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TABLE OF CONTENTS

EDITOR'S NOTE

This issue of *Disarmament Forum* assesses the current situation concerning missiles and investigates future prospects for control. Existing devices, such as the Missile Technology Control Regime and the Hague Code of Conduct (HCOC), UN Security Council resolution 1540 and the Proliferation Security Initiative, are all attempts at ameliorating some aspects of missile-related problems, as are the various bilateral confidence-building measures already in operation. Much remains to be done, however, as cruise missiles are largely unregulated, HCOC implementation is progressing but leaves much to be desired, and research, development, deployment and international cooperation on active anti-ballistic missile defences continue apace. Following two United Nations panels of governmental experts on missiles in 2002 and 2004 (the latter of which failed to adopt a consensus report) and an expert study conveyed by the UN Secretary-General to the General Assembly in 2006, a third panel of governmental experts will be convened later this year.

The next issue of *Disarmament Forum* will focus on the recently established Peacebuilding Commission (PBC). A robust and effective PBC is in all of our interests. What can be done now, in its early stages, to support it and assist in its success? Contributors to this issue will consider how the PBC can be supported "beyond NY", address maximizing the effectiveness of civil society engagement with the PBC, examine the challenges of peacebuilding coordination and identify possible challenges and opportunities in both the shorter and longer term.

One of the consequences of the global arms trade is the increasing reliance on arms brokers. Brokering is often a necessary supportive activity to facilitate the supply of arms required for legitimate national defence, law enforcement and civilian uses. However, the absence in most countries of effective laws and regulations to govern arms brokering has created a significant grey area in the international arms trade that is open to substantial abuse. A growing number of reports indicate that strict state control of arms brokering—including of small arms, light weapons and related materiel—is an essential component in efforts to eradicate the illicit trade in small arms and light weapons.

On 28 November, UNIDIR, the UN Department for Disarmament Affairs and the Small Arms Survey launched the joint study *Developing a Mechanism to Prevent Illicit Brokering in Small Arms and Light Weapons: Scope and Implications*. This launch was timed to coincide with the first week of meetings of the UN Group of Governmental Experts on brokering. The study examines existing instruments and mechanisms to regulate small arms brokering at the national and international levels. It identifies common elements and options for regulation, to enhance understanding of the issue and to clarify its most complex aspects. (See UNIDIR Focus, at the end of this issue, for more information about the publication.)

Preparations are under way for UNIDIR's annual conference on space security. This year we observe the fortieth anniversary of the Treaty on Principles Governing the Activities of States in the

Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (the Outer Space Treaty). Protection of the peaceful use of outer space becomes more urgent with each year that passes. The 2007 conference will build upon previous years' discussions on space security architecture. The edited proceedings of past conferences are available through our web site.

Kerstin Vignard

Missiles matter

Christophe Carle

Missiles are to WMD arms control as ammunition is to small arms and light weapons. In both cases, a crucial component of weapon systems finds itself relegated or altogether ignored in negotiations, arrangements and treaties. In the field of weapons of mass destruction (WMD), it is the explosives and other warheads that get all the attention, whereas cartridges and bullets (the "warheads" for guns) are the poor relations of small arms and light weapons (SALW). Yet missiles do matter to international security in a variety of ways, which this article illustrates with some current issues and trends relating to missiles.

Perhaps the single greatest obstacle to missile control is the sheer diversity of existing missile systems. A shoulder-fired anti-tank or anti-aircraft device weighing less than 10kg, measuring just over a metre and with a range of a couple of kilometres is a missile, but so is an intercontinental ground-to-ground rocket weighing over 100 tons, measuring over 20m in height and capable of delivering multiple nuclear warheads to ranges of over 10,000km. If only for this reason, the very idea of addressing missiles in all their aspects can only have very limited value, and only at preliminary phases, before more focused discussions or negotiations.

The most developed international instrument addressing missiles is the Hague Code of Conduct (HCOC).[1] The HCOC binds its members to curbing the proliferation of ballistic missiles capable of delivering WMD. Its transparency and confidence-building measures are limited, yet worthwhile, provided they are demonstrably and reliably implemented—which is certainly not yet the case. The HCOC's membership—which can only be voluntary—would also require expansion to a number of important countries that have as yet shown no intention of joining. Given these difficulties, and those that were involved in the elaboration of the HCOC's text, the prospect of any more ambitious missile control measures is poor in the current and foreseeable environment.

When the HCOC was in gestation, it was commonly observed that the draft international code of conduct (as it was then) was a way to forestall the deployment of active missile defences. To some extent, the same held true for the Russian Federation's efforts to voluntarily control missile proliferation through transparency measures—the Global Control System for the Non-proliferation of Missiles and Missile Technology (GCS). The situation was sometimes portrayed as if there were two alternative, and opposing, ways of tackling missile threats: missile defences being the military–technical option, and the code of conduct or GCS the diplomatic arms control option.

Christophe Carle is a specialist in arms control, with particular interest in missiles. He served as consultant to the Panels of Governmental Experts on missiles established in 2001 and 2004, he took part in the 2006 General Assembly study of The Issue of Missiles in All its Aspects, and was Deputy Director of UNIDIR between 1996 and 2006.

In practice, both missile defences and the HCOC (though not the GCS) have come into existence—with at best questionable impacts on missile acquisition, transfer, development, threats and use; in short, on dealing with the security problems caused or aggravated by missiles of various sorts.

In fact, missile improvements by existing possessors, efforts by others to acquire missiles and the use of missiles in warfare have all continued apace. The development of missile defences themselves is accelerating and, most important, spreading internationally; more countries are making progress in areas such as solid-fuel propulsion, more are also seeking to acquire or develop their own cruise missiles or both, and very short-range missiles have emerged as potent threats, especially when in the hands of non-state actors.

Two of the most recent missile-related issues, missile tests by the Democratic People's Republic of Korea (DPRK) in early July 2006 and the intensive use by Hezbollah of short-range unguided rockets in the conflict with Israel in August 2006, illustrate the continued and manifold relevance of missiles—their acquisition, transfer, development and use—to international security.

Missile testing and development

Missile tests are not always deemed newsworthy: it depends on who conducts them, as well as on the politico-strategic circumstances and message conveyed explicitly or implicitly by those who test.

Most often, test launches by major powers are roundly ignored. Exceptions to this can take two forms: one, when the test is used to display a new, and preferably successful, capability (as in Russian testing of manoeuvrable re-entry ballistic missiles or, on a few occasions, the United States' interceptor missiles); the second exception is tests that are averred or deemed to have failed (for example, the United States' interceptor missiles, on a number of occasions).

As Peter Hayes notes,[2] no attention outside the most specialized circles was paid to the United States' test of a Minuteman III missile on 14 June 2006. Less than a month later, however, on 5 July 2006, the DPRK's testing, with mixed results, of a Taepodong-2 and other missiles was the only international news item to rival coverage of the FIFA World Cup.

A mere four days later, on 9 July 2006, India's test of an Agni-3 drew very little attention or comment. This was to be expected, as India has successfully secured a seat in the Very Important Power lounge and even managed to acquire a willing sponsor, and can now hold a missile test if it so pleases. Admittedly, India does observe missile etiquette, and gives good neighbourly prior notice when it plans a missile party.

The DPRK, on the other hand, nurtures its status as a rebellious gatecrasher, seeking self-justification in adversity. Pyongyang claims that "it would be quite foolish to notify Washington and Tokyo of the missile launches in advance, given that the US, which is technically at war with the DPRK, has threatened ... that it would intercept the latter's missile in collusion with Japan".[3]

If prior notification were all that was needed to defuse tensions surrounding the DPRK's missile tests, the answer would be easy: sign the HCOC. One of the paradoxes of the DPRK's behaviour is that this would apparently be an easy thing to do. It would seem cost-free to Pyongyang, and indeed rather advantageous. Despite the HCOC's stipulation that "(i)mplementation of the above Confidence Building Measures does not serve as justification for the programmes to which these Confidence Building Measures apply", subscribing to the code and providing a succinct yearly statement of ballistic missile and space launch policy, as well as filing pre-launch notifications (PLNs) with the HCOC Point of Contact in Vienna of ballistic missile tests or space vehicle launches, would actually have some form of

legitimizing impact on the DPRK's missile activities. It would formally put the DPRK in better standing than India, which has not adopted the code.

This would not be significantly onerous. All the HCOC's provisions are strictly voluntary for all signatories, and at least some of the signatories' reports provided to the Point of Contact seem rather succinct and generic. Moreover, the transparency measures that PLNs involve might not even be all that important, since preparations for ballistic missile test launches (especially for missiles of the liquid-fuelled variety) can be—and have been—detected in advance by national means.

At face value, such unwillingness to subscribe to the HCOC could appear paradoxical, but in fact it is not. It becomes much more readily explicable when it is acknowledged that the DPRK's objective is not to defuse the tensions surrounding missile launches, but to manipulate them—ramping them up or alleviating them when it chooses. The aim is not to make the DPRK's missiles and missile programmes consensually acceptable. It is not to assuage worries that a missile visibly readied for a test flight might—who knows—be equipped with something other than a dummy warhead, whether nuclear or not. The guiding thread is the use of missiles and their flight-testing in a broader strategy of sowing discord among significant neighbours and extra-regional powers for the sake of Pyongyang's twin priorities: regime security and nuclear weapons. As everyone now knows, the DPRK's follow-on decision was not whether or not to test such or such missile, but whether and when to test a nuclear explosive device. That is now history. The next steps will also be designed to divide opinion and confuse near-neighbour strategies. Unless coherence and determination are cemented among key states in the region and in the Security Council, the next steps could indeed be even more explosive. Far more than in the Persian Gulf, the gravest and most immediate challenge to global nuclear non-proliferation lies in North-East Asia, where the single most critical factor will remain the continued nuclear self-restraint of Japan, the Republic of Korea and Taiwan.

The gravest and most immediate challenge to global nuclear non-proliferation lies in North-East Asia.

Missile testing, however, is not the sole preserve of the DPRK or Iran. The tests conducted by many states clearly show that the missile sector is anything but moribund.

In the United States, Minuteman III intercontinental ballistic missiles (ICBMs) have been fired in tests on at least 11 separate occasions from June 2004 to September 2006 over distances of 6,500km to over 8,000km between Vandenberg Air Force Base in California and the Kwajalein Missile Range in the Marshall Islands.

Tests of the Standard Missile-3 (SM-3) and Standard Missile-2 (SM-2) took place on at least six occasions in the same period. These are interceptor missiles, so each intercept test also involves the launching of a target ballistic missile. Eight such intercept tests have been held to date.

Similarly, flight tests of various versions of Patriot missile interceptors (PAC-3 and Patriot Guidance Enhanced Missiles) usually involve the "ripple firing" of two interceptors against two ballistic missiles simulating an attack, adding up to four missiles in each test. The target missiles are usually PAAT (Patriot-as-a-Target, older Patriot missiles modified to represent a short-range incoming ballistic missile). Tests of this nature were held at least six times between June 2004 and June 2006. One such test, on 18 November 2004, involved some six missiles in the air simultaneously. In another instance, in early September 2004, Patriots were fired at both a short-range ballistic missile and at a cruise missile.

In the framework of missile defence research and development, the ballistic missiles acting as targets are also test-fired on their own, as in the test of an orbital long-range target missile from the Pacific Missile Range Facility in Hawaii on 28 April 2006, or of a long-range Strategic Target System (STARS) rocket from the Kodiak Launch Complex on Kodiak Island in Alaska on 23 February 2006. A medium-range target missile, the Castor IVB target vehicle, also underwent a test flight on 4 August 2005. On 6 October 2004, the Missile Defense Agency launched a suborbital rocket to test the tracking abilities of missile defence systems.

Conversely, interceptor missiles also get flight-tested on their own on occasions, as was the case with the Ground-based Interceptor (GBI) missile on 14 December 2005, or of a Terminal High Altitude Area Defense (THAAD) missile on 22 November 2005.

Tests carried out in the United States can also involve interceptors developed in international cooperation and, apparently, target ballistic missiles of foreign origin. Thus the test on 29 July 2004, near Los Angeles, of the Arrow missile defence system jointly developed by the United States and Israel involved the use as target of a Scud ballistic missile reportedly confiscated from Iraq.

The Russian Federation has carried out some 27 ballistic missile test launches between June 2004 and September 2006. Of these, 7 were ground-launched ICBMs and 11 were submarine-launched ballistic missiles (SLBMs). Tests of shorter-range ballistic missiles, of air-launched cruise missiles for conventional warheads, of target missiles for missile defence development and anti-ballistic missile interceptors (such as the S-300 tested in August 2006), were also carried out in that period. Air defence missiles with an increased capability against cruise missiles were also tested (such as the Pechora-2M). The majority of ICBM tests involve warheads designed to be manoeuvrable during re-entry, with the explicitly stated aim of defeating missile defence systems.

China appears to have conducted considerably fewer long-range ballistic missile tests, with three firings of ground-launched ICBMs (DF-21 and DF-31) and two of SLBMs (the JL-2 with a range of some 8,000km), again during June 2004–September 2006. Unconfirmed reports, however, indicate a far greater number of tests of ballistic missiles with shorter ranges of up to 600km. China is also testing the S-300 anti-aircraft and anti-missile system imported from the Russian Federation, and is working on its own versions for local production.

In the same time span of June 2004–September 2006, India has performed about a dozen missile tests involving various versions of the Agni and Prithvi missiles. This figure does not include tests of the shorter-range surface-to-air Akash and Trishul systems, which may be developed for some anti-missile capabilities. The Dhanush, a naval version of the Prithvi nuclear-capable ballistic missile, which may well form the basis for a submarine-launched ballistic missile, was tested two or three times. In another notable development, testing also continued of the Brahmos supersonic cruise missile developed jointly with the Russian Federation.

Also in the same period, Pakistan conducted tests of its Hatf-2 (Abdali), Hatf-3 (Ghaznavi), Hatf-4 (Shaheen-1), Hatf-5 (Ghauri) and Hatf-6 (Shaheen-2) on nine occasions, three of which were for the solid-fuelled, 2,000km-range Shaheen-2. A newer missile tested by Pakistan is the Hatf-7 (Babur) nuclear-capable cruise missile. Tests to date have taken place in August 2005 and March 2006.

The number of missile tests actually carried out by Iran is more difficult to estimate, owing to some of the unverifiable claims made for some of the missiles in question, such as the "sonar evading" or "radar evading" missiles supposedly capable of hitting several targets simultaneously, which were launched in early April 2006. On the other hand, the Shahab-3 ballistic missile, with a range of some 2,000km, appears quite clearly to have been tested three times during June 2004–September 2006. Iran is also occasionally reported to be carrying out static engine tests for various ballistic missiles.

Other countries have also tested various missiles in recent months. For example, Syria fired three Scuds or Scud variants in June 2005, and in the same month Taiwan tested a 500km Hsiung Feng cruise missile, as well as two Patriot PAC-2 interceptors in military exercises held in July 2006. Israel performed an intercept of a target missile using its most recent Arrow-2 anti-missile in December 2005 from a military base near Tel Aviv.

From a broad survey of missile-related activities around the world in the last few years, a number of fairly clear current trends emerge.

- Research and development on ballistic missiles, far from abating, continues intensively.
- A significant proportion of intermediate to advanced ballistic missile development focuses on two main objectives: devising warheads or re-entry vehicles capable of defeating missile defence systems; and mastering the difficulties of ballistic missile launch from submerged submarines.
- An increasing number of countries are developing cruise missiles—for both conventional and nuclear delivery—on their own instead of seeking to procure them from abroad.
- An increasing number of countries are moving from liquid-fuelled to solid-fuelled ballistic missiles, which do not require lengthy pre-launch fuelling procedures.
- The pace of work on missile defence systems is increasing, with greater resources and broadening international political and industrial cooperation.
- Missile defence systems are being developed both for the producers' own use and with export markets in mind, and are being deployed.
- For more advanced countries, in the first instance the United States, improvements in guidance and accuracy are opening up the possibility for long-range ballistic missiles to be designed and used not just for nuclear strikes, but for conventional ones as well.

Within range? Missile control efforts and prospects

On the diplomatic arms control front, the only area in which significant progress has been made is the very particular case of man-portable air-defence systems (MANPADS).[4] Since the failed attempt to shoot down an Israeli airliner in Mombasa in 2002, a variety of initiatives have been undertaken to attempt to alleviate the severe threat that MANPADS can pose to civilian aviation.

There is broad agreement that MANPADS, widely disseminated in legitimate state armed forces around the world, have also been obtained by non-state actors in significant numbers, and not just since the disintegration of Iraq. Their relative ease of use—provided adequate basic instruction, which is broadly available—and ease of concealment, as well as the physical vulnerability of the approaches to many international airports, make further attempts on civilian aircraft highly probable.

Although likely to be illicitly disseminated in the order of thousands, the number of MANPADS involved is much smaller, for example, than that of automatic assault rifles outside of authorized hands. Therefore, measures of collaborative stockpile management—including the destruction of MANPADS deemed obsolete or in excess of current needs—are a distinctly positive achievement. The United States is the most active in this respect, through its various bilateral programmes that have resulted in the destruction of some 15,000 MANPADS in Africa, Asia, Europe and Latin America, and in the improved accounting and security of existing stocks. Australia conducts similar activities, albeit on a lesser scale. Mutual information and consultation on MANPADS and their transfers also exists among the members of the Commonwealth of Independent States.

Another important contribution are the rigorous measures adopted by the states participating in the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-use Goods and Technologies. Almost identical regulations have been adopted by others, such as the member states of the Organization for Security and Co-operation in Europe (OSCE), and the challenge is now for these commitments to be implemented strictly and reliably by all concerned.

On a more general, declaratory level, MANPADS stand out as one topic on which the United Nations General Assembly has reached consensus, adopting resolution 60/77 of 8 December 2005.[5]

Taken together, these initiatives and others (usually regional) constitute a rare area of arms control where there actually exists some scope for concerted and effective action.

Indeed, there is the potential for fruitful complementarity by building on the overall consensus on the seriousness of the issue expressed in the United Nations General Assembly on the one hand, and on the tight measures initiated by the Wassenaar Arrangement on the other. The latter are specific but not universal, and need to be broadened; the former is universal, but unspecific, and needs to be deepened. If consensus in the General Assembly can provide a basis for broadening effective adherence to Wassenaar or equivalent standards, while at the same time practical stockpile management activities are also pursued, then arms control will at least have made some genuine contribution to alleviating the MANPADS threat.

