Thwarting U.S. Missile Defense From Within the Missile Technology Control Regime

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America's steady accretion of military, economic, and 'soft' power since the end of World War II has led most scholars and security practitioners to assume an incontrovertible U.S. dominance of the international security system. But there are subtle actions that states might wish to take to increase the costs or question the effectiveness of such U.S. dominance. This case study examines how states may wish to thwart America's presumed dominance in military power — specifically the perceived effectiveness of its global missile defenses — through actions taken from within the 34-nation Missile Technology Control Regime (MTCR), the only existing multilateral mechanism governing the transfer of missiles and related technologies relevant to the delivery of weapons of mass destruction (WMD).[1]

Global missile defenses consist of both regional missile defenses protecting U.S. forward-based forces and America's friends and allies and national missile defenses protecting the American homeland against rogue-state or non-state actor missile attacks. A key assumption of this case study is that U.S. national security strategy no longer depends as heavily as it once did on nuclear deterrence. Instead, American defense

[1] There are currently 34 nations holding equal status within the MTCR, including Russia, plus two states, Israel and China, who are "adherents" to the regime's guidelines, though not formal participants. There is a push underway by certain regime states to add China to the list of formal members. See http://www.mtcr.info/english/index.html for background details on MTCR activities.

policy formulations reflect a transition to a denial strategy, one that depends critically on the broadly perceived effectiveness of denying one's adversaries the achievement of their military objectives. This denial strategy necessarily rests on precision conventional strike systems, even though the Nuclear Posture Review's (NPR) authors would wish to see a new family of low-yield nuclear weapons studied and then possibly developed to cope with a growing population of deep underground facilities. But prospects for even studying such nuclear options, no less their development, are highly doubtful. Although global missile defenses by no means represent the only component in America's emerging denial strategy, they are expected to play a central role. Missile defense effectiveness will hinge chiefly on meeting important technical challenges, which are largely defined by the quality of offensive missiles that attempt to penetrate missile defenses. Thus, a non-proliferation mechanism like the MTCR, which seeks member-state adherence to an agreed set of export-control guidelines on missiles and technology, offers an unusually rich case study of how states might thwart the effectiveness of U.S. global missile defenses as a key component of its deterrence strategy of denial.

From Nuclear Deterrence to Deterrence by Denial

Until very recently nuclear deterrence formed the foundation of U.S. national security strategy. Nuclear weapons were not only expected to deter strikes on the American homeland, but upon allies in Europe and Asia, too. Nuclear deterrence hinged critically on the delivery of a devastating second-strike attack against the Soviet Union, although a determined number of strategists (so-called nuclear utility theorists) sought more discrete attack options than those implied by a strategy of mutual assured

destruction.[2] 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.[3] Although the abolitionist quest is far from being realized, 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 1700 to 2200 by December 2012. However, non-deployed nuclear warheads will be retained in a strategic reserve. Thus, it was of no great surprise that the Bush administration's January 2002 issuance of the NPR, required by the FY2001 National Defense Authorization Act, was greeted largely as evidence of growing U.S. reliance on nuclear weapons.[4] Media and expert attention immediately fixed on the NPR's call for the potential development of new types of nuclear weapons designed to destroy deeply buried underground targets. Lost in noise were the truly revolutionary features of the NPR, which augur a transformation of strategic deterrence away from nuclear dependence and increasingly toward a combination of conventional offensive and defensive forces.

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[2] For just one representative example of this school of thinking, see *Discriminate Deterrence: Report of the Commission on Integrated Long-Term Strategy*, co-chairmen, Fred C. Ikle and Albert Wohlstetter (Washington, D.C.: U.S. Government Printing Office, 1988). Wohlstetter, while certainly a nuclear utility theorist, was perhaps the strongest advocate of precision conventional strike systems, including arming nuclear-capable cruise missiles with conventional warheads and developing increasingly accurate guidance systems.

[3] See *Report of the Canberra Commission on the Elimination of Nuclear Weapons*, at www.wagingpeace.org/butlerspeech.html.

[4] The NPR remains a classified document today, but major portions of it were leaked on its publication and are found at http://globalsecurity.org/wmd/library/policy/dod/npr.htm. The Congressional Act authorizing the preparation of the NPR called for a comprehensive review of U.S. nuclear forces, including a plan for their long-term sustainability and modernization. For a useful summary of the NPR's implications for U.S. national security strategy, see "Transforming US Nuclear Strategy," *IISS Strategic Survey 2003/4* (Oxford: Oxford University Press for IISS, 2004), pp. 38 – 48.

Rather than resting on the threat of nuclear retaliation, the NPR's denial strategy hinges on developing credible war-fighting options to deny potential adversaries the capacity to do harm to America and its allies—most notably by using WMD. Because post-cold war threats are more diverse, the NPR argues that these threats demand better integration of the full range of offensive and defensive weapons and doctrine. While this integration includes both nuclear and conventional weapons, it is far more likely that conventional weapons, not nuclear, will become the primary means of executing America's new denial strategy. This is due not only to their potential effectiveness but also because decision-makers are vastly more likely to use conventional than nuclear options.

The antecedents of America's emerging denial strategy became evident in the writings of the Soviet Union's former Chief of the General Staff, Marshal Nikolai Ogarkov. In the mid-1980s, Ogarkov wrote about a qualitative leap in conventional weapon effectiveness, sufficient to suggest that long-range conventional strike might begin to approximate the effectiveness of nuclear weapons.[5] Of course, Ogarkov was referring to a technological and conceptual transformation largely taking place then in the United States, which became more apparent, if not fully evolved, in the 1991 Persian Gulf War. Even though virtually all the weapons used during that conflict were decades old, and no new doctrinal, conceptual, or organizational innovation was on display, signs of revolutionary progress were evident in the use of precision-guided munitions (PGM). While less than five percent of the weapons employed were PGMs, these weapons

[5] N.V. Ogarkov, *Krasnaya Zvezda*, May 9, 1984, trans. by BBC Monitoring Service, SU/7639/C/10.

demonstrated at least an order of magnitude increase in effectiveness over unguided air-delivered bombs.[6]

Coming on the heels of the collapse of the Soviet Union and dissolution of the Warsaw Pact, the performance of PGMs during the first Gulf War triggered a reassessment of nuclear weapons policy within the defense community. The idea that "smart" conventional weapons might represent a far more credible and usable instrument of deterrence and warfighting found expression among many military officers. In a series of RAND Corporation-sponsored war games held between 1991 and 1993, military participants generally found nuclear weapons largely extraneous because smart conventional weapons were seen capable of destroying virtually every military target that was once assigned to nuclear weapons.[7] But the most profound impact, because of its influential source, came from the pen of Paul H. Nitze, one of American's principal architects of Soviet containment and nuclear deterrence policy. In an article written in January 1994, Nitze argued that the time had come for the United States to reexamine 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 decisionmakers would be unwilling to use nuclear weapons to punish such aggression. As a result, Nitze recommended converting the principal U.S. strategic deterrent from nuclear weapons to precision guided 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

[6] Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report* (Washington, D.C.: U.S. Government Printing Office, 1993), p. 243.

[7] Mark Dean Millot, "Facing the Emerging Reality of Regional Nuclear Adversaries," *Washington Quarterly* 17, no. 3 (Summer 1994), pp. 50 – 51.

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."[8]

Cold War strategists debated endlessly about what precisely was required to enhance nuclear deterrence. Central to defining the role of nuclear weapons was (and still is) the question of whether or not the nation can afford to see its nuclear arsenal become an "existential" deterrent. Is the mere existence of a nuclear stockpile — as Sir Michael Quinlan observed in 1997, "an inert pile of materiel" — sufficient to deter potential adversaries from using nuclear, biological, or chemical weapons?[9] Of course, America's nuclear arsenal today is far from being merely existential in its makeup. Nevertheless, there have been longstanding concerns about sustaining the U.S. nuclear stockpile over the next 50 years, particularly in the absence of nuclear testing. This led the Pentagon's Defense Science Board (DSB) 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 a generalized erosion in nuclear expertise within the Department of Energy's weapons laboratories, the Department of Defense, and the military services.[10] The DSB report also expressed concern that U.S. declaratory nuclear

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[8] Paul H. Nitze, "Is It Time to Junk Our Nukes?" *Washington Post*, January 16, 1994, p. C1. For an analysis of the post Cold War debate over the future role of nuclear weapons, see Dennis M. Gormley and Thomas G. Mahnken, "Facing Nuclear and Conventional Reality," *Orbis* 44, no. 1 (Winter 2000), pp. 109 – 125.

[9] Sir Michael Quinlan, *Thinking About Nuclear Weapons* (London: RUSI Whitehall Paper Series, 1997), p. 15.

[10] *Report of the Defense Science Board Task Force on Nuclear Deterrence* (Washington, D.C.: Office of the Under Secretary of Defense for Acquisition and Technology, October 1998). The erosion of nuclear expertise was seen to derive from the absence of new weapon development, the need to maintain the existing stockpile indefinitely without testing, the quickly fading appeal of a military career in nuclear operations or planning, and the virtual absence of any serious long-range nuclear planning. Anecdotally, this author has heard from knowledgeable sources within both the Departments of Energy and Defense that

policy was more ambiguous than seemed useful in regard to threatening nuclear responses against non-nuclear states that might brandish biological or chemical threats.[11]

Consistent with the concerns raised by the 1998 DSB report, the Bush administration's 2002 NPR takes on the credibility issue in a radically new way. It joins Paul Nitze's notion of strategic conventional strike to a greatly reduced nuclear stockpile, active and passive missile defenses, and a revitalized nuclear infrastructure to create the "New Triad." As already noted, public and expert attention focused exclusively on the administration's desire to study a low-yield nuclear earth penetrator as evidence of increased dependence on nuclear weapons.[12] However, the NPR's authors argue that the New Triad will actually reduce U.S. dependence on nuclear weapons, while improving the ability to deter attack because of increasingly robust long-range conventional strike and missile-defense capabilities. Indeed, the argument is made that the adoption of global missile defenses means that the United States will no longer depend as it once did on nuclear strike systems to enforce deterrence. And the advent of global conventional strike forces correspondingly suggests a lessened American reliance on nuclear forces to furnish its offensive deterrent capability.[13]

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assignment to a nuclear billet within the armed forces now virtually guarantees that an officer will not rise beyond the rank of Colonel or Captain, in the case of the U.S. Navy.

[11] This matter is delicate because of American renunciation, in 1978, of the use of nuclear weapons except to deter attack by nuclear-armed states. For a supporting case for changing policy to deal with such threats, see David Ochmanek and Richard Sokolsky, "Employ Nuclear Deterrence," *Defense News*, January 12, 1998, p. 21.

[12] Such low-yield nuclear weapons are defined in Section 3136 of Public Law 103-160 (1994) as a weapon with a yield of less than five kilotons.

