Is relying solely on smart weapons a smart approach?

Warrant Officer David Turnbull, Royal Australian Air Force

> Advanced aerospace technology works. In the right circumstances it saves lives on both sides and, when available in sufficient quality and quantity, wins wars.
>
> Attributed to US Defense Secretary William Cohen (1997-2001)[1]

Introduction

The above quote reflects the sentiments of many air power advocates, that advanced aerospace technology and, in particular, advanced weapons technology, wins wars. Alan Stephens also contends that:

> The continuing success of precision-guided standoff munitions … capabilities which facilitate fighting precisely and from a distance … can only generate greater interest and investment in [these] kind of weapons.[2]

Precision-guided munitions (PGMs) have become the standard for kinetic air power application since their revolutionary success in the first Gulf War in January 1990. Cutting-edge PGMs are capable of pin-point accuracy in all weather conditions—by day or night—and often from large standoff ranges. This precision, however, comes at a cost, with increasingly capable technologies driving increasingly eye-watering price tags.

While 'dumb' bombs are markedly cheaper than their 'smart' counterparts, the overwhelming success of precision weapons (politically and militarily) has made the humble 155mm artillery shell, 70mm rocket and Mk82 low-drag 'Slick' and their ilk effectively obsolete in the eyes of many. But is this really the case? According to Mark Thomson:

> If you want to safeguard Australia's national security, then you stockpile guided and smart munitions, not bullets and explosives.[3]

The aim of this article is to critically evaluate this statement in the context of the importance or otherwise of PGMs and the implication that Australia's national security can be assured by the application of high-tech weaponry. It will consider what 'precision' really means and whether 'dumb' munitions still hold a place in planned fifth-generation air power applications; qualitatively examine the associated cost of the technology of PGMs; and test if they are really the infallible 'silver bullet' they have been made out to be. These points will form the basis of a discussion on whether a sole reliance on smart weapons, as suggested by Thomson, is a smart approach.

Considerations

Precision: 'to be precisely accurate'

> Precise forecasts masquerade as accurate ones.[4]

Precision and accuracy are often used interchangeably but, in reality, they have very specific and different definitions, particularly in the world of weapon employment. The darts player aiming for the bullseye who sprays their shots all over the board (and wall) is neither precise nor accurate. The player capable of grouping their darts tightly but off to the left would be regarded as a precision shot, whereas the one landing darts around the bullseye in a loose grouping would be an accurate shot. The ideal then is to combine the two to achieve a tight grouping that centres on the bullseye as the intended impact point—precisely and accurately.

The employment of kinetic weapons is essentially the same as playing darts at the pub, in that to achieve the best effect against a target (bullseye), munitions—particularly PGMs—must be both precise and accurate, especially when utilising low-explosive yield (low-collateral) weapons, where missing by metres may result in the target remaining a threat. For the purpose of this article, 'precision' in the context of precision-guided/smart weapons will equate to the munition being both precise and accurate in its performance when measured against unguided 'dumb' stores.

Do dumb bombs still hold a place in air power application?

> To use air power in penny packets is to disregard the importance of a menacing and even mysterious military reputation.[5]

'Precision' has become a favoured buzzword for the media, politicians and commanders commenting on military operations, such that:

> The ability to create precise effects is not only the hallmark of advanced air forces, but arguably the greatest contribution air power brings to the modern battlespace. The RAAF creates precise effects through its capability to conduct precision attack.[6]

However, the RAAF's *Air Power Manual* notes that 'there is an important distinction between precision as a means to achieve a desired and focused effect and as a descriptor for precision-guided [weapon] capabilities', noting that the precision employment of air power does not always involve the use of PGMs.[7] Conflicts offer up threats and target sets as varied as large industrial complexes to specific individuals. Air power options for negating such targets can range from a single strike using a precision weapon to multiple/mass strikes utilising a number of unguided stores.

The method of attack is determined by a range of factors, including the type and quantity of available weapons and delivery platforms; the specific outcome desired (total destruction versus disruption of operations); operational limitations (such as weather and the quality/availability of intelligence, surveillance and reconnaissance [ISR]); rules of engagement specific to the conflict; and political limitations placed on weapon employment and types (such as the use or otherwise of cluster-bomb munitions).

Regardless of the weapons used or delivery profiles employed, the ultimate aim of striking a target is to realise a precise effect. As an example, Eliot Cohen asserts that the 'massive raids by B-52s raining down conventional bombs helped crush the morale of Iraqi soldiers' during the first Gulf War.[8] While not a pin-point precision strike, the effect desired and achieved was precise with the weapon sets available.