Whether, in the best of cases, this is enough to forestall future MANPADS attacks and the resulting human and economic costs remains to be seen. But even if not, arms control practitioners would be able to say with some justification that they tried their best.

In other areas of missile-related security concerns, no such constructive patterns are at hand.

The challenge to Israel of the use of short-range rockets is not new, but it rose to unprecedented dimensions in the latest conflict. Hezbollah's firing of unguided Katyusha-derived rockets of various types seemed to be inspired more by the "war of the cities" between Iran and Iraq in the late 1980s than by the battlefield use against enemy combatant units for which such rockets were intended, and originally used, in the Second World War.

Missile defences such as Patriot or Arrow could not be effective against such rockets. They were developed to counter the threat from Scud or equivalent missiles with longer ranges, longer flight times and higher trajectories. Even if these problems could be addressed, cost issues would remain distinctly asymmetrical, given the price tag on every single Patriot or Arrow and the advantage to the attacker of firing cheap rockets by the dozen.

The Tactical High Energy Laser (THEL) system, collaboratively designed with the United States to counter just such rockets as the Katyushas, was not ready (either in its initial airborne or subsequent ground-based form) and development has been hampered over the last few years by technical as well as funding aspects.

Despite ongoing operational deployment, the United States' Ground-based Missile Defence (or GMD, the new name for what used to be called National Missile Defense) is not ready either. Interceptor missiles are in place in Alaska and California, discussions are in progress for the emplacement of further interceptors in one or two East European countries, and as indicated above, missile defence cooperation is ongoing with Israel, Japan and Taiwan, as well as within the North Atlantic Treaty Organisation. Missile defence developments by China and the Russian Federation continue, with India also showing increasing activity.

The rather caricatural "pro" and "anti" missile defence debate that took place, largely in the United States, a few years ago, has failed international security altogether.

The rather caricatural "pro" and "anti" missile defence debate that took place a few years ago has failed international security altogether.

The fixation of systematic opponents of missile defence on the Anti-Ballistic Missile Treaty and their unqualifiedly dire predictions of what would happen upon its abrogation set the scene for their failure. When the treaty was scrapped and the sky failed to fall down, missile defence proponents could all too easily claim victory. The opposition's

other main argument (that a less than fully effective system would never be deployed and would be blocked by spending cuts) was equally misjudged.

Nevertheless, the proponents' argument for missile defence was just as naive. They claimed that strategic missile defences would be effective enough to yield not just a net security benefit by themselves, but also non-proliferation dividends, by demonstrating the military futility of acquiring offensive missiles and thus "discouraging" other countries from pursuing the development of ballistic missiles.

Missile defence and arms control

Missile defence, like it or not, is now a reality.[6] And it is expanding fast. Measured in terms of industrial, financial, scientific and political resources, missile defences are proliferating faster and with much greater momentum than ballistic missiles. Compare and contrast the likely scale of the DPRK's boastful but ramshackle ballistic missile programmes with the weight and dynamism of missile defence initiatives by several of the world's foremost economic and military powers, singly and together.

The resulting situation is the worst of both worlds: a GMD is being deployed with alacrity, if not with any certainty that it can protect the population of the United States or of its allies. Whatever its effectiveness, the very fact of its deployment is taken very seriously by those that are not allies (even though they may no longer, or not yet, be labelled as enemies).

No one can prove that the Russian Federation's development of missile defence-evading ballistic missile re-entry warheads or China's vigorous ICBM and SLBM modernization were triggered or hastened by GMD deployment. But it is a fact that GMD deployment has not prevented or otherwise "discouraged" these and other missile developments. In this respect, GMD is already failing.

It is a fact that GMD deployment has not prevented or otherwise "discouraged" missile developments.

Where GMD succeeds is in acting as a trendsetter. Countries other than US allies are developing their own missile defences, and these will sooner rather than later find their way into export markets. How certain are we that whatever balance may exist between, say, India and Pakistan, will be more secure when either or both have partially effective Patriot or S-300 or S-400-style missile defences of their own?

In addition, far from inhibiting missile development, fast-growing international cooperation on missile defences is boosting transfers of eminently dual-use capabilities, technologies, equipment and know-how. Whether in terms of detection, targeting, propulsion, guidance or aerodynamics, the ability to hit a missile with another missile or projectile is critically relevant to the conception and improvement of increasingly potent and accurate offensive missiles. It is commonly accepted that ballistic missile technology is highly similar to that of rocket-based space launch vehicles. To try and claim otherwise carries no credibility. No further proof of such dual use is needed than the frequent use in test flights of older-generation interceptors modified to mimic an offensive ballistic missile.

Strategic ballistic missile defences will not be rolled back before they improve, cost more money and spread further. Whether they function as advertised or not, they will be taken seriously by friends and foes alike. They already are. All that may be attempted is to blunt the sharper edges of misunderstanding and overreaction that can be prompted by current and future deployments.

The HCOC attempts to instil some confidence-building measures into the security perceptions and misperceptions engendered by ballistic missiles. Constructive—or damage-limiting—thought should now turn to confidence-building initiatives that might help to avoid the most threatening consequences of the advent of strategic anti-missile defences, whether regionally or globally. An unlikely thought, perhaps, but the alternative is considerably worse.

Notes

1. The Hague Code of Conduct (formerly the International Code of Conduct against Ballistic Missile Proliferation), adopted 25 November 2002, in UN document A/57/724, 6 February 2003.
2. Peter Hayes, 2006, "Stop Hyperventilating, Start Talking", *Policy Forum Online,* Nautilus Institute, 7 July, at <nautilus.org/fora/security/0654_Hayes.html>.
3. "DPRK Foreign Ministry Spokesman on Its Missile Launches", Korean Central News Agency, 6 July 2006, filed under 7 July 2006 at <www.kcna.co.jp>; also available with the Peter Hayes article, see note 2.
4. For more on MANPADS, see the article by James Bevan in this issue of *Disarmament Forum*.
5. UN General Assembly resolution 60/77 of 8 December 2005, UN document A/RES/60/77, 11 January 2006.
6. This reality was in fact apparent some time ago, and runs deeper than the predilections of any specific United States presidency: "Even as the outcome of the United States presidential elections remains unclear as of this writing, the United States will, at some point, deploy NMD in some shape." Christophe Carle, 2001, "Fighting Fire with Fire, Missiles against Missiles", *Disarmament Forum*, no. 1, p. 21, at <www.unidir.org/pdf/articles/pdf-art93.pdf>.

Missiles in conflict: the issue of missiles in all its complexity

Jürgen Scheffran

"Our scientific power has outrun our spiritual power.
We have guided missiles and misguided men."

Martin Luther King Jr, 1963, *Strength to Love*

The centrality of missiles to today's security concerns became glaringly apparent in mid-2006. Hezbollah militia fired almost 4,000 missiles from Lebanese territory, causing serious damage and 43 deaths in the densely populated Galilee region in northern Israel. The town of Kiryat Shmona alone was the target of 911 Hezbollah-launched rockets.[1] The mostly Iranian-built rockets—portable short-range (20–40km) Katyushas, but also Zelzal rockets with a range of about 200km—were launched from sites that are hard to detect. They reached their targets within seconds, which made interception nearly impossible. Despite dropping thousands of bombs and missiles on Lebanon, destroying its infrastructure, killing more than 1,000 people and driving hundreds of thousands from their homes, Israel was not able to stop the use of these rockets against its territory. These crude rockets challenged the domination of Israel's air power and made large-scale ground operations more difficult.[2]

The hostilities in Lebanon and Israel demonstrate that the use of rockets, ballistic missiles, cruise missiles and even unmanned aerial vehicles (UAVs) is no longer the exclusive privilege of technologically advanced state armies; it has become an option for low-tech states and non-state actors. Although the number of casualties remains relatively low considering the large numbers of rockets launched (on average, about 100 rocket launches by Hezbollah caused one death in Israel), the characterization of missiles as weapons of terror has once more been realized.

As illustrated by the Hezbollah–Israel case, defence against missiles is not yet possible, and attempts to prevent further launches by eliminating launchers or supply stocks are rarely successful. Furthermore, such countermeasures cause substantial casualties if the launchers are deployed in areas where the civilian population serves as a (voluntary or involuntary) human shield. With international media highlighting the civilian victims of such raids, public opinion exerts considerable pressure on the counteracting state to stop such operations.

Experts have been warning of the looming danger of shorter-range missiles in the hands of hostile regimes or non-state actors for quite some time; this represents a significant addition to the missile threat. Rockets and missiles encompass an extremely diverse class of weapons, ranging from the

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aforementioned Katyushas to intercontinental ballistic missiles (ICBMs), from relatively crude constructions to sophisticated high-tech devices, carrying payloads from a few kilograms of conventional explosives to megaton nuclear warheads. This complexity adds to the growing security problem posed by missiles and their proliferation, demanding more determined and coherent efforts from the international community to actually resolve the issue of "missiles in all its aspects", as suggested by the name of the United Nations Panel of Governmental Experts.[3]

Box 1. Missile definitions

Rocket: a vehicle that obtains thrust by the ejection of fast-moving fluid. In military terms it is a self-propelled weapon without a guidance system (i.e. once fired, it cannot be redirected). Most rockets have a relatively short range and can carry only small payloads.

Missile: an unmanned, self-propelled, self-contained, unrecallable, guided or unguided vehicle designed to deliver a weapon or other payload.

Ballistic missile: a missile guided during powered flight and unguided during free flight, when the trajectory that it follows is subject only to the external influences of gravity and atmospheric drag.

Cruise missile: a manoeuvrable missile that is propelled, usually at low altitudes, to its target by an air-breathing jet engine that operates throughout the flight.

Unmanned aerial vehicle (UAV): a pilotless aircraft with similar characteristics to a cruise missile; sometimes called a drone.

Payloads: these can consist of conventional weapons (explosives, cluster bombs, etc.), or nuclear, biological and chemical weapons.

Launching: missiles can be launched from land (hand-held or shoulder-fired, mobile erector, truck, train, silo), sea (ship and submarine), and air.

Ranges are used to classify ballistic missiles:

Short-range ballistic missile (SRBM) = 70–1,000km

Medium-range ballistic missile (MRBM) = 1,000–3,000km

Intermediate-range ballistic missile (IRBM) = 3,000–5,500km

Intercontinental ballistic missile (ICBM) = over 5,500km

Sources: Weapons of Mass Destruction Commission, 2006, *Weapons of Terror: Freeing the World of Nuclear, Biological and Chemical Arms,* Stockholm; *The Issue of Missiles in All Its Aspects: Report of the Secretary-General,* UN document A/57/229, 23 July 2002.

Increasing or decreasing? The state of missile arsenals

The psychologically devastating effect of the unpredictable missile threat remains undiminished since the first missiles, the German V1 (cruise missile) and V2 (ballistic missile), terrorized the populations of European cities in 1944. The accuracy of the V2 was low (with a 17km deviation) and the blast of the explosive payload was partly contained in the crater created by the missile impact, but the lack of warning, and the angst, confusion and helplessness suffered by the population added considerably to the physical damage, creating a unique sense of terror.

Despite absorbing an enormous amount of resources, comparable only to the Manhattan Project, the V2 had no significant impact on the war's outcome. The weapon's performance—3,200 V2s caused around 8,000 deaths—could not match the destructive effect of the warring parties' bombing

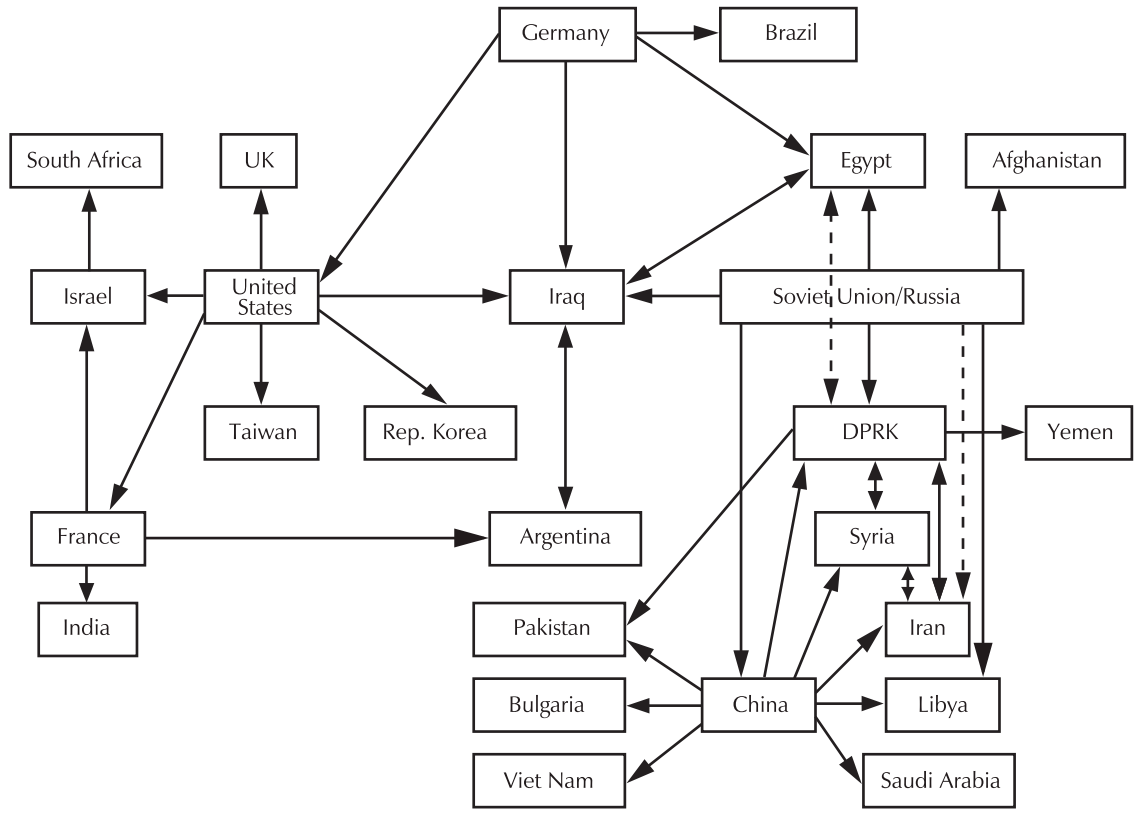
campaigns, but this novel military technology has had a lasting effect on arsenals, doctrines and policies worldwide.

Today, proliferation of missile technology is a critically important issue for international security, even more as it is linked with the proliferation of nuclear and other weapons of mass destruction (WMD). A nuclear weapon, after all, poses much less of a threat if there are no appropriate means to deliver it. The delivery requirements of a nuclear weapon consist of a payload capacity of a few hundred kilograms, a range of a few hundred kilometres and accuracy to within at least a few kilometres. A specific infrastructure—including command and control systems—is also needed.

WMD could potentially be delivered via a number of systems, including aircraft, ballistic missiles, cruise missiles, artillery and UAVs, as well as a wide range of low-technology options, such as civilian cars, ships or even suitcases. The more sophisticated and precisely targetable a delivery system, and the longer its range and bigger its payload, the more difficult and costly it is to develop and produce. But the faster and higher it can fly, the more difficult it is to defend against. Whatever the range and sophistication, missile development is a key international security concern.

Ballistic missiles

Figure 1. The network of ballistic missile technology proliferation

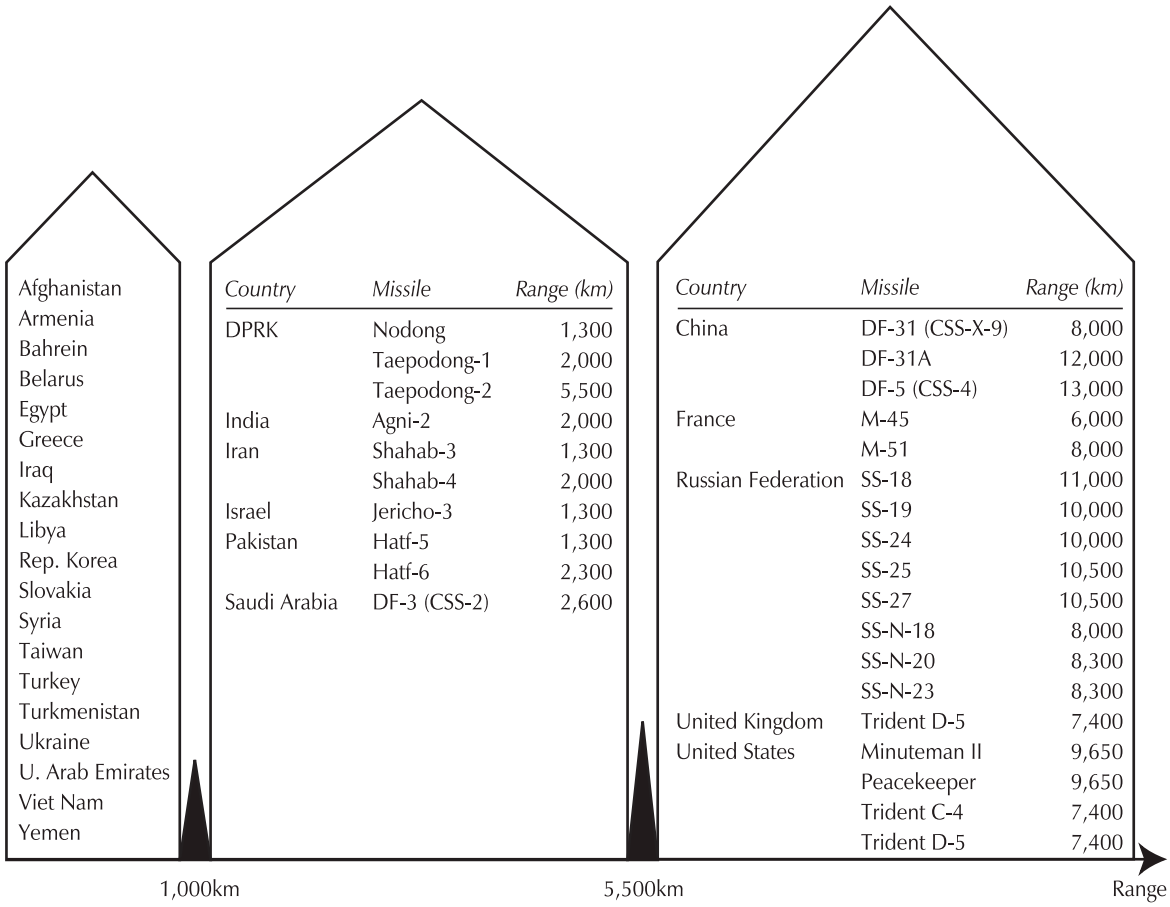


Source: For details about the missile proliferation network, see Alexander H. Montgomery, 2006, "Proliferation Networks in Theory and Practice", *Strategic Insights*, vol. V, no. 6, July, at <www.ccc.nps.navy.mil/si/2006/Jul/montgomeryJul06.asp>.