[13] Pentagon planners envisage an implementation strategy for global strike forces over three time periods: near-term (2000 – 2007); mid-term (2008 – 2013); and far-term (2014 – 2025. Near-term strike capabilities would entail a force of twelve B-2 bombers and 48 F-22 stealth fighters, complemented by conventionally armed B-1 bombers, sea- and air-launched cruise missiles and several armed and unarmed unmanned air vehicles. Four converted U.S. Navy Trident submarines armed with cruise missiles and special operations forces would be available in the mid-term period, along with such U.S. Air Force as the Small Launch

Of course, nuclear weapons still exist, making it only natural for diehard nuclear utility theorists—chief architects of the NPR—to probe for improvements to existing weapons to make them a more responsive to emerging threats. They found that no existing nuclear weapon in the U.S. stockpile could suitably threaten a growing number of hardened underground targets—over 1,400, as of 2002, according to the NPR—suspected of housing WMD, missile basing, and supporting leadership cadres. They therefore proposed studying the feasibility of converting existing nuclear bombs into earth penetrators adequate to contain collateral damage while destroying the target. The proposal sparked not only political controversy over sending the wrong signal about lowering the nuclear threshold and promoting nuclear proliferation. It also begged important scientific questions about available or conceivable materials supporting a shell casing capable of sufficient penetration to eliminate chances of spewing radiation into the atmosphere. The Republican-controlled Congress, to the administration's surprise, deleted all funding ($27 million) for the nuclear penetrator and research into new types of nuclear weapons in the fiscal 2005 Omnibus Appropriations Bill. It also sharply cut funding for a new factory to make plutonium pits, the cores of nuclear devices, and for a program to shorten the time to prepare for full-scale testing. These latter programs were viewed by the NPR's authors as critical to bolstering the credibility of the nation's nuclear infrastructure. Secretary of Defense Rumsfeld reportedly urged the DOE to include funds for the nuclear penetrator study in the President's proposed fiscal 2006

Vehicle and Common Aero Vehicle, allowing prompt strikes from U.S. territory. The Hypersonic Cruise Vehicle, capable of taking off from standard runways and striking targets 9,000 miles away in less than two hours, would figure importantly in the far-term period. For an analysis of future global strike challenges and prospects, see Dennis M. Gormley, "Global Strike and Nuclear/Conventional Integration," in James J. Wirtz and Jeffrey A. Larson, eds., *Nuclear Transformation: The New U.S. Nuclear Doctrine* (New York: Palgrave, forthcoming).

budget, but both houses of Congress appear steadfast in their aversion to sponsoring a nuclear weapon development program at a time of such absolute U.S. conventional military dominance. Indeed, in 2003, Admiral James O. Ellis, Jr., then head of the U.S. Strategic Command, the nation's primary agent for nuclear delivery, supported the idea that conventional PGMs could do just as good a job as any nuclear penetrator by sealing off underground facilities through repeated attacks.[14]

From the perspective of nuclear utility theorists, having a small number of low-yield nuclear earth penetrators in the New Triad's mix of otherwise conventional offensive and defensive capabilities would make declaratory policy — especially vis-à-vis non-nuclear states brandishing biological threats—more credible. It would also represent a hedge against the possibility that key elements of the conventional leg of the New Triad may not emerge as quickly as planned. Yet, there is an undeniable reality — confirmed in the memoirs of former presidents and their top advisors — that taking the decision to use nuclear weapons is a decidedly difficult and dubious form of retaliation.[15] In fact, even Donald Rumsfeld seems to appreciate this point:

> We have 55 or 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

[14] Walter Pincus, "Rumsfeld Seeks to Revive Burrowing Nuclear Bomb," *Washington Post*, February 1, 2005, p. A2. For a critical appraisal of both nuclear and non-nuclear options, see Michael A. Levi, "Fire in the Hole: Nuclear and Non-Nuclear Options for Counterproliferation," Carnegie Endowment for International Peace, Working Papers, No. 31, November 2002. For a proponent's view, see Bryan L. Fearey et. Al., "An Analysis of Reduced Collateral Damage Nuclear Weapons," *Comparative Strategy* 22, no. 4 (October-November 2003), pp. 305 – 324.

[15] See, for example, George H.W. Bush and Brent Scowcroft, *A World Transformed* (New York: Knopf, 1998) and Colin L. Powell, *My American Journey: An Autobiography* (New York: Random House, 1995). Bush privately ruled out a nuclear response in the 1991 Gulf War, and then acknowledged so in his book. Powell, like most of his military peers, dismisses the utility of nuclear use.

> period and there are not just large weapons; they are distinctively different weapons . . . .[16]

These words resonate remarkably well with Paul Nitze's logic calling for converting the nation's strategic deterrent from nuclear weapons to primarily precision global strike and missile defense forces.

Making Missile Defenses Effective

Implementing the truly revolutionary transformation of global strike and missile defense capabilities will rest as much on conceptual and organizational agility as it does on technological achievement. The history of purported "Revolution in Military Affairs" attests to the shortsightedness of focusing alone on the technological challenges of military transformation.[17] This is true as much for missile defenses as it is for global strike forces, a point often overlooked by critics of missile defenses who tend to fixate on the many technical problems that have plagued the program thus far.

Despite persistent development problems and the elimination of any realistic, system-level flight-testing, the U.S. Missile Defense Agency (MDA) has pressed ahead to meet President George W. Bush's December, 2002 directive to deploy "a set of initial missile defense capabilities beginning in 2004." Although the Bush administration's objective is to provide a layered defense of the entire U.S. homeland, its overseas forces, friends, and allies, the first increment of global missile defenses consists only of 20 ground-based interceptors (GBIs) employing exoatmospheric kill vehicles (EKVs), three *Aegis*-class cruisers/destroyers armed with *Standard* missile-3 interceptors (SM-3s), and

[16] Secretary of Defense Donald H. Rumsfeld, Joint Press Conference with British Secretary of State for Defense Geoffrey Hoon, June 5, 2002.

[17] This truism is best captured in MacGregor Knox and Williamson Murray, eds., *The Dynamics of Military Revolution, 1300-2050* (Cambridge, UK: Cambridge University Press, 2001).

an unspecified number of *Patriot* PAC-3 interceptors. These interceptors are to be supported by various early warning and command, control, and communications capabilities. Taken together, these initial missile defense capabilities offer what Secretary of Defense Donald Rumsfeld and other senior defense officials view as a "better than nothing" shield against a limited number of enemy ballistic missiles.[18] And by making operational a few GBIs at Fort Greely, Alaska in early Autumn, 2004, the President was able to fulfill his December, 2002 deployment commitment.

Missile defense proponents argue that the President's rush to deploy is driven by strategic imperatives rather than political necessity. Critics see in it a determination to deliver on a longstanding Republican Party policy commitment — one which, they feel, may lead to the neglect of efforts to resist more imminent threats.[19] Beneath the political disagreements in Washington lie substantive differences between two diametrically opposed acquisition strategies. For critics who support more traditional "fly-before-you-buy" strategy, any missile defense system should undergo enough operational testing to determine its potential effectiveness, suitability, and survivability in combat before a commitment is made to full-rate production or deployment. Missile defense supporters, on the other hand, abjure relying on extensive intercept flight tests to determine system reliability and performance. Instead, they support a deployment decision based on simulations that integrate real-world test results with conceptual components reproduced in a model. They also downplay the need for specifying a system architecture, preferring instead to pursue block development, where product improvements are introduced in two-

[18] Bradley Graham, "Missile Defense Testing May Be Inadequate," *Washington Post*, January 22, 2004, p. A4.

[19] Bradley Graham, "U.S. Missile Defense Set to Get Early Start," *Washington Post*, February 2, 2004, p. A10.

year intervals. While proponents recognize the risks inherent in such an approach, they argue that it would be negligent to deny the nation at least some capability, however problematic, to meet an "urgent need" to defend against ballistic missiles. Moreover, using the example of Israel's early deployment of the *Arrow* missile defense system, Pentagon officials argue that even an unproven missile defense system will provide some degree of deterrence by sending adversaries a message that at least some, if not a fully layered, missile defense system was available.[20]

The presumptive threat emanates from North Korea, which first tested a three-stage *Taepo-Dong* missile in 1998 (although only the first two stages worked), and then, after negotiations with the United States in 1999, announced a moratorium on long-range missile testing. Nevertheless, Pyongyang is believed to be pursuing both two- and three-stage missiles capable of striking the continental United States. Less certain is North Korea's current and near-term capacity to manufacture a deliverable nuclear warhead for these missiles. Nevertheless, the administration's decision to move ahead with deployment seems predicated on its new "capabilities based" approach to defense acquisition: instead of planning against narrowly defined threat scenarios, which are increasingly difficult to anticipate, decisions will be based on achieving desired capabilities that reduce clear U.S. vulnerabilities.[21]

Critically important, too, is North Korea's development of countermeasures against U.S. defense interceptors. The CIA believes that if a country can develop long-range ballistic missiles, it can also produce simple but effective countermeasures, which

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[20] Graham, "U.S. Missile Defense Set to Get Early Start."

[21] For an articulation of capabilities-based planning, see *Quadrennial Defense Review Report*, U.S. Department of Defense, September 30, 2001, at http://www.comw.org/qdr/qdr2001pdf.

critics believe could render any limited defensive system of questionable effectiveness.[22] But, inevitably, without adequate testing of Pyongyang's nascent missiles and any accompanying countermeasures, the issue of equivocal effectiveness cuts two ways — neither the offense nor defense will have been tested sufficiently to foster any confidence in real-world performance.[23]

The most significant technical hurdle in the way of even a patchwork missile defense capability concerns the production of an operational launch booster capable of carrying the EKV into space. All GBI intercept tests thus far have employed surrogate *Minuteman* II — offensive missile — boosters, while two MDA contractors, Lockheed Martin and Orbital Sciences, competed to produce an operational booster. The Orbital booster has undergone a successful developmental test, albeit without attempting an EKV intercept, and important developmental and operational testing remains to be accomplished. A key intercept test involving the Orbital booster produced yet another program failure when the new booster failed to fire during a scheduled test on December 15, 2004.[24]

The missile defense program has also failed to deal with problems in midcourse tracking and discrimination, particularly in instances where countermeasures are employed. In 2002, then MDA director Lt. Gen. Ronald Kadish called the ground-based

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[22] See Andrew M. Sessler et al., *Countermeasures: A Technical Evaluation of the Operational Effectiveness of the Planned US National Missile Defense System* (Cambridge, MA: Union of Concerned Scientists, 2000), at http://www.ucsusa.org/CM_exec.html.

[23] It's also important to point out that however "simple" an adversary's countermeasures appear, their installation will reduce the missile's range or payload (or both) and increase overall cost. See Uzi Rubin, "A Comparative Review of the Technologies of Missile Defense and Their Countermeasures," Rubincon Defense Consulting Ltd., January 15, 2003, p. 12.

[24] Robert Wall and David A. Fulghum, "Pentagon Missile Shield Booster Fails to Fire," *Aviation Week & Space Technology*, December 20, 2004, p. 34.

X-band radar at Shemya, Alaska, the critical element in the mid-course tracking program.[25] X-band radars have short wavelengths, providing much greater discrimination and tracking resolution than longer wavelength L-band radars, such the early warning *Cobra Dane* radar. The MDA abruptly cancelled the ground-based X-band program and turned instead to deploying it at sea on a modified oil-drilling platform, which gives the radar some degree of mobility, and potentially greater latitude against future threats. It will not be ready for integration into midcourse test-bed infrastructure until sometime in 2005. In the meantime, midcourse tracking will hinge on the current upgrading of the *Cobra Dane* radar at Shemya. No plans currently exist to conduct a flight intercept test using the *Cobra Dane* radar in the important tracking and discrimination role. Given the *Cobra Dane*'s lower resolution, it is unlikely that it will be able to discriminate between warheads and decoys, thus leaving the discrimination problem to the EKV's on-board sensors. These employ infrared technology and are far less capable than high-powered short wavelength radars in discriminating decoys from real warheads.

The sea-based *Aegis* defensive system has encountered far fewer problems than the GBI midcourse segment, perhaps because its successful test program (four of five flight intercept successes) has been limited to simple unitary targets. Nonetheless, the *Aegis* test program will introduce more test realism through plans to use multiple simultaneous engagements and separating targets. The current *Aegis* weapon system employs hit-to-kill technology on the SM-3, making it a complimentary system in the

[25] David Ruppe, "U.S. Plans I: Congressman Questions 2004 Deployment Goal, *Global Security Newswire*, July 19, 2002, at http://www.nti.org/d_newswire/issues/2002/7/19/9s.html.

midcourse phase of missile defense (either the early ascent or late descent phase of the midcourse envelope).

Notably absent from the initial defense capability plan is any capacity to intercept ballistic missiles in the boost phase of the target's flight history — a phase lasting no longer than three to five minutes while the target missile is thrusting to gain the acceleration to reach the early midcourse phase outside the earth's atmosphere. Although the boost phase is short, successful interception would destroy the missile before countermeasures are deployed and regardless of the missile's range or intended aim-point. Ideally conceived, boost-phase intercept would furnish global protection against ballistic missiles. More practically, it would complement the limitations inherent in each segment of a layered missile defense system.

