the potential for disastrous consequences should any conflict need to be fought against an opponent more sophisticated than a cave dwelling insurgent armed with man portable weapons.

The problem of proliferating guided munitions will not go away. The opposite is true. Globally, Russia and China will continue to export guided weapons, having a strong profit-driven incentive to expand their global markets. Other nations have actively invested in these technologies; a good example being India with multiple programs, including the Brahmos supersonic cruise missile and indigenous ballistic missiles. Smaller nations will be procuring export weapons, and given the commodification of basic technologies the only entry barrier to guided munitions development and manufacture will be the availability or otherwise of sufficient numbers of suitably academically trained personnel. Such technologies would include gyroscopes, accelerometers, CMOS imaging chips, monolithic microwave chips, satellite navigation receiver chips, and fast embedded processing chips, to support the automotive consumer, general aviation and robotics markets. There are dozens of university level textbooks available dealing with advanced guidance control laws and algorithms, mostly well beyond what is required to develop basic guided munitions control systems and seekers.

The failure to apprehend the nature of this problem in Western planning circles reflects significant losses in the organic technological skills base in Western defence departments. A thought process locked into the idea of divining the future intent of most likely opponents provides a poor starting point for understanding deeper global trends, in a rapidly changing strategic environment, paralleled by rapid technological evolution.

Air Defence Capabilities for Armies

A study of how armies have specifically invested in air defence capabilities could fill many volumes. A complicating factor is that responsibilities for strategic land based air defence are in some nations vested in the army but in others in the air force, and in Soviet and post-Soviet Russia a dedicated fourth military service. In the United States the US Army is responsible for all tiers of land based air defence, ballistic missile defence, strategic air defence, down to unit-level air defence of deployed Army and Air Force formations. Concurrently, the US Navy provides all tiers of air and ballistic missile defence for warships and upper tier defence for the Marine Corps, who provide their own small unit short range air defence, following the retirement of the medium range Hawk Surface to Air Missile system from Marine Corps service.

Australia in no different, in that what capabilities exist are fragmented across the three Services, resulting in gaps in capability and a lack of coherent thinking in air defence planning.

Division of 'roles and missions' remains an issue globally in air defence planning, and arguably is at the root of Australia's difficulties as well.

Until the advent of globally proliferating guided munitions technology, army air defences were most often divided into tiers, and with the exception of the uppermost tiers focused on the defence of small units and larger formations against low flying strike aircraft, and more recently low flying or terrain masking attack helicopters. The COIN campaigns of the last decade have expanded this domain to include Counter Rocket Artillery Mortar (C-RAM) systems procured to defeat insurgent attacks on central basing facilities.

Australia's Land Based Air Defence Capability Gaps

Australia has never been a major investor in land based air defence systems, reflecting in a large part a mostly benign strategic air environment since 1945. During the period of Konfrontasi, when Indonesia procured and operated Soviet supplied Tu-16K Badger bombers with the range to cross the sea-air gap, the RAAF procured the Bristol Bloodhound Mk.1 long range ramjet SAM in the UK, equipping 30 Squadron RAAF with the weapon, and deploying the weapon in Darwin. The Bloodhound Mk.1 was retired in 1968 after only seven years of service, while the last RAF Bloodhound Mk.II unit disbanded in 1991, without replacement.

From 1987 the Australian Army's 16 Air Defence Regiment operated Swedish RBS-70 MANPADS. With subsequent upgrades, it is the sole land based air defence missile in ADF service. In any escalated contingency, US supplied FIM-92 Stinger MANPADS would likely be available at short notice. The RBS-70 has the virtue of immunity to counter-measures used against infrared homing MANPADS due to its use of laser beam riding guidance. Like all MANPADS it is highly effective against helicopters, prop driven aircraft, and moderately effective against closing fast jet targets. Its kinematic limitations, common to all MANPADS, make it marginally effective against crossing or receding low altitude fast jet targets, or pop-up attack helicopters masking behind terrain. It has no capability against medium to high altitude fast jet targets, cruise missiles or smart bombs.