With the end of the Second World War, both the Soviet Union and the United States exploited V2 technology and transferred missiles, blueprints and spare parts to their own states. With the help of German scientists and engineers, the two world powers laid the foundations for both their space programmes and their military missile arsenals. Both states in turn passed know-how and technology on to other states: the United States to France and the United Kingdom, the Soviet Union to China. Within two decades of Hiroshima, the five nuclear-weapon states possessed the means to use their nuclear weapons anywhere on the globe. To date, ballistic missile technology (over 150km in range) has spread to over 30 states (the relationship between some of them is shown in Figure 1). Altogether the number of missiles is estimated to be 120,000 worldwide, compared with 35,000 at the end of the Second World War.[4]

A number of states are attempting either to procure or develop mid-range ballistic missiles to accurately deliver WMD over greater distances.[5] However, most of the arsenals or development programmes beyond the five main nuclear-weapon states are far from long or even medium range. As of 2005, only the Democratic People's Republic of Korea (DPRK), India, Iran, Israel and Pakistan have produced or flight-tested missiles with a range of over 1,000km.[6] Saudi Arabia has purchased between 20 and 25 CSS-2 missiles from China. Currently, only the DPRK seems to be aiming for intercontinental

Figure 2. States with ballistic missiles by category of range



Source: Joshua Williams, *2005, World Missile Chart,* Carnegie Endowment for International Peace, <www.carnegieendowment.org/npp/ballisticmissilechart.cfm>. A German version has been published in J. Scheffran, 2005, "Rüstungskontrolle bei Trägersystemen", in G. Neuneck, C. Mölling (eds), *Die Zukunft der Rüstungskontrolle,* Nomos, pp. 354–366.

range, but it utterly failed (again) to show this capability in its July 2006 missile tests. All other states' arsenals or programmes remain in the shorter range (see Figure 2). If there is a global missile threat, then it is from the established five nuclear-weapon states.

While in the perception of the public and policy makers the ballistic missile threat seems to continually increase, the facts show a somewhat different picture. The overall number of missile-owning states has noticeably decreased since the mid-1980s, and Russian and US missiles have been disassembled or converted for space launch use.[7] Only in the field of mid-range systems have a few more states initiated programmes during the last two decades (see Table 1).

It cannot be excluded that more states will in the future be able to cross the thresholds of 1,000km and 5,500km, although this is a complex, time-consuming and expensive task. The physical stress of a ballistic vehicle increases in the terminal phase by a factor of about 5 when increasing range from 1,000km to 5,000km (50 times gravity on Earth, 100 million joules of energy).[8] And at larger distances it becomes increasingly difficult to hit a target with high precision. Only a few developing states are able and ready to obtain the necessary technology, particularly as key components (e.g. accurate guidance, composite materials, thrust vector control) are not easily available on the market. Some states' missile programmes have stalled because of technical difficulties, economic limits and political pressure. But in other cases missile sales balance production costs.

Table 1. The decreasing global ballistic missile threat

Threat	*Status (2005 in comparison with 1987)*	*Trends*
ICBM and submarine-launched ballistic missiles (>5,500km)	51% decrease	↓
IRBM (3,000–5,500km)	97% decrease	↓
MRBM (1,000–3,000km)	Four new national programmes	↑
SRBM (<1,000km)	Declining as Scud inventories age	↓
States of concern that have ballistic missile programmes	Fewer, less advanced programmes (11 in mid-1980s, 6 in 2005)	↓
Potentially hostile states with ballistic missile development programmes	Fewer and smaller overall arsenals (4 in mid-1980s, 3 in 2005)	↓
Potential damage to the United States from a missile attack	Vastly decreased	↓

Source: Joseph Cirincione, 2005, *The Declining Ballistic Missile Threat, 2005*, Carnegie Endowment for International Peace Policy Outlook, February, at <www.carnegieendowment.org/files/DecliningBallisticMissileThreat2005-2.pdf>.

Cruise missiles

Public attention has so far been focused on ballistic missiles, but for some observers their military effectiveness has been exaggerated in comparison with aircraft or cruise missiles, which can be capable and cost-effective alternatives. Cruise missiles cost four to ten times less than ballistic missiles, they are easier to acquire and to maintain, require less training and logistical support, perform with better accuracy and are more reliable.[9] Cruise missiles have been dubbed "the poor man's air force" and, for some, their proliferation is of greater concern.[10]

Cruise missiles are suited for spraying biological or chemical agents over a target area, because of their flight stability, range, payload capacity and low altitude. Their relatively small size means they are difficult to detect with visual, infrared or radar surveillance and they make early warning or defensive countermeasures difficult. These qualities have contributed to their proliferation. Cruise missiles are produced in 19 states and owned by some 75. About 70 possess short-range anti-ship cruise missiles—adding up to approximately 70,000 missiles in total. These are technologically less complex than land-attack cruise missiles: it is far easier to identify a large ship on water than a building or bridge in a heterogeneous land environment.

In the ten years prior to 2001, about 1,100 cruise missiles had been used (against Afghanistan, Iraq, Sudan and Yugoslavia), while only 90 ballistic missiles were launched (by Iraq) in the same period. In the 2003 Iraq War, the United States fired nearly 800 cruise missiles.[11] This war, however, taught an unexpected lesson: Iraq's use of five primitive land-attack cruise missiles "sowed such confusion among U.S. forces that it contributed to a series of friendly fire casualties: a Patriot erroneously shot down two friendly aircraft, killing three crew members, while an American F-15 crew destroyed a Patriot radar, in the belief that they were being targeted".[12]

Unmanned aerial vehicles

Many of the characteristics of cruise missiles also apply to a non-missile type of weapon system: UAVs. It has been pointed out that the "distinctions between cruise missiles and UAVs are becoming blurred as the militaries of many nations, in particular the United States, attach missiles to traditional reconnaissance UAVs and develop UAVs dedicated to combat missions".[13]

Even more than ballistic and cruise missiles, UAVs have a high civil–military dual-use potential, are relatively cheap, easy to handle and represent a comparatively accessible means to disperse biological and chemical agents. They profit from the availability of satellite-based positioning and navigation data, which grant a high degree of targeting accuracy.[14] For low-tech users, even commercial plane kits can serve as a basis for a capable UAV. All necessary equipment and parts are available on the open market and are relatively cheap. Such a widely available system might have been used in November 2004, when Hezbollah flew a UAV from Lebanon over land to the Israeli town of Nahariyya and back north along the coast. The vehicle did not go unnoticed but could not be shot down: air defences were not prepared to deal with something flying so low.[15]

Threat perception and security implications

To deal with the problems missiles are causing it is necessary to understand the motives driving missile proliferation and security implications.

Demand

Among others, the following factors can be identified as driving missile demand:

- the perception of the military effectiveness of missiles for strategic deterrence or tactical use against military targets;

- the perception of the missile threat posed by other states;
- missiles' role in military doctrines of provocation or pre-emption;
- missiles' role as symbols of prestige, power and independence;
- economic reasons (export revenues, creation of an indigenous industrial base); and
- scientific–technical reasons (exciting research, scientific competition, creation of a national research and development base).

These motives apply to varying degrees to different states and missile types, but here we will focus on ballistic missile demand.

Ballistic missiles are often seen as the weapon of choice to deliver nuclear weapons across large distances with high speed and little warning, and with high accuracy and probability of penetration against even the most advanced defence systems. However, these qualities are most relevant for the more recent, sophisticated generations of ballistic missiles. They only partially apply to the Scud and its variants, which are short range and inaccurate. Putting a nuclear warhead on a primitive or unreliable ballistic missile would be a risky and costly business for a state with only a limited amount of nuclear-weapon material, such as the DPRK today or perhaps Iran in the future.

From a military viewpoint, using a ballistic missile to deliver a conventional warhead appears relatively inefficient. Old generations of missiles lack accuracy, and the more advanced ballistic missiles are expensive compared with other means of dropping bombs. But if used in significant numbers, conventionally-armed ballistic missiles could serve as weapons of terror. This condition was fulfilled in the Iran–Iraq war of the 1980s, and partially during the 1991 Iraq war and the 2006 conflict in Israel and Lebanon. With increasing accuracy, more advanced conventionally-armed ballistic missiles can also serve a strategic role, as intended by the United States with its decision to deploy conventional Tomahawk cruise missiles on Trident submarines.[16]

Using chemical and biological weapons with ballistic missiles is generally possible, although they seem less efficient and less reliable than cruise missiles, aircraft and low-tech means of delivery suh as ships and trucks. Nonetheless, they are attractive even to actors with limited technical and economic capabilities.

If nuclear-armed ballistic missiles were to fall into the hands of terrorists, this could pose a major threat, but such a scenario depends on the supply of nuclear weapons from a nuclear-weapon state.

Threats and threat perception

For the time being, the five nuclear-weapon states remain the only states that could conceivably attack each other with ICBMs, and improved relationships among China, the Russian Federation and the United States have diminished this threat.

However, developments in other missiles programmes have highlighted the potential of conflict elsewhere. The DPRK has developed significant missile potential with its Nodong and Taepodong missiles, with possible ranges of up to 5,000km. Test flights by the DPRK raised international concern, in particular among Japan, the Republic of Korea and the United States. This declined somewhat after Pyongyang reaffirmed its flight test moratorium in 2002. Since its nuclear test in October 2006, however, the DPRK's missile programme has again fuelled heightened threat perceptions among its neighbours, some of which are seeking protection through missile defence.[17]

In the Middle East, Iran's Shahab-3 missile is based on Russian expertise and DPRK exports. With an estimated range of 1,300km Iran would be able to reach Israel—provided the current testing programme leads to a deployable missile force.

In South Asia, the missile race between India and Pakistan continues. Missiles on both sides of the border threaten each other with a flight time of minutes. In 2003, Pakistan launched production of its 1,300km-range Ghauri missile, which, like the 600km-range Shaheen missile, is operated by the army.[18] India has tested its 700km-range Agni-1 missile as well as the Prithvi short-range ballistic missile. Dialogue between these two states in an attempt to settle their disputes by diplomatic means may have an impact on slowing missile proliferation and preventing missile use.

These and other missile arsenals may also be able to reach overseas-deployed forces of major powers, and some missile systems can reach part of the territories of the Russian Federation and Europe. Their military capability may be small, but the missiles could have a major political effect. Nonetheless, the risks associated with these missile programmes are not comparable to the Cold War threat of global nuclear war. This is important to bear in mind to avoid a disproportionate response.

Under the Bush Administration, the threat posed by WMD and delivery systems moved to the centre of US security policy, along with the fight against terrorism. The United States' threat perception is still based on the 1998 report by the Commission to Assess the Ballistic Missile Threat to the United States (known as the Rumsfeld Commission). The Commission states that rogue states could acquire an ICBM capability in a short time and unnoticed by the US intelligence community. It asserts that "Scud-based ballistic missile infrastructure would be able to achieve first flight of a long range missile, up to and including intercontinental ballistic missile (ICBM) ranges … within about five years of deciding to do so".[19] The DPRK and Iran were identified as "pursuing advanced ballistic missile capabilities to pose a direct threat to U.S. territory".

Eight years later, neither state has flight-tested an ICBM and progress of long-range missile programmes remains slow. Nonetheless the alarmist and controversial position of the Rumsfeld Commission still dominates US policy on missile proliferation and anti-missile systems. The 2001 National Intelligence Estimate (NIE) came to the conclusion that "the probability that a missile with a weapon of mass destruction will be used against US forces or interests is higher today than during most of the Cold War, and it will continue to grow as the capabilities of potential adversaries mature".[20] However, it also concluded that US territory is more likely to be attacked with WMD not by missiles but by non-missile delivery (primarily because this is less costly, easier to acquire and more reliable and accurate, and can also be used without attribution), but this was largely ignored.[21] The argument that the United States would most likely face ICBM threats from the DPRK and possibly Iran before 2015 was used to justify the missile defence programme. The 2001 US Quadrennial Defense Review even argues that "the pace and scale of recent ballistic missile proliferation has exceeded earlier intelligence estimates and … these challenges may grow at a faster pace than previously expected".[22] The 2004 NIE report, *Mapping the Global Future,* however, prolonged the date when the DPRK and Iran would have ICBMs to 2020.[23] The 2006 Quadrennial Defense Review did not repeat any of the previous statements and abstained from any future projections.

Deterrence and counterproliferation

While so-called states of concern and terrorists still lack the necessary technical capabilities to pose a global missile threat, the use of missiles by current nuclear-weapon states remains an issue. These states already have all the means for nuclear ballistic attack, and their doctrines explicitly provide reasons for such an attack—all of the nuclear-weapon states' doctrines at least assign these weapons

either a deterrence role or use as a weapon of last resort if the existence of the state is at stake. Deterrence doctrines pose dangers in themselves, as was demonstrated during the Cold War. While the Russian Federation and the United States have established some barriers to nuclear holocaust, regional competitors like India and Pakistan are now facing first-strike scenarios, and at much shorter range and warning time. Deterrence remains dangerous, and missile defence will complicate rather than diminish the risk.

Regional competitors like India and Pakistan are now facing first-strike scenarios, and at much shorter range and warning time.

The gravest danger lies in doctrines that place nuclear missiles in a pre-emptive role, to destroy targets that are perceived as threatening. Such targets include components of the supposed WMD or missile complex of a "state of concern".[24] The discussion on conditions for actual nuclear use reached a new level in the context of attempts to prevent Iran from building a nuclear-weapon capability.[25] The impossibility of destroying Iran's underground enrichment capabilities by conventional means has spurred a debate within US military and political circles over the use of bunker-busting nuclear warheads. As could be expected, such counterproliferation efforts provide emerging proliferators with a major reason for acquiring nuclear status to deter such foreign intervention.

Instabilities and risks

As these developments demonstrate, there is a close link between horizontal proliferation of weapons of mass destruction and delivery capabilities in developing states and vertical proliferation of advanced weapons in industrialized countries. The new arms races emerging from this interaction are potentially destabilizing. Whether the technology works or not, the pursuit of missile technology could substantially disrupt regional balances, lead to military escalation, increase the probability of war, and fuel a regional crisis, as was the case in the two Gulf wars. Missiles obscure the threshold between conventional, biochemical and nuclear war and increase the risk of nuclear war by accident, in particular if they are left on hair-trigger alert.

Missile proliferation is primarily a regional problem, notably in regions where peace is fragile: the Middle East, North-East Asia and South Asia.[26] In other parts of the world missile arms races are of secondary importance. Regional conflicts spur demand for more advanced missile technology, and this could spread beyond the region. Under these circumstances, a grave, global missile threat may emerge.

Prospects for preventing the missile threat

Since the projected global missile threat is still several years in the future, the time to take political action to prevent it is now. The existing approach is largely based on export controls among potential missile suppliers (the Missile Technology Control Regime, MTCR) and on bilateral arms controls between the Russian Federation and the United States (the Intermediate-Range Nuclear Forces Treaty, the Strategic Arms Reduction Treaty and the 2002 Strategic Offensive Reductions Treaty), which includes confidence-building measures and the exchange of data on missile tests. The MTCR has been able to slow down or even end some missile programmes, but its effectiveness in the long run is limited if motivation to acquire missiles persists. Further missile control measures have occasionally been discussed but not implemented, including the Russian proposal for a Global Control System (GCS) and a Global Monitoring System (GMS) on missile technology. The Hague Code of Conduct (HCOC) was agreed on 26 November 2002 by the MTCR member states, and the Proliferation Security Initiative (PSI), founded by 11 MTCR member states in 2003, aims at pre-emptive interdiction of the international transport of

WMD and related missile components. The most ambitious missile control attempt so far has been the United Nations Panel of Governmental Experts on missiles, which published its report on the "issue of missiles in all its aspects" in 2002.[27] Despite its comprehensive approach, the report came to no policy-relevant conclusions.

Even though some of these initiatives appeared promising in the beginning, their effectiveness has been limited by competing interests between states and the disinterest of the Bush Administration in arms control. In recent years, arms control and disarmament have not been seriously considered for missiles, and other delivery systems have also been largely neglected. Global missile control initiatives are not currently on the international agenda, but regional activities for missile control, such as the confidence-building measures between India and Pakistan, do stand a chance. The key for further progress is to find mechanisms that restrain both capabilities *and* motivation to acquire missiles. Building international and regional security regimes, combined with political and economic cooperation, would provide incentives to diminish reliance on missile arsenals. Cooperative approaches are also required for preventive arms control and disarmament. This includes qualitative constraints on missiles, most notably a ban on missile flight tests, which would freeze missile development.

The key for further progress is to find mechanisms that restrain both capabilities and motivation to acquire missiles.

An effective missile control regime needs to reflect the complexity of the issue. It should include the various stages of missile development and take into account that the potential missile threat increases with the missile development process, making control efforts at later stages more difficult. It would consider the linkages between different categories of delivery systems. Ballistic missiles still receive more attention in talks and negotiations than cruise missiles or UAVs. For instance, the HCOC fails to cover cruise missiles. Even on a regional level, cruise missiles are exempted from confidence-building measures. The pre-notification agreement between India and Pakistan covers only launches of ballistic missiles.[28] Any regime also needs to cover the asymmetries between missile owners. It would have to consider the issue of dual-use technology and the link to space technology.[29] Regional approaches (e.g. missile-free zones) and global disarmament concepts (e.g. the 1992 Zero Ballistic Missiles concept of the Federation American Scientists) would ideally go hand-in-hand.[30] An essential aspect would be the monitoring of missile activities and the verification of agreements.[31] Inspections were successful in Iraq, where the United Nations Monitoring, Verification and Inspection Commission (UNMOVIC) was able to destroy the Al Samoud missile, which exceeded the admissible range of 150km.[32]

Strengthening an international missile control regime is a continuous, step-by-step process, which includes many interrelated measures.[33] Prospects for international missile control will ultimately not just depend on technical capabilities but also on the security landscape and political will. It is becoming obvious that missile technology will not remain in the hands of those who dominate the international security discourse. The use of missiles by Hezbollah in 2006 was a warning of things to come. Missile proliferation can only be prevented if it deals with both supply and demand, and if an international norm against development, production and use is established. In a world in which multiple missile technologies are spreading to multiple actors, some of whom are non-state, the chances of success are diminishing. Whether this race has been already lost is yet to be determined.