The Bush plan would begin to address the critically important boost-phase requirement essentially with a two-pronged approach. In the directed energy area, it intends to deploy the Airborne Laser aircraft, currently configured on a wide-bodied 747-400 airplane with a multi-megawatt chemical laser, once it proves itself operationally worthy, probably late in the decade at the earliest. A common family of boost-phase and midcourse kinetic kill interceptors will also be explored as a future complement to the early plan's limited capabilities. A sea-based program, likely a candidate for *Aegis* ships, is focused on a high-acceleration booster coupled with a boost-kill vehicle. Both the Airborne Laser aircraft and *Aegis*-based boost-phase options necessitate deploying in close proximity (say, within 500 miles) to the launch point of the target ballistic missile. A more radical and longer-term concept is to detect missile launches from low-earth orbit and then maneuver the satellite closer to the launched missile in order to intercept it in its

boost phase with a kinetic kill vehicle. MDA announced a month after the President disclosed his early deployment plan that it hopes to launch three to five experimental satellites beginning in 2008 and then two to three more every two years, to form a space-based interceptor test bed for boost-phase interception. This complementary array of programs underscores the importance of achieving success in the critical boost phase of a missile's flight history.[26]

As for protecting friends and allies abroad, further *Patriot* PAC-3 and *Aegis*-based interceptors would eventually complement the U.S. Army's Theater High Altitude Area Defense (THAAD) system, which is designed to intercept short- and medium-range ballistic missiles at high altitude. The Airborne Laser program would also focus on shorter-range missile threats. Ironically, the decision to place the midcourse GBI system on alert at Fort Greely earlier than planned may have stemmed in part from lessons learned by MDA Director Kadish, who decided to rush *Patriot* PAC-3 hit-to-kill interceptors into service prior to the U.S.-led invasion of Iraq in March, 2003, despite repeated problems experienced during PAC-3's operational testing.[27] Earlier *Patriot* models had performed poorly during the first Gulf War in 1991, although their mere presence in Israel furnished enough reassurance to the Israeli public to keep their decisionmakers from intervening in the war and splitting the coalition apart at a decisive point. During the 2003 Gulf War, while *Patriot* missile batteries performed admirably against Iraq's short-range ballistic missiles (all nine of their threatening missile launches were intercepted and destroyed), they failed to detect or intercept five low-flying and

[26] For an overview of alternative programs for boost-phase intercept, see the Congressional Budget Office report, "Alternatives for Boost-Phase Missile Defense," July 2004, at http://www.cbo.gov/showdoc.cfm?index=5679&sequence=0.

[27] Author interview with a missile defense industry official, September 15, 2004, Washington, D.C.

antiquated Iraqi cruise missiles. One of these cruise missiles came within 600 meters of destroying a Marine encampment on the opening day of the war, while another just missed a Kuwaiti shopping mall. Further north, two Iraqi ultralight aircraft, which U.S. intelligence officials feared might carry chemical or biological agents, were belatedly detected (but not engaged) only after flying over a U.S. Army division's thousands of troops, equipment, and command facilities prior to the unit's advance on Baghdad. Iraq's use of low-flying cruise missiles and slow-flying ultralights also contributed to the *Patriot's* unfortunate series of friendly-fire incidents, two of which led to the loss of two aircraft and the deaths of three crew members.[28]

These events are a sad reminder of the weak state of cruise-missile defenses, which, by comparison with the high priority given to ballistic missile defense, have always been treated as an afterthought. In FY2005, for example, the Pentagon requested $9.2 billion for ballistic missile defense and only a paltry $239 million for cruise-missile defense.[29] The situation may be desperate, but it is not hopeless. Solutions have less to do with seemingly insurmountable technological challenges than with new conceptual and organizational thinking and determined leadership.[30] Perhaps the most egregious

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[28] For details on *Patriot's* performance during *Operation Iraqi Freedom*, see Dennis M. Gormley, "Missile Defense Myopia: Lessons from the Iraq War," *Survival*, vol. 45, no. 4 (Winter 2003/04), pp. 61-86. During the 1991 war with Iraq, coalition air forces avoided friendly-fire incidents because they first removed Iraq's air force as a threat, which permitted *Patriot* batteries to employ restricted rules of engagement. That is, *Patriot* radars were trained exclusively on the comparatively steep trajectories of Iraq's ballistic missiles, not on low-flying aircraft of cruise missiles. When Iraq surprised US and Kuwaiti *Patriot* batteries with their cruise missiles on the first day of the war, *Patriot* radars had to drop their highly restrictive rules of engagement to focus on both low-flying and high-angle threats, leaving them more susceptible to friendly-fire errors. Simulated exercises in the U.S. suggest that attrition rates under these circumstances often produce rates of 10-20 %. *Ibid*., pp. 68 – 71.

[29] Prepared testimony of U.S. Secretary of Defense Donald H. Rumsfeld before the Senate Appropriations Committee, Defense Subcommittee, May 12, 2004.

[30] For example, to reduce inter-service rivalries over differing views of cruise missile defense, a single Pentagon agency to lead development of cruise missile defenses, similar to the MDA, which manages all aspects of ballistic missile defenses, may be needed.

weakness impairing cruise missile defenses is inadequate connectivity among each military service's air defense systems. This is attributable to the disparate array of unique military service data links, each of which uses different techniques for target tracking. Improving the capacity to distinguish friendly aircraft from enemy cruise missiles will require the merging of various service and MDA battle management command, control and communications programs to achieve connectivity across the services. The quest for such a joint approach, now known as the Single Integrated Air Picture (SIAP), was initiated as far back as 1969 in an attempt to improve tactical air control. If SIAP were fully realized, it would afford users, including allies, the wherewithal to share multiple-aspect viewing of threat objects over a broad geographic region, thereby greatly reducing gaps in coverage and widening the window within which to provide timely cues to air and missile defense weapons. Having one fully interoperable view of the air picture would also accelerate decision-making on identifying friend from foe, mitigating the incidence of air fratricide.[31]

However much improved tracking through SIAP interoperability makes sense, its effectiveness depends ultimately on improved airborne sensors for detecting low- and slow-flying cruise missiles and UAVs. *Patriot* missile defense interceptors are theoretically capable of shooting down low-flying cruise missiles, but the horizon limits of their own ground-based radar means they must depend on a sensor deployed on an airplane or balloon to alert the fire battery in sufficient time to engage the incoming missile. The U.S. Army is developing a surveillance and fire-control sensor carried by an

[31] According to the Congressional Research Office, SIAP's five-year development costs will be around $160 million, while the services will need to invest $600 million to incorporate the technology into their existing platforms. See Ravi R. Hichkad and Christopher Bolkcom, "Cruise Missile Defense," CRS Report for Congress, RS21921, Aug. 27, 2004.

aerostat (a blimp-like balloon flying at 15,000ft). Called the Joint Land-Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS), the system suffers from several shortcomings. While the U.S. Navy has expressed some interest, JLENS remains essentially an Army program. More limiting are the time it would take to deploy such a system, its inherent weather sensitivity and insufficient altitude to cope with terrain masking problems in an area like Northeast Asia. Nevertheless, JLENS could complement higher-flying, faster-reacting, weather-insensitive aircraft like the U.S. Air Force's next-generation wide-area surveillance and battle management platform, called the Multi-Sensor Command and Control Aircraft (MC2A). Meant to incorporate the functions of both the airborne and ground-based surveillance missions of today's AWACS and JSTARS, MC2A would include improved sensors to detect low-flying cruise missiles and to furnish fire-control information to both airborne and ground-based interceptors. The challenge here is to take full advantage of just such a capability by linking various army and navy missile defense systems into a new concept of operation called air-directed surface-to-air missile (ADSAM). This concept would radically alter and dramatically improve the currently service-centric approach to controlling the firings of missile defense batteries, whereby each missile is guided to its target by its own horizon-limited radar. ADSAM would hand over fire-control responsibility to a centralized, elevated platform — namely, MC2A — meaning that the army and navy would depend on an air force system to execute their missile defense responsibilities.[32] No longer limited by their ground-based radars, each army and navy missile defense interceptor would be capable of intercepting low-flying cruise missiles to their full range

[32] In theory, the airborne sensor would guide the interceptor during both its mid-course and terminal phases, or the surface-to-air interceptor could guide itself using its own on-board seeker.

potential of 100-150km. Air-to-air missiles fired by air force fighters would also see their range extended to perhaps 60km. Unfortunately, MC2A will not be available until the 2013 timeframe, assuming, of course, that its funding remains steady and technical challenges are suitably met. Should the cruise missile and UAV threat intensify more quickly, it may become necessary to accelerate MC2A's availability or incorporate ADSAM capabilities into existing-service airborne platforms.

The benefits derived from ADSAM's revolutionary concept of operations are far-reaching. With increased interceptor range comes multiple shot opportunities and greatly reduced leakage against large onslaughts of cruise missiles. High-quality fire-control sensors on a high-flying airborne platform mean that air fratricide could be significantly reduced, as potential targets, friend and foe alike, would be identified and tracked over great distances. Although ADSAM would not lessen the need to develop much cheaper missile defense interceptors, the concept would make more efficient use of finite interceptor inventories.[33] This is because each battery would provide much greater coverage with its interceptors, eliminating the need to bunch several batteries around point targets. MC2A would go far to improve the U.S. military's capacity to cope with a toxic mix of ballistic and cruise missile threats in regional warfighting contingencies.

If regional cruise missile defenses are a difficult challenge, protecting the homeland against both off-shore and domestic cruise missile threats is even more daunting — and perhaps more expensive. Cruise missiles or UAVs might be launched

[33] Given that each *Patriot* PAC-3 interceptor costs between $2 to $5M, it is clear than cheaper seekers will become essential to deal with saturation attacks from much-cheaper cruise missiles. The Defense Advanced Research Projects Agency (DARPA) of the US Department of Defense is pursuing such a cost-reduction effort. Because around 60 % of an interceptor's cost is attributable to the missile seeker, DARPA is focusing on cheaper missile seekers. See http://www.darpa.mil/spo/programs/lowcostcruisemissiledefense.htm.

from concealed locations at modest distances from their targets, or brought within range and launched from freighters or commercial container ships — in effect, a "two stage" form of delivery. The 2002 National Intelligence Estimate on the ballistic missile threat to the United States drew attention to the covert conversion of a commercial container ship as a launching pad for a cruise missile.[34] The North American Aerospace Defense Command (NORAD) is currently studying the idea of using unmanned airships operating at an altitude of 65-70,000 feet and carrying sensors to monitor and detect offshore low-flying cruise missiles. Several such airships would be needed together with fast-moving interceptors to cope with perceived threats. Perhaps 100 aerostats at an altitude of 5000m could act as a complementary or alternative system of surveillance and fire control for an interceptor fleet. Still, other problems remain. Some way is needed of providing warning information to the Coast Guard on potentially hostile ships embarking from ports of concern. Missile threat sensor data must be capable of distinguishing between friendly traffic and enemy threats, prior to threat engagement. Progress in national cruise missile defense will not be made without corresponding improvements to respective service programs, foremost among them implementing the SIAP program. The question of affordability looms large. Even a limited defense against offshore cruise missiles would cost $30–40 billion.

As for dealing with unmanned threats launched from domestic points of origin, America's capacity remains virtually non-existent. A July 8, 2004 U.S. House of Representatives hearing drew grim attention to the lax state of America's defenses against low-flying airplanes by examining the near-catastrophic circumstances

[34] See http://www.fas.org/irp/news/2002/01/bmthreat-2015.html.

surrounding the June 9, 2004 funeral for President Ronald Reagan. As officials gathered in the nation's capitol, a combination of human error, onboard technical malfunction, and computer incompatibility between the Federal Aviation Administration (FAA) and the Transportation Security Administration caused U.S. security personnel to mistake the governor of Kentucky's official airplane—a 1972 King Air turboprop with a maximum capacity of 15 passengers—as a terrorist threat. This led to the evacuation of hundreds of officials and the dispatch of two F-15 interceptors, and circumstances that almost prompted NORAD's top general to order the governor's plane shot down.[35]

The near disaster of June 9, 2004 in Washington, D.C., points up the inadequacy of the nation's capacity to identify friend from foe. In the case of the governor's plane, this led to erring on the side of caution. But the fact remains that a disastrous mistake nearly ensued could produce an even more tragic result: inaction in the face of a genuine terrorist threat. The head of the U.S. Department of Homeland Security's directorate in charge of air defense has admitted that the current system may not be able to stop a determined adversary.[36] An intelligent and committed terrorist is unlikely to fly a small airplane, whether manned or unmanned, above the altitude of 3,000 feet, the minimum threshold of where the FAA's radars are able to detect and query the aircraft's transponder to establish its intentions. Flying beneath the FAA's existing radar system, an attack targeting Washington would face detection and interdiction only by unarmed Immigration and Customs Enforcement helicopters operating within the highly restricted 15-mile radius around the city. Even assuming the helicopter crews were able to detect a

[35] Spencer S. Hsu, "Plane That Caused Capitol Evacuation Nearly Shot Down," *Washington Post*, 8 July 2004, p. A1.

