Florida State University Journal of Transnational Law & Policy

Volume 14 | Issue 1 Article 2

2004

Strategic Myopia: The United States, Cruise Missiles, and the Missile Technology Control Regime

Michael Dutra

STRATEGIC MYOPIA: THE UNITED STATES, CRUISE MISSILES, AND THE MISSILE TECHNOLOGY CONTROL REGIME

MICHAEL DUTRA*

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I. INTRODUCTION: STRATEGIC MYOPIA

The year is 2009. The last American troops have withdrawn from Iraq after six years of occupation and reconstruction. As the final U.S. soldiers depart, sectarian violence erupts, crippling the divided and weak Iraqi regime; full-scale civil war results. As the Iraqi government crumbles, Iran intervenes and invades southern Iraq, threatening the Kuwaiti and Saudi oil fields so vital to the

* Associate, White & Case LLP, New York; J.D., *cum laude*, 2003, Georgetown University Law Center; B.A., *summa cum laude*, 2000, University of Southern California. The views expressed in this article are the author's personal opinion and are not those of any other group or organization. I would like to thank Professor David Koplow for his suggestions and comments; Gaurav Kampani, Tim McCarthy, Richard Speier, and especially Dennis Gormley, for sharing their insights and expertise; and Jacqueline Tully for tolerating me.

well-being of the American economy. The United States reacts by sending several fighter wings to Qatar to contain the conflict.

As the sun sets over the sands of the Qatari desert, scores of small, slow, remotely-piloted vehicles (RPVs) fly across the Persian Gulf towards the massive Al Udeid air base, where dozens of American military aircraft are dispersed on ramps around the airfield because there are not enough hardened shelters or bunkers for all the U.S. warplanes. American radar operators spot the incoming aircraft, and Patriot surface-to-air missile (SAM) batteries begin firing at the RPVs, but there are too many targets to shoot down. Even after the Patriot batteries expend their final missiles, more and more Iranian RPVs arrive in successive waves. Each RPV drops dozens of conventional submunitions on the runways, dispersal areas, and tent cities housing the hundreds of personnel needed to keep a modern air wing flying. After the smoke clears, the Al Udeid airfield is littered with wrecked F-15s and burning tanker aircraft, as well as hundreds of dead and wounded American military personnel. While the military losses to the U.S. forces are significant, the political damage is catastrophic, and the United States decides to withdraw its air assets from the Arabian Peninsula.

This nightmarish scenario is not so far-fetched as it might seem. It is loosely based upon RAND Corporation assessments of the vulnerability of American overseas bases to missile attacks, and how such attacks could threaten U.S. force projection capabilities.[1] It also illustrates the danger of the emerging cruise missile threat and the deficiencies of the Missile Technology Control Regime (MTCR) — the suppliers' group designed to prevent the proliferation of missiles and related technologies.[2] The MTCR is ill equipped to deal with the emerging threat of cruise missiles largely due to the reticence of its constituent members to recognize the cruise missile threat, as well as the regime's primary focus on stopping the spread of ballistic missiles.[3]

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1. *See* DENNIS M. GORMLEY, DEALING WITH THE THREAT OF CRUISE MISSILES 48-50 (The International Institute for Strategic Studies, Adelphi Paper No. 339, 2001) [hereinafter GORMLEY, DEALING WITH THE THREAT]; JOHN STILLION & DAVID T. ORLETSKY, AIRBASE VULNERABILITY TO CONVENTIONAL CRUISE-MISSILE AND BALLISTIC-MISSILE ATTACKS: TECHNOLOGY, SCENARIOS, AND U.S. AIR FORCE RESPONSES 16-28 (RAND 1999) [hereinafter STILLION & ORLETSKY].

2. Missile Technology Control Regime: Agreement on Revised Guidelines for the Transfer of Equipment and Technology Related to Missiles, Apr. 16, 1987, 32 I.L.M. 1298, *available at* http://www.mtcr.info (last visited July 15, 2004) [hereinafter MTCR].

3. *See* Dennis M. Gormley, *The Neglected Dimension: Controlling Cruise Missile Proliferation*, 9 NONPROLIFERATION REV. 21, 22 (2002) [hereinafter Gormley, *Neglected Dimension*].

This article argues that although the cruise missile threat has not yet matured, the United States needs to adopt a hedging strategy to deal with the looming problem. The United States cannot afford to stick its proverbial head in the sand and wish the cruise missile threat away. Reinvigorating the MTCR and remedying its gaping deficiencies, so that the regime's provisions are effective at stopping the proliferation of both ballistic and cruise missiles, should be the United States' main priority. However, the United States should hedge its bets and accelerate plans to build a reliable theater anti-cruise missile defense system so that, should nonproliferation efforts fail, U.S. forces and allies will not be defenseless against cruise missile strikes.

Part II of this article discusses the military utility of cruise missiles and how they can be used to create parity between less-advanced states and those with modern militaries. The first section gives a brief historical background on cruise missile development. The second section discusses the military doctrine and motivations for obtaining cruise missiles. The pathways by which a state can obtain a cruise missile strike capability are addressed in the third section, while the final section of Part II provides an assessment of the current cruise missile threat.

Part III shifts the focus of the article to the MTCR, its regulations on cruise missiles and related technologies, and other international efforts to curb missile proliferation. The first section of Part III provides a historical account of the MTCR's creation and development. The MTCR's focus on ballistic missiles is discussed in the second section. Other missile nonproliferation mechanisms and their impact on cruise missile proliferation are examined in the final section of Part III.

The article then addresses the cruise missile proliferation threat in Part IV. The first section of this part explores the time frame and detectability of cruise missile proliferation. The second section discusses the technological chokepoints involved in indigenous cruise missile development. The third section of Part IV is a brief case study of Britain and France's sale of Black Shaheen cruise missiles to the United Arab Emirates (UAE), illustrating the dangers of selling complete cruise missile systems to non-MTCR members.

Part V sets forth policy prescriptions for the United States in dealing with cruise missile proliferation and addresses the need for redefining certain provisions of the MTCR, specifically its range and payload limits. Part V further explores other nonproliferation efforts outside the structure of the MTCR.

II. THE CRUISE MISSILE THREAT

Land-attack cruise missiles (LACMs) represent one of the most significant conventional weapons threats facing the world today. This article addresses how the United States should deal with the proliferation of land-attack cruise missiles and the technology needed to build them.[4] The threat is magnified by the capability of cruise missiles to deliver chemical, biological, and nuclear weapons. This section examines the historical background of the cruise missile threat, the tactical and strategic motives for obtaining cruise missile attack capability, the pathways by which a state can acquire cruise missiles, as well as a current assessment of the cruise missile threat.

A. Cruise Missiles: An Overview

1. What is a Cruise Missile?

Cruise missiles are expendable, unmanned aircraft that sustain flight through the use of aerodynamic lift,[5] have flight controls, are powered by one or more engines, and deliver a warhead or other payload to the intended target.[6] Cruise missiles are powered by engines until they reach their designated target, unlike ballistic missiles, which are powered by engines only during the initial boost phase before entering an unpowered parabolic flight path.[7] Most cruise missiles are guided by internal computer guidance systems, though remote control devices are used to guide some short-range cruise missiles.[8]

2. Historical Background

Following the Second World War, the United States and the Soviet Union focused their development efforts on ballistic missiles as a means of delivering weapons of mass destruction, devoting fewer resources to cruise missile development.[9] This was the result

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4. This article examines how the United States should seek to curtail the proliferation of LACMs. It does not specifically address the proliferation of anti-ship cruise missiles.

5. Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Elimination of Their Intermediate-Range and Shorter-Range Missiles, Dec. 8, 1987, U.S.-U.S.S.R., art. II, 1657 U.N.T.S. 2, *available at* http://www.state.gov/www/global/arms/ treaties/inf2.html (last visited July 15, 2004). The Intermediate Range Nuclear Forces (INF) Treaty defines a cruise missile as "unmanned, self-propelled vehicle that sustains flight through the use of aerodynamic lift over most of its flight." *Id.*

6. W. SETH CARUS, CRUISE MISSILE PROLIFERATION IN THE 1990S 7 (Center for Strategic and International Studies, The Washington Papers No. 159, 1992).

7. *Id.* at 8.

8. *See id.* at 7-8, 110.

9. Richard K. Betts, *Innovation, Assessment, and Decision, in* Cruise Missiles: Technology,

of major difficulties with the development of accurate guidance systems for second-generation cruise missiles, leading to diminished institutional enthusiasm for cruise missiles.[10] For instance, the U.S. Snark cruise missile program was an absolute fiasco, with the missiles missing their targets by an average of over 1500 km.[11] During the 1970s, the United States, the Soviet Union, and their allies overcame the technological hurdles and developed reasonably accurate cruise missile guidance systems[12] that could hit targets the size of warships.[13] This technological breakthrough led to the development of primitive, high-flying (and thus easily intercepted) anti-ship cruise missiles (ASCMs), which were widely sold around the globe in the following decades.[14] The success with ASCM guidance systems led to the development of longer-ranged ground attack cruise missiles such as the U.S. Tomahawk.[15] Both the United States and the Soviet Union continued their cruise missile programs and developed longer-range strategic versions that could travel intercontinental distances.[16] Presently, only the United States and Russia deploy cruise missiles with intercontinental range.[17] In recent years, the United States has used Tomahawk LACMs to attack difficult to reach targets in Iraq, Afghanistan, and Sudan.[18] Cruise missiles have become a key tool of U.S. diplomacy and foreign policy because there is no risk of losing pilots or aircraft in LACM strikes.

3. *Cruise Missile Varieties*

Cruise missiles can take a great variety of different forms, but come in three major types: (1) short-range ASCMs; (2) tactical land-attack cruise missiles; and (3) strategic cruise missiles.[19] This article concentrates primarily on the middle variety, LACMs, but

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Strategy, Politics, 1, 3 (1981).

