

Securing Nuclear Obsolescence

Dennis M. Gormley

We have [57] years since nuclear weapons have been fired in anger and that's an impressive accomplishment on the part of humanity ... I don't know of any other time in history where there has been a significant weapon that has not been used for that long a period and these weapons are not just larger weapons; they are distinctively different weapons.

US Secretary of Defense Donald Rumsfeld, 5 June 2002¹

Except as a weapon of last resort, nuclear weapons have no legitimate or compelling military role to play in any conceivable national security challenge facing American decision-makers today. Yet, like their Cold War-era predecessors, some policymakers still cling to assigning nuclear weapons an important place in ensuring American security. Six months before asserting the now almost universally accepted distinction between nuclear and conventional weapons, US Secretary of Defense Donald Rumsfeld signed off on the 2002 Nuclear Posture Review, which argued the potential need for new types of nuclear weapons that would be more credible instruments of prospective use.

Instead of building modernised nuclear weapons for especially taxing missions like attacking an adversary's nuclear or biological weapons hidden deep underground, America's challenge ahead should be seen as one centring on conventional weapons. Since at least 1991, US security has depended almost exclusively on increasingly capable conventional weapons, the effectiveness of which is arguably equal to that of nuclear weapons for attacking the most difficult targets. More important, deterrence through conventional weapons is decisively more credible than it is through any existing or prospective nuclear

Dennis M. Gormley is a Senior Fellow in the Washington DC office of the Monterey Institute's Center for Nonproliferation Studies and a faculty member in the Graduate School of Public and International Affairs at the University of Pittsburgh.

alternatives. America's adversaries know that the United States will use its conventional weapons if compelled to do so. But the mere possession of unprecedented conventional military superiority is not enough; a truly potent denial strategy hinges on perceived effectiveness in denying the adversary his military goals, not just on threatening retaliation. Success in this regard depends less on technology than on the creation of new operational concepts and organisational schemes. Along with addressing conventional needs, America must reformulate its position on nuclear weapons into one that severely diminishes their salience and solidifies the longstanding international taboo against their use.

Several developments make this reformulation especially urgent. While US nuclear reliance is surely not the most vital reason states choose to acquire nuclear weapons, American notions of making new nuclear weapons more 'usable' foster the unwanted impression that nuclear weapons are instrumental to securing American interests. Bolstering the perceived value of nuclear weapons as the Nuclear Non-Proliferation Treaty has become enervated can only undercut non-proliferation diplomacy – most notably, in regard to Iran. Even worse, the Pentagon's linking America's post-11 September 2001 formulation of the doctrine of pre-emption with nuclear weapons, while attempting (unsuccessfully thus far) to modify doctrine for nuclear operations to accommodate requests for pre-emptive nuclear use under a wider range of conditions, recklessly strives to legitimate nuclear utility when very little actually exists.² Overly aggressive articulation of the pre-emption doctrine has also yielded unintended and unwarranted consequences, including a potentially dangerous global scramble among copycat states to adopt pre-emption doctrines.³ America should cast pre-emption as a last resort, not a licence to legitimate aggression. And finally, great care will be needed to safely implement America's emerging strategy of conventional denial without causing strategic instability. In his 2006 State of the Nation address, Russian President Vladimir Putin reacted to Bush administration plans to arm a small number of long-range ballistic missiles with conventional instead of nuclear warheads by suggesting that their use might inadvertently provoke a nuclear riposte.⁴ Thus, the skilful and judicious roll-out and implementation of any new policy establishing near-exclusive reliance on robust conventional forces will be key to that policy's utility.

Toward nuclear obsolescence

Until very recently nuclear deterrence was the foundation of US national security strategy. Nuclear weapons were expected to deter strikes not only on the American homeland, but upon allies in Europe and Asia, too. Nuclear deterrence hinged centrally on the delivery of a devastating second-strike attack

against nuclear adversaries, although a determined number of strategists, who eyed particular details of nuclear utility as important, sought more discrete attack options than those implied by a strategy of mutual assured destruction.⁵ The end of the Cold War found a growing community of nuclear abolitionists arguing that a rare historical turning point had been reached in the longstanding quest to eliminate nuclear weapons globally.⁶ Although the abolitionist quest is far from being realised, Russia and the United States have agreed, in the 2002 Moscow Treaty, to reduce their respective holdings of strategic nuclear warheads to a level of 1,700–2,200 by December 2012. Non-deployed nuclear warheads, however, will be retained in a strategic reserve. Thus, it was no great surprise that the Bush administration's January 2002 issuance of the Nuclear Posture Review, required by Congress, was greeted largely as evidence of growing US reliance on nuclear weapons.⁷ Media and expert attention immediately fixed on the review's call for the potential development of new types of nuclear weapons designed to destroy underground targets. Lost in the noise were the truly revolutionary features, which augur a transformation of strategic deterrence away from nuclear dependence and increasingly – if not fast enough – towards a combination of conventional offensive and defensive forces.

Rather than resting on the threat of nuclear retaliation, the review's 'denial' strategy hinges on developing credible war-fighting options to deny potential adversaries the capacity to do America and its allies and friends harm – most notably by using chemical, biological or nuclear weapons. Because post-Cold War threats are more diverse, the review argues that they demand better integration of the full range of offensive and defensive weapons and doctrine. By calling for such integration, however, it wrongly conflates both classes of weapons as if they were equally useful weapons of war.

This is not the first time policymakers have sought to make nuclear weapons just like any other weapon. Two brief examples illustrate the periodic testing of the longstanding nuclear taboo on and universal revulsion against nuclear weapons and their use, which extends not just to megaton-yield strategic nuclear weapons but also to so-called 'tactical' ones.⁸ In its 'New Look' policy, formulated after the Korean War, the Eisenhower administration attempted, without success, to reduce the stigma associated with nuclear use by placing heavy reliance on tactical nuclear weapons for battlefield use. An even more compelling case occurred during the Carter administration. Responding to broad public pressure, President Jimmy Carter cancelled the enhanced radiation weapon. Although the weapon arguably was no more indiscriminate in its effects (albeit nuclear ones) than large conventional bombs, the chance that it might blur the critical distinction between nuclear and conventional weapons made the risk of deployment seem prohibitive.⁹