[36] *Ibid*.

low-flying threat and alert military authorities rapidly, the defense of the nation's capital would be left to modest anti-aircraft defense around a few high-profile sites. While some progress in linking FAA and NORAD radars together has been achieved, much more needs to be done, particularly against threats flying below 3,000 feet. One area showing particular promise, not least because of its potential affordability, is the exploitation of the nation's existing High Definition Television infrastructure to detect, track, and classify such low-flying threats.[37] Still, the nation will remain ill prepared to cope with such threats for the foreseeable future, and even then, the best one might hope for is a preferential form of defense protecting the nation's capital, other major urban areas, and critical infrastructure targets.

Perceiving Missile Defense Effectiveness

Missile defenses help deny adversaries the achievement of their military objectives. But by no means are active missile defenses, however layered they may eventually become, expected to do it alone. To contend with ballistic and cruise missile attacks, the Joint Chiefs of Staff embrace a multifaceted doctrine comprised of attack operations (or counterforce), active defenses (*Patriot*, GBI, etc.), and passive defenses (vaccines for biological attack, for example). Although the lion share of funding goes to active missile defenses, military planners recognize, as one U.S. Air Force briefing put it, that counterforce strikes—because they find and attack missiles, launchers, warheads, and supporting infrastructure preferably before they are used—offer "the greatest

[37] Called passive coherent localization (PCL), the system concept would use ambient HDTV or other broadcast signals (cell phones, FM radio, ect.) as an illuminator for a networked set of passive receivers that would collect signals, process them, and form tracks of moving objects below 3,000 feet. Such a bi-static radar system is rather affordable.

leverage at [the] lowest cost."[38] Leverage derives from destroying the warhead on enemy rather than friendly territory and eliminating the missile defense challenge of coping with countermeasures in the subsequent midcourse phase. Funding for attack operations programs is a small fraction (around 2%) of the $9.2 billion earmarked for missile defenses in FY2005. Notwithstanding such modest investments, the military services have achieved significant progress in upgrading counterforce capabilities since their abysmal performance in finding and attacking Iraqi *Scuds* during the 1991 Gulf war.[39] Passive defense measures in the biological warfare area have also experienced recent boosts in defense spending. Thus, the perceived effectiveness of missile defenses, whether as seen from an adversary or U.S. perspective, is a product of more than just how well active missile defenses on their own are seen to perform.

No matter how much active missile defenses may continue to suffer from adverse perceptual problems due to repeated test failures, the mere existence of a robust missile defense program appears to have a salutary effect on the American public. While missile defense critics are intimately aware of, and write widely about, missile defense flaws, the American public remains curiously oblivious of the facts about missile defences. In an academic poll taken shortly after September 11, 2001, only 31% of the respondents correctly understood that the United States does *not* currently possess a national missile defense system against long-range ballistic missiles.[40]

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[38] Dennis Gormley, "Track It, Then Attack It," *Defense News*, Jan. 18, 1999, p. 15.

[39] Vernon Loeb, "U.S. Gains in Attacking Mobile Arms," *Washington Post*, July 5, 2002, p. A14.

[40] Kerry G. Herron, Hank C. Jenkins-Smith, and Scott D. Hughes, *Mass and Elite Views on Nuclear Security* (Albuquerque, NM: The University of New Mexico, 2000), pp. 53 – 61.

How current and possible future adversaries of the United States perceive the effectiveness of active U.S. missile defenses (separately or in combination with counterforce and passive defense measures) is difficult to calculate. Yet, there is little evidence that foreign audiences share the harshest critics' belief that available or even conceivable missile defense technologies will simply never perform as claimed. Indeed, even critics realize that many of the reasons for poor missile defense performance thus far have less to do with the mission's impossibility than with the intense pressures to maintain politically mandated schedules, which have virtually eliminated efforts at risk reduction and sensible developmental testing. This so-called "rush to failure" was self-evident even to supporters of missile defenses late in the Clinton administration, and remains so today.[41] Heavy political pressure to deploy missile defenses in advance of having proven their effectiveness came from Republican Members of Congress during the Clinton administration, while more recent pressure has resulted by way of President Bush's 2002 directive to deploy an initial if limited system in Alaska by September 2004.[42]

Nothing is likely to disabuse the harshest critics of missile defense of their firm belief in the impossibility of building a credible and cost-effective missile defense

[41] The characterization "rush to failure" came from a panel chaired by Gen. Larry Welch, USAF (ret.), which met in late 1997 to investigate ways of reducing risk in missile defense flight testing in order to improve the prospects for successful and consistent missile defense performance. For the full report of the Welch Panel, see http://www.fas.org/spp/starwars/program/welch/. After issuing its report in February 1998, the Welch panel convened once again and prepared a follow-up report dated November 1999, which recommended that President Clinton delay deployment of a national missile defense system until the GBI program was proven adequately in testing. See http://www.clw.org/pub/clw/coalition/welch1199.htm for details.

[42] There is an unsurprising similarity between the 1998 Welch Panel's conclusions and those of the Government Accounting Office (GAO) in a report issued in 2003. Both conclude that political considerations are rushing the missile defense program toward failure. See "Missile Defense: Knowledge-Based Practices Are Being Adopted, But Risks Remain," GAO Report No. GAO-03-441, June 4, 2003.

system, even were the hurried and incautious rush to deployment brought under control. Yet, most critics remain gravely concerned that given the amount of resources being devoted to missile defense, American technological ingenuity may well succeed in making global missile defenses work in a decade or so — at least well enough in the eyes of both U.S decisionmakers and America's chief adversaries.[43] In light of the Bush administration's intentionally opaque deployment strategy emphasizing block development, with no overarching architecture specified, these critics worry that Moscow and Beijing will grow increasingly fitful about the survivability of their strategic nuclear arsenals.

Russian and Chinese reasons for concern about where America's missile defenses are headed differ slightly. What animates Russian officials most is that with the eventual U.S. deployment of highly powerful ground-based X-band radars and spaced-based infra-red sensors (known as Spaced-Based Infrared System or SBIRS-Low), America will have a "break-out" potential in place for a thick, global system of missile defense.[44] Compared with the poor discrimination performance of today's early warning radars (5-10m resolution), X-band radars have a resolution of 10-15cm, or good enough to discriminate between real warheads and decoys. More ominous, once they are deployed globally, not only will midcourse GBI interceptors be able to take advantage of their improved resolution, but so too will a growing network of sea-based interceptors on *Aegis* cruisers/destroyers and land-based upper-tier THAAD, the size of which is no

[43] See, for example, Tom Sauer, "Limiting National Missile Defence," Bulletin 22 – Nuclear Policy, Terrorism, and Missile Defense, International Network of Engineers and Scientists Against Proliferation, available at http://www.inesap.org/bulletin22/bul22art31.htm.

[44] See, for example, Jack Mendelsohn, "The Impact of NMD on the ABM Treaty," in Joseph Cirincione, et al., *White Paper on National Missile Defense* (Washington, D.C.: Lawyers Alliance for World Security, 2000).

longer subject to ABM treaty restrictions. True, X-band and especially, SBIRS-low, may not prove to be as effective as promised, but this does not lessen the desire of arms controllers and Russian defense planners alike to see the uncontrolled expansion of American global missile defenses avoided through some numerical caps on defense interceptors.[45] China, for its part, appears to be sufficiently concerned about the consequences of American missile defense expandability, particularly in space, that it has stalled further negotiations on a fissile material cut-off treaty in the Conference on Disarmament in Geneva contingent upon the start of negotiations within that forum on banning space-based weapons.[46]

Not unexpectedly, Bush administration officials view such arms-control restraints on expanding missile defense as unnecessary in today's change strategic environment and antithetical to the requirements of their emerging strategy of military denial. Although the adverse impact of missile defenses on strategic stability seems to have largely disappeared from today's strategic discourse, few strategic analysts doubt that it will reappear as layered defenses begin to demonstrate more than their currently feeble performance effectiveness. Tied to an ever increasing separation of American military prowess from any conceivable competitor's, especially in the area of prompt, global conventional strike, and a national security strategy explicitly emphasizing pre-emption,

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[45] For a review of the technical status of these critical sensor programs, see *Missile Defense: Alternate Approaches to Space Tracking and Surveillance System Need to Be Considered*, GAO-03-597 (Washington, D.C.: U.S. General Accounting Office, May 2003), at http://www.gao.gov/new.items/d03597.pdf. Arms control advocates suggest severe limits on midcourse and terminal interceptors (as few as the ABM treaty's 100 or 200 interceptors), while boost-phase interceptors are seen as far less threatening because they cannot threaten Russian and Chinese land-based ICBMs deployed far removed from where such sea- or air-based interceptors might operate. See, for example, Tom Sauer, "Limiting National Missile Defense."

[46] Sauer, *ibid*. For an illuminating analysis of what the possible consequences of American missile defense expandability might mean for both China and the United States, see Wade L. Huntley, "Missile Defense: More May Be Better — for China," *The Nonproliferation Review*, Summer, 2002, pp. 68 – 81.

effective global missile defenses are surely destined to resurrect concerns about strategic stability.

In the absence of American restraint, it would not be surprising to see Moscow and Beijing, either separately or together, cobble together a strategy of resistance from within the MTCR to thwart the perceived effectiveness of missile defenses, or at least raise their already high costs. It bears repeating that missile defenses are only one component of a multi-dimensional mix of offensive and defensive forces that comprise a denial strategy. As such, it will remain difficult to establish useful metrics for calibrating the perceived effectiveness of missile defenses. But the ever-increasing costs and prospective adverse international repercussions of expanded missile defenses could stand as the most compelling motivations for Moscow and Beijing to resist American pretensions from within the MTCR. If costs spiral higher and higher, the public's overwhelming support for missile defenses is likely to falter significantly. When polled both before and after September 11, 2001 on the question of alternative choices to, or the possible consequences of, deploying national missile defenses, pluralities are concerned that money spent on missile defense might be better spent on other programs and that deploying such a missile defense system might lead to new a new arms race with Russia and China.[47] Moreover, the military services — beset by demands to transform cold-war-era force structures — may balk at the disproportionate share garnered by national missile defenses compared with defenses designed to protect engaged forces overseas and

[47] For each of these two issues a plurality of respondents were grouped near midpoint on a scale of one (strongly disagree) to seven (strongly agree), while those with firmly held positions (lowest or highest two scale values) were roughly divided. See Herron, Jenkins-Smith, and Hughes, *Mass and Elite Views on Nuclear Security*, pp. 56-59 and Hank 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, forthcoming).

U.S. friends and allies. Congress, too, may balk if the costs of missile defenses continue to rise, while technical difficulties shake confidence in the overall system's credibility. Commenting on how lawmakers may react on Capitol Hill, David Mosher of the Rand Corporation has observed: "Systems that keep going over budget, running into technical difficulties, and being delayed are eventually perceived as weak — and are then cut back or killed."[48] The potentially high costs of deploying missile defenses, together with associated opportunity costs in other defense arenas, may well become the Achilles heel of achieving any broadly credible force of global missile defenses.

Why Export Controls Matter

Among the chief reasons for instituting effective nonproliferation mechanisms is controlling the quantitative and qualitative evolution of the threat. Few avid supporters of missile defenses are willing to admit that the diffusion of technology can be effectively controlled. Arguably, however, the MTCR has achieved notable success in bringing a significant degree of order and predictability to containing the spread of ballistic missiles. Most missile programs that raise concerns today have their design origin in the widely proliferated *Scud* missile, essentially a 1950s Soviet improvement on the Nazi V-2 missile.[49] The poor accuracy, clumsy logistics, limited payload, and other weaknesses of the *Scud* and its many derivatives inhibit their users' capacity to create flexible and confident attack options that go beyond the crude delivery of WMD. Their poor performance also makes them easier to defend against than ballistic missiles with solid-

[48] For Mosher's analysis of the cost implications of missile defense, see "What Do We Mean by Transformation," *Naval War College Review*, Winter 2002, at www.nwc.navy.mil/press/Review/2002/winter/art2-w02.htm.

[49] *Scud* fingerprints are all over the following missile programs: North Korea's *No-Dong* and *Taepo-Dong* 1 and 2; Pakistan's *Ghauri*; Iran's *Shihab*; and Iraq's *Al-Husseyn*.

rocket motors, which ease logistical demands, and sophisticated guidance, navigation, and control technologies that not only permit great accuracy but maneuverable re-entry vehicles, which impose severe burdens on missile defenses. With the Soviet Union no longer dispensing *Scuds* to its client states, North Korea is left as the chief supplier of MTCR-restricted ballistic missiles.