For many years, Western nations have enjoyed advantage in conventional warfighting capabilities, with various enemies resorting to irregular methods such as insurgencies, guerrilla tactics, terrorism and suicide bombings to successfully wage war. Air power is frequently the first—and sometimes only—Western military force applied kinetically in irregular conflict, with PGMs the weapon of choice.

While irregular warfare is the current trend, it may not always be the case and Western nations must remain capable of 'closing with and killing large numbers of the enemy'.[9] Against massed enemy units in the field, the employment of individual cutting edge, high-end PGMs against individual targets (versus area bombing with dumb stores) would be both costly and inefficient.

In this respect, 'carpet bombing' could well be the better choice for a precision effect. Indeed, the simple and brutal fact that war is cruelty, and force works by destroying and killing, means that area bombing may well be required in future conflicts.[10] In certain circumstances, the application of 'penny packeted' PGMs cannot replace:

> [T]he importance of terrifying enemy soldiers through the fear of violent death from tons of ordnance raining down on them—fear of violent death only comes from the imminent possibility of the real thing.[11]

The cost of precision-guided munitions

It was not so long ago that a thousand-dollar bomb would be used against a million-dollar target; it seems now the opposite is true. Although not always the case, weapon cost and precision/accuracy typically go hand-in-hand, meaning absolute pin-point accuracy has a high price-tag attached. The acquisition and sustainment of precision-guided inventories comes at high cost—and does not cease with the last physical weapon delivery.

Ongoing cradle-to-grave requirements of the test and evaluation of new systems, upgrades and concepts; operator/maintainer training; regular live 'raise-train-sustain' employment; periodic maintenance; software/hardware updates; and through-life system upgrades all ensure that valuable sustainment dollars are being spent throughout the weapon life-of-type—and often before a single weapon has been used in anger.

With the rising cost of precision-guided capabilities becoming a concern for many military forces, the ability to keep pace with their technology will limit many to cheaper, lower-technology weapons or very small quantities of high-tech assets. As noted by Richard Hallion:

> Cost trends in precision weaponry are likely to force an evolutionary 'survival of the most capable for the least cost', particularly for those military services with scarce acquisition funding.[12]

For example, fielding AGM-88E Advanced Anti-Radiation Guided Missiles versus AGM-88B High-speed Anti-Radiation Missiles manifests a ten-fold increase in price. While there is no argument that the former is a more capable weapon, the latter is still a very effective anti-radiation capability that would work in the majority of tactical situations in Australia's region of interest—and at one-tenth the cost. Put simply, for every AGM-88E in the inventory, a force could field ten AGM-88Bs; and this is the decision point that many militaries and governments are faced with.

Adding to the spiralling investment dollars required for precision-guided capabilities, the cost of the weapons themselves is just one factor. Increasingly, smart platforms and targeting systems are required to employ smart weapons. While the F/A-18 Classic Hornet in RAAF service has been able to employ laser-guided bombs since its introduction, it was not until the Hornet upgrade program commenced in 1999 that modern precision weapons requiring more up-to-date digital interface (such as the AGM-158 Joint Air-to-Surface Standoff Missile) could be employed.

As improved precision weapons become available, a corresponding (and usually expensive) improvement in platform and/or sensor capabilities—either by way of upgrades to existing assets or new acquisitions—will be required to fully realise the potential of new technologies.

Are precision-guided munitions an infallible silver bullet?

> So long as there remains a substantial period, often up to ten years, between the inception of a new weapon system and its deployment, even the very latest weapons are out of date in terms of what technology could deliver.[13]

The current pace of technological advancement means that what is new today is obsolete tomorrow; and this is true for Apple I-Phones as much as it is for precision weapons. Given the relatively long service life of modern weapons, it is possible that many precision capabilities introduced into service inevitably fail to deliver over the life-of-type, at least from a cost/capability perspective, without some form of expensive upgrade to maintain their edge.

Added to this, no military technology (indeed no technology at all) works all the time: 'the truly fail-proof design is chimerical'.[14] Software glitches, ageing components, flat batteries and a multitude of other technical issues are all possibilities that can render even the best PGMs useless at some stage during their cradle-to-grave journey.