As for policymakers' personal views about using nuclear weapons, President Eisenhower and his secretary of state, John Foster Dulles, acknowledged that by the late 1950s the distinction between nuclear and conventional weapons remained solidly in place from a public perspective.¹⁰ As the Kennedy administration moved to reduce reliance on nuclear weapons by improving conventional military capabilities, Secretary of Defense Robert McNamara and Secretary of State Dean Rusk both came to view the use of nuclear weapons as mostly 'unthinkable' on political and moral grounds as well as military ones.¹¹ More recently, President George H.W. Bush privately ruled out a nuclear response

America's new denial strategy is based on precision conventional weapons

in the 1991 Gulf War and later acknowledged this stance in a book.¹² Colin Powell, in a memoir written after the 1991 Gulf War, also dismissed the utility of nuclear use.¹³

The Nuclear Posture Review's re-blurring of the distinction between conventional and nuclear use should not obscure the growing reality that America's new denial strategy is based on precision conventional weapons. Since the early to mid-1970s, the US Department of Defense has made substantial investments in precision-guidance and long-range strike weapons, the fruits of which first became manifest in the 1991 Gulf War. Even though virtually all the weapons used during that conflict were decades old, and no new doctrinal, conceptual or organisational innovation was on display, signs of revolutionary progress were evident. Fewer than 5% of the weapons employed were precision guided, but those that were used demonstrated at least an order of magnitude greater effectiveness than unguided air-delivered ('dumb') bombs.¹⁴

Coming on the heels of the collapse of the Soviet Union and dissolution of the Warsaw Pact, the performance of smart conventional weapons in 1991 triggered a reassessment of nuclear-weapons policy within the defence community. The idea that smart conventional weapons might represent a far more credible and usable instrument of deterrence and war-fighting found expression among an increasing number of military officers. In a series of war games sponsored by RAND Corporation, held between 1991 and 1993, military participants generally found nuclear weapons extraneous because smart weapons were capable of destroying virtually every military target that was once assigned to nuclear weapons.¹⁵

In early 1993, three prominent 'wise men' of the US national security establishment – McGeorge Bundy, Admiral William J. Crowe and Sidney Drell – wrote in *Foreign Affairs*: 'There is no vital interest of the U.S., except deterrence of nuclear attack, that cannot be met by prudent conventional readiness.'¹⁶ But the most profound impact on the debate came from Paul H. Nitze, one of America's prin-

cial architects of Soviet containment and nuclear-deterrence policy. Writing in the *Washington Post* in January 1994, Nitze argued that the time had come for the United States to re-examine its longstanding reliance on nuclear deterrence. He reasoned that the threat of nuclear retaliation would be unlikely to deter aggression by regional powers. Even more important, American decision-makers would be unwilling to use nuclear weapons to punish aggression. As a result, Nitze recommended converting the principal US strategic deterrent from nuclear weapons to smart conventional weapons. Believing that such a conventional strategic force would furnish the United States with a more credible and flexible deterrent, Nitze argued that 'it may well be that conventional strategic weapons will one day perform their primary mission of deterrence immeasurably better than nuclear weapons if only because we can – and will – use them'.¹⁷

But Nitze's call for examining whether or not it was time to 'junk' America's nuclear dependence did not shape any notable consensus to do so – certainly not within the diehard nuclear establishment. Indeed, concern about not only the spread not just of nuclear weapons but of biological and chemical arms as well raised the question of how best to deter these weapons from ever being used. Is the mere existence of a nuclear stockpile, no matter its quality or reliability, or as Sir Michael Quinlan observed in 1997, 'an inert pile of materiel', sufficient to deter potential adversaries from using nuclear, biological or chemical weapons?¹⁸ Of course, the US nuclear arsenal was then and is today far from being 'inert'. Nevertheless, there have been longstanding concerns within the US nuclear establishment about sustaining the nuclear stockpile over the next 50 years, particularly without any further nuclear testing. This worry led the Pentagon's Defense Science Board to create a task force on nuclear deterrence, which, in a report issued in 1998, found that the credibility of nuclear deterrence threats was destined to suffer from general erosion in nuclear expertise within the Department of Energy's weapons laboratories, the Department of Defense and the military services.¹⁹ Such erosion stemmed not only from an absence of new weapons development and testing, but also from the virtual demise of serious long-range nuclear planning within military circles.

Consistent with the concerns raised by the 1998 Defense Science Board report, the Bush administration's 2002 Nuclear Posture Review tackled the credibility issue in a radically new way. In effect, it joined Nitze's notion of strategic conventional strike to a substantially reduced nuclear stockpile, active and passive missile defences, and a revitalised nuclear infrastructure to create the 'New Triad'.²⁰ This gave the chief architects of the NPR room to argue that the New Triad would at once reduce reliance on nuclear weapons while necessitating improvements to existing nuclear weapons to make them more responsive to emerging threats.

What were these threats and why couldn't existing nuclear weapons deal with them? According to the Nuclear Posture Review, new capabilities were needed to defeat hardened underground targets housing weapons of mass destruction (WMD), missile basing and supporting leadership cadres; mobile and relocatable targets (meaning ballistic and cruise missiles armed with WMD); and chemical and biological agents.²¹ In addition, improved delivery accuracy and lower collateral damage were needed to enhance the credibility of nuclear threats. Existing nuclear weapons were insufficient to deal with these threats because they were generally not accurate enough and their nuclear yields were too large to make them credible war-fighting instruments. Seemingly overlooked was the fact that strategic nuclear delivery systems are accurate to within 100 meters of their target, while cruise missiles are even more accurate. Moreover, nuclear yields of less than a kiloton are reportedly available in some bombs and cruise missiles.²² And, most important of all, why couldn't existing or prospective conventional attack systems do as good or better a job without incurring the moral and political consequences of breaking the longstanding nuclear taboo?

Earth-penetrating nuclear weapons were the primary focus of the review's architects. They proposed studying the feasibility of converting existing nuclear bombs into earth penetrators adequate to contain collateral damage while destroying the target. If such a study offered hope for such a 'usable' nuclear device, the review's architects could argue that while the overall nuclear stockpile was shrinking, remaining weapons would offer a more effective contribution to an emerging strategy of military denial.