The ADF's remaining SAM capabilities are wholly vested within the Navy, which currently deploys variants of the RIM-66 Standard SM2 on the FFG-7 frigates, and the RIM-162 Evolved Sea Sparrow Missile (ESSM) on the FFG-7 and ANZAC frigates. The 7,000 tonne Hobart class Air Warfare Destroyers (AWD) are to be armed with the SM-2 and the ESSM, but will be limited against very low altitude targets due to vendor insistence on using the long range SPY-1D radar and associated fire control system exclusively, and thus absence of an X-band AESA radar system such as the CEA package on the ANZACs.

Much of the rationale for putting nearly all of the ADF's future SAM capabilities into the three planned SPY-1D Aegis equipped AWDs derived from a belief that this was the best way to protect the ADF's two new 30,000 tonne Canberra class LHDs and Army amphibious forces. The concept of operations was that the AWDs would escort the LHDs during a regional amphibious operation and then provide an air defence umbrella over the beachhead for the duration of the deployment. The pursuit of the AWD was not hindered by internal Defence assessments which indicated the proposed weapon system would be ineffective against saturation sea skimming cruise missile attacks.

The only other investment made in air defence capabilities has been the RAAF squadron of six Wedgetail AEW&C aircraft. But there are no plans at present for combat aircraft with the performance to credibly perform air defence against advanced Russian and Chinese built Flanker series fighters, let alone the Russian built T-50 PAK-FA stealth fighter intended for export or the Chinese J-20 stealth fighter.

Decisions made by Defence over the past decade have resulted in a series of capability gaps in air defence. The first of these is that the RAAF will have a very limited ability to stop foreign aircraft intent on attacking ADF assets operating in the region, or in the far north of Australia. Much the same will be true of cruise missiles, whether launched by aircraft or submarines.

The second of these is that the RAN will have a limited ability to deal with cruise missile and guided bomb attacks against its own warships, and against protected assets such as the LHDs or any beachhead it is tasked with defending. Three AWDs will have the ability to put defensive medium to high altitude SAM umbrellas over three locations within the footprint of compatible RIM-66 SAM variants. In effect the ADF has three long range SAM batteries, which can only be deployed and operated from the sea.

In expeditionary operations, where the Army needs to operate at any distance from a beachhead, it will have organic capability against low altitude closing fast jets or helicopters, but will be exposed to attacks by fighter aircraft armed with guided bombs or missiles, as well as cruise missiles, guided artillery rockets, tactical ballistic missiles, guided artillery shells, and guided mortar rounds.

Even if all of the Navy's surface combatants were equipped with the best available short range weapons systems, the effective coverage footprint would be limited to the beach alone in an amphibious operation, and would force the ships to operate within the reach of coastal artillery, rockets and mortars. It is an open question as to how effective Anti-Ship Missile Defence (ASMD) systems optimised for warship self defence can be in providing defensive cover for other assets to distances of several kilometres.

While the currently planned air defence systems demonstrably will not provide robust capabilities in expeditionary warfare, they are even less well suited to the defence of Australia's far north.

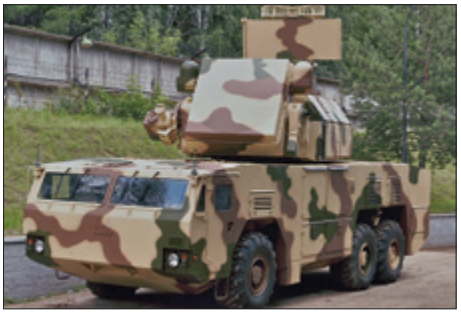
While an AWD patrolling within a few miles of Darwin would provide substantial high to medium altitude cover for Darwin and its suburbs, this cover would not extend to Tindal. In an extended contingency, committing one AWD to cover Darwin, one to cover the Learmonth / Karratha area, and one as a backup, leaves no credible capacity to cover the multiplicity of other critical economic and population targets across the north, RAAF and civil airfields and civil/military port facilities, or Army installations, be it with long range SAM cover, or terminal Counter-PGM cover.