Coupled with this, anti-PGM measures typically keep pace with new technology, which can negate the edge the munition was intended to achieve. Anti-PGM strategies can be surprisingly simple low-tech measures or sophisticated and high-tech in their design and employment. For visual or laser-guided weapons, smoke-screening a target can often be enough to disrupt weapon guidance accuracy. More sophisticated weapons can be rendered ineffective by jamming weapon guidance and target acquisition data signals. As an example, simply moving or hiding Scud missile launchers was enough for Saddam Hussein to frustrate allied air power's efforts to locate and destroy them during the first Gulf War.

The employment of many PGMs also requires a permissive tactical environment; the right operating conditions and operational targeting systems to generate a hit—especially early generation munitions or those at the budget end of the scale. The limitation of many first-generation or low-cost PGMs is that they require visual conditions between the weapon and the target. In bad weather, these systems cannot be used as they require visual or infra-red acquisition of the target. Further, laser-guided weapons require the target to be lasered—some continually—until impact.[15] As noted by Danielle Gilmore:

> When so many environmental [and technical] factors can readily cause a [precision-guided munition] to miss … it is easy to comprehend why they cannot be used in every military strike.[16]

Discussion

> There is no logical reason why bullets or bombs should be wasted on empty air or dirt. Ideally, every shot fired should find its mark.[17]

> In the fall of 1944, only seven per cent of all bombs dropped by the 8th Air Force hit within 1000 feet of their aim point. It took 108 bombers dropping 648 bombs to guarantee a 96 per cent chance of getting just two hits against a German power-generation plant; in contrast, in the Gulf War, a single aircraft dropping two LGBs [laser-guided bombs] could achieve the same results with essentially 100 per cent expectation of hitting the target.[18]

Precision-guided smart weapons work. As contended by Hallion, '[they] combine the attributes of accuracy, range, striking power and portability; and it is that combination that makes [them] a powerful force multiplier in today's military scene'.[19] Dropping thousands of bombs in order to destroy a single target is no longer palatable or affordable for governments or military forces: all modern conflicts demand precision, proportionality and discrimination in the application of force.

This is particularly important in urban conflict where the risk of collateral damage and unintended consequences increases.[20] The political and military fallout associated with collateral air strike casualties and damage manifests rapidly in the modern world and is ferociously meted out by both the enemy (through propaganda) and 'friendly' media/human-rights/anti-war organisations. For these reasons, 'precision attack is the RAAF's chosen means of applying combat air power to create precise effects against an adversary to achieve desired campaign outcomes'.[21]

With the above in mind, precision attack does not imply the use of precision weapons; it is

defined by the precision of the effect created. The destruction of targets such as industrial plants in permissive tactical environments is equally achievable using dumb bombs as it is with PGMs, given the ability of modern aircraft radars and stores management systems to accurately deliver unguided weapons.

Building on the proven capabilities that modern digital interface weapons bring, improved fifth-generation capable aircraft/sensor/weapon interfaces such as the Universal Armament Interface; off-platform capabilities such as the Joint Weaponeering System; and network enabling the complete system in all phases of the 'find, fix, track, target, engage, assess' targeting cycle are intended to further optimise the precision, fidelity and speed of the targeting and weapon employment process.

Due to the introduction of capabilities such as higher-fidelity sensors, the Universal Armament Interface and the Joint Weaponeering System, smart aircraft systems are increasingly better at delivering unguided bombs with accuracy. As noted by Hallion, 'it is undoubtedly cheaper to have a smart airplane drop a dumb weapon' when operational circumstances permit.[22] Ultimately, there is no reason why dumb bombs, in the right circumstances, are not capable of being delivered extremely accurately.

The caveat to this, however, is that the aircraft's operational flight program must incorporate the full suite of ballistic data for all weapons that are to be employed by the platform—particularly dumb/unguided stores. Without appropriate and integrated ballistic data, weapons cannot be employed accurately—and the cost of capturing data, if absent, and validating its veracity is typically more than a cache of cutting-edge PGMs.