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Lessons from regional approaches to managing missiles

Waheguru Pal Singh Sidhu

Despite (or perhaps because of) the failure of the last United Nations Panel of Governmental Experts on missiles to adopt a consensus report in mid-2004, the issue of missiles has remained on the front-burner for at least two reasons. First, the proliferation—both vertical and horizontal—of all types of missiles, evident in the frenetic pace of missile tests, has continued unabated. Although it is impossible to ascertain precisely how many and what kind of missiles have been tested over the past couple of years, conservative estimates based on open sources suggest more than 100 ballistic and cruise missiles of various sorts.[1] Prominent among these were over 30 tests (sometimes involving multiple missiles) each conducted by the Russian Federation and the United States. In addition, Iran spectacularly launched "dozens of missiles" as part of a military exercise in November 2006, which somewhat overshadowed even the Democratic People's Republic of Korea's (DPRK) launch of seven missiles in July 2006.[2] Finally, countries like Pakistan and the Republic of Korea, hitherto considered to be of concern on account of their ballistic missile ambitions, also unveiled potent cruise missiles in 2006.[3] All these events ensured that the international community could not ignore the issue of missiles even if it wanted to.

Second, not surprisingly, there is ample evidence that the international community has remained seized of the issue of missiles through various political–diplomatic as well as military–technological initiatives, such as the Proliferation Security Initiative (PSI) and missile defence.[4] In October 2004 the First Committee (Disarmament and International Security) of the United Nations General Assembly welcomed the adoption of the Hague Code of Conduct (HCOC) against ballistic missiles, invited all states to subscribe to it and sought further ways to "deal effectively with the problem of the proliferation of ballistic missiles capable of delivering weapons of mass destruction".[5] The code was again endorsed by a United Nations General Assembly resolution in 2005.[6] In addition, the United Nations First Committee adopted a resolution entitled "Missiles" in 2006 with 105 votes in favour, 6 against and 55 abstentions.[7] This resolution took note of the report of the Secretary-General on the issue of missiles and sets the stage for the third UN Panel of Governmental Experts in 2007. In addition, the Security Council adopted resolution 1695 in July 2006 following the series of missile tests by the DPRK, which almost exclusively focused on Pyongyang's ballistic missiles; resolution 1696 against Iran's enrichment programme also focused on its missile capabilities; and resolution 1718 following the DPRK's nuclear test also highlighted missile concerns.[8] The Weapons of Mass Destruction Commission's report devoted an entire section to missiles.[9]

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There is clearly a disconnect between ongoing, unfettered missile-related activities and efforts to address them. This state of affairs appears to reflect a serious limitation on the part of the international community to address the issue of missiles either in universal or individual terms. The most obvious reason for this is that "[n]o universal norm, treaty or agreement governing the development, testing, production, acquisition, transfer, deployment or use specifically of missiles exists".[10] The international community has taken on the unenviable task of enforcing rules, norms and regulations that are simply non-existent. Indeed, there is only a single instance in which the international community was able to address the issue of missiles effectively: Iraq. However, the single and exceptional experience of Iraq proves the rule.

There is clearly a disconnect between ongoing, unfettered missile-related activities and efforts to address them.

The issue of missiles has instead been most effectively addressed at the unilateral or the bilateral level. The most apparent examples of this are South Africa and Libya, where both countries unilaterally opted to give up their strategic ballistic missile capabilities.[11] (South Africa's actions were on account of an internally-driven regime change, while Libya's were the result of a change in the policies of the existing regime.) The best example of action at the bilateral level is the Soviet Union–United States Intermediate-Range Nuclear Forces (INF) Treaty (signed in December 1987), which led to the elimination of *all* ballistic and land-based cruise missiles with a range between 500km and 5,500km.

Are such effective approaches possible only at the unilateral or bilateral level? Or could they be attempted at the global level? Despite the efforts of several arms control experts and scholars calling for a "globalized INF Treaty" or a "zero ballistic missile" arrangement, such proposals have never taken off.[12] If successful unilateral and bilateral efforts cannot be globalized, could their success be replicated at the regional level? The answer would have to be a definite maybe.

Regional measures should be seriously considered because there are multiple missile actors in some regions, and unilateral and even bilateral measures alone are unlikely to address missile-related concerns effectively. But several issues would first have to be considered to get a more definitive answer on their likely success. For instance, could *all* arrangements related to missiles, such as disarmament, non-proliferation, arms control and confidence-building measures, work in all regions or are some regions more conducive to them than others? If it is the latter, then what is it that makes some regions more promising than others? Could regional arrangements be designed to disarm all the strategic ballistic and cruise missiles of countries in the region? Or would they only be able to achieve a degree of arms control, curtailing the use of only some kinds of strategic missiles? Or just prevent the proliferation of ballistic and cruise missiles? Or would they only work at the modest and minimal level of achieving some missile-related confidence-building measures? To answer these questions, this article will study the past and present experience of the three primary regions of missile activity—the Middle East, South Asia and North-East Asia—to evaluate the prospects of the issue of missiles being addressed regionally.

The Middle East

Of the 35 or so countries possessing missiles with ranges in excess of 150km, more than a third are located in the Middle East. In addition, the region has witnessed the most extensive use of ballistic and cruise missiles anywhere in the world since the end of the Second World War.[13] At the same time, the region presently lacks any form of regional arrangement where missile-related issues could be addressed.

Although the now defunct Arms Control and Regional Security (ACRS) working group, which emerged from the 1991 Middle East Madrid Conference, did provide a format for discussions on

missiles and other related issues, this process did not lead to any concrete measures to address missile concerns for several reasons. First, the absence of Iran, Iraq and Libya from the group and the refusal of Syria to participate meant that even when it was operational ACRS did not represent all the key actors of the region. These absences reflected not only the obvious Arab–Israeli divide but also the equally discordant Arab–Iranian divide. Second, there were differences over which missiles should be considered. Given the proximity of most of the key countries, even very short-range missiles (and rockets) could pose a threat to neighbours. Third, and in light of these serious disagreements, the objective of "a freeze on the acquisition, production, and testing of surface-to-surface ballistic missiles by states in the region, with a view to their ultimate elimination from national arsenals" proved to be much too ambitious for negotiation, let alone agreement.[14] Consequently, by the mid-1990s the process petered out.

According to Gerald Steinberg, "the absence of significant CSBMs [confidence- and security-building measures] turned out to be a major flaw and cause of failure. The impressive list of CSBMs that were discussed and developed in the beginning of the process was gradually eroded."[15] This perspective was also endorsed by Mohamed Kadry Said, another keen observer of the ACRS process, who noted that in the Middle East the problem is "not limited to confining missile proliferation in its material sense, but to fighting the proliferation of a 'missile culture' and the temptation to use such lethal weapons against population centres and the civilian infrastructure".[16] Both scholars argue strongly in favour of a regional arrangement (like ACRS) pursuing a step-by-step approach to deal with missiles, starting with confidence-building measures (CBMs). These CBMs could include "pre-notification of launches, range limitations, capping of stocks and transparency measures"[17]—these are precisely the CBMs with which the ACRS process made substantial progress before it lost momentum.

South Asia

In contrast to other regions, in South Asia only three countries—China, India and Pakistan—possess ballistic and cruise missiles with ranges in excess of 150km. Although the region has witnessed substantial testing activity (some of which was clearly designed to intimidate neighbours), long-range missiles have not yet been used in conflict.[18] While the region presently lacks any form of regional arrangement where missile-related issues could be addressed (neither the South Asian Association for Regional Cooperation—SAARC—nor the Shanghai Cooperative Organisation—SCO—currently have the mandate to discuss these issues), it is the only region that has developed significant missile-related CBMs, particularly between India and Pakistan.

On 3 October 2005 India and Pakistan signed a formal agreement on the pre-notification of flight-testing of ballistic missiles, only the second agreement of its kind.[19] The agreement calls for each side to notify the other "no less than three days in advance of their commencement of a five day launch window within which it intends to undertake flight tests" and to "ensure that the test launch site (s) do not fall within 40 kms, and the planned impact area does not fall within 70 kms, of the International Boundary or the Line of Control".[20] This agreement was the result of a long process that began in February 1999, when the two sides signed a memorandum of understanding and sought "to adopt appropriate measures aimed at preventing misunderstanding and misinterpretation and promoting a stable environment of peace and security".[21] One reason why such an agreement was possible between two otherwise hostile neighbours is that it is deliberately modest in scope. For instance, unlike elsewhere, India and Pakistan did not begin by seeking to freeze the acquisition, production or testing of ballistic missiles; they tacitly accepted the presence of such missiles in each other's arsenals. Similarly, the agreement did not seek to cover *all* missiles, especially cruise missiles, although it was clear that

both India and Pakistan were well on their way to acquiring this capability. Finally, although the arrangement does not cover the deployment, use or even the possible disarmament of certain classes of missiles, it clearly paves the way for further negotiations. Hence, it is quite likely that for a number of reasons, including technological and domestic factors, both India and Pakistan (and possibly China at a later stage) could not only move toward making the agreement more comprehensive (by eventually including cruise missiles) but also explore the possibility of some missile disarmament.

Although there is no comparable agreement between China and India, their 1996 agreement "on Confidence Building Measures in the Military Field along the Line of Actual Control in the India–China Border Areas" does contain the outline of a potential arms control arrangement for missiles. Article III, for instance, gives the two sides the option to reduce or limit the number of particular weapon systems, including "surface-to-surface missiles, surface-to-air missiles and any other weapon system mutually agreed upon".[22] However, such ambitious arms control arrangements are unlikely to come into effect without the presence of and experience with some basic missile-related CBMs, such as providing basic details of missile programmes.

At a later stage, depending on experience with these rather modest CBMs and the comfort level of all three countries with a limited degree of transparency on the missile issue, it might be possible for China, India and Pakistan to negotiate—either bilaterally or trilaterally—the dismantling of a particular class of nuclear-capable ballistic missiles. Among the potential missile candidates for such an arms control and disarmament agreement could be the Prithvi-1, -2 and -3; the Hatf-1, -2 and -3; and the Dong Feng-3 and -4.[23]

North-East Asia

Although not as plentiful as in the Middle East, multiple missile actors coupled with the absence of any effective regional mechanism means that even North-East Asia is ill equipped to address the issue of missiles regionally. While, unlike the Middle East, the region has not witnessed any significant missile use, regular tests by all the missile actors in the region have resulted in heightening tension.

The Six-party Talks arrangement (which began in August 2003), though not designed to deal with missile issues specifically, was regarded with great promise and expected to reduce tensions, especially around the issue of missile tests. However, after five rounds and the resumption of missiles tests by the DPRK (breaking an eight-year-long moratorium), followed by its nuclear test on 9 October 2006, the Six-party Talks failed to live up to expectations. Indeed, it could be argued that it was the failure of progress in the Six-party Talks that prompted Pyongyang to resume missile tests. The reasons for the failure of the Six-party Talks are complex, but it is apparent that they were unsuccessful on the missile front possibly because (like the ACRS process) they had an ambitious agenda.[24] By all accounts the nascent regional arrangement sought to curb and even reverse the missile arsenal of the DPRK in particular; a non-starter as far as Pyongyang is concerned.

Were the Six-party Talks to resume, a less ambitious agenda on missiles is more likely to succeed. According to Akira Kurosaki, who elaborates a three-stage "model road map for building a regional missile limitation regime in Northeast Asia", the first stage would inevitably require the establishment of "a regional organization for missile technology control, the prior notice of missile flight test, the exchange of data on missile armaments, and inspections and verification".[25] Although the DPRK has expressed reservations even about the most perfunctory prior notification of a missile test for fear that the missile would be intercepted by the United States "in collusion with Japan", pre-test notification is still worth seeking at the very least.[26]

Lessons from regional experiences

Based on the experiences of the Middle East, South Asia and North-East Asia, it is evident that formal regional arrangements (such as SAARC or SCO) have played little or no role in addressing missile issues. On the other hand, informal or ad hoc regional arrangements (such as the ACRS or the Six-party Talks) are useful but not always essential (as evident in the case of South Asia, where none exists). However, in Africa and South America, where formal regional arrangements have contributed to the establishment of local nuclear-weapon-free zones, these same arrangements could be explored to play a role in dealing with missiles.

It is evident that some regions are clearly more conducive to some form of regional missile arrangement than others. Based on the survey of missile regions above it would appear that a regional arrangement based on a key bilateral relationship (such as the—albeit antagonistic—relationship between India and Pakistan) is most likely to succeed. Conversely, a region that has a multiplicity of actors rather than a key bilateral relationship (as in the Middle East and North-East Asia) is less likely to succeed in creating a missile-related arrangement, except at the very lowest common denominator. While the Egyptian–Israeli relationship has the potential for a bilateral security arrangement, it has yet to come to fruition. In any case, the absence of Iran from the relationship would render any missile-related arrangement meaningless. In North-East Asia, a bilateral DPRK–United States relationship could provide the basis for a region-wide arrangement, but this is unlikely in the short term.

In terms of the content of any regional arrangement, arrangements that opt for a step-by-step approach, starting with the least intrusive of CBMs, are the most likely to be accepted. Approaches that set out ambitious non-proliferation, arms control and disarmament objectives are unlikely to succeed in the first instance. The process of establishing CBMs could eventually pave the way for more advanced and ambitious measures; in the absence of CBMs, nothing is likely to work. As the survey above shows, South Asia, which began with modest missile-related CBMs rather than far-reaching disarmament objectives, is the only region to have achieved any sort of effective regional missile arrangement.

In the absence of CBMs, nothing is likely to work.

Interestingly, however, other regions have also had some experience with CBMs. For instance, the ACRS process did discuss the prospects of pre-notification of launches and other transparency measures, while in North-East Asia the DPRK unilaterally maintained an eight-year moratorium on missile tests. The challenge would be for new or revived regional arrangements to revisit these CBMs.

Regions that do not currently face similar missile concerns, such as Africa and South America, could also be encouraged to adopt the most basic missile-related CBMs, for example pre-notification of flight tests and other information-sharing and transparency measures, including some of those outlined (but yet to be operationalized) in the Hague Code of Conduct. Depending on regional political dynamics, Africa and South America could also seek more ambitious military constraints on the missile programmes of their countries.

To conclude, it is evident that while efforts at addressing missiles at both the global and the individual country level are commendable, they are unlikely to be effective in the near term. In contrast, regional approaches to addressing missile issues hold more promise. Nonetheless, a one-size-fits-all approach is unlikely to work. Each regional arrangement would have to be tailor made, in the context of the history, geography, technology and politics of the region.

Finally, region-specific missile arrangements have the greatest chance of success if they begin with modest objectives, such as CBMs. Once these minimum objectives are achieved, the arrangement can

build on them and seek more comprehensive approaches to dealing with missiles. This is probably why the UN Secretary-General's 2006 report on missiles, while not discounting the role of global and even individual actors, gives particular emphasis to regional approaches that start with CBMs.[27]

Notes

1. Although in the past only ballistic missiles were a primary cause of concern on account of their inherent role as delivery systems for nuclear weapons, cruise missiles have also become of concern because of their frequent use with conventional payloads as well as their potential as delivery systems for nuclear, biological and chemical weapons. See International Institute for Strategic Studies, 2005, "A Missile Proliferation Tipping Point?", *Strategic Comments*, vol. 11, no. 8, October.
2. "Defiant Iran Fires Longer-range Missiles", *Middle East Online*, 3 November 2006, at <www.middle-east-online.com/english/Default.pl?id=18120> and "Pyongyang Succeeds in Ratcheting Up Tension but Falls Short of Mastering Missile Technology", *Financial Times*, 6 July 2006.
3. "Pakistan Fires New Cruise Missile", *BBC News*, 11 August 2005, at <news.bbc.co.uk/2/hi/south_asia/4140692.stm> and "South Korea Successfully Tests Longer-range Cruise Missile", *Space War*, 24 October 2006, at <www.spacewar.com/reports/South_Korea_Successfully_Tests_Longer_Range_Cruise_Missile_999.html>.
4. This article will focus only on the political–diplomatic initiatives; see the article by Christophe Carle in this issue of *Disarmament Forum* for more on military–technological initiatives.
5. UN General Assembly resolution 59/91 of 3 December 2004, UN document A/RES/59/91, 17 December 2004.
6. UN General Assembly resolution 60/62 of 8 December 2005, UN document A/RES/60/62, 6 January 2006.
7. General and Complete Disarmament: Report of the First Committee, UN document A/61/394, 14 November 2006. For the text of the resolution, see UN General Assembly draft resolution on missiles, UN document A/C.1/61/L.3, 4 October 2006.
8. UN Security Council resolution 1695 (2006), UN document S/RES/1695(2006), 15 July 2006; resolution 1696 (2006), UN document S/RES/1696(2006), 31 July 2006; resolution 1718 (2006), UN document S/RES/1718(2006), 14 October 2006.
9. Weapons of Mass Destruction Commission, 2006, *Weapons of Terror: Freeing the World of Nuclear, Biological and Chemical Arms,* Stockholm, at <www.wmdcommission.org>.
10. *The Issue of Missiles in All Its Aspects: Report of the Secretary-General,* UN document A/57/229, 23 July 2002, paragraph 32.
11. South Africa terminated its nascent ballistic and even space launch programme in June 1993, while Libya pledged to eliminate ballistic missiles beyond 300km range with a payload of 500kg in December 2003. See the Nuclear Threat Initiative's South Africa Profile on Missiles, updated February 2006, at <www.nti.org/e_research/profiles/SAfrica/Missile/index.html> and its Missile Chronology for Libya, updated September 2005, at <www.nti.org/e_research/profiles/Libya/Missile/3840_5213.html> as well as the White House's Fact Sheet on *The President's National Security Strategy to Combat WMD: Libya's Announcement,* 19 December 2003, at <www.whitehouse.gov/news/releases/2003/12/20031219-8.html>.
12. For details of such ambitious (and perhaps impossible to implement) proposals see Thomas Graham and Dinshaw Mistry, 2006, "Two Treaties to Contain Missile Proliferation", *Disarmament Diplomacy 82,* Spring, at <www.acronym.org.uk/dd/dd82/82tgdm.htm>; and Randy Rydell, 2002,"Models for Missile Disarmament: In Search of a Political Foundation", *INESAP Briefing Paper no. 9*, March, at <www.inesap.org/pdf/Briefing9_02.pdf>.
13. Missiles were widely used during the 1980–1988 Iran–Iraq war, the 1991 US-led war on Iraq and the 2003 US-led war and occupation of Iraq. Missiles were also used against Iraq in 1998 as part of the United States–United Kingdom Operation Desert Fox and in July 2006 Hezbollah fired nearly 4,000 rockets and missiles at Israeli targets. Although these are not the only instances of the use of ballistic and cruise missiles, they are probably the most significant military use.
14. Reuven Pedatzur, 2001, "The Missile Race in the Middle East: Is There a Way Out?", *Moving Beyond Missile Defense,* INESAP Bulletin no. 18, September, at <www.inesap.org/bulletin18/bul18art12.htm>.
15. Gerald M. Steinberg, 2001, "Starting Over: The Prospects for Regional Security and Arms Control in the Middle East in the Next Decade", *Disarmament Forum*, no. 2, at <www.unidir.org/pdf/articles/pdf-art79.pdf>, p. 72.
16. Mohamed Kadry Said, 2001, "Missile Proliferation in the Middle East: A Regional Perspective", *Disarmament Forum*, no. 2, at <www.unidir.org/pdf/articles/pdf-art75.pdf>, p. 59.
17. Ibid., p. 60.