Both Houses of the US Congress appear steadfast in their aversion to sponsoring new nuclear-weapon programmes at a time when America possesses such absolute conventional military dominance. Most surprisingly, the Republican-controlled Congress deleted all funding for the nuclear earth penetrator and research into new types of nuclear weapons in the fiscal 2005 and 2006 appropriations bills. The administration decided not to request any funding for the nuclear earth penetrator in its 2007 budget request but instead turned its attention to supporting the Reliable Replacement Warhead programme, which is supposed to improve the prospects for indefinitely sustaining the reliability of existing nuclear weapons. Sceptics fear that the programme will move beyond mere stockpile sustainability to create new nuclear weapons. Although the Department of Defense has not established a formal military requirement for new nuclear weapons, several thus far unsuccessful attempts to examine nuclear earth penetrators and other advanced concepts underlying lower yield nuclear weapons suggest that the Reliable Replacement Warhead programme bears close scrutiny.²³

Toward a conventional strategy of denial

America can confidently turn to conventional weapons to meet the Nuclear Posture Review-stipulated challenges of assuring friends and allies that the United States will defend their interests, dissuading adversaries from mounting military challenges against America, deterring adversary WMD attacks, and attacking and defeating opponents decisively should deterrence fail. No one argues that America does not possess overwhelming conventional military superiority over any prospective adversary. But quantitative advantage alone is not sufficient to meet the stringent demands of assurance, dissuasion, deterrence and, especially, denial. Possessing the capacity to effectively deny one's adversary its principal military objectives makes assurance, dissuasion and deterrence all the more feasible.

The Nuclear Posture Review specifically identifies high-value hardened underground targets, mobile or relocatable targets, and chemical and biological weapons as the most problematic. Similarly, in 1993, then Secretary of Defense Les Aspin called for capabilities to locate, identify and attack hardened targets and WMD-armed mobile missiles, and to shoot down enemy missiles that survived counterforce attacks – mainly as counter-proliferation measures.²⁴ Each one of these three missions is extraordinarily difficult to achieve. Yet, upon closer examination, smart conventional weapons hold as much promise for achieving them as any current or future nuclear weapon. Even more importantly, smart conventional weapons do not involve the unacceptable moral transgressions and incur the adverse non-proliferation costs that nuclear use – or, in some circumstances, even brandishing nuclear threats – would entail.

Dealing with strategic underground targets

The role for which nuclear weapons seem most indispensable is in attacking strategic underground targets, of which US intelligence believes there are roughly 2,000 of interest to US planners. While a few of these structures are buried between 500 and 700m deep in hard rock, many are between 100 and 400m underground, and the majority are less than 250m deep.²⁵ A good number of these facilities are clearly beyond the reach of existing conventional earth penetrators. Many are susceptible to destruction by one or more nuclear earth-penetrating weapons, but not without unwanted consequences. The US National Academy of Sciences reports that over half of these strategic underground targets are located near or in urban areas. This would mean that a nuclear attack could produce significant civilian casualties. Depending on weapon yield, one such nuclear attack could cause between thousands and more than a million casualties. In more remote areas, casualties could range between a few hundred to hundreds of thousands, depending

on yield and wind direction.²⁶ A new nuclear earth-penetrating weapon, which the Bush administration has favoured and the NPR endorses, would effectively capture a few hundred of these strategic underground targets, but some uncertain number would presumably remain beyond reach. One conventional attack concept under consideration takes advantage of precision location accuracy by attacking a single entry point repeatedly, thus drilling down the same entry hole

Underground facilities are detected too late

until the weapon achieves the required depth. A high degree of accuracy is obviously needed – perhaps an order of magnitude improvement over today’s weapons.²⁷

Eliminating biological agents stored underground presents its own unique challenges. Because the intense fireball created by either a nuclear or conventional weapon would sterilise biological agents in a confined space, knowing precisely where

such agents are stored is essential. Of course, assessing whether or not adequate damage has been achieved would be difficult. Sometimes US intelligence satellites closely monitor the construction of strategic underground structures, as they have at the Iranian facility at Natanz where uranium enrichment is believed to be taking place. But more often than not, strategic underground facilities are detected too late to disclose the precise location of the facility’s rooms and the specific construction techniques and materials employed.²⁸

Even if US intelligence managed to obtain the targeting specifications required to employ improved nuclear or conventional earth-penetrating weapons, adversaries could simply relocate their prized strategic assets deeper underground. As the United States has strived to improve its precision-attack capabilities with conventional weapons, nations have already sought to counter such smart weapons by going deeper and deeper. The US intelligence community has identified roughly 10,000 underground targets (not all of which are of strategic value) and many more may not yet have been detected. Commercially available boring equipment can now dig a tunnel 18m in diameter at the rate of 70m each day. Consequently, the best strategy may lie in persistent harassment, consisting of precise and repeated attacks with smart conventional weapons of the ground-level adits supporting underground facilities. In 2003, Admiral James O. Ellis, Jr, then head of the US Strategic Command (STRATCOM), agreed that precision conventional weapons could do just as good a job as any nuclear earth-penetrating weapons by sealing off underground facilities through multiple attacks.²⁹

Improving counterforce attacks against mobile missiles

Locating and attacking fleeting targets – in particular, launchers carrying missiles armed with nuclear, biological or chemical weapons – is a longstanding

challenge that thus far remains unmet by America's enormous conventional war-fighting capacity. Just as enhanced radiation weapons were designed with moving targets (namely tanks) in mind, very small-yield nuclear devices could be designed for use against unconventionally armed mobile missiles. Nuclear proponents might argue that if such weapons were used in unpopulated desert areas, they could compensate for inaccuracies in searching for such difficult-to-locate targets. Of course, were adversaries threatened by such an extreme tactic, they logically would operate closer to populated areas, which also could make the search task more difficult because missile launchers could be erroneously mistaken for civilian vehicles operating in or near urban areas. Given the inherent targeting uncertainties associated with searching for and positively identifying such fleeting targets, decision-makers have no choice but to rely on conventional weapons.

Unfortunately, conventional weapons remain inadequate to the task. Overwhelming American conventional firepower employed in an increasingly integrated fashion is still most effective in attacking fixed, not moving, targets. One of the few major failures during the first Gulf War was the inability of coalition air forces to destroy a single Iraqi mobile missile launcher. It was special-operations forces operating on the ground that achieved the only success by finding and destroying one such launcher.³⁰ During *Operation Allied Force* in Kosovo, US-led NATO air forces showed some improvement over the allied coalition in 1991 in neutralising armoured fighting vehicles (Serbia did not employ mobile missiles).³¹ Nevertheless, NATO air forces experienced difficulty identifying and striking moving Serbian targets operating under thick cloud cover or targets that were camouflaged or well concealed.