Certainly the MTCR's most notable success thus far was the forced dismantlement of the *Condor* missile program sought by Argentina, Iraq, and Egypt during the 1980s—a missile that included sophisticated *Pershing II*-level technology. But just as important has been the blocking, through effective export controls, of hundreds of components, technologies, and production capabilities—the necessary ingredients for developing complete ballistic and cruise missile systems.[50] Even more essential an ingredient in the development of any complex weapon system are system integration skills—that mysterious capacity to integrate technology components into complex systems that are capable of achieving repeatable results. Thus, the mere diffusion of technology, as reflected in tangible components and engineering drawings, is necessary but not sufficient to enable the widespread proliferation of missile systems.[51]

A few brief examples illustrate just why even imperfect export controls can have such an important constraining effect on missile proliferation. It has increasingly become

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[50] Richard Speier, "Can the Missile Technology Control Regime Be Repaired?" in Joseph Cirincione, ed., *Repairing the Regime* (Washington, D.C.: Routledge, 2000), pp. 205-216.

[51] See Kelvin W. Willoughby, *Technology Choice: A Critique of the Appropriate Technology Movement* (Boulder, CO: Westview Press, 1990), pp. 25-43, for a useful discussion of alternative perspectives on how technology diffuses. The reductionist camp views technology in explicit, tangible terms, which suggests that technology is transferred easily and readily. The other main camp views technology in more holistic terms, emphasizing the impact of certain social and technical influences (comprising tacit knowledge) that shape its spread. For a particularly insightful analysis of the importance of tacit knowledge, see Donald MacKenzie and Graham Spinardi, "Tacit Knowledge, Weapons Design, and the Uninvention of Nuclear Weapons, *American Journal of Sociology*, vol. 101, no. 1 (July 1995), pp. 44-99.

the general presumption that almost any person or small group with modest engineering knowledge and skills could build a simple, autonomous self-guided UAV or small cruise missile at minimal expense and based entirely on off-the-shelf component technologies. In order to demonstrate just that, a New Zealand engineer named Bruce Simpson created a website with the title "Do-It-Yourself Cruise Missile," where he documented his effort to build one in his garage for under $5,000.[52] Before completing his project and testing his product to demonstrate his objective, the New Zealand government, under pressure from the United States, forced Simpson to shut down his efforts. Simpson told BBC News that he proved "that by using off-the-shelf technology in a suburban garage at terrorist can create a weapon against which there is no effective defense." Iran, which Simpson claims offered to purchase technical details of his project, was among several potential buyers.[53]

But before too much is made of do-it-yourself cruise missiles, it is not clear whatsoever that Simpson's efforts would have proven successful. Just because Radio Shack offers all the component parts does not imply that they can be readily integrated to produce a reliable system. System integration skills, particularly those needed to integrate actuators and servo controls that are crucial for moving the UAV's control surfaces based on commands from the flight management computer, represent the most significant integration challenge. Without pointing out just where and how Simpson might have come up short, it is important to note that his technical approach to flight management belies the ease with which this task can be accomplished.

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[52] Simpson's website is http://www.interestingprojects.com/cruisemissile/.

[53] "DIY cruise missile thwarted," BBC News Online, 9 Dec. 2003, at http://news.bbc.co.uk/go/pr/fr/-/1/hi/world/asia-pacific/3302763.stm.

Integrating new guidance technology or an alternative propulsion system into a proven design has typically proven far more difficult and time consuming that predicted. Even with its vaunted system integration skills, it took the United States nearly a decade to successfully integrate a global positioning system (GPS) technology into a family of general purpose, unguided bombs to create the Joint Direct Attack Munition (JDAM).[54] Both long-range ballistic missile development and converting anti-ship cruise missiles into land-attack systems have proven more daunting than many had originally foreseen. The 1998 Commission to Assess the Ballistic Missile Threat to the United States (known as the Rumsfeld Commission, after its chairman, Donald Rumsfeld) concluded that countries like North Korea and Iran could compress the development of long-range ballistic missile into a much shorter time than it took either the United States or Soviet Union to achieve.[55] Yet, North Korea and Iran have notably struggled over the last five years—ironically, the time the Rumsfeld Commission argued it would take to move from primitive *Scud* technology to an intercontinental range ballistic missile capable of striking U.S. territory. Even though notable experts had predicted that countries such as Iraq and Iran could readily convert their aging *Seersucker* anti-ship cruise missiles into land-attack models in about one year, Iraq was found to have struggled for over a year just to integrate an alternative propulsion system into the existing airframe.[56] Given the

[54] Author interview with a former government official, December 20, 2004.

[55] *Report of the Commission to Assess the Ballistic Missile Threat to the United States, Executive Summary* (Washington, D.C.: USGPO, 1998), pp. 6-7.

[56] The author, in briefing the Rumsfeld Commission in 1998, argued that—depending on whether or not foreign assistance were available—it would take a country like Iraq or Iran three to six years to convert such an anti-ship cruise missile into a land-attack one. A commission member argued strongly that such a conversion effort could be accomplished in a year. For information on Iraq's effort to convert the *Seersucker* cruise missile, see the Interim report of the Iraqi Survey Group (also known as the Kay Report), delivered on October 1, 2003, at http://www.cia.gov/cia/public_affairs/speeches/2003/. For the author's

complexity of such seeming easy development programs, even imperfect export controls can impose severe time delays or dissuade developing countries altogether from pursuing such efforts.

Circumventing the Intent of the MTCR

The MTCR seeks delaying if not altogether thwarting the unwanted acquisition and development of missile delivery systems, or at least making it so expensive that it might dissuade interested states from acquiring missiles for WMD delivery. Achieving this intention is sought by bringing together 34 states who agree on a general set of guidelines governing the control of missile exports and the equipment and technology used in their production.[57] Unlike the nuclear, chemical, and biological nonproliferation regimes, the MTCR has no legal treaty provisions or international organization to assure compliance. Instead, a common set of guidelines backed up individually by national export control legislation within each participating state governs the MTCR's administration. Given the voluntary nature of the regime, it should come as no surprise that most member states seek to maintain some degree of flexibility in their export rights. Generally speaking, international norms against the acquisition of nuclear, biological, and chemical weapons are fairly robust, while consensus on the need to control delivery

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analysis, see Dennis M. Gormley, *Dealing with the Threat of Cruise Missiles*, Adelphi Paper 339 (Oxford: Oxford University Press, 2001), pp. 29 – 33.

[57] See the Appendix for an MTCR primer and complete list of existing state parties. China, Israel, Romania, and the Slovak Republic have also agreed to adhere to the regime's guidelines for exports. For a balanced treatment of the regime's pros and cons, see Sharon A. Squassoni, Steven R. Bowman, and Carl E. Behrens, "Proliferation Control Regimes: Background and Status," CRS Report for Congress, Order Code RF31559, February 10, 2005, pp. 34 – 43.

systems can be shaky at times. This is especially the case for cruise missiles and UAVs, which have only recently begun to spread as widely as ballistic missiles have.[58]

The Case of the Black Shaheen Sale

The MTCR's most restrictive "presumption of denial" guidance to its member states is applied to complete missiles or UAVs capable of carrying 500kg payloads to a range of at least 300km, as well as certain major subsystems for such missiles. These items are known as Category I systems. In spite of the fact that the Anglo-French *Black Shaheen* cruise missile appeared to be a Category I system, Paris and London decided to see the missile to the UAE in 1998.[59] The decision came notwithstanding strong protestations from Washington about he adverse consequences of such a transfer. The *Black Shaheen* and its various French and British derivatives feature a highly stealthy aerodynamic shape, low-observable materials, low IR signature, and a combination of guidance and navigation schemes designed to achieve a high probability of survival and high terminal accuracy.[60] Paris and London both argued that the *Black Shaheen* sale presented no proliferation danger, an argument that narrowly had some merit. The MTCR's guidelines do stipulate that on rare occasion, when a Category I item is exported, governments must obtain binding end-use assurances from the recipient that the

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[58] See K. Scott McMahon and Dennis M. Gormley, *Controlling the Spread of Land-Attack Cruise Missiles* (Marina del Rey, CA: American Institute for Strategic Cooperation, 1995).

[59] The story of the *Black Shaheen* sale is recounted in Gormley, *Dealing with the Threat of Cruise Missiles*, pp. 38 – 40 and 85.

[60] The shortest-range variant, called the *Apache*, has a nominal range of 140km and a payload of 520kg, but can fly with the aid of launch altitude to over 300km. A longer-range variant (300-400km), called the *Storm Shadow*, won the UK conventionally armed stand-off missile (CASOM) competition, which caused the merger of France's Matra with the UK's Bae, to form Matra BAe Dynamics. A purely French version, called the *SCALP*, is meant to satisfy French requirements for a "strategic" long-range (400-600km) cruise missile for their navy and air force. Italy and Greece have also decided to procure the *Storm Shadow* variant of the missile.

missile will be used only as a conventional weapon and will not be re-exported to another state. Behind the scenes, it became clear that even senior French Ministry of Defense officials viewed the sale with some alarm. In a leaked memorandum on the sale, the Chief of Staff of the Defense Minister, Alain Richard, argued not only that the missile exceeded the MTCR range threshold by 200km, but also that there were several nonproliferation reasons for vetoing the sale. In spite of the Defense Ministry's objections, the President, Jacques Chirac, approved the sale.[61]

The export market for land-attack cruise missiles (LACMs) is expected to grow dramatically in the next decade. To compete with the United States, European manufacturers of LACMs have leapt to the top rung of world producers, led by the Anglo-French firm, Matra Bae Dynamics (MBD). As of 2001, MBD was believed to have at least $2.1 billion world of development and early-production contracts and orders for over 2,000 of its LACMs, which come in three variants, all originally born the French *Apache* cruise missile. These orders largely will satisfy internal French and British requirements, but it remains obvious that for every export of this family of LACMs, unit costs for French and UK missiles will be positively affected. On the other hand, the U.S. and France have competed vigorously to secure the sale of advanced fighter jets and air-to-air missiles to the UAE air force. After the UAE decided upon the American F-16 over the French *Rafale*, the UAE attempted to extract additional sensitive technology from a reluctant United States by reopening talks with the French, who were willing to

[61] "Proliferation: How Paris Arms the UAE," *Intelligence Newsletter*, no. 398, Jan. 23, 2001.

offer such requested technology.[62] The fact that the *Black Shaheen* sale occurred in the midst of intense negotiations for 60 advanced fighters helps to explain why France was persuaded to defy MTCR guidelines.

Whatever the explanation for the Franco-UK decision to export the *Black Shaheen*, the fear among government and security analysts alike is that the decision will negatively affect the export control behavior of states with far more worrisome export behavior than either France or Britain.[63] This most notably includes Russia and China.

Russia: The Past as Prologue?

Russia joined the MTCR as a full member in 1995 after a bitter controversy with the United States over Russia's 194491 agreement to provide cryogenic rocket engines and related missile technology to India.[64] During the controversy, Russia's MTCR status was that of an informal "adherent" to the regime's guidelines — a category designed to encourage the observation of international norms on missiles and related technology transfers. Even as Russia became a full-fledged member, controversy continued over reports not only of Russian exports supporting India's missile program but also of exports by Russian state entities for Iran's ballistic missile program.[65] Although Russia has striven to improve its system of national export controls, it continues to foster close

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[62] Council for a Livable World, Arms Trade Insider #1, October 14, 1998, at http://www.clw.org/atop/inside/inside1.html. The requested technology consisted of software codes that permit the identification of friendly aircraft.

[63] One positive effect of the *Black Shaheen* sale is that the MTCR membership finally took action, in September, 2002, at its Warsaw Plenary meeting, to craft new language strengthening the ground rules to determining the true range and payload of cruise missiles.

[64] For background, see Alexander A. Pikayev, Leonard S. Spector, Elina V. Kirichenko, and Ryan Gibson, *Russia, the US and the Missile Technology Control Regime*, Adelphi Paper 317 (London: Oxford University Press, 1997).