10. *Id.* at 3.
11. *Id.*
12. *Id.* at 4-5.
13. CARUS, *supra* note 6, at 7.
14. *Id.* at 2-3.
15. Tara Kartha, *The Rationale of Cruise Missiles I*, 22 STRATEGIC ANALYSIS 799 (1998) [hereinafter Kartha, *Rationale I*], *available at* http://www.idsa-india.org/an-aug8-9.html (last visited Feb. 22, 2002).
16. *Id.*
17. CARUS, *supra* note 6, at 13.
18. Kartha, *Rationale I*, *supra* note 15.
19. *Id.* This article classifies cruise missiles according to the types of targets they are intended to attack. Cruise missiles can alternately be classified by method of launch. Classified in that manner, there are three categories: Air-launched cruise missiles (ALCMs), sea-launched cruise missiles (SLCMs), and ground-launched cruise missiles (GLCMs). Dennis M. Gormley, *Hedging Against the Cruise Missile Threat*, 40 SURVIVAL 92, 96 (1998) [hereinafter Gormley, *Hedging*], *available at* http://www.ceip.org (last visited Feb. 24, 2002).

also considers the implications of converting ASCMs into LACMs.[20] First, ASCMs, designed to attack warships, have a relatively short range (usually less than 150 km) and are primarily deployed in coastal defense batteries or launched from strike aircraft, ships, or submarines.[21] As most ASCMs are not covered under the MTCR because of their relatively short ranges, there are few restrictions on their sale, and thus, they have become an export staple for the defense industries of the United States, Italy, France, and Russia, among others.[22] More than 70 countries around the world deploy at least 75,000 ASCMs, although many of them are older, obsolescent designs such as the Soviet SS-C-2 Styx and the Chinese HY-1 and -2 Silkworm variants.[23] However, significant numbers of more capable designs such as the U.S. Harpoon and French Exocet have been sold to Third World states.[24]

LACMs are cruise missiles designed to penetrate air defenses and deliver their payloads to land targets that are too difficult or dangerous to attack with manned aircraft. The ranges of LACMs are variable, although not intercontinental; LACMs can be launched from strike aircraft, submarines, surface vessels, or mobile launchers and can be armed with various types of warheads, including weapons of mass destruction.[25] The performance of U.S. Tomahawk LACMs against Iraq in the 1991 and 2003 wars sparked increased interest in cruise missiles, making them one of the most sought after modern weapons systems because of their long-range attack capability and accuracy.[26] Although there have only been isolated incidents of the proliferation of complete LACM systems,[27] numerous states across the globe, ranging from India to the UAE, have sought to acquire such missiles.[28] Dual-use technologies that

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20. Kartha, *Rationale I*, *supra* note 15. There is really no difference between LACMs and strategic cruise missiles except the range of the missiles and their warheads. *Id.* Strategic cruise missiles are armed with nuclear warheads, while LACMs usually have conventional high explosive warheads. *Id.* This article addresses LACMs because they are the most immediate proliferation threat to the United States' interests.

21. Gormley, *Hedging*, *supra* note 19, at 95.

22. *See* Kartha, *Rationale I*, *supra* note 15.

23. *See* CARUS, *supra* note 6, at 34; GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 30; Gormley, *Hedging*, *supra* note 19, at 97-98.

24. Gormley, *Hedging*, *supra* note 19, at 96; Kartha, *Rationale I*, *supra* note 15; *see also* Richard H. Speier, The Missile Technology Control Regime: Case Study of a Multilateral Negotiation 7 (Nov. 1995) (unpublished manuscript, on file with The Florida State University Journal of Transnational Law & Policy) [hereinafter Speier Manuscript].

25. *See* Tara Kartha, *The Rationale of Cruise Missiles II*, 22 STRATEGIC ANALYSIS 841 (Sept. 1998), *available at* http://www.idsa-india.org/an-sep8-3.htm.html (last visited Feb. 22, 2002).

26. CARUS, *supra* note 6, at 1-2.

27. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 17-24. The sale of the Black Shaheen version of the French Apache LACM to the UAE is the most prominent example. *Id.* at 40. It will be discussed in Part V(C) of this article.

28. *Id.* at 25-28, 40.

could be used for indigenous LACM development have also proliferated.[29]

B. *Motives for Proliferation and the Indirect Approach*

Although the world remembers the damage done to Britain by German V-1 cruise missiles in the closing months of the Second World War,[30] cruise missiles largely languished in an anti-ship role as the forgotten sibling of ballistic missiles until the 1990s.[31] But in the last decade or so, cruise missiles have risen to new prominence as a tactically significant weapon for various reasons, including the increased diffusion of dual-use technology, the success of the MTCR in retarding the spread of ballistic missiles, as well as technological developments in anti-ballistic missile defenses.[32]

Military doctrine has also shifted to reflect the constantly changing world in the form of the revolution in military affairs (RMA), a conceptualization of modern military strategy and tactics that emphasizes a more flexible approach to dealing with potential threats through the employment of advanced technologies.[33] As discussed in this article, the spread of advanced technologies has made it possible for states in the developing world to field weapons that can challenge the most technologically advanced military powers. Cruise missiles are one of those weapons systems whose

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29. Gormley, *Hedging*, *supra* note 19, at 96.

30. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 9-10. Although the V-1s were essentially terror weapons because of their crude guidance systems, they, along with the V-2 (a first-generation ballistic missile), caused over 18,000 fatalities in Britain despite the fact that nearly seventy-five percent of the V-1s were shot down before reaching their targets. Gormley, *Hedging*, *supra* note 19, at 93. The V-1 attacks forced Britain to devote considerable resources to detecting and intercepting the missiles, diverting significant resources from the final drive into Germany. *See* Kartha, *Rationale I*, *supra* note 15. General Dwight D. Eisenhower claimed that had Germany perfected the V-1 and -2 six months earlier, D-Day and the invasion of Europe might have been impossible. *Id.*

31. Kartha, *Rationale I*, *supra* note 15.

32. *See generally* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 43-58.

33. Theodor W. Galdi, *Revolution in Military Affairs?: Competing Concepts, Organizational Responses, Outstanding Issues* (Cong. Res. Serv. 95-1170, 1995), *available at* http://www.fas.org/man/crs/95-1170.htm (last visited May 6, 2002). The concept of the revolution in military affairs (RMA) is derived from an earlier concept — military technical revolution — used by Soviet military theorists in the 1970s. RMAs take place when a military incorporates new technology, organization, and doctrine to the extent that it forever alters the tactical and strategic environment for the future. Any other actors that wish to challenge the transformational state must match or counter the new technology, organization, or doctrine in order to compete on the same level. Admiral William Owens, former Vice-Chairman of the Joint Chiefs of Staff, has identified three areas where the most recent RMA has taken place: (1) intelligence, surveillance, and reconnaissance; (2) command, control, communications, and intelligence processing; and (3) precision force. LACMs fall into the latter category of precision force because they are tools for countering the qualitative superiority of advanced militaries. LACMs can be used to cripple the technology and infrastructure needed to maintain a modern military's edge in intelligence gathering and command and control. *Id.*

value has dramatically changed through the RMA, from a narrow anti-ship use to much wider, more flexible roles. Lawrence Freedman argues that "[c]ruise missiles . . . are to some extent the paradigmatic weapon of the RMA, as delivery systems that can be launched from a variety of platforms and strike in a precise manner."[34] Cruise missiles are considered "transformational weapons" that can balance out the technological inferiority of Third World militaries in comparison to the more advanced armed forces of nations such as the United States.[35] Cruise missiles do not remedy the technological imbalance between Third and First World militaries, but rather provide less advanced countries with the capability to attack the most vulnerable parts of the complex logistical structures needed to support the weapons platforms of more advanced countries. The spread of cruise missiles with the capability to attack weak points in supply lines or vulnerable bases threatens to nullify the technological advantages of the United States in certain theaters, such as the Middle East or Korean Peninsula.[36] Andrew Krepinevich, Director of the Center for Strategic and Budgetary Assessments, has expressed that Third-World states could easily deny access to airfields needed to base short-range strike aircraft near potential battlefields by merely threatening possible cruise missile attacks.[37] There are also worries that the large static port facilities needed to unload heavy equipment, such as artillery pieces or tanks, and other supplies would be ripe targets for an adversary armed with cruise missiles.[38]

Noted twentieth century military historian Basil Liddell Hart has championed the concept of the "indirect approach," which can be summed up as attacking an adversary where it least expects an attack (and hence is the weakest) with the greatest amount of force that can be brought to bear.[39] In his seminal work, *Strategy*, Liddell Hart described the importance of the "indirect approach" by which an attacker is never justified in launching "a direct attack upon an

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34. LAWRENCE FREEDMAN, THE REVOLUTION IN MILITARY AFFAIRS 70 (The International Institute for Strategic Studies, Adelphi Paper No. 318, 1998).

35. *See id.;* Greg Jaffe, *New and Improved?*, WALL ST. J., Mar. 28, 2002, at R5. Cruise missile proliferation entails the spread of certain key technologies needed to develop and deploy such missiles; however, the spread of LACM-related technology does not change the large-scale technological inequalities between Third-World states and modern militaries. For instance, the technologies needed to deploy cruise missiles have nothing to do with the superior command, control, communications, and intelligence capabilities that advanced military powers, such as the United States, use to coordinate their forces.

36. Jaffe, *supra* note 35.

37. *Id.*

38. *Id.*

39. *See* B.H. LIDDELL HART, STRATEGY 23-26 (2d rev. ed., Frederick A. Praeger, 1967) (1954).

enemy firmly in position. . . . [I]nstead of seeking to upset the enemy's equilibrium by one's attack, it must be upset before a real attack is, or can be successfully launched."[40] Implicit in Liddell Hart's conceptualization of the indirect approach is consideration of an adversary's strengths and turning them against him through strategic surprise and flexibility.[41] Cruise missiles are weapons ideally suited to take advantage of the "indirect approach," as LACMs are particularly effective at striking logistical infrastructure, such as ports, supply dumps, and airfields,[42] upsetting an adversary's equilibrium before a more conventional direct attack is launched. Even the threat of a cruise missile attack against such high-value, vulnerable targets can be enough to disrupt a modern military force.[43]

Furthermore, LACMs can exploit weaknesses in modern air defenses to cause serious damage to other military targets and civilian infrastructure. Most modern air defenses and radars were originally designed to combat fast-moving strike aircraft flying at high altitude or missiles on a ballistic flight path, not low-flying cruise missiles.[44] Thus, it will be difficult to counter the cruise missile threat because extant defense systems were not originally designed for that purpose. Most advanced look-down radars for modern air defense systems have software that eliminates slow-moving targets near the ground to prevent their data systems from being overtaxed.[45] If LACMs were programmed to fly earth-hugging courses at speeds of approximately 150 km/hour, most modern air-defense radars would not detect the missiles, as their radar

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40. *Id.* at 164.

41. *Id.* Liddell Hart's theory of the "indirect approach" is based on careful analysis of the weaknesses of an opponent's position and calculated attacks to catch the adversary off balance:

> [T]hroughout the ages, effective results in war have rarely been attained unless the approach has had such indirectness as to ensure the opponent's unreadiness to meet it. The indirectness has usually been physical, and always psychological. . . . More and more clearly has the lesson emerged that a direct approach to one's mental object, or physical objective, along the 'line of natural expectation' for the opponent, tends to produce negative results. . . . In war, as in wrestling, the attempt to throw the opponent without loosening his foothold and upsetting his balance results in self-exhaustion, increasing in disproportionate ratio to the effective strain put upon him. . . . In most campaigns the dislocation of the enemy's psychological and physical balance has been the vital prelude to a successful attempt at his overthrow. This dislocation has been produced by a strategic indirect approach, intentional or fortuitous.

Id. at 25-26.

42. *See* Jaffe, *supra* note 35.

43. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 49-50.

44. *Id.* at 11.