The reality is that the ADF is confronting three major capability gaps in air defence. The first is in planned fighter acquisitions, the second in land based long range SAM capability, and the third in terminal area Counter-PGM capability, effective against the full spectrum of possible threats.

While these three gaps impact all three Services in contingencies involving defence of the north, they specifically and primarily impact Army operations in expeditionary combat in the region.

What is perhaps of most concern is that these capability gaps are neither acknowledged nor indeed accepted as such by Defence in Canberra. Even if they were, short of the Navy volunteering to take more AWDs, there is unlikely to be any interest in the Army or RAAF leadership to take on the force structure burden of operating and maintaining technically complex long range SAM batteries, and short range Counter-PGM weapons systems.

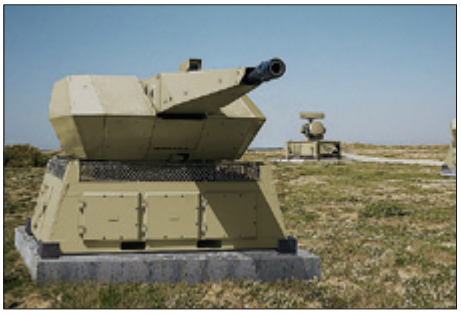
If we however assume that a policy decision might be in the future made to plug these capability gaps, would it be more appropriate for the Army or the RAAF to operate these systems? Long range SAMs are operated overseas either by air forces or armies, and the assignment of these systems appears to largely reflect historical factors rather than utility. Much the same is often true of short-range systems, and often these are concurrently deployed by air forces for airfield terminal defence, and armies for protecting fixed assets and manoeuvre forces.

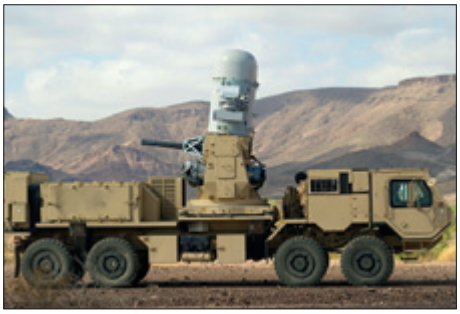


Russia has developed a successful export business selling Counter-PGM missile systems, such as this NIEMI Tor M2E Gauntlet (NIEMI).

The MIM-104 Patriot PAC-2 remains the most capable Western SAM in production, operated by many key US allies. Depicted is the C-Band MPQ-53 engagement radar, and a four round mobile launcher. The Patriot lacks the exceptional mobility of Russian SAM systems.

The JLENS aerostat based radar system was intended to provide over the horizon low altitude cruise missile engagement capability for the Patriot. It was cancelled in the latest round of United States defence cuts.





Modern Counter Rocket Artillery Mortar (C-RAM) systems can be readily adapted for the Counter PGM roles, but will require significantly better engagement radars, capable of tracking, sorting and engaging multiple inbound high speed PGMs. Depicted a Luftwaffe MANTIS/Skyshield 35 mm gun system, and a prototype high mobility Phalanx C-RAM system on a modified Oshkosh HEMMT chassis.

In terms of choices in systems, numerous options exist in both categories, although the simplest choice would be in long range SAMs, as surplus PAC-2 Patriot equipment will be easy to acquire. While there are numerous Western built SAM and AAA systems available which are compatible with a Counter-PGM and Counter-RAM role, few if any have the necessary radar and software optimisations for the role. Stopping a smart bomb or cruise missile is in many respects more challenging than stopping an insurgent fired mortar or artillery rocket round.

The reality is that the world has changed, and planning constructs which might have been viable one or two decades ago are no longer viable today. The ADF's planning in air defence capabilities is exactly such an example of thinking mired in the distant past.

The Global Situation

The US Army along with many NATO armies, the Soviet PVO-SV and China's PLA, have all deployed medium and long-range Surface to Air Missile system batteries to provide medium and high altitude air defence capabilities against aircraft, and later ballistic and cruise missiles at divisional, army and corps levels. In the post Cold War era the US Army and Russian PVO-SV have both deployed high performance ABM systems, the intent being to supplement the upper tier SAM capabilities.