18. Perhaps the only two exceptions are the barrage of Scud ballistic missiles used by government forces to break the siege of Jalalabad during the Afghan civil war in the 1990s and the use of cruise missiles by the United States against suspected militant camps in Afghanistan (1998 and 2001–2002).
19. See Erin Creegan, 2005, "India, Pakistan Sign Missile Notification Pact", *Arms Control Today*, November. The other agreement is the Russian Federation–United States Memorandum of Understanding on Notifications of Missile Launches of 16 December 2000.
20. Agreement between the Republic of India and the Islamic Republic of Pakistan on Pre-Notification of Flight Testing of Ballistic Missiles, 3 October 2005.
21. Ibid.
22. Agreement between the Government of the Republic of India and the Government of the People's Republic of China on Confidence Building Measures in the Military Field along the Line of Actual Control in the India–China Border Areas, 29 November 1996.
23. For details see Waheguru Pal Singh Sidhu, 2004, "A Languid but Lethal Arms Race", *Disarmament Forum*, no. 2, at <www.unidir.org/pdf/articles/pdf-art2115.pdf>, pp. 16–17.
24. See John S. Park, 2005, "Inside Multilateralism: The Six-party Talks", *Washington Quarterly*, Autumn, at <www.twq.com/05autumn/docs/05autumn_park.pdf>, for the principle factors behind the failure of the process.
25. Akira Kurosaki, 2004, *Moving Beyond Deterrence and Missile Defense: A Case for Building a Regional Missile Limitation Regime in Northeast Asia,* INESAP Briefing Paper no. 13, November, at <www.inesap.org/pdf/Briefing13_04.pdf>, Table 1.
26. "DPRK Foreign Ministry Spokesman on Its Missile Launches", *Korean Central News Agency*, 6 July 2006, at <www1.korea-np.co.jp/pk/231th_issue/20060706.htm>.
27. *The Issue of Missiles in All Its Aspects: Report of the Secretary-General,* UN document A/61/168, 20 July 2006.

Missile control agreements: a general approach to monitoring and verification

Michael Vannoni and Kent Biringer

Since the end of the Cold War, international concern about missile proliferation has increased significantly. Missiles present some unique security problems because of their long range, their potential to deliver both high-explosive and nuclear warheads, and the difficulty in defending against them. The political and psychological reaction to missiles can be out of proportion to their actual effects—largely because of the feeling of helplessness that missiles can inspire.

This paper focuses on generic strategies and techniques for controlling the deployment, growth and spread of missile forces. It focuses especially on the role of monitoring procedures and technology—techniques that should be integrated into a system (a "regime") for transparency or verification. A number of concepts are outlined for achieving these objectives. Their appropriateness and effectiveness depends on a complicated mix of political, technical and operational factors, as with any form of international cooperation.

Missile characteristics

The terminology used to describe missiles is somewhat complex. In general, a *rocket* is a self-propelled cylinder using liquid or solid fuel. A *missile* is a flying object intended to strike a designated target. In modern military terminology, a rocket is an unguided weapon propelled by a rocket engine. Military rockets are used like artillery and typically have ranges of less than 75km. A missile is a rocket with a guidance system that adjusts its flight path toward the target after launch. Military missiles fall into two categories: ballistic and cruise. Ballistic missiles have an initial powered boost phase followed by supersonic free flight along a high, arcing trajectory. Guidance occurs during the boost phase and, in more advanced systems, during the re-entry of the missile or warhead into the atmosphere. The term *cruise missile* refers to unmanned, automatically guided, self-propelled, air-breathing vehicles that sustain flight through the use of aerodynamic lift.

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A framework for missile agreements

Missile agreements can be broadly divided into confidence-building measures (CBMs) and arms control (or constraint measures). CBMs for missiles normally involve sharing information to clarify national capability or intent. Sharing information unilaterally, bilaterally or multilaterally is often referred to as transparency. Security analysts often recommend that transparency measures to build confidence be introduced before formalized arms control agreements because excessive secrecy about military status can damage relations by fostering suspicions. Confidence building can be an excellent first step in reducing tensions and cultivating an atmosphere in which formal arms control measures can be credibly implemented.

The role of transparency in reducing missile threat perceptions

The United Nations defines transparency in arms matters as "systematic provision of information on specific aspects of activities in the military field under formal or informal international arrangements".[1] Transparency measures can be unilateral, bilateral or multilateral and governments do not typically ratify transparency agreements. Sometimes it is in a nation's security interest to act unilaterally to avoid misinterpretation of intent.

There is a role for both transparency and opacity in missile threat reduction.

The concept of transparency, however, has limitations and does not fundamentally change military realities. In practice, there is a role for both transparency and opacity in missile threat reduction. Choosing *not* to share certain information can enhance stability by not allowing vulnerabilities to be exploited. Such information could include system deployment locations and performance capabilities. Generally, transparency leads to greater stability when it achieves the following:

- increased symmetry of forces and/or capabilities;
- increased warning time or reduced likelihood of pre-emption success;
- reduced likelihood of misinterpretation of intent; and
- reduced vulnerabilities for either side.

Constructing control agreements for missiles

Arms control is normally implemented in formal and ratified agreements that commit the signatories to conduct specified actions (e.g. eliminate a defined type of weapon). Arms control is accompanied by verification activities that evaluate compliance with mandated commitments. A standard conceptual approach helps to generate strategies for missile control agreements: six steps describe the process of constructing an agreement.

1. Determine the topic of concern of the agreement.
2. Select the geographic area where the agreement is to be applied.
3. Define the actions to be taken and, if information is to be exchanged, provide the mechanisms and details of information to be shared.

4. Identify the parameters that define the above actions. This step is used to determine the objectives for subsequent monitoring and verification.
5. Identify the specific items to which the above actions are to be applied.
6. Specify the point(s) in the missile life cycle where the control actions are applied.

Missile systems move through a life cycle, which begins at the research stage and ends in retirement. Actions for control are easier to implement at some stages than others. For example, while it may be difficult to determine the state of research, the number of missile tests may be counted and measured.

Figure 1 lists choices from which the basic structure of a missile agreement can be constructed. The shaded areas illustrate the applicable elements for the 1987 Intermediate-Range Nuclear Forces (INF) Treaty between the Soviet Union and the United States.[2] The INF treaty eliminated ground-launched ballistic and cruise missiles with ranges of between 500km and 5,500km. Both launchers and missiles were eliminated, and the agreement obligated the parties not to produce, test or deploy these systems, thus covering three phases of the life cycle.

Figure 1. Elements of a missile control agreement, with the INF Treaty as illustration

Topic	*Geographic scope*	*Action*	*Action parameters*	*Specific items*	*Point in life cycle*
Ballistic missiles	Global	Limit	Quantity	Complete systems	Research
Cruise missiles	Multilateral	Promote	Physical parameters	Components/ materials	Development
Space launch vehicles	Bilateral	Inform	Location	Facilities	Production
			Operations/use	Processes/ activities	Test
				Movements	Storage
					Transfer
					Deployment
					Use
					Retirement

Monitoring techniques

Monitoring is the collection of information that is then used to build confidence and verify arms control agreements. The information used to confirm compliance of parties with an agreement is collected using declarations, inspectors and sensors. In addition, states use their own intelligence systems and national technical means (NTM) to complement and confirm information collected by cooperative monitoring. The process of monitoring can be conducted unilaterally or cooperatively. For example, the Soviet Union and United States agreed in the 1972 SALT Interim Agreement on the limitation of strategic offensive arms to use their own NTM (primarily images from satellites) to monitor the agreement.

There are two major steps in designing a monitoring system. The first is determining the "observables" to be monitored. Observables are physical characteristics that can be measured by human or technological means. The nature of the observables depends on the terms of the agreement.

For example, under the Strategic Arms Limitation Talks, the number of missile silos was an observable. Observables fall into five general categories.

- Presence or absence of specific items of interest.
- Number of specific items of interest.
- Location of specific items of interest.
- Physical characteristics of specific items of interest.
- Movement of specific items of interest.

The second step is to select the types of monitoring equipment to be used. Equipment selection must account for operational factors including the physical characteristics of the observable (e.g. weight or length), the active area and range of the sensor, the physical environment of the sensor, the reliability of sensors and communication equipment, the level of cooperation required and the impact of monitoring on government and civilian activities.

Declarations

Declarations and notifications can be useful confidence-building measures when used with respect to missile development and deployment. Missile quantities, movements, test launches and exercises may be declared in order to avoid the risks associated with misinterpretation of intent. Notification agreements have been an important element of Russian–US nuclear cooperation. The two countries agreed under the first Strategic Arms Reduction Treaty (START) in 1991 to inform each other about launches of intercontinental and submarine-launched ballistic missiles.[3] A 2000 memorandum of understanding expanded the requirement to include shorter-range ballistic missiles, space launch vehicles and research.[4]

Notification agreements have been an important element of Russian–US nuclear cooperation.

In February 2002 more than 80 countries met to evaluate an International Code of Conduct against Ballistic Missile Proliferation. Renamed the Hague Code of Conduct (HCOC), 93 countries signed the agreement on 25 November 2002. The HCOC is a politically binding (but not verified) regime that encourages states to outline their ballistic missile programmes once a year and provide notification of ballistic missile tests.[5] In September 2006 111 states were signatories.

As a regional example of confidence-building declarations, in October 2005 India and Pakistan signed a bilateral Agreement on Pre-notification of Flight Testing of Ballistic Missiles. This transparency measure is intended to reduce tensions between the two nuclear-capable states. The agreement requires each country to provide the other with advance notification of all planned flight tests of ballistic missiles.

On-site inspections

Inspectors were first used systematically to assess conditions at military-related facilities under the 1919 Treaty of Versailles. On-site inspection requires access to a site and a certain level of intrusiveness. Intrusiveness can be defined as the degree of physical access of the monitoring regime (human or technical) to the territory, facilities and controlled systems of the parties to an agreement. It can also cover the type of information collected, the duration of information collection, the potential for the collection of national security information unrelated to the agreement, and the disruptive effect of monitoring on facility operations.

An advantage of human inspection is that trained observers can evaluate information and detect indications of non-compliance immediately; the interpersonal contact between inspectors and hosts can also build trust. On-site inspectors may use a variety of portable data collection and analysis equipment to assist their observations. This equipment can include cameras, radiation and chemical detectors, tape measures and equipment to obtain physical samples. A variant of on-site inspection is the examination of written records and determination of their validity.

Remote monitoring

Remote monitoring is the collection of data by unattended sensors and the transmission of that data from the point of collection to another location for evaluation. Complementary layers of sensors are integrated into a remote monitoring system to monitor and report a specific activity while ignoring unrelated activity. Data can be collected continuously or only when activity occurs. For example, the entry of a ferrous object could activate a magnetic sensor, which can command a video camera to take an image, which can then be used to identify the object.

The ability to collect information selectively may, in some circumstances, make remote monitoring less intrusive than human inspectors. An advantage of using sensors is that they can operate continuously over long periods, which may be impractical for human observers. A system must be designed to report credible data and installed to minimize the potential for evasion. Examples of monitoring functions and sensor types are contained in Table 1, overleaf.

Remote sensing

Remote sensing is the collection of information when the sensor is a significant distance away from an object or activity of interest. It is generally viewed as less intrusive than on-site monitoring. Remote sensing includes satellite or aerial imaging; radar data collection; electronic signal collection; and the collection of effluent samples (such as air or water) outside the boundary of a facility. A limitation of remote sensing is that some observables, such as the radiation emitted by nuclear material, are only detectable at distances of a few metres. However, the growth of the commercial satellite industry means any country can now purchase an image of virtually any location on the globe for a relatively low price.

Aerial monitoring may be conducted cooperatively. The Open Skies Treaty entered into force in 2002 and makes military status more transparent among its signatories in North America and Europe.[6] It permits a signatory to fly a jointly staffed aircraft over the territory of another signatory, subject to certain operational rules and using approved sensors (optical, thermal infrared and imaging radar with defined resolutions). Hungary and Romania also signed a bilateral agreement (with fewer operational and technical provisions) to permit cooperative aerial overflight in 1991.

Applying monitoring techniques to missile control

The goal of missile non-proliferation and control can be pursued in a variety of ways: reducing the missile threat by decreasing missile readiness; restricting the export of missiles and associated equipment; limiting missile development by restrictions on flight or engine tests; restricting the operational deployment of existing missile forces; or reducing existing missile forces by number or type or both.

Table 1. Examples of remote monitoring systems

Monitoring function	*Example of sensor type*	*Sensor description*	*Example of application*
Tracking	Commercial transport tracking system	Portable, GPS-linked device determines/broadcasts location	Monitor location of patrol, vehicle or cargo; record route taken
Detection of access to a closed or secured item or facility	Passive seals	Tape, wire, fibre-optic cable, plastic shrink-wrap, other means of sealing doors or containers	Reveal whether a sealed item or room has been opened since closure
	Active seals	Seals linked to audible/visual alarm or radio transmitter	Provide immediate alert of tampering with sealed item
Access control	Personal entry identifiers	Code locks, magnetic badges, hand geometry readers, other ID devices	Limit access to authorized people
Detection of specific materials and activities	Metal detectors	Walk-through and hand-held magnetic sensors	Locate concealed weapons or other metallic items
	Chemical detectors	Detection of traces of specific chemicals on vehicles, people or cargo	Locate missile-related chemicals or explosives
	Portable X-ray machines	Standard airport baggage viewers	Identify contents of bags and small boxes
	Alarmed fences	Standard security fence with pressure-sensitive wires linked to alarm, camera or transmitter	Provide visible access barrier, intrusion warning
	Buried fibre-optic cable	Pressure-sensitive buried cable linked to alarm, camera or transmitter	Detect people or vehicles crossing a line of control
	Seismic, magnetic, acoustic sensors	Transmitter activated by vibration, ferrous metal or sound waves	Detect people, weapons, vehicles
	Infrared and microwave break-beam devices	Alarm or transmitter activated when line-of-sight beam interrupted	Detect people or vehicles crossing a line of control
Identification of objects	Ground-based photography	Commercial video and still cameras	Provide recorded moving and still images in real time or with a time delay
	Aerial or satellite-based photography and imaging sensors	Visual, infrared, multi-spectral collecting charged couple devices (CCDs), Synthetic Aperture Radar	Image through darkness, clouds, vegetation; detect objects, terrain not visible to the human eye
Confirm identity of specific items	Bar codes	Adhesive tape with readable bar code; bar code scanner	Identify individual pieces of equipment; facilitate inventory
	Reflective particle tag	Metallic particles suspended in polymer coating form unique pattern on equipment	Identify individual pieces of equipment
	Electronic tag	Passive or active electronic tag that can be queried by a tag reader	Identify or provide information about the location or characteristics of the item tagged

Decreasing readiness

De-alerting

De-alerting measures are defined as "reversible actions taken to increase the time or effort required to launch a strategic ballistic missile".[7] States retain their missiles and continue training, but operational impediments are intentionally put in place. These measures are designed to prevent unauthorized use and to slow the intentional use of a weapon system by requiring time to re-activate or redeploy the system. Actions can be declaratory or verified by on-site inspection or remote monitoring. The following paragraphs summarize several de-alerting approaches (in order of increasing delay).

De-alerting could be achieved by storing fully assembled missiles rather than deploying them. Higher levels of de-alert could be achieved by removing critical missile components. Components that have been removed could be stored together, in another building or even at a separate base. Liquid-fuelled missiles could be stored unfuelled.

Delay could be increased by installing physical or electronic barriers to access at storage facilities. Such barriers would lengthen the process of deploying the missiles.

The continued presence of barriers can be verified by monitoring systems to detect removal. Various approaches are technically feasible: a massive block of concrete (requiring special equipment to move) could be placed in front of the door to a storage facility; electronic timers could be used to require a fixed time interval before opening or unlocking the door to a storage facility; or an item could be attached to a missile or missile launcher that makes the missile or launcher inoperable unless the item is removed.

De-targeting

De-targeting is the process of entering harmless target coordinates, such as broad ocean areas, into a missile guidance system. Precedents for de-targeting are the January 1994 Russian Federation–United States agreement, the September 1994 China–Russian Federation agreement and the June 1998 China–United States agreement. In practice, new target coordinates can be entered fairly quickly and the process is best applied to relatively sophisticated missiles with programmable guidance systems. Although de-targeting is primarily a symbolic gesture and difficult to verify, it can provide value as a unilateral measure.

Restricting the export of missiles and equipment

Because not all proliferation results from indigenous capabilities, international efforts have been undertaken to address the issue of trade and commerce in weapons of mass destruction and their delivery systems.

The Missile Technology Control Regime (MTCR) is a voluntary and informal association of states. MTCR adherents follow common export policy guidelines and seek to coordinate national export licensing policies and procedures in missile-related technologies and components to prevent the proliferation of unmanned delivery systems capable of delivering weapons of mass destruction (WMD).

The MTCR lacks any provisions for verification. Created in 1987, 34 countries participated in the MTCR as of September 2006.[8] As mentioned earlier, the Hague Code of Conduct was adopted in 2002 as a supplement to the MTCR (but it does not require MTCR membership). The HCOC provides for more information sharing on missile programmes and test flights.