45. *Id.*

signatures would be eliminated as ground clutter.[46] Even if air defense radars could detect cruise missiles, there would be a much smaller window of opportunity to intercept because, due to the earth's curvature, the missiles would only be detected at very close range (e.g. 35 km or less).[47] Additionally, even if effective anti-cruise missile detection systems are developed, cruise missiles are sufficiently cheap that successive saturation attacks could be used to overwhelm air defenses by depleting the missile inventories of surface-to-air missile batteries.[48] Thus, a Third-World state could potentially surprise or overwhelm modern air defenses with a large or successive cruise missile attack against a port, airfield, or staging area.[49]

Liddell Hart argues that the most important aspect of the "indirect approach" is destroying an adversary's capabilities before an effective defense can be mounted.[50] A potential Third-World opponent could do exactly that with LACM attacks against U.S. bases or logistical facilities during a military build-up or deployment. Missile defenses will likely not be in place immediately to defend U.S. forces and require time and effort to set up and deploy.[51] For instance, more than 16 C-5 transport aircraft sorties are required to move a single Patriot SAM battalion into a theater of operations.[52] Cruise missile attacks against vulnerable targets with limited air defenses early in a campaign could be so catastrophic as to cause the United States to end its involvement or withdraw to safer, albeit less convenient, bases.[53]

Cruise missiles represent a way for Third World states to offset the technological superiority of the United States and exploit the weaknesses of extant U.S. systems. The U.S. focus on building theater anti-ballistic missile systems such as the Theater High

46. *Id. See generally* STILLION & ORLETSKY, *supra* note 1. Modifications to the software for air defense systems can be made to allow for detection of low-flying objects. However, if the cruise missiles have stealth technology or are built with radar-absorbing materials it will be extremely difficult for them to be detected by extant radar systems.

47. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 10; DAVID ISENBERG, CENTER FOR DEFENSE INFORMATION TERRORISM PROJECT, THE REAL MISSILE THREAT: CRUISE NOT BALLISTIC (July 8, 2002), *at* http://www.cdi.org (last visited Aug. 11, 2003).

48. Owen Greene, *Missile Proliferation and Control, in* PROLIFERATION AND EXPORT CONTROLS: AN ANALYSIS OF SENSITIVE TECHNOLOGIES AND COUNTRIES OF CONCERN 55, 71 (1995). The cost of a Patriot SAM is approximately $5 million, while crude LACMs based on kit aircraft or UAVs can likely be built for less than $100,000. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 36, 107 n.22. The cost differential is clear, and the likelihood of saturation attacks with crude LACMs is obvious.

49. *See* Jaffe, *supra* note 35.

50. *See* LIDDELL HART, *supra* note 39, at 23-26.

51. *See* Jaffe, *supra* note 35.

52. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 47.

53. *Id.* at 49-50.

Altitude Area Defense (THAAD) program will only push nations such as North Korea and Iran, which have long sought to acquire long-range means to threaten U.S. interests, to look for an alternative to ballistic missiles. As the effectiveness of U.S. anti-ballistic missile defenses increases, potential foes are likely to turn to LACMs as an alternative.[54] In the 2003 war in Iraq, the effectiveness of U.S. Patriot SAMs at shooting down approximately fifty percent of Iraqi Scud ballistic missiles launched at U.S. forces should be contrasted with the failure of U.S. missile defenses to intercept any of the antiquated Iraqi Seersucker cruise missiles fired at U.S. forces.[55] David Tanks, an analyst with the Institute for Foreign Policy Analysis, notes that "[i]f we start fielding ballistic missile defense, other countries will start developing more cruise missiles. It is cheap and relatively easy."[56] The logical choice for such nations is to start a cruise missile program, which is increasingly technologically feasible, or to try to obtain LACMs from another source. As cruise missiles are more accurate than first-generation ballistic missiles like the Scud, less technologically complex, and less expensive to develop, they are the most attractive choice for a state seeking long-range strike capability as the technology required for indigenous LACM development becomes easier to obtain.[57]

Cruise missiles are also a cheaper and more survivable alternative to a modern air force, while providing a Third World state with a similar strike capability.[58] Compared with the enormous costs associated with building and maintaining a modern air force, missiles, particularly LACMs, are far more cost-effective in the long run. Cruise missile costs are variable, ranging from approximately $1 million for indigenously produced missiles to as low as $50,000 for modified kit aircraft converted into LACMs.[59] Although cruise missiles are expensive and difficult to develop or

54. Dennis M. Gormley, *New Developments in Unmanned Air Vehicles and Land-Attack Cruise Missiles*, *in* SIPRI YEARBOOK 2003: ARMAMENTS, DISARMAMENT AND INTERNATIONAL SECURITY 409, 411 (2003) [hereinafter Gormley, *New Developments*].

55. DENNIS M. GORMLEY, CENTER FOR NONPROLIFERATION STUDIES, NORTH KOREAN CRUISE MISSILE TESTS AND IRAQI CRUISE MISSILE ATTACKS RAISE TROUBLING QUESTIONS FOR MISSILE DEFENSES [hereinafter GORMLEY, NORTH KOREAN], *at* http://cns.miis.edu (Apr. 8, 2003).

56. Rick Newman, *Cruise Missiles, The Cheap, Easy Alternative*, 21 DEF. WK. 12 (Mar. 20, 2000).

57. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 9; *cf.* Savita Pande, *Missile Technology Control Regime: Impact Assessment*, 23 STRATEGIC ANALYSIS 923 (1999), *available at* http://www.ciaonet.org (last visited Feb. 22, 2002).

58. It should be noted that cruise missiles cannot completely replace a modern air force because they are incapable of some tasks. For instance, they cannot protect transport aircraft (or for that matter carry large payloads) or engage in aircraft-to-aircraft combat to gain air superiority.

59. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 72.

acquire, the costs decline once the missiles are deployed; whereas, maintaining the infrastructure to keep a modern air force effective is massively expensive. Furthermore, mobile missile launchers are also more difficult to track down and destroy, as opposed to fixed airfields, which are vulnerable to attack and require sophisticated (and expensive) defenses to protect them.[60] Iraq learned this lesson during Operation Desert Storm in 1991 as its air force was crippled on the ground; whereas, Iraqi mobile Scud ballistic missiles were far more effective at distracting U.S. air assets and causing terror in Israel and Saudi Arabia.[61]

All in all, it is logical for a state to seek a cruise missile capability considering the increasing hurdles and costs in acquiring and developing ballistic missiles imposed by the MTCR and the increased effectiveness of ballistic missile defenses. Cruise missiles provide a relatively inexpensive and effective way for a state to acquire a long-distance strike capability that most modern air defenses are ill- equipped to deal with. LACMs are ideally suited to exploit the weaknesses of modern militaries, the key to Liddell Hart's "indirect approach," because they can deny access to forward airfields and throw logistics into disarray. When properly integrated into existing force structures, cruise missiles can be transformational weapons that change the military balance in a conflict.

C. *Pathways to Proliferation*

Although LACMs have become among the most desired modern weapons because of their utility in exploiting the weaknesses of modern air defenses, it is still no easy task for a Third World state to obtain or develop a reliable cruise missile force. There are three major paths by which a state can take to develop a LACM capability: (1) Converting ASCMs from an anti-ship role to a land-attack role; (2) indigenous development; and (3) acquiring complete systems from states that produce LACMs.[62] None of these paths are easy, as there are significant diplomatic, financial, and

60. Speier Manuscript, *supra* note 24, at 8-9.

61. PBS FRONTLINE, THE GULF WAR: AN IN-DEPTH EXAMINATION OF THE PERSIAN GULF CRISIS (citing THOMAS A. KEANEY & ELIOT A. COHEN, GULF WAR AIR POWER SURVEY SUMMARY REPORT (Bernan Assoc. ed., 1993)), *at* http://www.pbs.org (last updated July 2002) (web site first published with the original broadcast of "The Gulf War," on January 9, 1996).

62. *The Role of Bilateral and Multilateral Arms Control Agreements in Controlling Threats from the Proliferation of Weapons of Mass Destruction: Hearings before the International Security, Proliferation and Federal Services Subcommittee of the Committee on Governmental Affairs*, 107th Cong. 322-30 (2001-2002) (statement of Dennis M. Gormley, Senior Fellow, International Institute for Strategic Studies) [hereinafter Gormley Senate Testimony], *available at* 2002 WL 25098851 (last visited July 26, 2004).

technological hurdles to each. However, in a rapidly changing world where commercial interests have taken precedence over nonproliferation concerns and the diffusion of advanced technology to Third World states is increasingly common, it has become much easier for a state to acquire a cruise missile capability.[63] The MTCR's myopic focus on ballistic missile proliferation has compounded this trend.

First, there has been much diplomatic hand wringing over the prospect of states converting extant ASCMs into LACMs; however, this threat, although quite possible, has been somewhat overstated. Although the United States has converted extant ASCMs into LACMs by replacing guidance systems, warheads, and propulsion units, most Third World states do not yet have the technological capability to do so.[64] Modern U.S. and Russian ASCMs such as the Harpoon and the 3M-55 Club, which have been sold to various states around the world, are smaller in physical volume than earlier ASCMs and are densely packed with electronics and subsystems, making it difficult to change engines, add fuel to increase range, or modify the guidance systems.[65] Furthermore, any tinkering with the innards of modern ASCMs risks throwing off the trim of the missile, making it wildly inaccurate.[66] Further problems with converting ASCMs into LACMs are finding appropriate propulsion and guidance systems with which to retrofit the missiles — although these hurdles have become less significant in recent years with the diffusion of cheap GPS receivers, microprocessors, and small turbojet engines.[67] The timeframe for modifying ASCMs for use as LACMs is fairly short. Dennis Gormley, a senior consultant at the Center for Nonproliferation Studies, estimates that even with foreign assistance, it would take a state with a moderate-sized industrial and technological base, such as Iran, "between six and ten years to produce the kind of modifications . . . and to establish

63. *See* Ian Anthony, *The Conventional Arms Trade, in* CASCADE OF ARMS 15, 15-17 (Andrew J. Pierre ed., 1997).

64. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 29-30; Gormley, *Hedging*, *supra* note 19, at 96-98. The United States has converted the Harpoon ASCM into the SLAM LACM. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 29-30. Although technically a conversion of the Harpoon, the SLAM is more of a redesign, as no existing Harpoons were rebuilt into SLAMs. The two missile systems share only a common airframe and propulsion unit. *Id.*

65. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 30.

66. Telephone Interview with Timothy McCarthy, Director, Monitoring Proliferation Threats Project, Center for Nonproliferation Studies, Monterey Institute for International Studies (Feb. 22, 2002) (interview notes on file with author) [hereinafter McCarthy Interview].

67. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 31-32; Gormley, *Hedging*, *supra* note 19, at 95, 97-98.

the capacity to manufacture significant quantities of missiles."[68] Furthermore, the costs of such a conversion program for modern ASCMs are not significant. The components needed to construct a moderately accurate LACM guidance system that could be mated to an extant missile cost in the neighborhood of $40,000 in 2001 and were readily procurable from commercial sources.[69]

Some of the older ASCMs such as the Chinese HY-1 and -2 Silkworm variants and Russian Styx are much larger than their more modern cousins, allowing for greater potential to change significant subcomponents within the missile.[70] Such ASCMs are inherently easier to modify because of their sheer size, large internal volume, and simplicity of design.[71] Replacing bulky older guidance systems and propulsion units with smaller, more modern subsystems also frees up considerable space in the missile that can be used to carry fuel to extend its range or carry a larger warhead.[72] There are reports that Iran and North Korea have already been able to extend the ranges of their Silkworms to as much as 500 km through such modifications.[73] In fact, David Kay, the head of the U.S. weapons hunting teams in Iraq following the 2003 Operation Iraqi Freedom, reported that Iraq also had launched a secret crash program to extend the range of old Soviet-era SA-2 SAMs and to convert Silkworm ASCMs into LACMs."[74]

In fact, during the 2003 war in Iraq, at least five Chinese-made HY-2 ASCMs were fired at ground targets in Kuwait, one of which landed perilously close to an American military encampment and another near a Kuwaiti shopping mall.[75] Although it is not clear if these Iraqi cruise missiles were modified to attack land targets (and it seems unlikely that they were so modified considering their inaccuracy), the potential certainly exists.[76] Even more disturbing is that U.S. Patriot SAMs were not nearly as successful in detecting

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68. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 32-33. Gormley suggests that the six to ten year estimated timeframe includes the time required to attain a modest level of system reliability and logistical support, as well as integrating the modified LACMs into an existing force structure. *Id.*

69. *Id.* at 31-32.

70. *Id.* at 30.

71. *Id.*

72. *Id.* at 27; Gormley, *Hedging*, *supra* note 19, at 97.

73. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 30; Newman, *supra* note 56.

74. Bob Drogin, *Botched Iraqi Arms Deal Is Detailed*, L.A. TIMES, Oct. 4, 2003, at A1; *see also* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 30-31; Newman, *supra* note 56.

75. GORMLEY, NORTH KOREAN, *supra* note 55; *see also* Peter Baker & Susan B. Glasser, *Iraq Fires Missiles Toward Kuwait*, WASH. POST, Mar. 21, 2003, at A21.

76. GORMLEY, NORTH KOREAN, *supra* note 55.

and intercepting the obsolescent Iraqi Silkworms as the Iraqi Scuds that were fired during the course of the conflict.[77]

Another area of growing concern is the conversion of unmanned aerial vehicles (UAVs) or RPVs into LACMs. Conversion of UAVs or RPVs into cruise missiles is technologically easier than converting ASCMs.[78] Many off-the-shelf UAVs are already equipped with GPS guidance systems and can carry small payloads long distances.[79] Indeed, at least 40 different countries manufacture 600 varieties of UAVs, the vast majority of which could be modified to deliver a warhead on a one-way trip over 300 km.[80] The ease of converting UAVs or RPVs into cruise missiles is apparent, as there are relatively few modifications needed other than attaching a warhead to the airframe.[81] It should also be noted that UAVs and RPVs are ideally suited for the delivery of chemical or biological weapons because they fly at relatively low speeds and usually have greater aerodynamic flight stability than other LACMs[82] because most UAVs have wings rather than winglets or fins like other LACMs. This flight stability allows for the more effective use of sprayers for disseminating chemical or biological agents from UAVs or RPVs.[83] UAVs and RPVs are quite vulnerable to anti-aircraft defenses compared to other LACMs, however, because they fly at relatively slow speeds and are easy targets for anti-aircraft guns, SAMs, and air-to-air missiles.[84] However, because of their small size and low speeds, UAVs and RPVs may be able to escape radar detection until they are quite close to their targets.[85]

The conversion of small, manned kit aircraft into weapons-carrying LACMs is another worry, particularly with the availability of relatively inexpensive and accurate guidance systems.[86] One expert has called such kit aircraft "the poor man's cruise missile" because of their low cost (approximately $50,000) and general availability.[87] Most such kit aircraft have a range over 500 km and can carry a payload of 250 kg.[88] Nearly 100,000 copies of 425

77. *Id.*
78. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 33.
79. *Id.* at 33-34.
80. *See* Dennis M. Gormley & Richard Speier, *Controlling Unmanned Air Vehicles: New Challenges*, 10 NONPROLIFERATION REV. 66, 67 (2003) [hereinafter Gormley & Speier].
81. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 33-36.
82. *Id.* at 34.
83. Gormley, *Hedging*, *supra* note 19, at 96.
84. *See id.* at 102.
85. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 35; Gormley & Speier, *supra* note 80, at 68.
86. Gormley Senate Testimony, *supra* note 62, at 324.
87. *Id.*
88. *Id.*

different varieties of kit aircraft have been produced worldwide – truly mind-boggling numbers in terms of attempting to prevent the proliferation of possible weapons systems.[89] Like UAVs and RPVs, converted kit aircraft, if programmed to fly low and slow, could evade modern air defense radars as they could be lost in the ground clutter;[90] however, such aircraft are vulnerable to anti-aircraft defenses once detected. Because of their low cost and ease of construction and operation, the conversion of kit aircraft for use as UAVs to deliver chemical or biological weapons or to attack high-value targets is the most likely avenue for terrorist groups seeking to develop and use cruise missiles.[91]

Second, a state could indigenously develop LACMs with official or unofficial foreign assistance. But even with foreign assistance and the increasing diffusion of technology, indigenous development is still the most time-consuming method for developing a cruise missile capability.[92] There are significant technological roadblocks that any Third World state seeking to obtain an indigenous cruise missile manufacturing capability must overcome. Even if a Third World state is able to develop a cruise missile on its own, it is unlikely that the state would progress "to true autarky or anything beyond low-tech designs."[93]

However, all this is changing. Third World states interested in developing cruise missiles have taken advantage of post-Cold War cuts in defense spending by purchasing technology and equipment that was previously unavailable to them, as many nations with extant cruise missile production capability are looking to export markets to offset sagging domestic demand.[94] A state could

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89. Gormley, *Neglected Dimension*, *supra* note 3, at 23.

90. Gormley Senate Testimony, *supra* note 62, at 324. The 1987 flight of German teenager Mathias Rust from Hamburg to Moscow in a small Cessna proves the ineffectiveness of modern air defenses at detecting such small aircraft. The plane was not picked up by the Soviets' layered air defense system until it landed in Red Square. Small, remotely piloted kit aircraft would have approximately the same radar signature as a Cessna and would possibly go undetected by air defense radars. The crash of another Cessna into the White House in 1994 further illustrates the potential of small aircraft to attack high value targets. *Id.* at 4.

91. *Cruise Missile and UAV Threats to the United States: Hearing before the International Security, Proliferation and Federal Services Subcommittee of the Committee on Governmental Affairs*, 107th Cong. 23-27 (2002) (statement of Vann H. Van Diepen, Acting Deputy Assistant Secretary, Bureau of Nonproliferation, U.S. Department of State), *available at* http://www.state.gov (last visited Aug. 11, 2003).

92. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 12.

93. *Id.*

94. *See* Aaron Karp, *The Maturation of Ballistic Missile Proliferation*, *in* THE INTERNATIONAL MISSILE BAZAAR: THE NEW SUPPLIERS' NETWORK 1, 10-12 (William C. Potter & Harlan W. Jencks eds., 1994); David Hobbs, *The Impact of Technology Control Regimes*, *in* ARMS AND TECHNOLOGY TRANSFERS: SECURITY AND ECONOMIC CONSIDERATIONS AMONG IMPORTING AND EXPORTING STATES 225, 225-31 (Sverre Lodgaard & Robert L. Pfaltzgraff, Jr. eds., 1995) (discussing Malaysia's acquisition of MiG-29 fighters, parts, and missiles from

purchase advanced engines, avionics, and other subsystems useful for building LACMs under the guise of upgrading existing systems or developing a manned-aircraft industry.[95] Furthermore, the increased dissemination of high-speed computer chips and miniaturized components has made the pathway to indigenous cruise missile development significantly easier for Third World states.[96] Only within the last decade has the technology needed to develop LACMs become available on the international marketplace.[97] Yet, despite increased access to technology, foreign assistance is crucial for indigenous development of LACMs.[98] Even nations with resources, such as India, have had to rely on Russian cruise missile expertise for their indigenous programs.[99] Because the airframes, propulsion units, and navigation systems used in cruise missiles are similar, and in some cases identical, to those used in manned aircraft, the spread of aircraft maintenance capability is another significant factor in a Third World nation's effort to indigenously produce cruise missiles.[100]

Third, the quickest and easiest option for obtaining a cruise missile capability is for a state to acquire complete systems from states that indigenously produce LACMs.[101] This pathway has become a more realistic option for obtaining a cruise missile capability within the recent years.[102] Until the mid- to late-1990s, the U.S. and Russia were the only major producers of LACMs, and they were both reluctant to sell advanced cruise missiles to other states.[103] However, the list of producers has increased with China, Israel, South Africa, and several European consortiums producing advanced cruise missiles available for sale on the international

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Russia and the impact of such sale on the air force modernization plans of surrounding countries).

95. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 86.

96. *Id.* at 17. Even relatively primitive computer technology, such as an Intel 486 processor chip with a 1Gb hard drive, could be used to power the guidance system of a modern cruise missile. *Id.*

97. Gormley, *Neglected Dimension*, *supra* note 3, at 24. Crucial technologies needed for LACM development such as GPS systems and integrated flight management systems have only become widely available over the past 10 years. *Id.*

98. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 24-26, 28.

99. *Id.* at 25. Russia is assisting India in the design and development of another LACM that is closely related to the Russian Kh-65. *See* GLOBAL SECURITY.ORG, INDIA MILITARY GUIDE: PJ-10 BRAHMOS FACTSHEET, *at* http://www.globalsecurity.org (last modified January 20, 2004). The Russo-Indian Brahmos missile represents the future of cruise missiles as it can be used in an anti-ship role, as well as against land targets. *Id.*

100. K. Scott McMahon, Cruise Missile Proliferation: Threats, Policy & Defenses, Presentation at American Institute of Engineers Conference on Missile Defense (Mar. 5, 1999), *at* http://www.veridian.com (last visited Feb. 24, 2002).

101. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 36.

102. *See id.*

103. *Id.*

arms market.[104] Furthermore, the dire fiscal straits of the Russian government and arms industry have resulted in increased efforts to market scaled-down (and supposedly MTCR compliant) versions of its strategic LACMs.[105] Russia has marketed a short-range version of the AS-15 LACM, which has a 3,000 km range, since the early 1990s.[106] Designated the Kh-65E, it has an advertised range of 280 km with a 410 kg warhead, thus making it technically MTCR compliant.[107] The sharp reduction in the size of the Russian military budget has left the Russian armaments industry with an overcapacity of cruise missile production capability and idle missile designers, which has led to more aggressive international efforts to market such weapons overseas.[108]

China represents another potential major source for states seeking to purchase a cruise missile capability outright. Benefiting from Russian technological assistance, China is developing at least three different LACMs, with ranges up to 2,500 km.[109] The Chinese are also believed to have received at least one intact U.S. Tomahawk LACM recovered following the 1998 cruise missile attacks on terrorist camps in Afghanistan.[110] There have been reports that China has been able to reverse engineer parts of the missile.[111]

The sale of Chinese cruise missiles to Third World states is not an insignificant threat considering China's previous willingness to sell complete ballistic missile systems to Saudi Arabia and Pakistan, despite pledges that it would adhere to MTCR guidelines.[112] In 2000, China pledged not to export nuclear-capable ballistic missiles or provide technological assistance to states seeking to develop such missiles.[113] The official Chinese statement adds that China will "take into account the relevant practices of other countries" in transferring other types of missiles.[114] The range

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104. *Id.*

105. *Id.* at 37-38.