Sadly, most of the time between the first Gulf War and Kosovo was squandered with respect to improving attack operations (Pentagon parlance for counterforce) against mobile missiles. Only modest sums were allocated among an array of poorly managed, piecemeal programmes, resulting in only marginal improvements in search, decision and attack capabilities.³² To be sure, the Pentagon's joint doctrine for missile defence specified attack operations as the preferred method for countering enemy missiles, defining success as being achieved when WMD payloads were destroyed on enemy territory before countermeasures (like decoys) were employed to complicate the task of missile interception. But time was wasted over doctrinal fights between the air force and army for ownership of roles and missions associated with attack operations. A further and perhaps even more important factor was the air force's propensity to view the challenges of attacking mobile missiles as no different from attacking any target – fixed or otherwise.

Nearly continuous combat operations since the terrorist attacks of 11 September 2001 have led to notable progress in attacking fleeting targets. US air assets did not face any mobile missiles during *Operation Enduring Freedom* in Afghanistan, but they did have to contend with Taliban and al-Qaeda forces hiding in caves, compounds and other sanctuaries that afforded some protection from air strikes. A foretaste of greatly improved counterforce capability was on display with the imaginative fusion of target identification on the ground by special-operations forces controllers linked to precision air strikes from above. This virtually instantaneous relay of targeting information greatly reduced the amount of time between identifying a target and attacking it. Still, making the decision to attack fleeting targets imposed unwanted delays during initial operations in Afghanistan, when several important time-sensitive targets were missed due to the requirement to report back to the US Central Command (CENTCOM)'s Tampa, Florida headquarters for approval. By the beginning of the second Gulf war in 2003, however, CENTCOM commander General Tommy Franks decided to delegate most of the authority to attack time-critical targets to his air component commander. As a result, during *Operation Iraqi Freedom's* 21-day combat phase, substantial progress was achieved in attacking time-sensitive targets: 156 such targets were destroyed, representing at least a 50% improvement compared with Afghanistan.³³ Effective search for Iraqi mobile missiles remained frustrated, however. The Iraqis managed to continue firing both ballistic and cruise missiles – though minimally and ineffectively – throughout the brief campaign.³⁴

The progress towards finding and attacking fleeting targets has as much to do with conceptual and organisational changes as with new search capacity, such as that furnished by unmanned aerial vehicles for dedicated reconnaissance missions. Conceptually, the US Air Force has only recently recognised that finding and attacking WMD-armed mobile missiles (and high-priority terrorists) cannot succeed with a one-size-fits-all doctrine, and that doing so constitutes a critically important and distinctively different combat goal, meriting specialised conceptual treatment.³⁵ According to one senior air force officer, the average time required to execute a time-sensitive targeting strike dropped from 120 minutes in 2002 to 10 minutes in 2004.³⁶ Apropos mobile missiles, such a reduction is critical: the full cycle of detection to strike should be reduced to five minutes or less – the amount of time it takes to break down a missile launcher and move it to a new hiding spot or launch position. This undoubtedly explains why former Air Force Chief of Staff John Jumper has formulated the notion of 'time of flight' time-sensitive targeting, or hitting the target in the amount of time it takes for weapons delivery, which could be less than a minute for a manned or unmanned weapons platform loitering nearby.

The brilliant mixture of forces and new tactics that contributed to locating and killing al-Qaeda in Mesopotamia leader Abu Musab al-Zarqawi furnishes important lessons for dealing with mobile missile targeting. No single service can take credit for the success of the hunt for al-Zarqawi. Without special-operations forces and perhaps other support on the ground, seamlessly integrated with attack forces in the air, shortening the attack cycle against mobile missiles will prove fruitless. Ever more effective sensor platforms, providing near-ubiquitous surveillance and reconnaissance, together with automated imagery exploitation, will surely help. But the most important missing ingredients thus far are conceptual and organisational.

To handle the distinctive mission of locating and attacking mobile targets, military planners would do well to borrow the conceptual and organisational approach used by the US Navy in its conduct of antisubmarine warfare operations. Under that approach, interlinked forces provide continuous, long-duration surveillance and strike capability over a wide area, operating 24 hours a day in peacetime, crisis and war. Such a systematic approach would demand tracking each and every mobile missile to understand its practice routines, the constraints units face in accommodating certain terrain conditions (indicating where they can and cannot operate), and likely deployment areas in wartime. Organisationally, a joint-force approach is essential. No one service can do the job alone. But each regionally based anti-mobile-missile operations centre would embrace tactics, techniques, training and procedures tailored to the particular demands of their combat arena. One operations centre might choose to employ a dedicated overhead sensor tied to a dedicated weapons platform, while another might find it more suitable to use wide-area sensors acting as command centres for multiple weapons platforms.³⁷ Sensors emplaced by special-operations forces or other agents along probable mobile-missile operating routes would also be featured. In any event, threat and geographic diversity dictate tailored joint-force packages focused exclusively on one combat goal: tracking and targeting mobile missiles around the clock.

Making missile defences more effective

Missile defences help deny adversaries their military objectives. But by no means are missile defences – however layered they may eventually become – expected to do the job alone. As noted, improved tracking of and attack operations against mobile missiles could reduce the in-flight threat considerably. And passive defences (vaccines for biological attack, for example) can further reduce the effectiveness of missiles that manage to survive counterforce attacks and penetrate missile defences. Of course, nations brandishing nuclear missile

threats against the United States face the prospect of a devastating, last-resort nuclear response, which even the Bush administration believes is more than adequate to deter even enigmatic countries like North Korea.³⁸ The mere existence of a robust missile-defence programme, regardless of repeated test failures, appears to have a salutary effect on the American public, which remains curiously oblivious to the facts about missile defences.³⁹

How current and possible future adversaries perceive the effectiveness of active US missile defences (either separately or in combination with counterforce and passive defence measures) is more difficult to assess. Yet there is little evidence that foreign audiences share missile-defence critics' belief that available or even conceivable missile-defence technologies will not perform as promised.⁴⁰ Indeed, even critics realise that many of the reasons for poor missile-defence performance turn less on the mission's impossibility than on the intense political pressures to maintain politically mandated development and deployment schedules. This so-called 'rush to failure' was self-evident to supporters of missile defence late in the Clinton administration and remains so today.⁴¹ Heavy political

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pressure to deploy missile defences in advance of having fully proven their effectiveness came from Republican members of Congress during the Clinton administration, while more recent pressure came from President Bush's 2002 directive to deploy an initial if limited missile-defence system before his re-election bid in 2004.