[65] Speier, "Can the Missile Technology Control Regime Be Repaired?" p. 215.

military-technical cooperation with Iran, including the signing of a new formalized agreement in March 2001.[66]

Russia entities involved in missile proliferation have diverse pedigrees. North Korea has now supplanted the former Soviet Union as the principal exporter of ballistic missiles globally, but it appears that Pyongyang's missile programs may have benefited significantly from the assistance of former Russian missile designers and engineers. In late 2004, reports in the Russian press indicated that an entire group of unemployed missile specialists from the State Missile Center, Makeyev Design Bureau departed Chelyabinsk, at the start of the Yeltsin era, for work on North Korea's ballistic missile program.[67] North Korean and Russian activities come together, it would appear, in Iran's emerging long-range missile programs. According to Israeli sources, Iran's *Shihab*-series of ballistic missiles depend importantly on North Korea's *No-Dong* missile and various Russian missile designs, including the SS-4 and SS-9.[68] The latest version, dubbed *Shihab*-3A by U.S. officials, includes a new nose cone, navigation system, re-entry vehicle, and a large fuel tank to extend the missile's range 2,000km. The exact nature of Russian entity assistance to Iran remains ambiguous, but should Russian state officials wish to accelerate the quality of engineering assistance together with the provision of more sophisticated missile subsystems (most notably, advanced propulsion technology),

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[66] Ivan Safronov, "Iran Demands Weapons," *Moscow Kommersant*, March 15, 2001, p. 10 [FBIS Translated Text].

[67] "Russia: Press Report Alleges 'Large Group' of Missile Developers Went to Work for North Korea During Yeltsin's Tenure," Chelyabins*k Ural-Press-Inform* in Russian, Nov. 26, 2004 [FBIS Translated Text].

[68] "Iran Reported to Manage Two Competing Intermediate-Range Missile Programs," *Jerusalem Middle East Newsline* E-mail Text in English, January 19, 2005 [FBIS Transcribed Text].

this would put Iran on a clear path toward an intercontinental-range ballistic missile system.

Intentionally sanctioned activities of Russian entities, or simply an unwillingness to implement effective monitoring of entity activities are not the only transfer pathways that Russia might employ to thwart American missile defenses. Direct transfers of complete missile systems, the MTCR notwithstanding, are also conceivable. A spate of news reports from Israel and Russia in early 2005 pointed to possible missile deal between Russia and Syria involving the transfer of the *Iskander*-E medium-range ballistic missile. The latter is believed to be modernized version of the Soviet-ear SS-23 ballistic missile eliminated under the provisions of the 1987 Intermediate-range Nuclear Forces (INF) treaty. By keeping the *Iskander's* range just under the MTCR's range threshold of 300km, while specifying a payload weight of 480kg, the Russians appear to believe that they can skirt of the MTCR's Category "presumption of denial" restriction.[69] According to one Russian press report, the Votkinsk Missile Factory, which produces the Iskander, believes that the missile has good export prospects, a point concurred in by Russia's official state arms trading company, Rosoboronexport.[70] The *Iskander* possesses the two most worrisome features of the *Black Shaheen* LACM: precision guidance and difficulty of defense. The missile has a reported accuracy of 20m and a terminal maneuvering

[69] Of course, the MTCR's guidelines were modified in 1993 when language was added directing members to assess whether recipient states could modify missiles or components via range/payload trade-offs so as to develop missiles meeting the 300km/500kg threshold. The *Iskander*-E certainly would appear to be a Category I missile.

[70] Pavel Felgenhauer, "Mysterious Missiles to Syria, *Moscow Times*, Jan. 21, 2005.

scheme, which, according to the Russians, renders the *Iskander* impossible to intercept.[71] In spite of strong defense industry pressure to approve the Iskander export to Syria, the adverse foreign policy consequences for Russia in early 2005 made it highly unlikely that any formal transaction was likely to occur. Despite denials by Israel that its ambassador to Russia would be recalled were such a deal approved, Israeli officials discussed the sale's prospects with Washington, who undoubtedly raised the matter with Moscow. By mid-January 2005, Russian officials had made it clear that Syria would not receive *Iskander*-E missiles among other defense items about to be sold to Damascus.[72]

Ballistic missile proliferation is not the only avenue available to Russia in order to stress the effectiveness and cost of missile defenses. Even though the MTCR membership tightened its guidelines with respect of cruise missile exports after the Franco-British sale of the *Black Shaheen* to the UAE, Russia could still use the sale as a pre-text for transgressions with regard to its own cruise missile exports. Russian arms manufacturers began marketing LACMs in earnest during their premiere Moscow Air Show in 1992, when a shorter-range version of the 3,000km-range Kh-55 air-launched cruise missile was offered for sale.[73] The missile's advertised range was 500km, 200km more than the MTCR's range threshold, while its payload was listed at 410kg. A year

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[71] "Russia Establishes Victory Prize for Arms Makers; Iskander System Profiled," *Moscow Channel One TV* in Russian, February 2005 [FBIS Translated]. Terminal maneuverability certainly would make the Iskander more difficult but not impossible to intercept.

[72] "Israel denies rift with Russia over arms," *United Press International*, January 12, 2005. For a Russian account, see Aleksey Nikolskiy, Vasiliy Kashin, and Yekaterina Kudashkina, "Russia is Not Selling Missiles to Syria," *Moscow Vedomosti* in Russian, Jan. 13, 2005 [FBIS Translated Text].

[73] Ukraine is believed to have diverted at least 12 Kh-55 (NATO designation AS-15 Kent) strategic LACMs to China and Iran. Six missiles each do not comprise a deployment-size arsenal, but small numbers of such an item would be enormously valuable for copying, or reverse engineering, particularly the turbofan engine that permits the Kh-55 to achieve its strategic range. On the diversion itself, see Pavel Felgenhauer, "Missile Carriers," *Moscow Novaya Gazeta* in Russian, Feb. 14, 2005 [FBIS Translated Text].

later at the IDEX Defense Exhibition in Abu Dhabi, the Russians once again displayed a scaled down Kh-55, called the Kh-65E, with a range of 280km. These offerings demonstrate not only the inherent modularity of cruise missiles, but also a clumsy attempt by the Russian manufacturer Reduga to keep the offerings below the MTCR's range and payload thresholds. Russia has also exploited the modularity of its sea-launched 3M-55 Yakhont cruise missile to produce the 3M-54E1, or *Club*, for the export market. This missile is believed to have both anti-ship and land-attack options built in. Among prospective recipients are India and China.[74] Russia may also lease to India an *Akula* II nuclear-powered submarine equipped to launch *Club* cruise missiles.[75] Equally controversial, because of its impact on the MTCR's effectiveness, is the co-development by India and Russia of *Brahmos* dual-mode (anti-ship and land-attack) supersonic cruise missiles, which both sides wish to market internationally. While the *Brahmos* does not appear to fall under the MTCR's Category I provisions, India clearly possesses WMD and the missile can readily fly to a range of 300kg, which compels Moscow to secure end-use assurances that the missile will not be used to deliver WMD. In sum, Russia clearly possesses ample financial and strategic incentives to exploit its strong position as a cruise missile manufacturer, should U.S.-Russian relations deteriorate further.

China: Half in, Half Out

China's relationship with the MTCR has been problematic from the start. In becoming an "adherent" to the regime's guidelines in October 1994, China took the unusual step of formulating its own version of precisely what adherence meant. China

[74] Gormley, *Dealing with the Threat of Cruise Missiles*, pp. 37-38.

[75] Nuclear Threat Initiative, "India: Russia agrees to lease nuclear submarine," *Global Security Newswire*, 2 Dec. 2002, at http://ww.nti,org.

agreed to "not export ground-to-ground missiles featuring the primary parameters of the MTCR"[76] — which suggests that its adherence applies only to complete Category I systems (and not obviously to air-to-ground cruise missiles). Prior to China's 1994 adherence to the MTCR's guidelines, Beijing had pledged in 1991 not to sell complete Category I missiles. Despite its pledge, China transferred at least 34 M-11 ballistic missiles to Pakistan. When confronted by the United States, China denied the transfer, while Washington imposed economic sanctions, which were lifted in late 1992 after yet another pledge by Beijing to adhere the MTCR's guidelines and parameters. Early in the Clinton administration, Washington implemented sanctions once again after learning that China had engaged in missile trade with Pakistan.[77] Even though the U.S. intelligence community reported in February 2000 that "some [Chinese] ballistic missile assistance [to Pakistan] continues," Washington and Beijing struck another deal in November 2000 to waive sanctions then in place for missile-related exports to Pakistan and Iran in exchange for China's publication of a specific export control list pertaining to missile exports. Discussions even began to occur informally within the MTCR to admit China as a full member state. Still, however, intelligence reports continued to implicate China in a continuing stream of component missile technologies to Pakistan and other states. According to Bush administration officials, Chinese state-owned corporations have transferred missile technology to Pakistan, Iran, North Korea, and Libya, justifying the imposition of economic sanctions 62 times — compared with only 8 times during

[76] Gormley, *Dealing with the Threat of Cruise Missiles*, p. 82.

[77] For the full details on China's transfers to Pakistan, see "China's Missile Exports and Assistance to Pakistan," at http://cns.miis.edu/research/india/china/mpakpos.htm.

President Clinton's two terms — during George W. Bush's first term.[78] Needless to say, Beijing's bid for MTCR membership during the 2004 MTCR plenary meeting in Seoul did not succeed, largely due to Washington's insistence.

Strategic, commercial, and foreign policy reasons underlie China's willingness to defy Washington's wishes to see Beijing curtail its missile sales. In regard to Pakistan, China maintains a strong strategic relationship and partnership that entails a full range of major weapon system transfers and other forms of defense cooperation. Countering India and Soviet designs originally informed this strategic partnership, but post Cold War needs, including using Pakistan as a balance against India, remain critically important to China. Commercially, Chinese defense industries were expected from the beginning of China's opening up in the early 1980s to exploit the increasingly lucrative international market for arms. Pakistan's need to compensate for Indian conventional superiority with advanced ballistic missile systems fit well with China's aggressive export needs. Finally, and most important to this study, Beijing understood well Washington's sensitivity to uncontrolled missile proliferation and has masterfully exploited it to provide leverage with Washington on missile defense deployments in East Asia and arms sales to Taiwan.

Potential Pressure Points

The potential convergence of Russian and Chinese interests — the former operating from within formal MTCR deliberations, the latter on its edges — to make America's emerging missile defenses more costly and suspect in the eyes of their prospective recipients could play out in a number of quite plausible ways. First, there are

[78] "Kyodo: Bolton Warns China's Alleged Proliferators of Weapons Technology," *Tokyo Kyodo World Service* in English, Feb. 7, 2005 [FBIS Transcribed Text].

already signs of growing common interests between Moscow and Beijing. Shortly after Russia suffered the loss of its traditionally close relationship with Ukraine, with Victor Yushchenko's December 2004 election, Moscow announced two accords with Beijing signaling a closer long-term relationship between the two powers. One involves a new degree of economic cooperation in exploiting Russia's vast energy resources. The other entails a historic first: large-scale joint military exercises on Chinese territory. At least one prominent American observer has described these new developments as signifying a new "anti-hegemonic" bloc consisting of Russia, China, and its covert relationships with such rogue states as North Korea, Iran, and Syria, among others.[79]

Regional Settings

Mutual Russian and Chinese interests in complicating America's pursuit of effective missile defenses has such compelling plausibility because the phenomenon of missile proliferation has already begun to show a new toxic character: a volatile mix of increases in medium- and intermediate-range ballistic missiles together with the acquisition of land-attack cruise missiles. Motivated in part by the lessons from the American invasion of Iraq in 2003 (viz., that defending against both cruise and ballistic missiles severely complicates and increases the costs of effective missile defenses), states considering acquiring a delivery system for WMD are likely to acquire both ballistic and cruise missiles, especially if they face an adversary armed with ballistic missile defenses. The primary reason has to do with the fact that most missile defense interceptors in regional settings are asked to defend against both ballistic and cruise missiles. States wishing to deter U.S. or regional military interventions were unlikely to invest heavily in

[79] Charles Krauthammer, "Tomorrow's Threat," *Washington Post*, Jan. 21, 2005, p. A17.

cruise missiles until American missile defenses performed decisively better than they had during the 1991 Gulf war. *Patriot's* success against Iraq's ballistic missiles in 2003 coupled with the problems *Patriot* faced in detecting and intercepting cruise missiles increases incentives to acquire cruise missiles.[80]

Where increased Russian assistance to China could adversely affect performance and increase the cost of American and allied missile defenses is in a future military conflict between China and Taiwan. Indeed, recent developments in the missile competition between China and Taiwan illustrate how the addition of cruise missiles — particularly increasingly more advanced designs provided with the aid of Russian engineering — could greatly exacerbate tension in the region. China has been deploying its M-series ballistic missiles in provinces within reach of Taiwan at the alarming rate of 50 to 75 a year for several years. Current estimates suggest they will have 800 deployed by the end of 2006. These missiles are thought to possess sufficient accuracy to make conventional payloads effective against Taiwan's ace in the hole vis-à-vis a cross-strait invasion: its large air force, which is reputed to be significantly more potent than China's, and capable of defeating any cross-strait invasion. Taiwan is constrained to deploy its highly effective air force on only a handful of airfields. Acting alone ballistic missiles armed with conventional munitions are not capable of closing Taiwan's airfields. But they could temporarily delay the takeoff of Taiwan's superior air force in the critical first hours of any cross-border military campaign, and permit China's more inferior air force more effectively to attack Taiwan's pinned-down air force. What's more, China would