106. *Id.* at 37.

107. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 37. It should be noted that it would be quite simple to convert the Kh-65E into a longer range LACM by reducing the payload or adopting a flight profile above sea level. *See id.*

108. McCarthy Interview, *supra* note 66.

109. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 38

110. *See* Clay Bowen, et al., *Nuclear- and Missile-Related Developments For Selected Countries, November 1998-February 1999*, 6 NONPROLIFERATION REV. 140, 140-41 (1999).

111. *See id.*

112. Hua Di, *China's Case: Ballistic Missile Proliferation, in* THE INTERNATIONAL MISSILE BAZAAR: THE NEW SUPPLIERS' NETWORK, *supra* note 94, at 163, 170.

113. J. Peter Scoblic, *China Issues Missile Export Pledge; US Says It Will Waive Sanctions*, ARMS CONTROL TODAY (Dec. 2000), *available at* http://www.armscontrol.org (last visited Feb. 20, 2002).

114. *Id.*

and payload guidelines specified in the statement generally mirror those of the MTCR.[115] It is unclear whether China considers this pledge to cover LACMs. Dennis Gormley warned:

> In becoming an 'adherent' to the MTCR's guidelines in October 1994, China took the unusual step of formulating its own version of precisely what adherence meant. China agreed to 'not export ground-to-ground missiles featuring the primary parameters of the MTCR' — which suggests that its adherence applies only to . . . Category I [ground-to-ground ballistic missiles, and] not [to] air-to-ground cruise missiles. Moreover, this formulation does not acknowledge adherence to the MTCR's extensive annex of Category II items. In effect, China has explicitly rejected all revisions to the original 1987 version of the MTCR, most importantly those made in 1993 to deal with controls over delivery systems for biological and chemical agents.[116]

There have been no reports of the sale of Chinese LACMs (although China has sold thousands of ASCMs that could be converted to LACMs); however, this is likely due to domestic demand from china's military and not any unwillingness to transfer technology.[117]

A more disturbing trend has been the willingness of the French and English governments to allow Matra-BAe-Dynamics, the European consortium behind the Apache cruise missile, to sell long-range versions to Third World states.[118] There have also been reports that the Spanish aerospace firm CASA is considering development of a cruise missile to compete with the Apache.[119] Also of concern are reports that Turkey is pursuing Israel's air-launched

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115. *Id.*; *see also* PHILLIP C. SAUNDERS, CENTER FOR NONPROLIFERATION STUDIES, PRELIMINARY ANALYSIS OF CHINESE MISSILE TECHNOLOGY EXPORT CONTROL LIST 2-14 (Sept. 6, 2002), *at* http://cns.miis.edu/cns/projects/eanp/pubs/prc_msl.pdf (last visited July 15, 2004) (examining and analyzing the differences between the MTCR's Annex and China's list of controlled technologies that it has pledged not to export).

116. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 82.

117. *See* Geoffrey T. Lum, *China's Cruise Missile Program*, MILITARY REV., Jan.-Feb. 2004, at 67, 71, *available at* http://www.leavenworth.army.mil/milrev/download/english/JanFeb2004/lum.pdf (last visited July 4, 2004). China is in the midst of a naval modernization program and a missile build-up along the Taiwan straits. *See id.* at 70, 72. It is likely that China will equip its own forces and ships before exporting LACMs to other countries. Thus, future Chinese LACM proliferation is a possibility.

118. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 38-40. The sale of the Black Shaheen variant of the Apache to the UAE is discussed at length in Part V.

119. Gormley, *Hedging*, *supra* note 19, at 99.

Popeye cruise missile with a range exceeding 300 km[120] and that South Africa has been vigorously marketing its Torgos LACM with an advertised range of 300 km with a 500 kg payload.[121]

Although the three different paths by which a Third World state could deploy LACMs are quite different, all of them are quite feasible, although two of them — indigenous development and converting ASCMs — require significant lead time and/or technological assistance.[122] However, nonproliferation efforts can retard the spread of cruise missiles or make their acquisition prohibitively costly for Third World states.

D. Cruise Missiles Today: A Threat Assessment

Although military experts have warned of the growing threat of cruise missiles in the past,[123] it is clear that the next decade will be crucial in determining whether the dire predictions will come to fruition. If no changes in the nonproliferation regime take place, it is likely that the cruise missile threat will become as serious as the ballistic missile threat to U.S. interests abroad and at home.[124] Just as the maturation of the ballistic missile threat in the late-1970s and early-1980s led to the creation of the MTCR, the cruise missile threat has reached such a threshold period where a theoretical threat is fast becoming a reality.

Production of LACMs is confined to a relatively few states at present; however, a 1999 National Air Intelligence Command (NAIC) report concluded that as many as ten states would be able to indigenously produce LACMs by 2009.[125] The report also suggested that several of those states would likely export missiles.[126] A NAIC spokesman commented that LACMs will "be like Scuds," and that "[i]n the old days just a few [states] had Scuds. Now everybody's got them."[127] It is likely that the world will see the

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120. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 40. Turkey is seeking to buy Popeye missiles to counter Greece's plans to purchase the British Storm Shadow variant of the Apache cruise missile. *Id.*

121. *Id.* at 26.

122. *See id.* at 28.

123. *See* Betts, *supra* note 9, at 6-7.

124. *See* Gormley, *Hedging*, *supra* note 19, at 92, 106-7. The MTCR has been effective at limiting the spread of advanced ballistic missiles; however, US forces are still threatened by older, more primitive ballistic missile designs, such as the Scud, which proliferated before the MTCR came into effect. *See* Newman, *supra* note 56.

125. *See* Mohammed Ahmedullah, *India Has Begun Cruise Missile Project, Official Says*, DEF. WK., Oct. 12, 1999. The states that the NAIC report concluded will have a LACM production capability in 2009 are: Sweden, Italy, Germany, South Africa, Israel, China, the United Kingdom, France, Russia, and the United States. *Id.*

126. Newman, *supra* note 56.

127. *Id.*

proliferation of LACMs and the emergence of a new missile threat if nothing is done.

The threat of cruise missile attack is most significant for the United States in the context of regional intervention. Although it is unlikely that any potential U.S. adversaries will develop intercontinental strategic cruise missiles anytime in the near future, U.S. forces will be vulnerable to cruise missile attacks when deployed in smaller theaters of operation, such as the Middle East or Taiwan.[128] National Intelligence Estimate 95-19, on missile proliferation, predicted that certain U.S. regional adversaries such as Iran and North Korea would be able to deploy short-range cruise missiles by 2005,[129] and that the cruise missile threat would increase over time from there as more and more states obtained cruise missiles.[130] Even short-range cruise missiles used in relatively small theaters of operation could pose serious threats to U.S. forces. The threat of a cruise missile attack could deter U.S. intervention and alter foreign policy objectives because of the increased risk of casualties. As the opening scenario to this article suggests, the RAND Corporation has simulated Iranian ballistic and cruise missile strikes against U.S. air bases in the Middle East.[131] The results of the simulated attack suggested that up to 90% of all exposed aircraft would be destroyed on the ground and that there would be a significant loss of American lives and destruction of equipment.[132]

Furthermore, the proliferation of cruise missiles, like other offensive weapons, leads to the increased probability of conflict in other parts of the globe, as well as potential fuel for arms races in volatile regions, such as South Asia and the Middle East. One example is the continuing arms race between Greece and Turkey,

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128. *See* Jaffe, *supra* note 35.

129. DIRECTOR OF CENTRAL INTELLIGENCE, NATIONAL INTELLIGENCE ESTIMATE: PRESIDENT'S SUMMARY: EMERGING MISSILE THREATS TO NORTH AMERICA DURING THE NEXT 15 YEARS (Nov. 1995), *available at* http://www.fas.org (last visited July 4, 2004) (reproduction of an originally classified document published in The Washington Times, May 14, 1996, at A15). In fact, North Korea tested two cruise missiles over the Sea of Japan in February 2003. GORMLEY, NORTH KOREAN, *supra* note 55, at 1. It is believed that they were modified versions of the Chinese HY-2 Seersucker. *Id.*

130. *See* McMahon, *supra* note 100, at 9.

131. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 48-50; STILLION & ORLETSKY, *supra* note 1, at 16-28.

132. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 49. Even during Desert Storm, the risk of an Iraqi Scud attack on U.S. airbases was underscored by a statement from Air Force Lt. General Chuck Horner on January 21, 1990: "Last night could have been the turning-point of the war. If [Saddam Hussein] had hit Riyadh air base and destroyed six AWACS or put chemicals on the F-15s at Dhahran, think of how the attitude and support of the American people might have changed." *Id.* at 49-50.

both members of the North Atlantic Treaty Organization.[133] Soon after Greece announced that it would buy Storm Shadow LACMs from the Matra-BAe-Dynamics consortium, Turkey went shopping for LACMs and decided to purchase Israeli Popeye cruise missiles.[134] These arms races may not pose a direct threat to U.S. forces; however, it is almost a certainty that U.S. interests will be in some way affected by future cruise missile proliferation.

Finally, in the post-September 11th world, terrorist use of cruise missiles remains a definite possibility. In fact, in July 2002, the Defense Department warned that terrorists may use cruise missiles to attack targets in the continental United States.[135] It is possible that terrorist organizations such as al-Qaeda could obtain cruise missiles from a state that already possesses such weapons. The most discussed scenario involves terrorists launching an illicitly obtained cruise missile, most likely a Chinese HY-2 Silkworm, from a freighter in American territorial waters.[136] However, this scenario would be quite a technological feat for terrorists without advanced engineering skills.[137] More likely is the conversion of a kit aircraft into rudimentary cruise missiles that could be launched from within the continental United States.[138] Such missiles would admittedly be quite crude, but could still cause serious damage or inflict heavy civilian casualties if the terrorist group had access to chemical, biological, or radiological weapons.[139]

III. STOPPING PROLIFERATION: THE MISSILE TECHNOLOGY CONTROL REGIME

The Missile Technology Control Regime (MTCR) remains the preeminent means for constraining the proliferation of cruise missiles and related technologies. Despite provisions that limit the transfer of certain key cruise missile technologies, the MTCR's members have not yet come to a consensus that cruise missiles are

133. *See id.* at 40.
134. *Id.*
135. Bradley Graham, *Cruise Missile Threat Grows, Rumsfeld Says*, WASH. POST, Aug. 28, 2002, at A1.
136. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 9, 74.
137. DENNIS M. GORMLEY, UAVS AND CRUISE MISSILES AS POSSIBLE TERRORIST WEAPONS 13, *available at* http://cns.miis.edu (Jun. 1-4, 2003) (on file with author).
138. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 35-36.
139. *See* Gormley, *New Developments*, *supra* note 54, at 411. The spread of dual-use technology has made the development of crude cruise missiles cheap and easy. In 2003, Bruce Simpson, a New Zealand engineer, set up a website chronicling his effort to build a cruise missile from off-the shelf parts for under $5,000. Simpson posted updates as to his progress on the Internet until the New Zealand government stopped the project. BRUCE SIMPSON, A DIY CRUISE MISSILE, *at* http://www.interestingprojects.com (last updated July 6, 2004).

a significant threat.[140] This failure to recognize that LACMs represent a serious threat is compounded by certain provisions of the MTCR that are vague or unclear regarding cruise missiles and dual-use technologies.[141] This section examines the relevant provisions of the MTCR, the focus of the regime and its members on ballistic missiles, and other nonproliferation efforts outside of the MTCR.