The Bush administration's goal is to furnish a layered missile defence of the entire US homeland, its overseas forces, friends and allies. The first increment of global missile defences is to consist of 20 ground-based interceptors employing exoatmospheric kill vehicles (so-called 'hit-to-kill' vehicles), three *Aegis*-class cruisers/destroyers armed with *Standard* SM-3 interceptors, and an unspecified number of *Patriot* PAC-3 interceptors deployed both at home and overseas. Various early-warning and command, control and communications systems support these interceptors. Responding to North Korea's anticipated test launch of a *Taepo-dong* 2 long-range ballistic missile in July 2006, the Pentagon reportedly switched its current deployment of 11 of the 20 planned ground-based interceptors (nine are deployed at Fort Greeley, Alaska and two at Vandenberg Air Force Base, California) from test to operational mode, although the move probably relates more to system readiness than to any improvement in capability.⁴²

Missile-defence advocates appreciate the risks of pursuing a strategy of early deployment, consisting of product improvements (or so-called 'blocks') intro-

duced every two years. They argue that it would be negligent to deny the nation some capability, however problematic, to meet emerging threats. Frequently cited is Israel's early deployment of the *Arrow* missile-defence system, which is thought to be providing some degree of deterrence while Israel pursues even more robust missile defences. Moreover, the highly successful *Aegis* SM-3 programme is touted as furnishing substantial capability now against short- to medium-range missile threats, and potentially as a future platform for boost-phase intercept as progress is made toward developing a new high-acceleration booster coupled with a boost-kill vehicle by the end of this decade. As additional blocks of capability are added over time, a truly layered if still imperfect global missile-defence system will begin to take shape.⁴³

The chief limitation of current and prospective US missile defences became clear in 2003 during combat operations in Iraq. *Patriot* missile defences then performed admirably against Iraqi ballistic missiles. Compared to *Patriot's* 9% rate of interception during the 1991 Gulf War, they achieved 100% effectiveness against all nine threatening Iraqi ballistic missiles.⁴⁴ But *Patriot* failed altogether to detect or intercept any of the five primitive land-attack cruise missiles Iraq launched against coalition targets. Although none of these missiles achieved any direct military effect, they contributed to a series of friendly-fire casualties: *Patriot* erroneously shot down two friendly aircraft, killing three crew members, while the crew of an American F-15 aircraft destroyed a *Patriot* radar in the belief that it was being targeted. For US officials, these events finally drove home the fact that current missile defences had little or no value against low-flying land-attack cruise missiles. Nations looking to acquire missiles saw the growing effectiveness of ballistic-missile defences set against their gaping weaknesses against cruise missiles. This perception has helped nudge longstanding interest (if not full-scale development) in cruise missiles toward a proliferation tipping point, as evidenced by an extraordinary increase in cruise-missile development activity over the last year.⁴⁵ Thus, improved defences against short- and medium-range ballistic missiles have made cruise missiles more attractive to US adversaries, and American missile-defence priorities have too exclusively focused on ballistic-missile threats.⁴⁶

Some modest capability to deal with low-volume cruise-missile attacks does reside in fighters equipped with advanced detection and tracking radars and air-to-air missiles. And significant investments in new radars and missile sensors have positioned the US military services to greatly improve existing cruise-missile defences.⁴⁷ Such programmes surely need additional funding, but the real challenge is less that of insufficient resources or achieving technological breakthroughs than of wresting financial control away from the individual services and placing cruise-missile defence under the organisational control of a Department of

Defense agency. Each of the three services approaches the challenge of defending against land-attack cruise missiles as if the other two services did not exist. Thus, an imaginative and potentially revolutionary concept that would greatly enhance the effective range of cruise-missile interceptors – to wit, having the army's ground-based *Patriot* missiles guided to their targets by air force airborne radars – remains unfulfilled. And the 37-year-old quest to implement a single integrated air picture, which would allow all service participants in cruise-missile defence to see the same threats and plan most efficiently and effectively, is still mired in service bickering over implementation standards. These are not insoluble problems; however, they do require the intervention of the secretary of defense, who must insist upon a 'network centric' solution to the problem. The palpable emergence of the cruise-missile threat ought to be reason enough to act quickly.

One immediate way of compensating for ballistic-missile-defence weaknesses – most notably discriminating between simple countermeasures and the actual re-entry vehicle in mid-course interception – would be to mate a very small-yield nuclear device to the interceptor. In theory, the interceptor would no longer need to discriminate real from fake targets, but instead would destroy everything nearby. Of course, the risk is that nearby objects might also include commercial or military satellites, which are notoriously susceptible to electromagnetic pulses generated by nuclear explosions. Sceptics also argue that an interceptor armed with only a small-yield device would have difficulty sweeping the skies of decoys, or destroying anthrax spores in bomblets.⁴⁸ The idea of nuclear-tipped interceptors is nothing new. The Russian anti-ballistic-missile system encircling Moscow employs large-yield warheads. The United States abandoned the use of nuclear interception three decades ago for both technical and political reasons. Today's political environment is no more hospitable to the idea. When news reports indicated that Rumsfeld had encouraged the Defense Science Board to study the concept in 2002, the Missile Defense Agency reacted by stating that it had no plans for nuclear-tipped interceptors.⁴⁹ Both Republicans and Democrats subsequently banned spending for the idea in the fiscal 2003 defence appropriations bill. Aside from the enormous political liability associated with the notion, nuclear-tipped interceptors have even less relevance against the most glaring gap in missile defence: detecting and destroying low-flying cruise missiles well within the earth's atmosphere, where nuclear effects would be palpable.

The road ahead

If US conventional war-fighting capabilities are demonstrably robust today, they are destined to become even more potent over the next two decades. These improvements further diminish the salience of nuclear alternatives. Conventional

options have already begun to replace nuclear ones as military planners integrate conventional and nuclear strike planning in accord with the 2002 Nuclear Posture Review and the Bush administration's National Security Strategy, which emphasises pre-emption. STRATCOM, formerly responsible for planning and delivering nuclear attacks, has turned the offensive leg of the so-called New Triad into a decidedly conventional strike force, called global strike. STRATCOM's operational plan for dealing with WMD threats like those posed by Iran and North Korea reportedly rejects a large-scale multi-service campaign in favour of swift and decisive conventional and cyber attacks complemented by special-operations forces on the ground to locate and secure targets, if needed.⁵⁰