In May 2003, the United States initiated the Proliferation Security Initiative (PSI) as a multinational response to the threat of proliferation of WMD, their delivery systems and related materials worldwide. The PSI seeks to promote international cooperation to prohibit WMD-related shipments at sea, in the air or on land that flow to or from state or non-state actors of proliferation concern. In addition to the prohibition, PSI partners are working to expand their cooperation to the enhancement of military, intelligence and law enforcement actions in support of non-proliferation objectives. In September 2006, there were 77 participants in PSI.[9]

Since the terrorist attacks in the United States in 2001, there has been growing global concern over the role of non-state actors in proliferation. In April 2004 the United Nations Security Council adopted resolution 1540, which, among other things, notes "that all States shall refrain from providing any form of support to non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery".[10] It encourages the adoption and enforcement of laws and domestic controls to help achieve these objectives. These controls would not only apply to the weapon systems themselves but also to the knowledge, experience and other skills that could be used to develop these weapon and delivery systems. National reports submitted pursuant to resolution 1540 are reviewed by a committee established for that purpose.[11]

Limiting missile development activities

Actions to limit missile development usually focus on testing activities. Missile test limits are intended to make the development of new or significantly modified missiles more difficult. Systems that lack sufficient development and testing are less likely to be used operationally. Testing can include static motor ignition, vibration, stress and balance tests on the ground. Other tests may validate safety features, such as the behaviour of the system under exposure to fire. The number, trajectory and type of test can limit development. For example, UN Security Council resolution 687 (April 1991), the cease-fire agreement ending the 1991 Gulf War, required that all Iraqi missiles with a range over 150km as well as all research and development, support and manufacturing facilities be dismantled. The subsequent resolution 715 (paragraph 7) called for the development of a mechanism for monitoring missile-related activities. This resulted in the formation of a missile monitoring group at the Baghdad Monitoring and Verification Centre. Activities included the installation of remote-controlled camera systems at two missile engine test stands. The cameras were arranged to enable the United Nations to assess whether a test was of a prohibited missile, engine or motor.

Monitoring flight tests

The objective of monitoring a test missile's flight is to detect when a flight has occurred, confirm that the trajectory is not a threat, confirm the type of missile being tested (if this is limited) and determine the range of the test (if this is limited).

Remote sensing, as in imagery from satellites or aircraft, can detect preparations for a test flight, missiles on launchers and post-launch effects such as burn marks. The observables associated with a test launch are transient and relatively small in physical size, so the spatial resolution of commercial satellite imagery and its fixed revisit times limit its effectiveness. Collecting imagery from aircraft results in higher resolution and operational flexibility. Optical sensors are adversely affected by weather conditions but imaging radar can be used in cloud or darkness.

Ground-based radar can detect test missiles as they rise above the launch site. A possible cooperative approach is to place autonomously operated radar at a test site. This system would detect and provide the initial trajectory for launches. Another approach is to incorporate a beacon on the test missile that announces the missile's launch and assists tracking by radars.

To confirm a test has occurred, if the test is declared in advance, observers could be invited to the site to observe test preparations and the launch. If there were concerns about preparations for undeclared launches, one option would be to permit a number of challenge inspections.

Remote monitoring using sensors installed at a launch site could confirm launches with less intrusiveness than inspectors. Video cameras could continuously observe certain locations at the test site or the testing country could activate the camera before the test.

Monitoring ground-based tests

The objective of monitoring a ground test is to detect when a test has occurred, confirm the type of missile component being tested (if this is limited) and determine the type of test being conducted (if this is limited).

Given that ground-based tests are smaller than complete missile tests and may be conducted inside buildings, remote sensing has a limited role. On the other hand, the presence of on-site observers is intrusive. Observers would not be able to detect undeclared tests unless they had unrestricted access to the site. Remote monitoring can provide continuous observation with less intrusiveness. However, facility access would be required to place monitoring and communication equipment. An example of potential remote monitoring is the use of visual and thermal video to record the duration of a rocket motor test and the size of the plume.

Restricting operational deployment of existing missile forces

Non-deployment zones

Restricting deployment of missiles from specific geographic locations moves them away from preferred launching points, so that potential targets are outside their range. This approach could include confining mobile missiles to their garrisons. Monitoring of such an agreement must supply information that is sufficiently geographically and temporally specific to provide assurance that the parties are in compliance, yet not so specific that it creates vulnerabilities. Knowledge of specific locations of missiles would permit a pre-emptive attack if one side decided to violate the agreement.

If missiles were located in fixed sites, the closure of bases could be monitored by imagery from commercial satellites or aircraft. Missiles are large enough to be easily identifiable on external launchers.

Silo doors could be opened during imaging to confirm that no missile is present. Facilities with vertical doors, such as tunnels or storage buildings, do not offer a line of site for imaging and their closure would need to be verified by on-site inspection.

Mobile missile launchers could be monitored if imagery were collected cooperatively. One approach is based on restricting missiles to a geographic zone with the option for parties to call a "census" of declared missiles. The census would require the missile launchers to move to positions within the zone where they could be photographed. (The time lag required to process the images provides the launchers with several hours to move into new positions, thereby reducing their vulnerability to attack if one side decides to violate the agreement.) Aside from remote sensing, observers could survey the non-deployment zone periodically to determine if any missiles are present. This is an intrusive process that is largely ineffective unless the non-deployment zone is small or observation is conducted frequently.

Remote monitoring could be used if the non-deployment zone is geographically separated by mountains or some other terrain feature; chokepoint monitoring could be established on routes that missile transporters-erectors-launchers (TELs) must physically traverse to enter the zone. Monitoring equipment applicable to chokepoints includes seismic, magnetic and infrared sensors to detect and count traffic. Additional information can be collected by using strain cables (to measure weight), multiple infrared break beams (to measure profile and length), radiation detectors and X-ray equipment (to examine characteristics of the cargo), and cameras (to check number, shape and colour).

Missile system capability

Setting limits on missile capability bounds threats and could include parameters such as range, payload capacity or multiple warheads. Capability limits could also seek to eliminate or prevent the development or deployment of an entire category of missiles such as sea-launched missiles. Verification would require inspections or remote monitoring or both to confirm the absence of banned missile characteristics or systems at garrisons or production facilities. For example, under the INF Treaty, the Soviet Union and the United States monitored shipments leaving their respective production facilities for 13 years (production areas inside the facilities were not inspected). Inspectors visually observed the destruction of missiles specified in the treaty. Traffic leaving the missile assembly plant in Votkinsk, Russia, was examined by a variety of sensors to determine whether a controlled item could be in the cargo. If the cargo appeared able to contain a treaty-controlled item, on-site inspectors examined it following agreed procedures.[12]

Reducing existing missile forces

Setting quantity and production limits for missiles limits their threat but verification requires significant intrusiveness. The existing number of weapon systems of a particular type is declared and a "baseline" inspection is conducted to confirm the declaration. Tagging might be necessary to ensure the accuracy of the count. Any items discovered without tags in subsequent inspections would be in violation of the agreement. If quantity limits require reductions in the existing inventories of missiles, destruction would need to be monitored.

Conclusions

The operational concepts described in this paper represent a wide range of possibilities for missile confidence building and control. However, political will, suspicion, custom and security perceptions do not make them equally acceptable. Furthermore, options for monitoring and control need to be integrated into a system to meet the needs of the participating states effectively. The characteristics of the system can evolve over time as confidence and cooperation develop. Table 2 presents some ideas in a generic sequence of implementation. The first step must be a willingness to discuss security and missiles. Dialogue could be initially limited in scope, with more topics addressed as experience and conditions permit.

Table 2. Potential missile control initiatives and time frames

Missile control initiatives	*Short term*	*Medium term*	*Long term*
General transparency	Establish communication infrastructure Determine participants and topics Initiate dialogue on selected topics	Conduct orientation visits Define and conduct cooperative monitoring experiments	Define and conduct cooperative monitoring experiments
Readiness	Declare de-targeting policy Declare de-alert status	Monitor de-alert status	
Exports	Participate in UN Arms Registry Join HCOC	Declare exports and imports consistent with MTCR	Formally join MTCR
Development	Declare tests	Formalize missile test notifications	Limit number or characteristics of tests and monitor
Deployment		Declare non-deployment zones	Formalize non-deployment zones and monitor
Force level		Declare missile force numbers	Establish and monitor missile quantity and/or elimination limits

Notes

1. United Nations Group of Experts, *Study on Ways and Means of Promoting Transparency in International Transfers of Conventional Arms*, UN Document A/46/301, 9 September 1991.
2. Intermediate-Range Nuclear Forces Treaty, signed 8 December 1987, entry into force 1 June 1988, at <www.state.gov/www/global/arms/treaties/inf2.html>.
3. Strategic Arms Reduction Treaty, signed 31 July 1991, at <www.state.gov/t/ac/trt/18535.htm>.
4. Elaine Monaghan, "Russia, US, Cut Risk of Inadvertent Nuclear Strike", *Reuters,* 16 December 2000.
5. Mark Smith, 2002, "Rules for the Road? The International Code of Conduct Against Ballistic Missile Proliferation," *Disarmament Diplomacy 63,* March–April, at <www.acronym.org.uk/dd/dd63/63op3.htm>.

6. Treaty on Open Skies, signed 24 March 1992, entry into force 1 January 2002.
7. Michael W. Edenburn et al, 1999, *De-alerting Strategic Ballistic Missiles,* Cooperative Monitoring Center Occasional Paper no. 9, Albuquerque, NM, Sandia National Laboratories, March, at <www.cmc.sandia.gov/links/cmc-papers/sand-98-0505-9/sand-98-0505-9.html>.
8. For information, visit the MTCR's web site at <www.mtcr.info>.
9. For more information, visit the US government web site presenting the PSI at <www.state.gov/t/np/c10390.htm>.
10. UN Security Council resolution 1540 (2004), UN document S/RES/1540(2004), 28 April 2004.
11. For more information, see the web site of the 1540 Committee at <disarmament2.un.org/Committee1540>.
12. Joseph Harahan, 1993, *On-site Inspection under the INF Treaty*, On-Site Inspection Agency, Department of Defense, US Government Printing Office.

Connecting paradigms: MANPADS in the national and human security debates

James Bevan

Man-portable air defence systems (MANPADS) have rocketed to prominence in the field of arms control. By virtue of their place in both the disarmament and small arms control debates, they are represented in both the national and human security paradigms. This article attempts to unpack how the MANPADS issue has gained this unique position, and what impact this is likely to have on its development.[1] It argues that MANPADS have achieved prominence because they resonate with new national security priorities post 11 September 2001. Their association with terrorism and connected issues such as weapons of mass destruction and rogue states has labelled MANPADS a national security issue and thrust them into the disarmament debate alongside major conventional weapons and weapons of mass destruction. Uniquely though, MANPADS measures have also been firmly linked to small arms control and hence to the human security paradigm.

MANPADS benefit from having feet in both camps. On the one hand, their importance is continually reasserted by elevation into the broader missile control debate. On the other hand, effective measures against MANPADS recognize the similarities between controlling their proliferation and controlling small arms flows.

Does this link then suggest some kind of merging between the national security and human security paradigms? No, but it does suggest that the security agenda has changed and that today's threats to national security, including MANPADS, require broader-ranging responses than traditional disarmament measures. MANPADS proliferation, like the terrorism it has become associated with, has its roots in poor governance and insecurity and control measures must reflect these factors.

MANPADS in the human security paradigm

MANPADS as small arms

In the early 1990s a number of security challenges, previously overshadowed by the Cold War, came to prominence. The "new" wars of the 1990s were dominated by small arms, and their resounding impact on people contributed to the emergence of the concept of human security as a counterpoint to the dominant focus on state security.

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In 1995, the United Nations General Assembly asked the Secretary-General to appoint a panel of governmental experts to establish, among other things, the types of small arms and light weapons (SALW) used in the conflicts the UN responded to.[2] Portability was the chief criterion for inclusion in the panel's list. All of the weapons identified could be carried and operated by one person or a small team of individuals, possibly with the aid of a light vehicle. The weapons ranged from small arms such as pistols, assault rifles and light machine guns to light weapons including heavy machine guns, grenade launchers and portable launchers of anti-aircraft missile systems.[3] The latter would become better known as man-portable air defence systems, or MANPADS.

Thus MANPADS are categorized as SALW. In contrast to larger missile systems, MANPADS are deployed alongside small arms and often stored in the same facilities. Their small size makes them easy to transport and easy to hide. They are primarily infantry weapons; they require no dedicated support vehicles, networked operation or associated infrastructure.

The UN Programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All Its Aspects (Programme of Action),[4] agreed in 2001, is the most high-profile focus of small arms control, and while the programme does not refer to the SALW categories defined by the Panel of Governmental Experts, in the absence of any intention expressed to the contrary, it is broadly assumed to cover them.[5] By association, the categories defined by the panel have come to define small arms and light weapons for the majority of policy makers, researchers and activists working on small arms issues. MANPADS are now an accepted part of the small arms control debate and hence the human security framework.

The impact of the human security paradigm on MANPADS

The Programme of Action on small arms is worded explicitly to differentiate small arms control from national security issues. It states clearly that its aims "are without prejudice to the priorities accorded to nuclear disarmament, weapons of mass destruction and conventional disarmament".[6] The term "national security" does not appear once in the programme.

Instead, the Programme of Action reflects a human security focus by making explicit reference to humanitarian and social impacts at the individual level.[7] Small arms control, as defined in the Programme of Action, considers factors such as poverty and underdevelopment, organized crime, drugs trafficking and the trade in natural resources as contributing to small arms proliferation. These issues are all relevant to controlling the proliferation of MANPADS; MANPADS proliferation is also subject to many of the same dynamics as small arms proliferation, such as poor stockpile monitoring, weak economies and the associated demand for hard currency, and lack of security sector reform.

MANPADS proliferation is subject to many of the same dynamics as small arms proliferation.

All the same, the Programme of Action is arguably not the ideal forum for effective MANPADS control. The programme covers a wide range of issues, and many are largely irrelevant to MANPADS. Some of the more contentious issues, such as civilian possession of SALW, have had a spurious, and damaging, impact on the MANPADS debate.

A prime example of this occurred at the 2006 Review Conference of the Programme of Action, in which states failed to make further progress on controlling MANPADS. It is unclear from an outsider's perspective why there was no agreement, but it is plausible that MANPADS were victims of the general antagonism in the conference: dissatisfied with the Programme of Action in general, some states used the MANPADS issue to express their discontent. As there has been progress on the MANPADS issue

elsewhere, this "false opposition" was evidence that the Programme of Action could be a negative influence on the MANPADS debate. A 2006 Conference on Disarmament seminar report recognized this, noting that "there was an argument for doing more work [on MANPADS] outside the complex agenda of the Program of Action".[8]

The statement recognizes that MANPADS differ greatly from most other SALW. MANPADS, like anti-tank guided weapons (also included as SALW by the panel of governmental experts), are guided weapons.[9] They are technologically more sophisticated, of higher monetary value, and have greater political significance than other SALW. As a consequence, they are used more rarely in contemporary armed conflict. They proliferate infrequently in civilian hands and are rarely used for the predation and crime that characterizes armed violence in many societies. Therefore, as the case of the Programme of Action shows, attempting to address MANPADS uniquely as a small arms issue may not prove effective for their control.

Nonetheless, MANPADS should remain within the small arms debate, as they still share much in common with other SALW. Indeed, the most comprehensive MANPADS controls to date are firmly grounded in small arms control. The Wassenaar Arrangement's Elements for Export Controls of MANPADS—and by extension the Organization for Security and Co-operation in Europe (OSCE) Principles (which are based on the Wassenaar elements)—are a commonly recognized gold standard.[10] Importantly, they include measures that have the potential to address the local dynamics of proliferation, such as theft from state arsenals or diversion by unscrupulous individuals. Such avenues of loss are common sources of small arms proliferation and measures to control them necessitate initiatives aimed at stopping loss at the grass-roots level.

In terms of technology, cost, political significance and applications, MANPADS share more similarities with major conventional weapons than they do with small arms. Their physical proliferation, however, responds to the dynamics common to most SALW.[11] Qualitatively, MANPADS lie midway between conventional weapons and small arms.

An uncomfortable fit: MANPADS as a national security issue

While MANPADS may differ from most other small arms, they also differ considerably from major conventional weapons that are traditionally considered under the rubric of national security.

The United Nations Register of Conventional Arms, a voluntary mechanism to encourage arms transparency, comprises armaments that are the backbone of a state's offensive and defensive capabilities. For example, tanks, armoured combat vehicles and large-calibre artillery systems are the basic elements of a massed ground assault or response. Combat aircraft and attack helicopters comprise the core of a state's air power. Warships are the nucleus of naval power. Missiles and missile launchers, "capable of delivering a warhead or weapon of destruction to a range of at least 25 kilometres", are fundamental to the offensive and defensive capacities of states.[12] These weapons have been, and remain, the primary subjects of the national security paradigm.

In 2003, the United Nations General Assembly decided to include MANPADS in the register.[13] Hence they are included in discussions at the Conference on Disarmament, alongside weapons that are at the heart of states' security concerns.[14] But MANPADS differ from the other weapons in the register on two counts. Above all, they are complementary to the large weapons listed above and not a core part of a state's military capability. In offensive terms, although they are potent weapons, MANPADS have more of a harassing role against aircraft than one of sustained attack. They would not be the primary means used by one state to cripple the air force of another. On the defensive side,

man-portable air defence systems are the infantry's last defence against air power—a measure to be used only when larger, more capable air defences are inoperable or limited in reach.

MANPADS perform different roles and share little in common with the weapons that are usually considered of importance to national security. This is acknowledged: the inclusion of MANPADS in the register was noted as an "exception" that recognizes the high importance of MANPADS but underlines that their inclusion should not set a precedent for further changes.[15] In some ways it also recognizes that, while the political significance of MANPADS is high, it is of a different kind than that of its "missile and missile launcher" counterparts of category VII.

Why therefore have MANPADS moved into the national security spotlight? One possible reason is that they are technologically advanced enough to pose a threat to air power. In doing so, they threaten the technological and military superiority of the most powerful states. In the hands of weak states or non-state actors, MANPADS could redress the balance of power—albeit in a limited set of circumstances. The MANPADS threat to coalition aircraft in Afghanistan and Iraq is but one example. Russian experience in Chechnya, where MANPADS have been used to shoot down military helicopters, is another.[16] In this sense, it would be quite logical to assume that, as instruments of asymmetric warfare, MANPADS are worthy of consideration under the rubric of national security.

However, MANPADS are not unique among small arms in posing such a threat. A number of other light weapons have also proved a serious threat to technologically sophisticated and powerful armed forces. Take, for instance, rocket-propelled grenade launchers (RPGs). Technologically less advanced than MANPADS, RPGs nonetheless have been used to shoot down two US UH-60 Black Hawk helicopters in Somalia in 1993,[17] and were employed against armoured vehicles in Afghanistan and Iraq.

There is no strategic reason why MANPADS are more of a threat to national security than some other light weapons.