A. *MTCR's Technology Controls*

The MTCR[142] is a multilateral informal missile technology suppliers' group with the goal of limiting the proliferation of complete ballistic and cruise missile systems, as well as missile-related dual-use technologies.[143] Announced in 1987 after years of secret negotiations spearheaded by the United States, the regime is designed to retard the spread of missiles and other weapons that can deliver a payload of 500 kg over a distance of 300 km.[144] In 1993, the 500 kg/300 km threshold was updated to take account of the ability to trade-off range and payload, thus taking into account the possible modification of missiles that fall under the set range and payload limits.[145] The MTCR officially seeks "to limit the risks of proliferation of weapons of mass destruction (i.e. nuclear, chemical and biological weapons), by controlling transfers that could make a contribution to delivery systems (other than manned aircraft) for such weapons."[146] The MTCR, with 33 signatories,[147] is the oldest and most comprehensive of the current international mechanisms to constrain the transfer of missile delivery systems and related material, equipment, and technology to non-member states.[148] Although the MTCR began with only seven members in

140. Wade Boese, *GAO Says Feds Lax in Countering Cruise Missile, UAV Threats*, ARMS CONTROL TODAY, Apr. 2004, *available at* http://www.armscontrol.org.

141. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 41.

142. MTCR, *supra* note 2. The MTCR has been updated several times, setting forth new export control lists in the Equip. & Tech. Annex. The MTCR's website has the full texts of the agreement, official statements and reports from the annual MTCR plenary sessions.

143. Pande, *supra* note 57.

144. MTCR, *supra* note 2, Item 1; *see also* Greene, *supra* note 48, at 62.

145. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 80.

146. MTCR, *supra* note 2. This language was added to the MTCR in 1993 to counter fears about the proliferation of delivery devices for chemical and biological weapons. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 80.

147. MTCR, *supra* note 2. The current membership of the MTCR includes: Argentina, Australia, Austria, Belgium, Brazil, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Republic of Korea, Russia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom and the United States. *Id.*

148. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 78. It should also be noted that there are several other states, including China, that "adhere" to all or a portion of the

1987, its membership has dramatically increased since the end of the Cold War, with much of the former Warsaw Pact and some South American countries becoming members.[149] The most important non-member is China, although it has conditionally agreed to support the MTCR despite its occasional sale of missiles and technology to non-MTCR states such as Iran, Pakistan, and Syria.[150]

The export policy embodied in the MTCR is a two-tiered system.[151] First, the Guidelines for Sensitive Missile-Relevant Transfers (Guidelines) articulate the MTCR's core tenets limiting the spread of certain missile-related technologies.[152] Second, the Equipment and Technology Annex (Annex) restricts the sale of specific controlled items and technologies that fall within the 500 kg/300 km threshold.[153] The Guidelines delineate the factors that each MTCR signatory must consider in determining whether items listed in the Annex should be transferred to a non-MTCR state: (1) concerns about the proliferation of weapons of mass destruction; (2) degree of development and intentions of the space and weapons programs of the benefiting state; (3) significance of the transfer for prospective development of a delivery system for WMDs; (4) end use of the equipment, including assurances of the recipient state as to the end use; and (5) relevance of other multilateral agreements.[154] The Guidelines also set forth when the transferring country's government is required to obtain end use certification from the recipient country.[155]

The Annex is divided into two categories that limit the export of certain items and technologies.[156] Category I covers items that could be used, directly or indirectly, to develop missiles capable of delivering WMDs.[157] Among the items included in Category I are complete missile systems, subsystems (including certain engines, re-entry vehicles, and warheads), UAVs, and specially-designed production equipment or technology designed for such systems.[158] The Guidelines suggest that there is a "strong presumption to deny" transfers or sales of items covered in Category I, regardless of the

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MTCR. *Id.* at 79.

149. Pande, *supra* note 57.

150. *See* Hua Di, *supra* note 112, at 168; Scoblic, *supra* note 113.

151. MTCR, *supra* note 2.

152. *Id.*

153. *Id.*

154. *Id.*

155. *Id.*

156. *See id.*

157. MTCR, *supra* note 2; GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 79-80.

158. MTCR, *supra* note 2.

recipient's intended end use.[159] Category I items may be exported on a case-by-case basis with the exporting state's approval conditioned upon assurances from the government of the recipient state as to the end use of the item or technology.[160] The exporting state "assumes responsibility for taking all steps necessary to ensure that the item is put only to its stated end use."[161]

Category II is much broader, covering dual-use components and technology that could be used to complete a missile system, including propellants, test equipment, and certain structural materials.[162] Category II has been updated to include any unmanned aerial vehicle that can travel 300 km, even with a negligible payload.[163] This change was prompted by worries that missiles with the capability to carry only a few kilograms of biological or chemical weapons were not covered by the MTCR.[164] End use assurances are not required for Category II items if they are exported as part of a manned aircraft or as replacement parts for manned aircraft.[165] The lists of technology, materials, and equipment controlled by the Equipment & Technology Annex are updated at the MTCR's periodic technical meetings.[166]

The MTCR does not have any formal enforcement provisions, but rather relies upon the individual signatories to enforce their obligations as to the common list of controlled systems, equipment, and technology.[167] The text of the MTCR encourages national legislation for enforcement of the agreement.[168] Although the regime does not mandate sanctions, each signatory state can enforce the regime unilaterally,[169] as the United States has done through the Arms Export Control Act[170] and the Export Administration Act.[171] Because MTCR obligations are implemented according to national legislation, enforcement activities vary from state to state, thus creating inconsistent standards of enforcement — although all MTCR signatories are, in theory, held to minimum level of

159. *Id.*
160. *Id.*
161. *Id.*
162. *See id.*
163. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 80.
164. *Id.*
165. MTCR, *supra* note 2.
166. *See* K. SCOTT MCMAHON & DENNIS M. GORMLEY, CONTROLLING THE SPREAD OF LAND-ATTACK CRUISE MISSILES 31, 35 (American Institute for Strategic Cooperation, The AISC Papers, No. 7, Jan. 1995) [hereinafter MCMAHON & GORMLEY].
167. *See* MTCR, *supra* note 2.
168. *See id.*
169. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 81.
170. 22 U.S.C. §§ 2751-2796 (2001).
171. 50 U.S.C. app. §§ 2401-2420 (2001).

enforcement mandated by the agreement.[172] Differing interpretations of the MTCR's requirements were the crux of the Black Shaheen LACM dispute between the United States, France, and Britain.[173]

It should be noted that the MTCR has been quite successful in slowing the proliferation of ballistic missiles. Although it is impossible to completely stop proliferation, the MTCR has retarded the spread of ballistic missiles by limiting access to foreign assistance and technology, thus raising the already high costs of acquiring ballistic missile technology, even when obtained under the guise of developing a domestic space launch capability. For instance, the MTCR's effectiveness against the proliferation of ballistic missile technology caused the abandonment of the Argentine-Iraqi-Egyptian Condor II ballistic missile program because the consortium could not obtain the technology and materials needed to build a long-range ballistic missile.[174] The MTCR has not been as effective when dealing with cruise missiles.[175] In fact, the very success of the MTCR as to ballistic missile proliferation has created an incentive for states to develop cruise missiles. Because the MTCR has driven up the costs of acquiring ballistic missiles, developing or purchasing LACMs looks more attractive, particularly because of the MTCR's relatively weak controls on the technology needed to develop cruise missiles.

B. *MTCR's Focus on Ballistic Missiles*

When the MTCR was being negotiated in the early-1980s, it was designed to deal with the emerging ballistic missile threat from Third World states.[176] Although the MTCR's limits on transferring missiles and related technology to non-signatories also apply to cruise missiles, the structure of the MTCR and its specific provisions were negotiated with ballistic, not cruise, missiles in mind, reflecting the conventional thinking during the early-1980s that ballistic missiles were a more serious threat to international security.[177] For instance, the items and technology controlled in Categories I and II are heavily weighted towards those technologies

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172. MCMAHON & GORMLEY, *supra* note 166, at 35.

173. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 40. The Black Shaheen LACM dispute is discussed below in Part IV(C).

174. Scott D. Tollefson, *El Condor Pasa: The Demise of Argentina's Ballistic Missile Program*, *in* THE INTERNATIONAL MISSILE BAZAAR: THE NEW SUPPLIERS' NETWORK, *supra* note 94, at 255, 258.

175. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 37.

176. Greene, *supra* note 48, at 55.

177. *See* Speier Manuscript, *supra* note 24, at 10-14.

and components required for building ballistic, not cruise, missiles.[178] Subsequent actions by MTCR members have confirmed the bias towards limiting the proliferation of ballistic missiles.

First, the events that precipitated the United States' initiation of the multilateral discussions that eventually became the MTCR were all tests of ballistic missiles or technologies vital for indigenous ballistic missile development.[179] These watershed events included South Korea's test of a ballistic missile based on the U.S. Nike-Hercules SAM in 1978, Iraqi efforts to purchase rocket stages from Italy in 1979, India's launch of a satellite in 1980, and Libya's testing of rocket stages (albeit unsuccessfully) in 1981.[180] These events served as notice to the United States and its allies that they had arrived at a threshold period with regards to the ballistic missile proliferation threat. There was no such warning that cruise missile proliferation in the Third World would become a threat at the time the MTCR was negotiated. However, there were several farsighted military officers on the American delegation who inserted language in Category I of the MTCR's Equipment & Technology Annex[181] so that it would cover both cruise and ballistic missiles.[182]

Second, the fact that ballistic missiles have traditionally been the delivery vehicle of choice for nuclear weapons led the United States and its allies to focus on them in the negotiations that led to the creation of the MTCR.[183] The growing shadow of the ballistic missile threat and potential nuclear annihilation focused the world's attention on those missiles as the greatest potential danger.[184] That then-President Ronald Reagan told the United Nations General Assembly "[t]he ballistic missile is the most awesome, threatening, and destructive weapon in the history of man" is illustrative of this focus on ballistic missiles as the most serious threat to peace.[185]

178. *See* Gormley, *Neglected Dimension*, *supra* note 3, at 26-27.

179. Anastasia A. Angelova, *Compelling Compliance with International Regimes: China and the Missile Technology Control Regime*, 38 COLUM. J. TRANSNAT'L L. 419, 435 (1999).