The employment limitations of precision-guided munitions

The conflict against Islamic State in Iraq and Syria highlights some of the limitations of precision attack, and demonstrates that the latest and greatest battlefield ISR capabilities and precision-guided munition technologies are not infallible. For example, the battle for Ramadi in early May 2015 saw a surge of IS fighters moving into Anbar and Salahuddin provinces from outer IS-controlled areas. Instead of using Toyota utilities as they had favoured in the past, IS members used nondescript sedans in an effort to blend with the civilian traffic and stay off the radar of US surveillance aircraft.[23]

Additionally, ISIS enforced a blackout of its own media posts from Ramadi to cover the build-up of fighters. Throughout this build-up, coalition air power was unable to detect or prevent the movement of IS fighters who were critical to the taking of Ramadi. According to US sources:

> They displayed admiral operational security. They understand the element of surprise. And they understand how [the coalition] can track them.[24]

As that demonstrates, even the most advanced munitions become useless if targets cannot be located and designated for attack. While these issues are not solely down to any limitations of PGMs themselves, it highlights that a reliance on ISR for target observation, identification and designation can degrade the ability to employ precision-guided assets. Of course, dumb bombs would be no better in these circumstances. But the fact remains that modern ISR and PGM technologies—and targeting processes—do have limits.

Added to this, the simple fact is that increased networked capabilities in the ISR, targeting and weapon engagement sphere will see a commensurate growth in the capacity to disrupt or degrade these systems, meaning that PGM employment in future tactical environments will likely be similarly degraded or denied.[25] If this is the case, building up and relying solely on inventories of smart weapons may well turn out to be a dumb idea. As noted by Cohen:

> The speciation of munitions brings unusual capabilities, but it also poses the risk of creating forces so specialised that they lack flexibility, and weapons so expensive that commanders will have only slender inventories to use when a war starts.[26]

Air power's inherent characteristics of flexibility and adaptability should ensure that dumb bombs still hold a place in air power capability. Seemingly obsolete dumb weapons are currently being revitalised in the counter-insurgency environment. Such weapons as the aircraft gun and unguided rockets are extremely accurate and have a small

collateral damage footprint, which this makes them well suited for use in crowded environments or where unacceptable damage may occur through bombing.[27] The RAAF's *Operational Air Doctrine Manual* usefully contends that:

> Through the careful selection of weapon systems for the task in hand, a commander can concentrate the required amount of force, but still apply the principle of economy of effort.[28]

The cost of capability

For certain targets, such as where low collateral damage estimates are not critical and when employing larger explosive yield weapons that can trade reduced precision for greater blast/damage effects (such as 2000lb class stores), utilising lower cost weapons, such as Paveway Series Laser Guided Bombs or Joint Direct Attack Munitions, may suffice over employing more expensive PGMs, such as the AGM-154 Joint Stand-Off Weapon.

For critical, 'exquisite' targets, it may well be that high-end, pin-point PGMs are the only dependable method of air attack. Critical target and collateral damage estimate analysis in the targeting cycle (especially for deliberate strike missions) can return cost benefits by utilising cheaper weapon options that still deliver a precise effect. Having affordable weapons options available, in conjunction with high-end PGMs, is the key to having the right mix and quantity of eggs in the basket to deal with foreseeable scenarios where Air Force may be called on to employ kinetic weapons—and do it cost effectively.

It would seem reasonable to argue therefore, that Thomson's statement regarding a reliance on smart munitions, which is widely supported by many PGM advocates, is fundamentally flawed as it diminishes air power's inherent characteristics of flexibility and adaptability.[29] Additionally, when and if Australia is ever involved in a future conventional conflict against a highly capable and resourced adversary, PGM stocks could well become a limiting factor by virtue of Air Force simply running out.

Resupply of high-tech smart weapons is not a simple, quick or cheap undertaking. Lead times can be very long for PGMs and, given the contracting timelines (many years) for specialised technology and manufacturing processes required to produce modern smart weapons, there is limited ability for timely surge production.

Countering this limitation, dumb bombs are cheap, easy and quick to produce, and have a built-in advantage of modularity in that they can be configured with a variety of mechanical, electronic or smart fuzes, dumb tail kits or guidance kits that turn them into cost effective smart weapons and increase their operational flexibility and adaptability.

The unguided dumb bomb is dead?

Air Force strike aircraft have dropped hundreds of bombs during Operation OKRA, none of which have been an unguided dumb store. Although unguided bombs have been the stalwart of air power throughout World Wars 1 and 2, Korea and Vietnam, the first Gulf War demonstrated the huge potential of precision weapons, with their use increasing in every conflict fought by the West ever since. This has culminated in the almost exclusive use of PGMs by the coalition in the fight against ISIS, with GPS-aided Joint Direct Attack Munitions the *de rigueur* weapon of choice.