There is no strategic reason why MANPADS are more of a threat to national security than some other light weapons. What makes them such a prominent subject of national security concern is conceptually more diffuse than purely technical considerations.

MANPADS AND THE NEW NATIONAL SECURITY PRIORITIES

MANPADS have become a national security issue by their association with other, higher profile, national security threats. They have found a place in the national security debate through a steadily growing number of speeches and texts that link them to threats such as terrorism (notably state-supported terrorism), rogue states and weapons of mass destruction.

The Federation of American Scientists' list of MANPADS documentation clearly demonstrates rising international interest in the subject after 11 September 2001.[18] Notably, this reached a critical density following the 2002 MANPADS attack in Mombasa. This attack on an Israeli passenger aircraft re-emphasized the link between MANPADS and their potential use by terrorists.[19] Attacks against civilian aircraft are not a traditional national security issue, but the use of MANPADS in Mombasa, combined with attacks against military targets in Chechnya and Iraq, arguably linked them to terrorism and to the threat to state security forces.[20]

Virtually every regional and international measure to control MANPADS since 2002 has made explicit reference to the danger of terrorists acquiring MANPADS. This dimension of the debate has undoubtedly been pushed by the United States, but many states have expressed the same fears. The G8 Action Plan on MANPADS, for instance, expresses deep concern about MANPADS, "especially in the hands of terrorists or States that harbour them"; it stresses the determination of G8 leaders to

"strengthen … joint efforts to curb terrorist threats against mass transportation", and leaders have undertaken to "[t]o ban transfers of Manpads [*sic*] to non-state end-users".[21]

By extension, this link with the war on terror has led MANPADS to be included in the renewed debate on weapons of mass destruction and "weapons of mass effect".[22] Security Council resolution 1617 (2005) relates MANPADS, terrorism and weapons of mass destruction by expressing concern:

> … over the possible use by Al-Qaida, Usama bin Laden, or the Taliban, and their associates of Man-Portable Air Defence Systems (MANPADS), commercially available explosives and chemical, biological, radiation or nuclear weapons and material, and encouraging Member States to consider possible action to reduce these threats.[23]

The Secretary-General's report, *In Larger Freedom*, arguably expands on the theme by juxtaposing MANPADS with missile control, weapons of mass destruction and terrorism:

> Member States should adopt effective national export controls covering missiles and other means of delivery for nuclear, biological and chemical weapons, rockets and shoulder-fired missiles [MANPADS], as well as a ban on transferring any of them to non-State actors.[24]

Association with terrorism has thus pushed the MANPADS debate in new directions. International terrorism was such an amorphous concept that it was very difficult to launch a "war on terror" without targeting something tangible. Just as Iraq was labelled by some as a supporter of terrorism and hence a legitimate target after 11 September 2001, the MANPADS issue was linked firmly to state-supported terrorism. And as Al-Qaeda became synonymous with networked terrorism in the digital age, MANPADS became a symbol of the threat posed by this new, high-tech terrorist. The resonation of MANPADS with all these issues provides an explanation as to why they, in contrast to other light weapons, have been elevated to the national security podium.

The inclusion of MANPADS in the UN Register of Conventional Arms is arguably the most concrete example of a permanent ratcheting-up of the MANPADS debate into the national security paradigm. Including MANPADS in the register puts them (despite some opposition) on the agenda in the Conference on Disarmament; it places them firmly in the wider missile control debate;[25] and, most important, it means MANPADS are always linked to weapons that are traditionally the focus of national security. A 2006 Report of the Secretary-General notes that, among missile-related security concerns, MANPADS have been placed on an "equal footing" with ballistic missiles.[26] In short, MANPADS are of equal national security concern, therefore their control is imperative.

Such a position has not gone uncontested; some states have argued that MANPADS should be addressed only within the Programme of Action on small arms, citing a duplication of effort in the Conference on Disarmament (CD). For others, the inclusion of MANPADS has the potential to focus discussion away from "priority issues" in the CD.[27] But others justify MANPADS' presence in this forum by citing the potential for MANPADS to achieve some consensus on the missile debate, which has not moved significantly for some time.[28] Clearly, for some states, MANPADS are "patently a matter of disarmament", and for others they are less so.[29]

For some states, MANPADS are "patently a matter of disarmament", and for others they are less so.

Regardless of the disagreement, both arguments confirm—and continue to reaffirm—the place of MANPADS within the disarmament debate. Indeed, the MANPADS issue may be becoming more firmly entrenched in the CD's broader missile control debate. There is no precedent of weapons having been removed from the register. MANPADS are unlikely to "descend" from their current position in the near future; they are firmly settled within the traditional disarmament framework.

The impact of the national security paradigm on MANPADS

By placing MANPADS in the national security paradigm, the issue has benefited from greater levels of attention.

There are numerous regional and international initiatives to control MANPADS proliferation. But the political reasons that gained MANPADS their place in the disarmament debate have shaped many of the measures that have since been designed to control them. Issues of terrorism and weapons of mass destruction have combined to focus a number of MANPADS initiatives on the matter of state transfer to non-state actors. For example, the Bangkok Declaration aims to "confront the threat posed by terrorists" and commits leaders to "ban transfers to non-state end users".[30] UN General Assembly resolutions in 2004 and 2005 recognized that controlling MANPADS has acquired "special importance in the context of the intensified international fight against global terrorism" and encouraged states, among other things, to "ban the transfer of [MANPADS] to non-State end-users".[31] There is a danger that this issue can dominate at the expense of other, more pressing concerns.

Available sources suggest that the direct transfer by states to non-state actors is in fact a relatively minor source of illicit MANPADS. For the most part, MANPADS enter the illicit sphere through theft or loss from state stocks.[32] MANPADS are in the hands of around 105 states across the globe. A good portion of these stocks is undoubtedly insecure. In Africa, for instance, 29 countries stock MANPADS and their security has been verified in only four or five cases.[33] Bilateral and multilateral stock security initiatives have been undertaken in only 20 or so states to date.[34] Press reports of 17 MANPADS seizures from 2004 to 2006 suggest the following: 5 were of unknown origin; 2 could plausibly have originated in state to non-state transfers; but 6 had certainly been diverted from state arsenals, and a further 4 had probably been sourced this way.[35]

State transfer to non-state actors builds consensus among diplomats, but for a reason—it does not require much political or strategic expenditure on the part of the majority of states to agree to controls, as very few of them engage in the practice.

There is a clear argument for broadening the focus of MANPADS control away from this one concern. The Secretary-General's 2006 report on *The Issue of Missiles in All Its Aspects* recommends deepening the measures in General Assembly resolution 60/77 of 2005 and broadening adherence to existing multilateral MANPADS agreements.[36] Arguably this implies applying, to a greater extent, existing small arms control measures to MANPADS. While these measures may lack the high profile of a national security concern, they are more suitable to MANPADS control. Both paradigms, therefore, play a key role in controlling MANPADS proliferation.

The future for MANPADS: connecting national and human security paradigms

Two recent UN General Assembly resolutions, 59/90 and 60/77, juxtapose national security concerns and references to the Programme of Action on small arms. On the one hand, the resolutions accept that MANPADS are a national security concern by recognizing "the legitimate right of Governments to possess such weapons in the interests of their national security".[37] On the other, both also emphasize "the full implementation of the Programme of Action",[38] which, as has been noted, is quite distinct from traditional appraisals of national security.

The resolutions recognize that the MANPADS debate cuts across the divide. By acknowledging the national security concern, but also referring to the Programme of Action in the first operational

paragraphs, the two resolutions acknowledge the issue's high priority *and* tacitly propose measures that are firmly rooted in human security.

MANPADS are a halfway house; straddling the disarmament and small arms control debates, rather than being considered in one forum alone, is potentially of great benefit to their control. MANPADS' inclusion in the Wassenaar Arrangement is most notable in this respect. Most of the world's important arms exporting companies are members of the Wassenaar Arrangement. Under the Arrangement's Initial Elements, participating states agree to control all weapons in the Wassenaar Arrangement Munitions List "with the objective of preventing unauthorised transfer or re-transfers of those items".[39] Like the evolving MANPADS debate, the Arrangement is something of a halfway house. Importantly, it includes small arms and light weapons alongside major conventional weapons. And it recognizes the impact of weapons on the balance of state forces while also recognizing their implications for human rights.[40] The measures listed in the Arrangement and its Elements—both initial and later additions—reflect these dual concerns.

With regard to MANPADS, the Wassenaar Arrangement recognizes the similarities between small arms control and restricting MANPADS proliferation. Like the UN resolutions on MANPADS, the Arrangement's Best Practice Guidelines for Exports of Small Arms and Light Weapons (of which MANPADS are nominally a part)[41] make reference to the Programme of Action (as an international agreement on small arms).[42] *Unlik*e the two UN resolutions, the Wassenaar Arrangement's guidelines are deeper in scope and binding. As discussed above, the Wassenaar–OSCE principles are an important step toward addressing MANPADS proliferation at source. They recognize the fundamental impact of stock insecurity on proliferation—emphasizing the role of the recipient state and its ability to protect against loss, theft and diversion.[43] In short, the measures go to the roots of proliferation—the political, economic and developmental reasons why some states are unable to keep control of their stocks.

As Ambassador Caroline Millar of Australia noted at a plenary meeting of the Conference on Disarmament:

> The Wassenaar Arrangement's "Elements for export controls of MANPADS" provide very good guidance for what States can do to ensure effective control over the export and storage of MANPADS. Measures in the Elements include maintaining inventories of weapons and their serial numbers, restricting access to MANPADS-relevant classified information and storing missiles and firing mechanisms separately. Moreover, exporting States are to satisfy themselves of a recipient State's willingness and ability to implement effective controls over MANPADS. The need for such a measure was highlighted in the Australian seminar, which noted the proliferation threat from poor stockpile management.[44]

Addressing MANPADS as part of the small arms issue is a reminder that effective MANPADS control requires measures that are "deeper" in scope than traditional arms control. At present, the Wassenaar–OSCE principles, with their links to the Programme of Action, offer a high standard of MANPADS control that could be used as the basis for future initiatives, such as further UN resolutions.

Conclusion

By virtue of the conceptual linkages that MANPADS share with state security concerns since 11 September 2001, they have become viewed as a national security concern in their own right. This has had a positive effect on the success of MANPADS controls. Including MANPADS in the disarmament debate heightens the profile of the issue and offers an avenue for it to develop outside of the potentially

limiting Programme of Action. As a small arms concern, the technical issues of MANPADS control can be appropriately addressed and controls can be more comprehensive.

In broader terms, the MANPADS debate typifies security concerns in the early twenty-first century. It is clear that national and human security issues are not as distinct as once thought. Just as international terrorism has its origins at the individual or community level, so too does the proliferation of MANPADS. Underdevelopment, poverty, poor governance and the associated ills of human insecurity are probably a stronger driving force for proliferation than transfers by states to non-state actors.

Notes

1. The author would like to express his sincere thanks to Glenn McDonald for his advice and support during the writing of this article. All errors are the responsibility of the author.
2. United Nations General Assembly resolution 50/70 B of 12 December 1995, UN document A/RES/50/70, 15 January 1996.
3. *Report of the Panel of Governmental Experts on Small Arms,* in UN document A/52/298, 27 August 1997, paragraph 26.
4. Programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All Its Aspects, adopted 20 July 2001, reproduced in UN document A/CONF.192/15, and at <disarmament.un.org/cab/poa.html>.
5. Small Arms Survey, 2005, *Small Arms Survey 2005: Weapons at War*, Oxford, Oxford University Press, p. 126.
6. Programme of Action, 2001, section 1, paragraph 17.
7. Programme of Action, 2001, section 1, paragraph 2.
8. Australia, *Summary Presented by the Chair of the Seminar on Preventing the Illicit Transfer and Unauthorised Access to and Use of Man Portable Air Defence Systems,* Conference on Disarmament document CD/1793, 31 August 2006, paragraph 9.
9. J. Bevan and S. Pézard, 2006, "Basic Characteristics of Ammunition: From Handguns to MANPADS", in S. Pézard and H. Anders (eds), *Targeting Ammunition: A Primer*, Geneva, Small Arms Survey, pp. 21–34.
10. Wassenaar Arrangement, Elements for Export Controls of Man-Portable Air Defence Systems (MANPADS), 12 December 2003, at <www.wassenaar.org/guidelines>, and OSCE Forum for Security Cooperation, Decision No. 3/04: OSCE Principles for Export Controls of Man-Portable Air Defence Systems (MANPADS), OSCE document FSC.DEC/3/04, 26 May 2004, at <www.osce.org/documents/fsc/2004/05/2965_en.pdf>.
11. Small Arms Survey, 2004, *Small Arms Survey 2004: Rights at Risk*, Oxford, Oxford University Press, pp. 78 and 88.
12. *Report on the Continuing Operation of the United Nations Register of Conventional Arms and Its Further Development* [referred to hereinafter as *Report on the UN Register of Conventional Arms*], in UN document A/58/274, 13 August 2003, Annex IV.
13. *Report on the UN Register of Conventional Arms,* 2003, op. cit., paragraph 112; United Nations General Assembly resolution 58/54 of 8 December 2003, UN document A/RES/58/54, 8 January 2004.
14. Just how far MANPADS has edged into the national security paradigm is illustrated by considering how the CD defines its role:
    > Currently the CD primarily focuses its attention on the following issues: cessation of the nuclear arms race and nuclear disarmament; prevention of nuclear war, including all related matters; prevention of an arms race in outer space; effective international arrangements to assure non-nuclear-weapon States against the use or threat of use of nuclear weapons; new types of weapons of mass destruction and new systems of such weapons including radiological weapons; comprehensive programme of disarmament and transparency in armaments.
    >
    > United Nations Office at Geneva web site, Conference on Disarmament, *Disarmament: An Introduction to the Conference,* at <www.unog.ch/80256EE600585943/(httpPages)/BF18ABFEFE5D344DC1256F3100311CE9?OpenDocument>.
15. *Report on the UN Register of Conventional Arms,* 2003, op. cit., paragraph 108.
16. Small Arms Survey, 2004, op. cit., p. 90.
17. Mark Bowden, 1999, *Black Hawk Down: A Story of Modern War*, Berkeley CA, Atlantic Monthly Press.
18. Federation of American Scientists Arms Sales Monitoring Project, *MANPADS Proliferation,* at <fas.org/asmp/campaigns/MANPADS/MANPADS.html>, accessed October 2006.
19. Small Arms Survey, 2004, op. cit., pp. 77 and 88.
20. Small Arms Survey, 2004, op. cit., p. 90.

21. *Enhance Transport Security and Control of Man-Portable Air Defence Systems (MANPADS): A G8 Action Plan*, G8 Evian Summit, 1–3 June 2003, at <www.g8.fr/evian/english/home.html>, sections 1.2 and 1.6.
22. Weapons of mass effect can be loosely defined as "weapons capable of inflicting grave destructive, psychological, and/or economic damage … [and] include chemical, biological, nuclear, radiological, or explosive weapons" (Homeland Security Advisory Council Weapons of Mass Effect Task Force, *Preventing the Entry of Weapons of Mass Effect Into the United States*, Washington, DC, Department of Homeland Security, 10 January 2005, at <www.dhs.gov/xlibrary/assets/hsac_wme-report_20050110.pdf>, p. 3).
23. United Nations Security Council resolution 1617 (2005), UN document S/RES/1617(2005), 29 July 2005, preamble.
24. United Nations Secretary-General, *In Larger Freedom: Towards Development, Security and Human Rights For All,* UN document A/59/2005, 21 March 2005, paragraph 101.
25. Consider, for example, MANPADS' prominence in *The Issue of Missiles in All Its Aspects: Report of the United Nations Secretary-General,* UN document A/61/168, 20 July 2006.
26. *The Issue of Missiles in All Its Aspects,* 2006, op. cit., paragraph 27.
27. Conference on Disarmament, Final Record of the One Thousand and Second Plenary Meeting, document CD/PV.1002, 7 February 2006.
28. *The Issue of Missiles in All Its Aspects,* 2006, op. cit., paragraph 99.
29. Conference on Disarmament, 7 February 2006, op. cit.
30. Asia-Pacific Economic Cooperation, *Bangkok Declaration on Partnership for the Future*, 21 October 2003, at <www.apec.org/apec/leaders__declarations/2003.html>.
31. United Nations General Assembly resolution 59/90 of 3 December 2004, UN document A/RES/59/90, 17 December 2004, paragraph 5; United Nations General Assembly resolution 60/77 of 8 December 2005, UN document A/RES/60/77, 11 January 2006, preamble.
32. Analysis of media reports of MANPADS seizures and their probable sources.
33. Small Arms Survey, 2004, op. cit., pp. 77 and 83.
34. Combined reports of bilateral and multilateral verification and stock security initiatives to date, 2004–2006.
35. Analysis of media reports of MANPADS seizures and their probable sources.
36. *This Issue of Missiles in All Its Aspects,* 2006, op. cit., paragraph 100 a and b.
37. Preambles of United Nations General Assembly resolutions 59/90 and 60/77, op. cit.
38. Paragraph 1 of United Nations General Assembly resolutions 59/90 and 60/77, op. cit.
39. Wassenaar Arrangement, Initial Elements (as amended and updated in December 2003 and July 2004), at <www.wassenaar.org/guidelines>, section III.
40. Wassenaar Arrangement, Elements for Objective Analysis and Advice Concerning Potentially Destabilising Accumulations of Conventional Weapons, 3 December 1998, at <www.wassenaar.org/guidelines>, section 1, paragraphs b and e.
41. MANPADS are included under section 8, "Small Arms and Light Weapons" of the Initial Elements (Appendix 3), although they are listed distinctly from the subcategories of "small arms" and "light weapons".
42. Wassenaar Arrangement, Best Practice Guidelines for Exports of Small Arms and Light Weapons, 12 December 2002, at <www.wassenaar.org/guidelines>, section 1, paragraph 2.
43. Small Arms Survey, 2005, op. cit., pp. 130–136.
44. Conference on Disarmament, Final Record of the One Thousand and Thirty-Seventh Plenary Meeting, document CD/PV.1037, 24 August 2006.

The final frontier: missile defence in space?

Bruno Gruselle

Since President George W. Bush took the oath of office in 2001, concerns have grown about the possibility that the United States will develop and deploy space platforms capable of striking both on Earth and in outer space. Much of the anguish was based on memories of efforts conducted by the Reagan Administration to design space-based missile defence systems—the Brilliant Pebbles programme of small, satellite-based interceptor missiles—and on existing research efforts on space-based lasers. Official US documents, such as the United States Space Command's *Vision for 2020,* insisting on the dominance of space for military purposes, did nothing to alleviate these concerns, as everybody drew the conclusion that Washington's plan was to assure dominance by being able to wage war in and from space.[1] Ugly terms such as "arms race in space" were used to describe the grim future that the policy, as perceived by arms control experts, was promising.