180. *See id.*; Pande, *supra* note 57; Jurgen Scheffran & Aaron Karp, *The National Implementation of the Missile Technology Control Regime — The US and German Experiences*, *in* CONTROLLING THE DEVELOPMENT AND SPREAD OF MILITARY TECHNOLOGY: LESSONS FROM THE PAST AND CHALLENGES FOR THE 1990S 235, 240 (Hans Gunter Brauch et al. eds., 1992).

181. This language states that "unmanned aerial vehicle systems (including cruise missile systems, target drones and reconnaissance drones)" are covered under Category I of the MTCR. MTCR, *supra* note 2.

182. E-mail from Richard Speier, Independent Nonproliferation Consultant, to author (Mar. 6, 2002, 22:14 EST) (on file with author) [hereinafter Speier E-mail].

183. Speier Manuscript, *supra* note 24, at 8.

184. *Id.*

185. *Id.*

Moreover, the structural provisions of the MTCR were clearly designed to deal with the ballistic missile threat, despite the regime's avowed purpose to deal with both ballistic and cruise missiles. First, the regime's 500 kg/300 km limit on payload and range was clearly designed to deal with ballistic missiles, rather than cruise missiles. Those numbers represent a significant technological threshold for ballistic missiles in terms of guidance, but are purely arbitrary with regard to cruise missiles.[186] At ranges over 300 km, accurate ballistic missile guidance is much more difficult to attain.[187] Cruise missiles, on the other hand, can be reconfigured with ease so that payload and range can be traded-off, meaning that an LACM that nominally fell under the 500 kg/300 km guidelines could be modified to fly much farther than 300 km with a 250 kg warhead.[188] Unlike ballistic missiles, which do not have such clear payload/range trade-off capabilities, a cruise missile permissible to be exported under the MTCR could be converted within a matter of hours to one that was not.[189] Second, the MTCR does not contain any clear formulas or standards for calculating the ranges of the missiles covered by the agreement. This glaring omission does not make any difference for ballistic missiles, which must fly on a parabolic flight path where rocket engine efficiency is not a significant issue, but it is a major oversight with regards to cruise missiles.[190] Cruise missile ranges can vary widely depending upon the altitude at which the missile flies because of different engine efficiencies at various altitudes.[191] The lack of standards for determining the range of cruise missiles for MTCR purposes would later become a serious problem, creating confusion and undermining the effectiveness of the regime.[192] Although some language regarding cruise missiles is included in the Annex, the very structure and language of the MTCR, as well as other evidence, suggests that, for political reasons, the MTCR was primarily aimed to control the spread of ballistic missile technology and the cruise missile language was added to the MTCR at the behest of lower level diplomats.[193]

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186. *See* Greene, *supra* note 48, at 56.
187. *See id.;* Pande, *supra* note 57.
188. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 30.
189. McCarthy Interview, *supra* note 66.
190. *See* Gormley, *Neglected Dimension*, *supra* note 3, at 27.
191. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 37; Speier E-mail, *supra* note 182.
192. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 85-88; Greene, *supra* note 48, at 63.
193. Speier E-mail, *supra* note 182.

Finally, subsequent actions by MTCR members prove that the regime's purpose was to limit the spread of ballistic missile-related technologies. The official statements and rhetoric regarding the MTCR and the spread of missile technology have focused primarily on preventing the spread of ballistic missile technology. There was hardly a mention of cruise missiles in speeches, congressional testimony, or policy proclamations by high-level officials in the Clinton Administration when discussing U.S. missile non-proliferation policy.[194] This has changed in the second Bush Administration, as the cruise missile threat has received increased congressional and executive attention;[195] however, ballistic missiles still receive the lion's share of attention, as evidenced by increased funding for anti-ballistic missile defense, abrogation of the ABM Treaty, and fear of North Korea's ballistic missile program.[196] Furthermore, discussion at the MTCR annual plenary meetings tends to focus on the ballistic missile problem, even though some states do want to discuss cruise missile issues.[197] Although the delegates concede that the proliferation of cruise missile technology is a significant problem, the issue is regularly ignored as being too difficult to tackle.[198]

C. Other Nonproliferation Tools: National Suppliers' Group and Codes of Conduct

Efforts outside the MTCR have been made to limit the proliferation of missiles; however, the majority of these efforts, like the MTCR, have focused their attention on limiting the spread of ballistic missiles and have largely ignored cruise missiles. The first missile-focused effort outside of the MTCR was Russia's 1999 proposal for the Global Control System for the Nonproliferation of Missiles and Missile Technologies (GCS).[199] A blatant attempt to undermine the United States-led MTCR by offering access to space-launch capabilities and other technologies, the GCS seeks to attract non-MTCR signatories into a competing arrangement.[200] The GCS further seeks to put missile proliferation under the aegis of the United Nations rather than the exclusive group of technology

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194. MCMAHON & GORMLEY, *supra* note 166, at 76-78.
195. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 84, 118-19 n.17; Gormley, *Neglected Dimension*, *supra* note 3, at 21.
196. *See, e.g.*, BAKER SPRING, KEEPING MISSILE DEFENSE AT THE HEART OF DEFENSE TRANSFORMATION: EXECUTIVE MEMORANDUM 874 (May 7, 2003), *at* http://www. heritage.org.
197. *See* Gormley, *Neglected Dimension*, *supra* note 3, at 26.
198. McCarthy Interview, *supra* note 66.
199. Yuri E. Fedorov, *The Global Control System and the International Code of Conduct: Competition or Cooperation?*, 9 NONPROLIFERATION REV. 30, 33 (2002).
200. *See id.* at 31.

suppliers that make up the MTCR's membership,[201] something that the United States considers anathema because of the UN's structural incapability to enforce this sort of regime.[202] Furthermore, the United States is leery of having the UN, composed mainly of nations that do not possess advanced missile technology, administering such a nonproliferation arrangement.[203] Although the GCS embodies an alternate approach to dealing with missile proliferation on the demand-side of the equation rather than the supply-side view of the MTCR, the GCS also focuses primarily on ballistic missiles.[204] The GCS completely ignores the threat of LACMs; whereas, despite its flaws, the MTCR at least addresses the problems.

The International Code of Conduct Against Ballistic Missile Proliferation[205] was proposed in reaction to the Russian challenge to the MTCR's supremacy in regulating the proliferation of missile technology and international fears about national missile defense.[206] In February 2002, a draft of the proposed code was reviewed by more than eighty nations.[207] The proposed code called for signatories to declare their ballistic missile programs and inform all other signatories before conducting ballistic missile tests.[208] It also offers an undefined case-by-case incentive system to encourage states to give up their missile programs.[209]

The most serious concern with both the GCS and the proposed ballistic missile code of conduct is their blatant disregard for the LACM threat. This egregious failure to consider the cruise missile threat reinforces the perception that states are primarily worried about the ballistic missile threat and are ignoring cruise missiles.[210]

IV. PROLIFERATION OF CRUISE MISSILES

The threat of cruise missile proliferation is maturing, as the key technologies needed to develop and produce LACMs are becoming

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201. *Id.* at 33.
202. *See* McCarthy Interview, *supra* note 66.
203. *See id.*
204. *See* Fedorov, *supra* note 199, at 33.
205. Draft Text of the Proposed International Code of Conduct Against Ballistic Missile Proliferation, *at* http://www.projects.sipri.se/expcon/drafticoc.htm (last visited Feb. 20, 2002) [hereinafter Draft Text]. *See generally* Jonathan Stoel, Note, *Codes of Conduct on Arms Transfers — The Movement Towards a Multilateral Approach*, 31 LAW & POL'Y INT'L BUS. 1285 (2000) (analyzing an array of proposed or enacted arms transfer codes of conduct).
206. DENNIS M. GORMLEY, A BALLISTIC MISSILE CODE OF CONDUCT: JUST HOW VALUABLE?, (Feb. 22, 2002), *available at* http://www.iiss.org (last visited Feb. 24, 2002).
207. *Id.*
208. Draft Text, *supra* note 205.
209. *Id.*
210. *Id.*

easier to obtain each year. However, policymakers around the world appear to be either oblivious to the cruise missile threat or believe that it will follow the same path as ballistic missile proliferation, giving them plenty of lead time to deal with the threat. Just as MTCR provisions tailored for ballistic missile proliferation are not effective at constraining the spread of cruise missiles, the very nature of the cruise missile threat is fundamentally different from the ballistic missile threat. There is significant potential for cruise missiles to be developed non-sequentially and within a short period of time. The technological chokepoints preventing indigenous LACM development will disappear without prompt action on the part of those that control access to the technology. Furthermore, there is the threat of states skirting the MTCR's guidelines and selling complete missile systems to Third World states.

A. *Timeframe for Development*

Unlike ballistic missile development, which is sequential and cannot be kept completely covert,[211] the timeframe and sequence for developing and testing cruise missiles is not linear and can be conducted under the guise of domestic aircraft production or maintenance programs.[212] LACMs are significantly easier than ballistic missiles to develop because of the general availability of the technology to build first-generation LACMs; a state committed to developing an indigenous production capability could do so in a far shorter span than developing ballistic missiles.[213] Cruise missile systems could conceivably spread fairly quickly, with states deploying relatively crude LACMs based on modified ASCMs or more sophisticated LACMs incorporating more sophisticated guidance systems and stealth technology.[214] The level of foreign assistance and access to technology are key determinants in how quickly a state can obtain LACMs.[215]

The United States will have little advance warning as to the sale of complete LACM systems to any particular state, other than the sales announcement or intelligence regarding the transfer. The United States may hear rumors that a state is seeking to purchase cruise missile strike capability, but as the sale of the Black Shaheen to the UAE demonstrates, there is often little that can be done

211. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 11.
212. *Id.* at 11-12, 33-36.
213. CARUS, *supra* note 6, at 33-34, 70-83; GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 53-54.
214. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 11, 29-33.
215. *See id.* at 19-23, 28.

except make angry protests.[216] The United States may not discover the LACM capability of a state until the missiles are fully integrated into that nation's force structure.[217] This lack of advance warning and powerlessness to affect the sale make the direct acquisition pathway for obtaining LACMs particularly troubling for the United States.

The proliferation of cruise missiles will not follow the same course as ballistic missile proliferation.[218] Although there will undoubtedly be some cases where a state slowly develops an indigenous production capability over a period of years, it is far more likely that a state will either obtain foreign technological assistance and develop a production capability fairly rapidly or purchase missiles directly.[219] This means that the United States must be prepared to deal with quickly emerging threats. There will not be the luxury of lead time that the United States has enjoyed in its dealings with possible ballistic missile proliferators because it is much easier for states developing cruise missiles to develop or acquire such weapons without much, if any, advance warning.[220]

B. Chokepoints: Fewer and Harder to Control

The most likely means by which a state will be able to field a LACM capability is through indigenous development of a complete missile system. Fortunately, all the elements needed to develop a long-range LACM are not easily procured on the international market at this time; however, that will likely change in the future as the pathways to developing a cruise missile production capability shorten through the spread of dual-use technology and expertise. Cruise missiles have traditionally consisted of four major components — an airframe, a payload, a guidance and navigation

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216. *Id.* at 11-12, 33-36; Pande, *supra* note 57; *see also* Nick Cook, *Dilemmas in the Desert — the Devil's in the Details*, JANE'S DEF. WKLY., Nov. 10, 1999, at 45-46, 48-49.