While it is argued that dumb bombs do have a place in modern kinetic conflict, the reality is that these stores simply do not make it to the capacity-limited explosive storage and preparation areas of far off war-zones. Casting an eye across any operational coalition airbase explosives area typically reveals a sea of Joint Direct Attack Munitions, augmented by a handful of backup laser-guided munitions for use in case of issues with GPS or tail kit assemblies. The dumb bomb, regardless of its proven ability, is operationally dead from the new-age, PGM-centric point of view—with their employment relegated to raise-train-sustain activities. Is this how it will be in the future though?

When it all boils down, it is not very smart to put all of one's weapons solely in a cutting-edge PGM basket. While there are times when only a PGM will do, there are others where a Mk82 Slick coming through the door will be more than adequate—and more cost effective. As Hallion has argued:

> Though there is a continuing role for the dumb munition … the reshaping of military affairs that has been wrought by the precision munition will increasingly dominate logistical and strategic planning issues.[30]

Regardless of (and possibly because of) the domination of PGMs, careful requirements assessment and balancing of dumb and smart inventories to ensure adequate logistical/strategic support against all future scenarios (small insurgency conflicts through to all-out conventional war) should be at the forefront of future weapon capability and acquisition planning. The acquisition, storage and distribution, through-life support and disposal of weapons is a vastly expensive undertaking; therefore, weapon costs versus the required capability must be balanced.

To this end, stockpiling cheap, modular smart weapons such as laser-guided bombs and Joint Direct Attack Munitions; maintaining smaller quantities of dumb bombs for insurance; and holding niche PGMs for the exquisite targets sets would ensure that Air Force has the capability to wage war in all foreseeable kinetic scenarios, and also possess the deterrent (and large hammer) that high-end PGMs bring.

Broadening out from air power specifically, the increasing use of PGMs across the wider Defence environment, such as the M982 Excalibur GPA-aided 155mm artillery shell and Advanced Precision Kill Weapon System guidance kits for 70mm rockets means the validity of stockpiling smart weapons is no longer an exclusively Air Force issue—it is fast becoming a joint concern.

Ultimately, there is no single 'silver bullet' weapon solution. What is required is careful matching of desired weapon capabilities to the individual characteristics of the battlefield environment.

Conclusion

The aim of this article has been to critically evaluate Mark Thomson's contention regarding the importance or otherwise of PGMs and the implication that Australia's security can be assured by the application of high-tech weaponry. Australia's security is certainly closely tied to the application of high-tech air power weapons but security assurance is not guaranteed by smart weapons alone.

Maintaining a capability against those circumstances where PGMs are unsuitable (weather, availability, countermeasures, cost, etc) is a smart approach. Future weapon systems must be 'right-tech' for Air Force, in that they should be viable, cost effective and appropriate options—with the key being the ratio of inventories (the appropriate balance between quality and quantity).[31]

Ultimately, an emphasis on smart weapons is a smart approach but it needs to be insured against with a dumb bomb policy just in case: PGMs are not the panacea for every target in every conflict that some would have us believe. Stephens is right in his assessment of the criticality of advanced aerospace technology in modern air power; however, it is his use of the words 'circumstances' and 'sufficient' that are the key.[32]

This article has critically assessed the suggestion by Mark Thomson that Australia's security can be assured solely by smart weapons, and found it wanting simply because the characteristics of flexibility and adaptability that are so important to Air Force need to take into account all the circumstances that Air Force—and the wider ADF—may be required to deal with in the future.

Additionally, the reality of tight defence budgets and spiralling costs of PGM technology mean that Defence simply cannot afford to stockpile guided and smart munitions exclusively. To this end, relying on smart weapons as our only kinetic option is not a smart approach, and Defence should specifically aim to maintain a balanced inventory of conventional and precision munition capabilities that centre on low-cost smart weapons that are commensurate with fifth-generation smart platforms. Anything less could ultimately end up being rather 'dumb'.

Warrant Officer Turnbull enlisted in the Royal Australian Air Force as an Engineering Trade Apprentice in January 1989 and graduated as an Armament Fitter in September 1990. He has enjoyed postings to 75 Squadron, 77 Squadron, 3 Squadron and 22 Squadron; and numerous stints within Capability Acquisition and Sustainment Group in both acquisition and sustainment project offices.

Warrant Officer Turnbull currently works within Air Force Headquarters' Air Capability Enablers Directorate. He completed a Bachelor of Administrative

Leadership through the University of New England in 2010 and a Master of Business through the Australian Defence Force Academy in 2012, and has previously been published in the ADF Journal with his paper, 'A Warrant to Lead' (Issue 187, March/April 2012).

Notes

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