The Soviet investment into Red Army air defences produced by far the most capable system deployed operationally, and the intellectually most coherent supporting rationale. Much of this hardware remains in use in Russia, and many legacy systems in former Soviet Republics, Warsaw Pact nations and client states. The Red Army model was based on the concept of highly mobile batteries of long range SAMs, medium range SAMs, short range SAMs, and radar aimed low calibre artillery, providing overlapping and redundant coverage. This scheme was intended to deny airspace over Warsaw Pact land manoeuvre force formations, by inflicting unacceptable attrition to deter the use of opposing air power. A standard requirement since the early 1960s was a five-minute 'shoot and scoot' capability for all tiers of the system, a capability never matched by NATO nations. This requirement was initially devised to provide the capability for the air defence umbrella to provide uninterrupted coverage over rapidly moving tank armies, but since then has proven to be of enormous value in keeping air defence assets alive when under aerial attack. Most of Serbia's obsolescent Soviet supplied 3M9 Kvadrat / SA-6 Gainful SAM batteries survived the 1999 NATO aerial onslaught.

The US Army and its European NATO allies invested in a parallel scheme in the late Cold War, built around the long range MIM-104 Patriot SAM, the medium range MIM-23 Hawk, and various short range weapons. The NATO scheme never matched the high mobility of the Soviet model, or the effectiveness of latter Soviet medium and short range weapons.

United States land based air defence capabilities are now primarily split across four systems. The upper tier system is the THAAD (Terminal High Altitude Area Defense) a specialised Anti Ballistic Missile system optimised to defeat Intermediate Range Ballistic Missiles (IRBM), with a limited capability against Inter Continental Ballistic Missiles (ICBM). The MIM-104 Patriot PAC-2 and PAC-3 provide the second tier in the system, with the capability to intercept the lower tier of ballistic missiles, aircraft at all altitudes, and some capability against cruise missiles. The intended replacement for the medium range MIM-23 Hawk, the AIM-120 based SLAMRAAM, was cancelled in 2011, although Raytheon continue to offer export variants. The lowest tier remains the FIM-92 Stinger in its various incarnations, and recently acquired Phalanx C-RAM systems, deployed initially in Iraq to thwart insurgent attacks. The United States Marine Corps operated four air defence battalions, equipped with the MIM-23 Hawk until 2002, since then converted to Stinger / Avenger systems.

European NATO nations have not invested heavily in air defence, and many nations have been actively selling off inventories and war stocks. Germany's Luftwaffe operated six Patriot squadrons, each with six batteries, but halved the force over the past decade, selling off PAC-2 equipment to South Korea, and upgrading remaining systems to MIM-104F PAC-3 configuration. The Netherlands operates two Patriot squadrons, Greece three squadrons, and Spain one squadron. The biggest investment in long range SAMs has been in North Asia, with Japan operating six PAC-2/PAC-3 squadrons, South Korea six PAC-2 batteries, and Taiwan ten batteries of PAC-2/GEM and PAC-3. Variants of the MIM-23 Hawk were widely deployed with US allies globally, but have mostly been retired. Notable current users include a number of NATO nations, South Korea, Taiwan. Japan built the Hawk under US licence and is reported to still operate the system.

The poor level of investment in Army air defences characteristic of NATO nations, and underinvestment in the mid-range categories of SAM, results in unbalanced capabilities. In particular the ability to defeat aircraft with standoff munitions and cruise missiles is compromised. The current focus in most investment has been in ABM capabilities of various levels of effectiveness, and some investment in COIN optimised C-RAM systems.

While Russian industry has been very active in the development and export of all classes of air defence equipment, the Russian Army has until this year been operating legacy Cold War era equipment, albeit very good equipment. Recently authorised funding will see the upgrade of the very potent S-300V / SA-12A/B Gladiator / Giant SAM/ ABM to the S-300V4 configuration, with a 250 km / 135 NMI range two stage missile, as well as replacement of extant Buk M1 / SA-11 Gadfly systems with new, wheeled Buk M2 / SA-17 Grizzly systems, the latter with mast mounted X-band 9S36 engagement radars for engaging low altitude targets.