The US Air Force contribution to STRATCOM's new global strike mission includes today's B-52, B-1 and B-2 bombers loaded with precision-strike munitions, and plans call for a new long-range bomber by 2018. The US Navy has converted four of its 18 *Trident* submarines, which will carry 154 *Tomahawk* cruise missiles, with options to trade off a few cruise missiles for special-operations mini subs or small unmanned aerial vehicles for reconnaissance missions. Two of the four converted *Trident* boats have already joined the fleet. Pentagon plans also include spending \$503 million to outfit a small number of *Trident* D-5 nuclear missiles on the remaining 14 *Trident* boats with conventional warheads (either many small-diameter bombs or fewer bunker-buster warheads) to achieve a prompt (i.e., within 60 minutes of the decision to launch) global strike capability.⁵¹ Even more robust global strike forces could emerge from current research and development programmes involving small expendable rocket boosters launching highly manoeuvrable and conventionally armed aerospace vehicles over intercontinental distances and reusable hypersonic cruise missiles carrying 5,500kg payloads over 14,500km within two hours.⁵²

But while clear opportunities for diminishing America's dependence on nuclear weapons appear promising, the conventional road ahead is not without its own bumps. The most immediate challenge is designing a safe path to virtually exclusive reliance on robust conventional forces. Two immediate challenges stand out. The first has to do with the inherent ambiguity of determining a conventionally armed long-range ballistic missile from a nuclear-armed one. Russia, which possesses an early-warning system, has already raised this concern. Both the US House and Senate, too, have so far reacted with caution to the Pentagon's proposal to arm some of the Navy's *Trident* D-5 nuclear missiles with conventional warheads. They have asked the Bush administration to provide details on how to ensure that use of such a missile would not result in an inadvertent or accidental retaliatory nuclear response.⁵³ One obvious way to allay these concerns is to provide advance notification on missile flight trajec-

tories for all ballistic-missile launches. Russia and the United States agreed to such a joint warning concept in September 1998, which was subsequently made more formal in June 2000 when Presidents Clinton and Putin agreed to establish a Joint Data Exchange Center in Moscow.⁵⁴ Legal and tax issues have prevented the centre from becoming operational, however. In any case, the only true means of eliminating ambiguity over whether a missile is nuclear or conventional is to move to an exclusively and verifiably conventional missile force. Doing so is by no means an inconceivable prospect given trends in precision conventional weapons and past success in verifying even more complex agreements. In the interim, the best approach would be to avoid mixing conventional and nuclear ballistic missiles launched from submarines and instead place conventional warheads on land-based missiles located separately from extant land-based nuclear-missile sites.⁵⁵ The current legislative pause offers an opportunity to explore the pros and cons of turning never-used intercontinental-range missiles into usable conventional ones, particularly at a time when international norms against their acquisition are in an early, formative stage.⁵⁶

Given the Bush administration's aggressive articulation of the pre-emption doctrine, it is easy to see why some nations might be concerned about what otherwise should be seen as a positive development (dramatically reducing nuclear missiles for conventional ones). Washington's emphasis on a pre-emptive national

Washington's emphasis on a pre-emptive national security strategy is being mimicked

security strategy is being mimicked in some expected and not-so-expected places. Shortly after America's invasion of Iraq, President Putin said Russia retained the right to launch pre-emptive strikes to defend its interests. Israel, too, cited the US pre-emption doctrine when it attacked an alleged terrorist camp in Syria in October 2003. While it is hardly surprising to see North Korea announce that a 'pre-emptive strike is not the monopoly of the United States', Taiwan's and Japan's unanticipated interest in pre-emption is cause for concern. After announcing that

it intended to deploy new land-attack cruise missiles capable of striking China, Taiwanese military analysts began discussing the possibility of instituting a 'preventive self-defence' strike option, entailing the early use of cruise missiles to sow confusion in China's strike plans. Even more surprising – in light of its constitutional constraints against offensive systems – is Japan's interest in land-attack cruise missiles together with an October 2004 report in which a Japanese Defense Agency panel stipulated a requirement for launching pre-emptive strikes against ballistic-missile launch installations.⁵⁷ Fearing that Taiwan's actions might provoke China, Washington has begun to quietly express its worries about

Taiwan's pursuit of offensive missile options.⁵⁸ These developments suggest the need for Washington to cut a path back to strategic stability by toning down, if not entirely eliminating, the pre-emption option – not least because doing so would facilitate the process of diminishing nuclear salience.

If concerns about replacing nuclear missiles with conventional ones and pre-emption's potential blowback are roadblocks to diminishing the role of nuclear weapons, the most consequential impediment is America's unwillingness to link its overwhelming conventional capabilities to reductions in its nuclear holdings and changes in its nuclear policies. Overwhelming US conventional superiority, measured against even the stiffest denial challenges, offers US policymakers ample reason to begin discussions with Moscow about how to proceed with further reductions in strategic nuclear forces beyond those agreed upon in the 2002 Moscow Treaty. The Bush administration's early propensity to spurn formal arms control for loosely fashioned open-ended agreements shows hints of change. Senior US and Russian officials met in Moscow in mid-June 2006 to discuss creating a new bilateral intergovernmental strategic security group, which aims to discuss the full spectrum of non-proliferation issues.⁵⁹ A rich menu of issues could be conceived, but priority ought to be given to extending the provisions of the US–Russian START I Treaty on nuclear weapons, rather than letting them expire in 2009. Most important, Moscow and Washington should work toward reducing their respective strategic holdings substantially below the Moscow Treaty's target of 1,700–2,200 warheads by 2012. Half that number of weapons would suffice for purposes of last resort. The group should also jump-start stalled efforts to build the Joint Data Exchange Center in Moscow to allay Russia's concerns about US conventional missile plans. And if the Bush administration is truly interested in reducing Moscow's uneasiness over whether a missile is nuclear or conventional, it should immediately change its declaratory nuclear-weapons policy to one of 'no first use'.

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It has been over 12 years since Paul H. Nitze called for relying on precision conventional instead of nuclear weapons for deterrence. At the time, Nitze said that it was imperative first to conduct a serious debate about the performance of smart weapons, yet few analysts and senior officials have joined that debate.⁶⁰ Nevertheless, the preponderance of evidence supports the proposition that for even the most challenging military missions, precision conventional weapons perform as well as nuclear weapons. Other than for simple deterrence, there is no morally responsible reason for making nuclear weapons more usable.

At a time when both states and terrorist groups have clear nuclear ambitions, America has no choice but to lead responsibly toward radically reducing the role of nuclear weapons for every conceivable purpose except for last resort. It may not be time, as Paul Nitze reflected rhetorically in 1994, to ‘junk our nukes’, but it is time to substantially reduce weapons stockpiles, ratify a test-ban treaty, and galvanise the international community towards coordinated action to ensure that the 60-year-old taboo against nuclear use is never broken.