[80] For details, see Gormley, "Missile Defense Myopia: Lessons from the Iraq War."

have far less difficulty penetrating Taiwan's air space due to the latter's aircraft having been delayed from meeting China's in air-to-air engagements.[81]

In response to China's ballistic missile buildup, Taiwan has purchased missile defenses, including U.S. *Patriot* PAC-2 interceptors, while the latest hit-to-kill PAC-3 interceptors are scheduled for acquisition in the near future. But *Patriot* batteries alone will have difficulty defending against both ballistic and cruise missiles. *Patriot* missile defense systems have a nominal capability to intercept low-flying cruise missiles, but only if they have advanced (fire-control quality) information of the whereabouts of the incoming target in enough time to engage it. That information must come from airborne radars with advanced detection capabilities (like the future U.S. Air Force MC2A), which add to the already high price of defending against much less costly ballistic missiles. Thus, recent reports that China has tested a new LACM, named *Dong Hai-10*, with a range of 1,500km and accuracy of 10m, and has already deployed a shorter-range LACM (*Ying Ji-63*) with a range of 400-500km, as well as *Harpy* UAVs furnished by Israel, have sparked an open debate in among Taiwan's legislators about the feasibility of relying alone on costly missile defenses as a counter to these developments.[82] As one Taiwanese government official observed, "Relying on purely defensive systems to

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[81] For an appraisal of how this campaign might unfold, see Dennis Gormley, "Defusing China's Threat to Taiwan," *Defense News*, March 24, 2000, p. 29. On recent Chinese military developments, see *FY04 Report to Congress on PRC Military Power*, at www.**defense**link.mil/pubs/d20040528PRC.pdf.

[82] For information on China's LACM test and other cruise missile and UAV programs, see *Space Daily*, "China Test-Firing New Cruise Missile Which Threatens Taiwan: Journal," September 19, 2004, at www.spacedaily.com/news/missiles-04zzh.html. Signs of Russian and Chinese collusion with regard to cruise missile development are longstanding. Relying in part on extensive Russian technical assistance, China is believed to have several new LACMs already deployed or under development. The *Jing Ji-63* LACM possesses features indicative of a Russian pedigree in that it looks like the Russian Kh-55 strategic cruise missile, having the distinctive rear-mounted engine and under-body air intake; its range (400+km), payload, and guidance characteristics also mimic the Russian Kh-65E, the shorter-range variant of the Kh-55. See Gormley, *Dealing with the Threat of Cruise Missiles*, pp. 37 – 38.

protect ourselves from China means we will have to outspend them 10 to one; we have to buy anti-missile missiles plus more early-warning and other detection equipment. That is impossible in the long run." As an antidote, Taiwan is pursuing a LACM program of its own that is believed to be within four years of completion.[83]

In addition to making U.S. missile defense effectiveness more uncertain and costly, Russian-Chinese collaboration could foster a missile arms race in Northeast Asia and elsewhere. A classic missile arms race shows signs of unfolding already in Northeast Asia. Unlike the Cold War doctrine of mutual assured destruction, which involved the threat of nuclear retaliation, the one developing along the Taiwan straits involves, initially at least, conventionally armed missiles, which suggests a lower threshold surrounding the decision to commence hostilities. But as the brief analysis of Taiwan's air force and early-warning vulnerabilities shows, there is a compelling urge — and perceived benefit — to usurp control at the outset of conflict. Such an appeal aptly describes the tyranny of preemption.

Japan, too, is not immune from considering the merits of cheaper offensive solutions to the growing missile threat it faces. In October 2004, a Japanese Defense Agency panel report indicated that Japan requires a capability to launch a preemptive strike against foreign threats.[84] To illustrate such a preemptive option, the report used a foreign ballistic missile launch installation. Although Japan's Prime Minister, Junichiro Koizumi, rejected such a notion as inconsistent with Japan's "defense only" policy, the high cost of missile defenses and growing recognition that these defenses might be

[83] Kathrin Hille, "Taiwan speeds up race to match Beijing missiles," *Financial Times* (Asia Edition), Sept. 25, 2004, p. 3.

[84] "Pre-emptive strike ability said necessary for Japan," *The Japan Times*, Oct. 2, 2004.

overwhelmed by a combination of ballistic and cruise missiles may explain why Japan felt it necessary, in spite of Koizumi's public reassurances, to include a plan to study a 300km-range ballistic missile in the fiscal 2005-2009 defense buildup program.[85] Prominent news accounts of the costs of missile defense illustrate Japan's dilemma: because each *Patriot* PAC-3 missile costs an estimated $4.75 million, Japan's budget allocation for missile defenses will only cover the acquisition of no more than 12 to 13 interceptors.[86] Worse, the *Aegis*-based SM-3 missile cost four times as much as *Patriot*, meaning that only 9 interceptors can be afforded each year. With North Korea's arsenal of *No-Dong* ballistic missiles standing at over 200, the arithmetic is stark. Were China to lend assistance to North Korea's nascent cruise missile development program, it may become fiscally infeasible for Japan to afford a sufficient number of missile defense interceptors to protect major population centers and critical military and industrial facilities. Under such circumstances, much cheaper offensive strike options could become an acceptable alternative.

Mixing cruise missiles with already growing arsenals of ballistic missiles in the Middle East could also play out as yet another Russo-Chinese pressure point affecting the performance and cost of American and Israeli missile defenses. Until recently, Israel had dominated development and acquisition of cruise missiles and UAVs. Besides being a major developer of reconnaissance drones and the air-launched *Popeye* LACM, Israel has

[85] Under pressure from its coalition partner, New Komeito, the Liberal Democratic Party decided to drop the ballistic missile study plan from its next defense buildup program. See "Japan Drops Long-Range Missile Deployment Plan in Defense Program," *Tokyo Jiji Press* in English, December 7, 2004 [FBIS Transcribed Text]. On possibilities for North Korean cruise missiles, see Dennis M. Gormley, "North Korean Cruise Missile Tests — and Iraqi Cruise Missile Attacks — Raise Troubling Questions for Missile Defenses," CNS Research Story of the Week, posted April 8, 2003, at http://cns.miis.edu/pubs/week/o3048.htm.

[86] See, for example, Shigeru Handa, "Whom is Missile Defense For?" *Tokyo Shimbun* (Internet Version-WWW) in Japanese, Dec. 24, 2004 [FBIS Translated Text].

also explored the notion of using armed UAVs to perform counterforce missions against enemy ballistic missile launchers. Iran's *Shihab* ballistic missile has motivated Israel to pursue its own missile defense system — the *Arrow* — with substantial financial support from the United States. As *Arrow* and *Patriot* deployments have proceeded, Iran has become noticeably interested in both LACMs and UAVs. Tehran has acquired cruise missile systems and technology from both Russia and China in support of its new anti-ship cruise missile program, called *Nur*.[87] And China has exported various version of the *Silkworm* anti-ship cruise missile to Iran. Older versions, like the HY-2 or HY-4, could be converted into LACMs with range of at least 1,000km.[88] As previously noted, Iraq was in the midst of converting its *Seersucker* (or *Silkworm*) anti-ship cruise missiles into 1,000km-range LACMs when the American intervention interrupted the program in early 2003. Iran apparently took note of the fact that American *Patriot* missile interceptors failed to detect or intercept any Iraqi cruise missiles. In light of apparent American cruise missile defense weaknesses, Iran now believes that cruise missiles would support *Shihab* 3's success by complicating the task of American and Israeli missile defenses.[89] Acquiring more cruise missiles to complement its already substantial ballistic missile arsenal would also send a strong message to Gulf Cooperation Council states, Kuwait, and Saudi Arabia, all of whom have been offered or expressed interest in American missile defense systems. Israel, too, has become alarmed about Iran's growing interest in cruise missiles and UAVs. Underscoring the difficulty of detecting such low-flying

[87] For details on the Nur, see *Middle East Newsline*, "Iran reports that it has developed a range of cruise missiles," at http://www.menewsline.com/stories/2002/october/10_43_3.html.

[88] On converting Silkworms into LACMs, see Gormley, *Dealing with the Threat of Cruise Missiles*, pp. 30 – 33.

[89] "Iran Seeks Cruise Missile to Support Shihab," *Middle East Newsline*, June 10, 2004.

objects, Hizbollah reminded Tel Aviv of its vulnerability in early November 2004 when it launched an Iranian-supplied UAV that flew undetected over northern Israel for five minutes before landing out at sea for recovery.[90]

Russia and China could also choose to exacerbate a dangerous mix of offensive and defensive missile developments currently unfolding in South Asia. Not only could Russian and Chinese activities destabilize a delicate balance of power in the region, but make any potential U.S. intervention to staunch a potential nuclear catastrophe more problematic than it might otherwise have to be. The barely stable balance of forces between India and Pakistan could be adversely affected by the substantial addition of cruise missiles and UAVs to growing deployments of ballistic missile systems. In early December 2002, a Pakistani reconnaissance UAV violated Indian airspace near the Kashmiri Line of Control (LOC), one of several similar violations that have occurred along the LOC. Tensions in Kashmir have been mirrored in the broader arms-acquisition domain. Pakistan is seeking to purchase either highly sophisticated *Predator* UAVs, or perhaps a less controversial system, from the United States to replace its domestically developed but limited *Vision* UAV. Of course, the U.S. *Predator* comes in an armed version, although Pakistan claims that their needs are purely for monitoring the LOC in Kashmir.[91]

India is even more exertive in both its development and acquisition of cruise missiles and UAVs. Its *Lakshya* unmanned target drone, thought to be capable of delivering a 450kg payload over a range of 600km, is reportedly to be exported to an

[90] Riad Kahwaji and Barbara Opall-Rome, "Hizbollah: Iran's Battle Lab," *Defense News*, Dec. 13, 2004, p. 1.

[91] A. Koch, "Pakistan look to USA to fill UAV gap," *Jane's Defence Weekly*, Oct. 2, 2002, p. 5.

unknown country (probably Israel).[92] Israel, in turn, is supplying India with two Heron long-range reconnaissance UAVs, with more to follow, to support its first major UAV base located at the southern naval command in Kochi.[93] Of course, India's co-development with Russia of the *Brahmos* cruise missile, which was declared ready for deployment in early 2005, and New Delhi's leasing of a Russian *Akula* II nuclear submarine equipped with nuclear-capable cruise missiles, presents Pakistan with a robust offensive strike force with which to contend.[94] One sure way to aggravate regional arms racing would be for Russia to accede to nascent Indian military ambitions to rapidly incorporate advanced, longer-range versions of the *Brahmos* cruise missile into Indian air and land forces. With its missile partner Russia providing certain "restrictive technologies," the Indian military could integrate a turbojet engine to achieve around 500km range and perhaps even a more advanced turbofan engine to propel a miniaturized nuclear warhead to strategic ranges (~2,000km). Indian military sources note that such an expansion of *Brahmos'* capabilities is feasible for two reasons: first, unlike their ballistic missile development programs, the *Brahmos* is "not under the global scanner;" and second, because *Brahmos* is a joint venture, India can turn to its partner Russia for technological help.[95]

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[92] "India to soon export pilotless target aircraft to 'a foreign country'," *New Delhi All India Radio*, Home News Service, Dec. 13, 2002.

[93] "Kochi to become naval center for UAV," *Kottayam Mathrubhumi* (in Malayalam), Dec. 19, 2002.

[94] "Brahmos Missile 'Ready to Be Inducted' Into Armed Forces," *Chandigarh The Tribune* in English, Feb. 26, 2005 [FBIS Transcribed Text].

[95] "No Time to Lose," *New Delhi Force* (Internet Version-WWW) in English, March 9, 2005 [FBIS Transcribed Text]. This unattributed article in an independent monthly magazine dealing with Indian national security quotes an unnamed Indian general officer who proposes turning to the Russians for technical assistance by essentially working around Russia's obligations to the MTCR.