Beijing felt it was directly threatened and garnered support for its idea of establishing an ad hoc committee of the Conference on Disarmament to discuss a treaty on the prevention of an arms race in outer space (PAROS). China argued in particular that it felt the deployment of missile-defence systems in space would threaten its deterrent and would consecrate the United States' domination of space.[2] The US government steadily opposed the creation of such a committee for fear that a treaty would reduce its ability to operate in space and undermine its security interest.[3] It is improbable that such a position will change in the coming years—or ever—as US military dependence on its space assets is becoming ever more important.

This article argues that even if the United States is likely to continue resisting attempts to reinforce the existing treaty on the militarization of space (the Outer Space Treaty) since most of its future security and defence will be based on space-based platforms, the deployment of space-based weapons does not seem to be its aim. Therefore, it seems possible to find a way to balance US security concerns and the necessity to prevent an arms race in space.

Facts die hard

Arguably, PAROS negotiation having so far proved impossible, an arms race in space should have started. So where are the space lasers and doomsday machines?

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More than six years after President Bush's election, no real work on sending weapons into space seems to have started. The proponents of the deployment of space-based interdiction[4] capabilities to complement ground- and sea-based missile defence assets even noted that "the administration has so far done little to revive the cutting-edge technologies developed under the administrations of President Ronald Reagan and George H.W. Bush".[5]

The Missile Defense Agency's budget for fiscal year 2007 actually gives little emphasis to the space-based weapons programme;[6] from a total budget of about US$ 10 billion, the budget for the programme barely exceeds US$ 200 million. This is more consistent with a research plan than with a fully fledged design and development programme.[7] (One of the Clinton Administration's most disputed programmes, the Space-based Laser, was even cancelled.) Taking into account air force and army efforts in this domain would bring the total figure for directed-energy weapon research to a little more than US$ 400 million.[8]

If one takes a closer look at US guideline documents, such as the 2001 US Space Commission Report,[9] it is hard to find anything that actually pushes for the deployment of weapons in space. As Richard Garwin argues, "[i]n fact the commission does not specifically advocate the development of offensive weaponry for deployment in space".[10]

All the same, it cannot be denied that the US National Space Policy, published in 2006, fuels concern about Washington's future policy on the use of space. The principles declared in this document could be considered as milestones in the future development and deployment of space-based weapons:

- The United States considers space capabilities—including the ground and space segments and supporting links—vital to its national interests. Consistent with this policy, the United States will: preserve its rights, capabilities, and freedom of action in space; dissuade or deter others from either impeding those rights or developing capabilities intended to do so; take those actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities hostile to U.S. national interests;
- The United States will oppose the development of new legal regimes or other restrictions that seek to prohibit or limit U.S. access to or use of space. Proposed arms control agreements or restrictions must not impair the rights of the United States to conduct research, development, testing, and operations or other activities in space for U.S. national interests.[11]

But again these principles do not call for an open, immediate weaponization of space. In fact, other principles put forward in the same policy document actually act as limits to further deployment of space-based weapons. By promoting "the rights of passage through and operations in space" of space systems and by stating that it will "seek to cooperate with other nations in the peaceful use of outer space to extend the benefits of space", the National Space Policy somehow structures the limitations that the United States would be willing to accept on any future use of space for military purposes. In particular, these principles seem to virtually rule out the deployment of anti-satellite weapons, as they would infringe on the right of passage and peaceful use of space.

The National Space Policy does not ultimately rule out any future deployment of space-based weapon systems.

Nonetheless, the National Space Policy does not ultimately rule out any future deployment of space-based weapon systems for purely defensive purposes, whether for the protection of the US homeland or of US space-based assets.

Security in a proliferated world: a need for every means necessary?

By funding programmes to research weapon systems that could be used in space, the United States government is leaving open options to develop and deploy such systems. This may appear to some as "facts in orbit"; that is, a drive to create and deploy space weapons without public debate. But if one looks at the existing security situation, the development of every possible means of defence should perhaps not be rejected without further examination.

The proliferation of weapons of mass destruction is a fact, illustrated by the present crises with Iran and with the Democratic People's Republic of Korea (DPRK), which could lead to a dramatic increase in security threats to the world in general and to the United States and its allies in particular.

In the realm of missiles, the development of more efficient, longer-range weapons is gaining pace, as illustrated by the launch on 4 July 2006 of a Taepodong-2 from the DPRK. Pyongyang possesses a large ballistic missile arsenal, comprising mainly Scud-type missiles in addition to longer-range systems.[12] According to some assessments, the DPRK today possesses between 300 and 400 Scud-B and Scud-C missiles as well as 60 mobile launchers deployed north of the Demilitarized Zone and capable of reaching most of the Republic of Korea and in particular Seoul. With its Nodong missile arsenal, the DPRK can strike most of Japan in a matter of minutes, including US assets deployed there. Today, worst-case assessments give the DPRK a total capability of about 200 Nodong missiles and 10–15 mobile launchers.[13] More disturbing is the willingness of Pyongyang to sell such weapons to literally any state willing to pay for them. Its cooperation with Syria and its assistance to Iran's Shahab programme must today be considered as one of the most worrying trends in missile proliferation.

Indeed, Iran's missile programme has reached an unprecedented level of sophistication and size for a proliferant country. Tehran is reported to possess a tactical arsenal comprising several hundred Shahab-1 and Shahab-2 missiles[14]—equivalent to Scud-B and Scud-C.[15] The quest for longer-range systems reportedly started at the beginning of the 1990s with support from the DPRK. The first flight test of the 1,300km-range Shahab-3 in 1998 started a long series of tests and the official deployment of the missile in 2003.[16] With such a missile Tehran gains the ability to threaten Israel as well as part of Europe. Iran has also conducted the development of modern anti-ship cruise missiles, culminating with the announcement from Tehran of the deployment of a Raad anti-ship cruise missile in 2004.[17]

Furthermore, Iran allegedly illegally acquired six AS-15 missiles from Ukraine in 2001.[18] The transfer was revealed by Hryhoriy Omelchenko, member of the Ukrainian parliament, in February 2005, and since then has been the subject of a legal investigation in Ukraine. According to this investigation, intermediaries of the operation—including a Russian national employed by the Oboronexport weapons export company—apparently used false end-user certificates to circumvent Ukrainian export control regulations. This missile, with a theoretical range of 2,500km, was apparently part of a batch of Soviet missiles for which the nuclear warheads had been returned to Moscow as part of a bilateral agreement in the middle of the 1990s. It would seem realistic to believe that Tehran has attempted to copy the received missiles since the sale, particularly the propulsion and navigation systems. On the other hand, considering information available about the state of the missiles as received by Iran[19] and the relative inexperience of military units in the use of ground attack missiles, it seems improbable that they were immediately deployed.

Everything tends to demonstrate a dramatic acceleration in the spread of missile weapons.

Whatever the virtues of arms control, one must conclude from an analysis of today's ballistic missile arsenals that their threat is very real and that only limited ways to curb them exist today. Furthermore, everything tends to demonstrate a dramatic acceleration in the spread of missile weapons.

Two trends are of particular concern:

- The increase in short- to medium-range systems, not to mention very short-range—less than 100km—rockets such as those used by Hezbollah against Israeli cities in the 2006 conflict.[20]
- The emergence of longer-range systems that have the potential of giving countries a larger spectrum of possible targets, particularly in the DPRK and Iran.

Defending against large numbers of missiles or long-range systems poses a number of challenges that cannot be ignored. And the 2006 hostilities in Lebanon and Isreal have shown the limit of classical kinetic means to defeat large salvos of incoming missiles. Only two possible responses to these threats remain.

- Direct action against launch capabilities. The number of launch platforms is usually very limited compared to the volume of missiles, the usual ratio being 1:30. Destroying launch platforms would certainly curb the ability of an adversary to make full use of its complete arsenal. Yet to accomplish such a deed a state would need a very rapid detection–action loop so that it could strike and destroy launch capabilities as they are used.[21]
- An almost endless number of interceptions. For a defence system to rely on shooting down incoming missiles, it will need a large supply of interceptors at its disposal.[22] This implies energy weapons such as lasers, which expend only power in their operation.

Space-based assets could clearly play a role in both responses. Space-based sensors could give the necessary alert and tracking data to the interception network that land-based sensors would not be able to obtain. More important, space-based interceptors could be the most appropriate means to target long-range missiles fired from deep within a country's territory or to rapidly destroy the launch capabilities of a rogue state set on defeating limited land-based interception system inventories.

Space-based interceptors could be the most appropriate means to target long-range missiles.

The latter clearly lies at the core of the debate on the non-weaponization of space as it means the deployment of a space-to-Earth strike capability. However, it is doubtful that weapon platforms will be deployed in space in the near future. Orbiting weapons capable of striking land-based systems are neither economically nor technically interesting for the moment, and other means to conduct anti-launcher operations already exist, such as piloted or unmanned airborne systems. Indeed, the proponents of missile defence are not asking for space-to-Earth strike systems. Rather, they are advocating the development of space-based interception capabilities,[23] which would have only a very marginal—and probably no—offensive potential against Earth targets.

What about the future?

Considering the current global security situation and trends, any debate on the deployment of weapons in space should be focused on finding a balance between all states' security needs rather than on trying to find a way to ban the larger spectre of military application platforms in space. Future US administrations may be willing to engage in a debate—even negotiation—on the weaponization of space if US security concerns could really be addressed by it. To make this possible, a tentative first step would be to recognize that not all space-based weapons constitute a threat to international security. Some may even enhance it—such as a future global capability to intercept in-flight missiles fired from a rogue state. Failure to make any concession on the reality of the proliferation concern and the potential of space systems to address this concern will probably lead to the continuation of the present US policy and ultimately to the absence of any progress in the prevention of an arms race in space.

Notes

1. United States Space Command, 1997, *Vision for 2020,* available at <www.fas.org/spp/military/docops/usspac/visbook.pdf>.
2. Kori Urayama, 2004, "China Debates Missile Defence", *Survival,* vol. 46, no. 2.
3. Eric M. Javits, 2002, "A US Perspective on Space", in James Clay Moltz (ed.), *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs,* Occasional Paper no. 10, Monterey Institute of International Studies, Center for Nonproliferation Studies and University of Southampton, at <cns.miis.edu/pubs/opapers/op10/op10.pdf>
4. Interdiction is the capability to intercept missiles in flight or to strike missile launchers.
5. Independent Working Group on Missile Defense, the Space Relationship and the Twenty-first Century, 2006, *2007 Report,* Washington, DC, The Institute for Foreign Policy Analysis, at <www.ifpa.org/publications/IWGReport.htm>, p. ix.
6. Although development of space-based detection systems has continued.
7. Theresa Hitchens, Mickael Katz-Hyman and Victoria Samson, 2006, *Space Weapons Spending in the FY 2007 Defense Budget*, Center for Defense Information and Henry L. Stimson Center, at <www.stimson.org/space/pdf/FY07SpaceWeapons.pdf>.
8. Knowing that some of the army and air force's money will go to non-space applications.
9. *Report of the Commission to Assess United States National Security Space Management and Organization,* 2001, Washington DC, at <www.defenselink.mil/pubs/space20010111.html>.
10. Richard L. Garwin, 2003, *Space Weapons: Not Yet*, Pugwash Meeting no. 283, workshop on "Preserving the Non-weaponization of Space" held at Castellón de la Plana, Spain, 22–24 May 2003, at <fas.org/RLG/030522-space.pdf>, p. 6.
11. *US National Space Policy,* 31 August 2006, at <www.ostp.gov/html/US%20National%20Space%20Policy.pdf>.
12. Joseph S. Bermudez Jr, 1999, *A History of Ballistic Missile Development in the DPRK,* Monterey Institute of International Studies, Center for Nonproliferation Studies, Occasional Paper no. 2, at <cns.miis.edu/pubs/opapers/op2/op2.pdf>.
13. General B.B. Bell (Commander US Forces Korea), *Statement before the Senate Armed Services Committee,* 7 March 2006, p. 7, at <armed-services.senate.gov/statemnt/2006/March/Bell%2003-07-06.pdf>, and Joseph S. Bermudez Jr, 1999, op. cit.
14. G. Samore (ed.), 2005, *Iran's Strategic Weapons Programme: A Net Assessment,* London, International Institute for Strategic Studies and Routledge, p. 89.
15. The average production rate of Scuds in Iran could be assumed to be an average of three missiles a month. It is reported to have started at some point in 1988.
16. "Iran's Missile Show for Domestic Audience", *Asia Times Online,* 24 July 2003, at <www.atimes.com/atimes/Middle_East/EG24Ak02.html>.
17. S. Jones, 2004, "Ra'ad Cruise Missile Boosts Iran's Military Capability", *Jane's Intelligence Review*, April.
18. For more on the transfer, see *X-55 Long Range Cruise Missile,* at <www.globalsecurity.org/wmd/world/iran/x-55.htm>; and "Iran and China linked to Ukraine missiles", *Financial Times,* 2 February 2005.
19. These would be missiles delivered to Soviet forces in Ukraine in 1987 to be fitted on long-range bombers. Before being able to use them, Tehran would have to design an appropriate warhead and also make modifications to launch from another launching platform.
20. David Makovsky and Jeffrey White, 2006, *Lessons and Implications of the Israel-Hizballah War: A Preliminary Assessment*, Washington Institute for Near East Policy, Policy Focus no. 60, October, at <www.washingtoninstitute.org/pubPDFs/PolicyFocus60.pdf>, p. 41.
21. James A. Russell, 2002, "WMD Proliferation and Conventional Counterforce: The Case of Iraq", *Strategic Insights*, vol. 1, no. 5, July, at <www.ccc.nps.navy.mil/si/july02/middleEast2.asp>.
22. Even taking into account a tracking capability to downsize the number of interceptions to be made.
23. Independent Working Group on Missile Defense, the Space Relationship and the Twenty-first Century, 2006, op. cit., p. xi.

UNIDIR FOCUS

NEW PUBLICATION

Developing a Mechanism to Prevent Illicit Brokering in Small Arms and Light Weapons—Scope and Implications

One of the consequences of the global arms trade is the increasing reliance on arms brokers. Brokering is often a necessary supportive activity to facilitate the supply of arms required for legitimate national defence, law enforcement and civilian uses. However, the absence in most countries of effective laws and regulations to govern arms brokering has created a significant grey area in the international arms trade that is open to substantial abuse. A growing number of reports indicate that strict state control of arms brokering—including of small arms, light weapons and related materiel—is an essential component in efforts to eradicate the illicit trade in small arms and light weapons.

During the past decade, the problems posed by unregulated arms brokering activities have become an issue of growing concern for governments, international organizations and civil society in the context of international efforts against the illicit trade in small arms and light weapons. An important body of research has brought the role of arms brokers in facilitating arms transfers to unlawful or illegitimate recipients to the fore of the political agenda. Despite their central role in the arms business, the activities of arms brokers are often unregulated. Arms brokers who facilitate unlawful arms transfers are aiding and abetting violators of arms embargoes, armed groups, criminal gangs and terrorists, thus fuelling insecurity and conflict in many regions of the world.

A number of regional organizations such as the African Union, the Andean Community, the Economic Community of West African States, the European Union, the Organization of American States, the Organization for Security and Co-operation in Europe, and the Southern African Development Community, as well as the states party to the Wassenaar Arrangement and the states of the Great Lakes Region and the Horn of Africa, have developed instruments and standards for the regulation of brokering activities that the respective member states are encouraged or required to adopt. Such instruments could form the basis of a global effort to curb illicit arms brokering. Partly as an effect of these regional agreements, about 40 countries throughout the world have developed specific controls

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In each issue of *Disarmament Forum*, UNIDIR Focus highlights one activity of the Institute, outlining the project's methodology, recent research developments or its outcomes. UNIDIR Focus also describes a new UNIDIR publication. You can find summaries and contact information for all of the Institute's present and past activities, as well as sample chapters of publications and ordering information, online at <www.unidir.org>.

on brokering activities. In the majority of national legislations, however, brokering activities remain unregulated. In addition, loopholes and inconsistencies in existing systems of control continue to be exploited by unscrupulous brokers.

Following the Secretary-General's consultations with all Member States and interested regional and subregional organizations, and recognizing the need for concerted global action, in 2005 the United Nations General Assembly adopted resolution 60/81 establishing a group of governmental experts to consider further steps to enhance international cooperation in preventing, combating and eradicating illicit brokering in small arms and light weapons.

This study, conducted under the auspices of the United Nations Coordinating Action on Small Arms (CASA), examines existing instruments at the national and international levels. It aims to identify common elements and options for regulation, to enhance understanding of the issue and to clarify its most complex aspects.

Developing a Mechanism to Prevent Illicit Brokering in Small Arms and Light Weapons: Scope and Implications

UNIDIR, UN Department for Disarmament Affairs and the Small Arms Survey, 2007
218 pages
Sales number GV.E.06.0.17
ISBN 978-92-9045-188-4
US$26 (plus shipping and handling)

ACTIVITY

International Assistance for Implementing the Programme of Action on the Illicit Trade in Small Arms and Light Weapons

In January 2006 UNIDIR launched a multi-phase research project on the international assistance offered to states for implementing the United Nations Programme of Action on the illicit trade in small arms and light weapons (PoA).

The first phase of the project identified the types of assistance that states themselves have stated they would like to receive, and revealed certain challenges related to submitting and receiving assistance requests. This phase of research culminated in the publication of a global overview of international assistance allocated between 2001 and 2005. The report offers recommendations for both short- and long-term measures to improve coordination of assistance requests. Over 130 UN Member States and international organizations participated in the first phase of research and many more were reached through discussions and awareness-raising activities.

The second phase of the project is now under way. UNIDIR is conducting a series of case studies with a view to establishing a mechanism to facilitate the matching of resources with needs. The first set of case studies will take place in the East African countries of Burundi, Kenya, Rwanda, Tanzania and Uganda. In parallel to building a set of indicators to identify needs, UNIDIR is establishing a web-based database where National Focal Points in affected states will be able to post their self-identified assistance needs, and donors and implementing agencies will be able to pinpoint opportunities for cooperation in particular regions or thematic areas.

UNIDIR would like to extend its gratitude to the Governments of Austria, Canada, Finland and the United States of America for their financial support of the international assistance project.

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