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Notes

- 1 Joint Press Conference with British Secretary of State for Defence Geoffrey Hoon, 5 June 2002. I am grateful to David S. Yost for directing my attention to this statement.
- 2 ‘Pentagon Cancels Controversial Nuclear Doctrine’, at <http://www.nukestrat.com/us/jcs/canceled.htm>.
- 3 Steven Andreasen and Dennis Gormley, ‘Edging Ever Closer to a Nuclear Death Row’, *Minneapolis Star-Tribune*, 29 March 2006.
- 4 See <http://www.mosnews.com/column/2006/05/11/PutinAddress.shtml> for the complete text.
- 5 For a representative example, see *Discriminate Deterrence: Report of the Commission on Integrated Long-Term Strategy*, co-chairmen, Fred C. Ikle and Albert Wohlstetter (Washington DC: US Government Printing Office, 1988).
- 6 See *Report of the Canberra Commission on the Elimination of Nuclear Weapons*, at <http://www.dfat.gov.au/cc/cchome.html>.
- 7 The 2002 Nuclear Posture Review remains a classified document today, but major portions of it were leaked on its publication and can be found at <http://globalsecurity.org/wmd/library/policy/dod/npr.htm> (hereafter cited as ‘NPR excerpts’).
- 8 For a comprehensive look at this history, see Nina Tannenwald, ‘Stigmatizing the Bomb’, *International Security*, vol. 29, no. 4, Spring 2005, pp. 5–49.
- 9 Enhanced radiation weapons, or ‘neutron bombs’, release most of their energy in the form of neutron radiation, which kills people without producing significant structural damage from blast effects.
- 10 Tannenwald, ‘Stigmatizing the Bomb’, pp. 26–7.
- 11 *Ibid.*, p. 30.
- 12 George Bush and Brent Scowcroft, *A World Transformed* (New York: Knopf, 1998).
- 13 Colin Powell, *My American Journey: An Autobiography* (New York: Random House, 1995).
- 14 Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report* (Washington DC: US Government Printing Office, 1993), p. 243.
- 15 Mark Dean Millot, ‘Facing the Emerging Reality of Regional Nuclear Adversaries’, *Washington Quarterly*, vol. 17, no. 3, Summer 1994, pp. 50–51.
- 16 Quoted in Jack Mendelsohn, ‘Deligitimizing Nuclear Weapons’,

- Issues in Science and Technology*, Spring 2006, p. 70.
- 17 Paul H. Nitze, 'Is it Time to Junk Our Nukes', *Washington Post*, 16 January 1994, p. C1.
- 18 Michael Quinlan, *Thinking About Nuclear Weapons* (London: RUSI Whitehall Paper Series, 1997), p. 15.
- 19 *Report of the Defense Science Board Task Force on Nuclear Deterrence* (Washington DC: Office of the Undersecretary of Defense for Acquisition and Technology, October 1998). For one recent appraisal, see James J. Wirtz, 'Do U.S. Nuclear Weapons Have a Future?', *Strategic Insights*, <http://www.ccc.nps.navy.mil/si/2006/Mar/wirtzMar06.pdf>.
- 20 The old triad consisted of exclusively nuclear-armed ground-based ballistic missiles, submarine-launched ballistic missiles and aircraft.
- 21 NPR excerpts, p. 46.
- 22 Roger Speed and Michael May, 'Dangerous Doctrine', *Bulletin of the Atomic Scientists*, vol. 61, no. 2, March–April 2005, at http://www.thebulletin.org/article.php?art_ofn=ma05speed.
- 23 For details on these Congressional activities, see Jonathan Medalia, *Nuclear Weapons: The Reliable Replacement Warhead Program*, CRS Report for Congress, RL32929, 9 March 2006, at <http://www.fas.org/sgp/crs/nuke/RL32929.pdf>.
- 24 Les Aspin, 'The Defense Department's New Nuclear Counterproliferation Initiative', address to the National Academy of Sciences, Washington DC, 7 December 1993.
- 25 All data on the characteristics of underground targets and weapons performance are derived from *Nuclear Earth Penetrator: Effects of Nuclear Earth-Penetrator and Other Weapons* (Washington DC: National Academy of Sciences, 2005), <http://www.nap.edu/catalog/11282.html>.
- 26 *Ibid.*
- 27 Interview with industry official, April 2006. Improvements in accuracy will occur naturally as Global Positioning System upgrades are made, but for this particular idea could be developed more rapidly with adjustments to existing space-borne systems.
- 28 'US Military Options Against Emerging Nuclear Threats', *Strategic Comments*, vol. 12, no. 3, April 2006.
- 29 Walter Pincus, 'Rumsfeld Seeks to Revive Burrowing Nuclear Bomb', *Washington Post*, 1 February 2005, p. A2.
- 30 Clyde Walter, director of the Defense Intelligence Agency's Missile and Space Intelligence Center, acknowledged this accomplishment on 27 April 2006 at the 2006 Cruise Missile & IED Defense Conference, Arlington, VA.
- 31 According to Jonathan Pollack, coalition air forces achieved a kill-per-sortie ratio against armoured fighting vehicles of 0.039 during the first Gulf War and a 0.07 ratio during operations in Kosovo. Pollack argues that this near-doubling is perhaps attributable to improved munitions and more concentrated and thus vulnerable Serb forces. Jonathan Pollack, 'Air Power in the Six-Day War', *Strategic Studies*, vol. 28, no. 3, June 2005, pp. 471–503.
- 32 'USAF Theater Missile Defense Attack Operations, Briefing to Mr. Dennis Gormley', HQ USAF/XORT, 21 January 1999.
- 33 Amy Butler, 'Moseley: Time Sensitive Targeting Improved from Afghanistan to Iraq', *Inside the Air Force*, 20 June 2003, p. 1. One should be wary of such comparisons, not least because the reported improvement was expressed as 'a 50 to 100 percent improvement' without any detailed reference (other than to time-sensitive targets) to what was being compared. While the two combat environments are certainly