But the development that is certain to animate Chinese action most is New Delhi's pursuit of ballistic missile defenses. Indian strategists argue that New Delhi has no choice but to balance comparative Pakistan's advantages in offensive ballistic missiles (aided by North Korea and China) and its strategy of nuclear blackmail with a no-first use nuclear strategy complemented by active missile defenses.[96] While the United States has held up any prospect of Israel furnishing India with its American-financed *Arrow* missile defense system, it has encouraged New Delhi to examine an offer to purchase the *Patriot* PAC-3, its most advanced terminal missile defense interceptor. The logic for such American behavior is to avoid seeing Israel profit from an American-financed missile when *Patriot* could theoretical satisfy New Delhi's missile defense requirements. Moreover, the *Arrow* propulsion system exceeds the MTCR's Category I parameters — it could propel an offensive missile to over 300km with at least a 500kg payload. The *Patriot* falls beneath the Category I threshold. Nonetheless, providing India with missile defenses could prompt Pakistan to seek missile defenses of its own, or more likely, acquire cruise missiles to increase the likelihood that some missiles could penetrate India's missile defenses. China could furnish Pakistan with *Silkworm* HY-4 anti-ship cruise missiles, which comes with a turbojet engine sufficient to propel a converted version of the missile to around 1,000km. China could also ease the burden of conversion by providing technical assistance in guidance and navigation to achieve a potent land-attack capability for the missile. Armed then with both a substantial arsenal of ballistic missiles complemented by a growing number of LACMs, both India and Pakistan would have accelerated their already costly arms race with unpredictable implications for future

[96] C. Raja Mohan, "Next Steps in Missile Defence," *The Indian Express* (Internet Version-WWW) in English, Feb. 22, 2005 [FBIS Transcribed].

regional stability. This would necessarily include any contingency involving U.S. military engagement.

The Homeland Defense Setting

We have already seen how Russian engineering and component technology support have already and could further benefit North Korean and Iranian long-range ballistic missile programs. But there are other less demonstrable ways to threaten the U.S. homeland that might be indirectly aided by Russia's lack of cooperation within existing missile nonproliferation regimes. The means are low-tech aircraft converted to fly fully autonomously as UAVs. Analysts have begun to worry about such unfamiliar attack mechanisms for two principal reasons. First, they represent perhaps the most effective way to deliver biological, chemical, or certain forms of nuclear materials (powdered Cesium-60). And second, these low-flying UAVs could exploit the previously discussed gap in air defense coverage of the continental United States below 3,000 feet. Al Qaeda has asserted that it is a religious duty to acquire WMD. Moreover, their members are have reportedly hatched plans, which failed to materialize, to use unmanned model airplanes with plastic explosives to kill G-8 leaders in Genoa, Italy in 2001, and a drone to attack the British House of Commons with anthrax.[97] The director general for Canada's armed forces has stated publicly in early 2004 that terrorist groups have already purchased ultra-light aircraft and hang-gliders to work around the post-9/11 improvements against highjacking large commercial airliners.[98] The MTCR took an

[97] The Genoa, Italy plan is one of many cases accumulated by a former U.S. intelligence officer named Louis Mizell. See http://www.securitymanagement.com/library/001324.html. On the drone attack in London, see Severin Carrell, "British prisoner 'confesses' plot to poison-bomb Parliament," *London Independent*, Nov. 30, 2003, p. 1.

[98] David Pugliese, "Terrorist are training on hang-gliders, experts warn," *Calgary Herald*, March 26, 2004, p. A1.

important first step toward addressing possible terrorist use of UAVs by concluding its 2002 plenary meeting with a commitment to examine ways of limiting the risk that controlled items and their technologies fall into the hands of such groups or individuals. The most effective action in this regard would be to improve lax controls of flight management systems that enable to conversion of small light aircraft into fully autonomous UAVs.[99] But given the MTCR's consensus nature, Russia, among several other states, could stall substantive efforts to meet the MTCR's new mandate.

The United States took the initiative in January 2003 to prevent the flow of dual-use technology that might enable a terrorist group to acquire a small UAV. Using the Wassenaar Arrangement (WA) as a starting place, the United States introduced an "antiterrorism proposal to the WA's 33 co-founding nations, which strive to achieve transparency and greater responsibility in transfers of conventional arms and dual-use goods and technologies (including UAVs).[100] Expressing concern about the possible terrorist use of kit airplanes and other manned civil aircraft as makeshift UAVs, the U.S. proposal sought export control reviews and international notifications for all equipment, systems, and specially designed components that would enable these airplanes to be converted into UAVs. The WA membership failed to take action on the U.S. proposal because it lacked sufficient descriptive detail on precisely what technologies or systems required review and notification. Although the United States may well re-introduce improved language at a future WA meeting, a more appropriate venue for such a proposal

[99] For an analysis of possible terrorist use of small UAVs, see Dennis M. Gormley, "On Not Confusing the Unfamiliar with the Improbable: Low-Technology Means of Delivering Weapons of Mass Destruction," Paper No. 25, Prepared for the Weapons of Mass Destruction Commission, Chaired by Dr. Hans Blix, available at www.wmdcommission.org/files/No25pdf.

[100] See http://www.wassenaar.org/.

is the MTCR. This is because the WA does not incorporate the MTCR's strong denial rules and no-undercut provisions (if one member denies a transfer, others are obliged not to transfer as well). But here too Russia might choose to drag its feet on any U.S. initiative, if only because it may figure that such terrorist threats are far more likely to affect U.S. interests than Russia's.[101]

Adjusting U.S. Behavior to Encourage Cooperation

Western arms control theory is predicated on the importance of transparency, or making both sides of any competition aware — as specifically as is possible within the limits of security — of what the other side is doing. In considering how the United States might adjust its behavior to mitigate Russian and Chinese actions designed to thwart the effectiveness of U.S. global missile defenses, nothing is more important that increased American transparency with respect to its defense programs. The current U.S. administration simply dismisses the necessity for such transparency. According to the 2002 Nuclear Posture Review, Russia no longer figures into American nuclear targeting plans as a primary threat. Nor should Russia and China fear American global missile defenses, the administration argues. Such defenses aim only to protect American interests from comparatively small missile attacks from rogue states, not strategic attacks from Russia or China. These assurances notwithstanding, Russia and China face a decidedly opaque U.S. missile defense program characterized by an open architecture and yearly block purchases of additional capabilities as they mature. As noted earlier, Russia is most concerned about the future deployment of ground- and space-based sensors that

[101] For an alternative Russian view, see Eugene Miasnikov, "Threat of Terrorism Using Unmanned Aerial Vehicles: Technical Aspects," Center for Arms Control, Energy and Environmental Studies at the Moscow Institute of Physics and Technology, June 2004 (English Translation, March 2005), available at http://www.armscontrol.ru/UAV/report.htm.

would provide the basis for a "break out" scenario in which the United States could rapidly expand a "limited" system into a one that threatened even Russia offensive forces, and certainly China's substantially smaller offensive arsenal.

The purest form of reassurance would resurrect formal arms control constraints, involving perhaps limits on the number of mid-course and upper-tier interceptors, or even constraints on ground- and space-based sensors. Because they do not threaten Russian and Chinese strategic missiles, boost-phase interceptors could remain uncontrolled. China is animated most over U.S. prospects for deploying weapons in space, including the positioning of space-based kill vehicles for mid-course intercept. Here the United States might allay international concerns, including China's, by agreeing to an international code of conduct to promote peaceful uses of outer space. Barring an American about-face on formal arms control, the administration might consider informal outreach activities with Russian and Chinese military and diplomatic officials to inform them about the direction, scope, and pace of their offensive and defensive military programs — notably those that comprise the Nuclear Posture Review's "New Triad." The frequency and quality of such outreach efforts might not entirely mitigate Russian and Chinese concerns, but at least they would dissipate the veil of secrecy surrounding America's longer-term strategic direction.

Taking a more progressive approach to addressing missile proliferation concerns within the 34-nation MTCR is just not the responsibility of Russia, but America as well. Were America to adjust its behavior with regard to multilateral regimes generally and the MTCR and the Hague Code of Conduct (HCOC) against the proliferation of ballistic missiles specifically, it might just make it less likely for Russia and China to act

inconsistent with the MTCR's and HCOC's intentions. Two brief examples illustrate this point. First, if the United States wishes other members of the MTCR to avoid a repeat of the *Black Shaheen* stealthy cruise missile sale to the UAE, it would be advisable to adjust its own behavior with regard to promoting the loosening of MTCR rules on large UAVs and missile defense interceptors. Early in 2002, the Bush administration established a confidential interim policy governing the export of UAVs that otherwise merited Category I treatment (a strong presumption to deny transfer).[102] Increasingly in demand to enhance the prospect of precision delivery of conventional weapons, large reconnaissance UAVs were seen as weapon support mechanism for discriminating forms of warfare, not as delivery systems for WMD. But the stark reality is that large UAVs can also deliver 500kg payloads to over 300km, which merits the MTCR's strong denial rules. The danger of loosening controls after nearly 18 years of experience is to foster a more pliable attitude toward other Category I controls, perhaps even on space launch vehicles, which can rapidly form the basis for an intercontinental ballistic missile program. The same precaution applies as well to the Bush administration's wish to promote sales of missile defense systems through a loosening of controls on missile defense interceptors. As one senior administration official put it, "MTCR is not, should not be, and is not intended to be a restraint on missile defense. It is intended to restrict trade in ballistic missile technology . . .."[103] But the fact is that missile defense interceptors are proscribed under Category I MTCR rules to the extent their rocket motors are capable of propelling a 500kg payload to over 300km range. One possible

[102] On UAV transfers, see Dennis M. Gormley and Richard Speier, "Controlling Unmanned Air Vehicles: New Challenges," *The Nonproliferation Review*, vol. 10, no. 2 (Summer 2003), pp. 66-79.

[103] Amy Svitak and Gopal Ratnam, "Missile Defense Vs. Non-Proliferation," *Defense News*, July 14, 2003, p. 1.

action under Bush administration review is removing missile defense interceptors altogether from MTCR consideration, and action that would surely exacerbate rather than dampen the missile threat American missile defenses would face.

The second example of a more enlightened U.S. approach to nonproliferation relates to the improving the scanty normative guidelines that currently exist for missile restraint. One blatant shortcoming of the HCOC, implemented in November 2002, was the absence of cruise missiles and UAVs, even though the normative regime's progenitor was the MTCR, which covers both missile categories. While the HCOC was under formulation, the United States did nothing or actually prevented cruise missiles and UAVs from being included in the code's language. Since its creation, the HCOC members have focused on expanding its membership rather than deepening its normative coverage by including cruise missiles and UAVs. However insubstantial the HCOC as a normative mechanism, this shortcoming solidifies the second-class status of cruise missiles and UAVs precisely at a time when their proliferation has become inextricably linked to the spread of ballistic missiles. America would be wise to change this perception or otherwise inadvertently foster actions that make the effectiveness of its future missile defenses more problematic. It is difficult to imagine U.S.antiterrorism proposal dealing with conversion of manned airplanes into UAVs getting much traction in either the WA or MTCR without a broader international consensus about the danger of cruise missile and UAV proliferation.

Finally, U.S. behavior regarding formal Chinese accession to membership in the MTCR will surely affect Beijing's calculations about thwarting America's missile defense ambitions from within the MTCR. As an informal adherent to the MTCR, China

has carefully crafted a self-serving interpretation of the MTCR's guidelines, one meant to afford sufficient latitude to proliferate when its suits China's security or economic interests. Fearing that it would be worse off were China a formal member, U.S. decision-makers thus far have denied China the membership it and most other MTCR member seek. On balance, however, it would be better to have China operating from within the MTCR than from the convenience of its current "adherent" status. Despite the fact that China was a target country for years, Beijing has joined the Nuclear Suppliers Group. Formal accession to the MTCR would mark not only China's formal involvement in a key security institution, but also an increasingly closer engagement in international economic and political institutions as well.[104] Even without formal membership status, but surely in anticipation of achieving such status, Beijing has upgraded its national export control system dealing with MTCR systems and component technologies. Continuing to prevent China's accession to the MTCR will only increase Beijing's predilection toward iconoclastic behavior regarding missile sales. That would make it easier, not harder, for China to subvert U.S. policies from the comfort of its informal relationship with the MTCR today.

[104] According to Victor Zaborsky, accession to the MTCR involves not only meeting certain membership criteria but also negotiating with member states on political and economic tradeoffs and side payments. See Victor Zaborsky, "Does China Belong in the Missile Technology Control Regime?" Arms Control Today, Oct. 2004, at http://www.armscontrol.org/act/2004_10/Zaborsky.asp.