- different, delegation of execution authority undoubtedly contributed to greater targeting success against fleeting targets.
- ³⁴ *Patriot* missile batteries were, however, involved in friendly-fire accidents leading to the loss of two aircraft and three crew members. The first Iraqi cruise missile fired nearly struck a Marine encampment on the war's first day. And, of course, none of the Iraqi missiles carried WMD warheads. Thirty-three Iraqi cruise missiles along with two launchers were discovered intact after the war. See Dennis M. Gormley, 'Missile Defence Myopia: Lessons from the Iraq War', *Survival*, vol. 45, no. 4, Winter 2003–04, p. 72.
- ³⁵ Robert P. Haffa, Jr and Jasper Welch, 'Command and Control Arrangements for the Attack of Time-Sensitive Targets', Northrop Grumman Analysis Center, November 2005, p. 34. The most influential proponent was General John Jumper, Chief of Staff of the US Air Force, who retired in November 2005. Haffa and Welch argue that such distinctive treatment merits the development of special tactics, techniques, training and procedures.
- ³⁶ General Hal M. Hornburg, Air Combat Commander, quoted in *Air Force*, November 2004, p. 72, as cited in *ibid.*, p. 39.
- ³⁷ See Haffa and Welch, 'Command and Control Arrangements', pp. 35–7, for five stylised examples of command and control arrangements for time-sensitive targeting.
- ³⁸ David Sanger, 'Don't Shoot. We're Not Ready', *New York Times*, 25 June 2006, Section 4, p. 1.
- ³⁹ In an academic poll taken after 11 September 2001, only 31% of respondents correctly understood that the United States did not then possess a national missile-defence system against long-range ballistic missiles. See Hank C. Jenkins-Smith and Kerry G. Herron, *Comparing Public Views on Security: US National Security Surveys 1993–2002, Vol. II, Trends in Perspectives on Nuclear Weapons, Terrorism, and Nuclear Energy* (College Station, TX: The George Bush School of Government and Public Service, 2002).
- ⁴⁰ Russia seems most animated by the prospect of the United States deploying highly powerful ground-based X-band radars and spaced-based infrared sensors, which could offer a 'break-out' potential for much thicker defences than planned. China seems most concerned about expansion of US missile defences into space. For concern that American technological ingenuity may well succeed in making global missile defences work, see Tom Sauer, 'Limiting National Missile Defence', *Bulletin 22 — Nuclear Policy, Terrorism and Missile Defence, International Network of Engineers and Scientists Against Proliferation*, <http://www.inesap.org/bulletin22/bul22art31.htm>.
- ⁴¹ The characterisation 'rush to failure' came from a panel chaired by General Larry Welch, US Air Force (ret'd), which met in late 1997 to investigate ways of reducing risk in missile-defence flight testing. For the full panel report, see <http://www.fas.org/spp/starwars/program/welch/>.
- ⁴² Bill Gertz, 'N. Korean Threat Activates Shield', *Washington Times*, 20 June 2006, <http://www.washtimes.com/national/20060620-123010-4554r.htm>.
- ⁴³ For an overview of future missile-defence components, see 'U.S. Missile Defense Programs at a Glance', *Arms Control Today*, vol. 33, no. 5, June 2003, pp. 25–8.
- ⁴⁴ Gormley, 'Missile Defence Myopia'. The 9% rate of success in 1991 was

- ascertained by the US Government Accountability Office.
- ⁴⁵ Dennis M. Gormley, 'Cruise Control', *Bulletin of the Atomic Scientists*, vol. 62, no. 2, March–April 2006, pp. 26–33.
- ⁴⁶ In FY2005, for example, the Pentagon requested \$9.2bn for ballistic-missile defences and a paltry \$239m for cruise-missile defence. Prepared testimony of US Secretary of Defense Donald H. Rumsfeld before the Senate Appropriations Committee, Defense Subcommittee, 12 May 2004.
- ⁴⁷ See Amy Butler, 'Low, Slow and Stealthy', *Aviation Week & Space Technology*, 11 June 2006, http://www.aviationnow.com/avnw/news/channel_awst_story.jsp?id=news/awo61206p1.xml.
- ⁴⁸ See Peter D. Zimmerman and Charles D. Ferguson, 'Sweeping the Skies', *Bulletin of the Atomic Scientists*, vol. 59, no. 6, November–December 2003, pp. 57–61.
- ⁴⁹ Bradley Graham, 'Nuclear-Tipped Interceptors Studied', *Washington Post*, 11 April 2002, p. A2.
- ⁵⁰ William M. Arkin, 'Early Warning: Attack Iran? We're Ready', *Washington Post*, 17 January 2006, http://blog.washingtonpost.com/earlywarning/2006/01/attack_iran_were_ready.htm.
- ⁵¹ The most prominent type of target mentioned by the Pentagon is terrorist related. See http://www.dod.mil/news/Mar2006/20060309_4439.html.
- ⁵² Dennis M. Gormley, 'Conventional Force Integration in Global Strike', in James J. Wirtz and Jeffrey A. Larsen (eds), *Nuclear Transformation: The New U.S. Nuclear Doctrine* (New York: Palgrave, 2005), pp. 53–68.
- ⁵³ For an insightful analysis, see Steve Andreasen, 'Off Target? The Bush Administration's Plan to Arm Long-Range Ballistic Missiles with Conventional Warheads', *Arms Control Today*, July–August 2006.
- ⁵⁴ For more on the Joint Data Exchange Center, see <http://www.fas.org/nuke/control/jdec/index.html>.
- ⁵⁵ An idea offered, if not supported, in Andreasen, 'Off Target?'.
⁵⁶ The Hague Code of Conduct Against Ballistic Missile Proliferation came into existence in 2002. Although replacing nuclear warheads with conventional ones seems on the surface consistent with the Code's objective focus on WMD delivery, many argue that any attempt by the United States to make ballistic missiles more usable will increase incentives to acquire them, albeit for WMD delivery. See Steve Andreasen, 'The Ramifications of Making Ballistic Missiles more Usable', *San Francisco Chronicle*, 14 February 2006.
- ⁵⁷ Gormley, 'Cruise Control'.
⁵⁸ Wendell Minnick, 'Taiwan's Missile Program Draws Concern', *Defense News*, 19 June 2006, p. 1.
- ⁵⁹ 'US, Russia to Set Up New Bilateral Security Group', Moscow ITAR-TASS in English, 13 June 2006.
- ⁶⁰ Notable exceptions are Ivan Oelrich, *Missions for Nuclear Weapons after the Cold War*, Occasional Paper no. 3 (Washington DC: Federation of American Scientists, 2005) and Michael A. Levi, *Fire in the Hole: Nuclear and Non-Nuclear Options for Counterproliferation*, Working Papers no. 31 (Washington DC: Carnegie Endowment for International Peace, 2002). For an analysis of the nuclear side, see Bryan L. Fearey, Paul White, John St. Ledger and John Immele, 'An Analysis of Reduced Collateral Damage Nuclear Weapons', *Comparative Strategy*, vol. 22, no. 4, October–November 2003, pp. 305–24.