217. E-mail from Dennis M. Gormley, Senior Fellow, Center for Nonproliferation Studies, Monterey Institute of International Studies, to author (Mar. 28, 2002, 09:58 EST) (on file with author) [hereinafter Gormley E-mail].

218. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 11.

219. *Id.* at 12.

220. *See id.* at 11. An illustration of this point is the U.S. concern over North Korea's ballistic missile program. The United States has used satellite imagery to observe rocket tests, as well as the flights of North Korean ballistic missiles, as such tests are difficult to conceal. *See* CENTER FOR NONPROLIFERATION STUDIES, CHRONOLOGY OF NORTH KOREA'S MISSILE TRADE AND DEVELOPMENT, *at* http://cns.miis.edu (last visited July 5, 2004). Thus, the United States has an idea as to the extent of North Korean ballistic missile development and how close it is to fielding operational ICBMs. Cruise missile components are much easier to test surreptitiously, making it much for difficult to ascertain how advanced a LACM program might be. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 11.

system, and a propulsion unit.[221] Until the early-1990s, it was impossible for nations other than the United States, Russia, Britain, and France to even conceive of indigenously producing LACMs.[222] According to conventional wisdom, the guidance and navigation system and the propulsion unit were the chokepoint technologies that prevented other states from developing cruise missiles.[223] However, the increased diffusion of advanced technologies, particularly in the field of navigation and guidance, has made it possible for a nation to develop a latent LACM production capability.[224] Thus, the only technological chokepoint remaining is the propulsion unit. In addition to the four major cruise missile components mentioned above, this article addresses factors generally ignored by most of the extant literature: program management capacity and technological integration capability and what effect such factors have on cruise missile development.

First, the airframe is the easiest part of the LACM to obtain. Because cruise missiles do not fly particularly quickly or accelerate rapidly, airframes can be built out of normal aluminum.[225] Any airframe that could be used for a normal aircraft could be employed in a cruise missile.[226] Almost any metallurgical engineer could design and construct an LACM airframe.[227] However, integrating radar cross-section-reducing materials or stealth designs for an LACM would require extensive computer modeling and access to composite radar-absorbing materials.[228]

The payload is the second major LACM component. Again, this is fairly straightforward, as LACMs can be armed with a variety of different payloads ranging from conventional high explosives to submunitions of different varieties to WMDs, depending upon the intended mission. One area of particular concern is that LACMs are ideally suited for dispensing chemical or biological weapons because of a cruise missile's inherent in-flight stability compared to ballistic missile delivery systems.[229] However, it should be noted that

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221. CARUS, *supra* note 6, at 70-79; GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 18; MCMAHON & GORMLEY, *supra* note 166, at 18-25.

222. *See* CARUS, *supra* note 6, at 15-16.

223. *See, e.g.*, GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 18.

224. *Id.* at 18-21.

225. DEP'T OF DEF., OFFICE OF THE UNDER SEC'Y OF DEF. FOR ACQUISITION & TECH., MILITARILY CRITICAL TECHNOLOGY LIST, PART II: WEAPONS OF MASS DESTRUCTION TECHNOLOGIES, § 1.3 at 34 (1998) [hereinafter DOD REPORT], *at* http://www.fas.org/irp/threat/mctl98-2/p2sec01.pdf (last visited Feb. 20, 2002).

226. *Id.*

227. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 24.

228. *See* CARUS, *supra* note 6, at 74-76; GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 24; DOD REPORT, *supra* note 225.

229. CARUS, *supra* note 6, at 80.

because most cruise missiles are easier to intercept than ballistic missiles, a state with the choice of deploying its nuclear warheads on either type of delivery vehicle would likely choose ballistic missiles.[230]

The guidance and navigation system, the third major cruise missile component, was previously believed to be the most serious technological hurdle to the development of LACMs[231]; however, that changed when GPS and its Russian equivalent, GLONASS, became available to users other than the U.S. and Russian militaries.[232] Prior to that time, LACMs relied upon rather inaccurate inertial guidance systems or terrain contour matching (TERCOM) for guidance and navigation to the intended target.[233] Until alternatives to TERCOM and inertial guidance evolved, there were no other ways to provide long-range, accurate guidance for LACMs.[234] Not surprisingly, TERCOM technology has been kept under the utmost secrecy.[235] However, once cheap GPS systems became available, the guidance and control genie was out of the bottle and it became relatively easy for a state to develop guidance systems built around GPS receivers.[236] The United States, recognizing this potential, introduced a policy of "selective availability" in which subtle errors were introduced into commercially available GPS receivers, which degraded the accuracy of the signal.[237] However, the United States ended "selective availability" in May 2000 after it was revealed that the process could be easily circumvented.[238]

The widespread availability of cheap, accurate GPS receivers in conjunction with access to commercial satellite imagery makes the development of an LACM guidance system substantially easier.[239]

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230. *Id.* at 79-81. It should also be considered that placing a nuclear warhead on a cruise missile might be easier because of the reduced stress on LACM warheads because they do not have to go through the changes in velocity and acceleration that a nuclear weapon mounted on a ballistic missile would have to go through. *Id.*

231. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 18.

232. *Id.* at 19-21.

233. *Id.* at 18. TERCOM involved a miniature radar receiver in the cruise missile nose to sense the terrain over which it is flying and compare it to a map that has been stored in the missile's guidance system. The system then makes course corrections based upon the comparison. The TERCOM system obviously required the existence of very detailed terrain maps of any potential theatre of operations, an expensive proposition in the days before commercial satellite photography. *Id.*

234. DOD REPORT, *supra* note 225, at 34-35.

235. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 18-20; DOD REPORT, *supra* note 225, at 35.

236. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 20-21.

237. *Id.* at 19-20.

238. *Id.*

239. *Id.* at 20-21.

Experts suggest that the widespread availability of GPS dramatically cut the costs required to develop an accurate guidance system.[240] GPS/GLONASS receivers that can be used to build cruise missile guidance systems are available from commercial suppliers for as little as $6,000 each.[241] A pure GPS-based guidance system would require that the LACM fly at a high enough altitude to miss all potential obstructions because GPS guidance systems follow a set of preprogrammed coordinates and do not take the terrain surrounding the target into account.[242] Combining satellite imagery mapping technology with GPS in a guidance system could result in a significantly more accurate and more survivable LACM, as it could be programmed to fly around obstacles or defenses revealed by the satellite imagery, while using GPS for course navigation.[243] These developments have eliminated the guidance and navigation system as a major chokepoint in the technology needed for a Third World nation to develop a cruise missile capability.

The final structural component of a cruise missile is the propulsion unit, which is the sole remaining chokepoint technology preventing the widespread proliferation of LACMs through indigenous development.[244] Small, efficient propulsion units represent the final key enabling technology for LACM production.[245] Although turbojet engines are widely available from producers such as China, they are not sufficiently fuel efficient for use in longer-range LACMs.[246] The engines of choice for modern LACMs are light turbofans, which are surprisingly difficult to produce without outside foreign assistance due to their intricate nature and the specialized materials and alloys needed to build them.[247] The

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240. *Id.* at 20; *see also* DOD REPORT, *supra* note 225, at 35.

241. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 31-32.

242. *See id.* at 19-21; DOD REPORT, *supra* note 225, at 35.

243. *See* DOD REPORT, *supra* note 225, at 35.

244. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 21-22.

245. *Id.* at 21.

246. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 21-22. Turbojet engines are used on most high performance aircraft; however, turbojets tend to be heavy and inefficient, burning large amounts of fuel to create thrust. Turbofan engines differ from turbojets as they are essentially propeller engines mounted inside a cowling with ducted exhaust to create thrust. *See* CISLUNAR AEROSPACE, INC., PRINCIPLES OF AERONAUTICS: PROPULSION, STRUCTURES AND CONTROLS: PROPULSION: TYPES OF AIR-BREATHING ENGINES, *at* http://wings.avkids.com/Book (last modified June 16, 1997). Although capable of producing far less thrust than turbojet engines, turbofans are much more efficient as they are able to suck four times as much air into the engine, improving fuel efficiency. *See id.* The increased fuel efficiency of turbofan engines make them the propulsion unit of choice for cruise missiles because they can vastly extend the range of a missile or allow for a larger warhead because the missile does not need to carry as much fuel.

247. *See* Rick Martin & Daniel Evans, *Reducing Costs in Aircraft: The Metals Affordability Initiative Consortium*, 52 JOM: THE MEMBER JOURNAL OF THE MINERALS, METALS & MATERIALS SOCIETY 24, 26 (2000) (discussing the high cost of exotic alloys needed to

greatest technological difficulty is designing a small, efficient turbofan engine, with enough thrust to power a cruise missile over long ranges.[248] Considering the difficulties of developing such engines, states with active cruise missiles have sought to acquire complete engines from suppliers in the United States and Russia, but thus far have been unsuccessful in doing so in large numbers.[249] However, it is possible for such engines to be cannibalized from commercial aircraft like the Cessna Citation, among others.[250]

As the propulsion unit is the final hurdle for most countries developing cruise missiles, they have become the final chokepoint technology that must be controlled to slow the spread of LACMs. It is certainly possible for a state to use less efficient turbojet engines for indigenously produced cruise missiles, but range would be limited accordingly. It is possible a nation could develop a turbofan engine and that nation might be willing to export such engines to potential cruise missile proliferators. This seems unlikely at the present time considering the technological constraints, but it is something that should be considered over the long term.

The final area limiting the spread of LACMs is the program management capacity and technical integration capability of a state seeking to build cruise missiles. A major indicator of a state's ability to develop an indigenous cruise missile production capacity is its experience in building technologically complex military systems.[251] A state that has some indigenous military production capacity and experience in integrating complementary foreign technology with domestically produced systems will have a great advantage in developing a cruise missile capability.[252] Having a domestic aircraft industry or substantial numbers of trained aircraft maintenance personnel can also affect the speed at which the missile program develops.[253] The existence of a trained pool of engineers and scientists is also crucial.[254] Having universities with significant engineering departments willing to work on the technological hurdles surrounding an LACM program would obviously be useful as well, especially if they have expertise with wind tunnels, computer design routines, and spray flow field modeling.[255] Furthermore, if a state has a highly-trained cadre of key scientific

withstand the high temperatures of turbofan engines).

248. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 21-22.
249. *Id.*
250. *Id.* at 22.
251. *Id.* at 22-25.
252. McCarthy Interview, *supra* note 66.
253. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 24-25.
254. *Id.* at 22-25.
255. *See id.* at 25.

management personnel, so-called "program managers," with experience in integrating military technology, the indigenous development pathway to a cruise missile capability is much shorter.[256] There is nothing that can be done to limit the spread of such knowledge and expertise unless there is a comprehensive ban on access to certain engineering and management disciplines. That result is unlikely considering the intellectual freedom prized in most Western states and the virtual impossibility of enforcing such a policy.[257]

C. Threats from within the MTCR: The Black Shaheen

Although indigenous development or modification of LACMs by a Third World state is the most likely means by which such a state could obtain a cruise missile capability, acquisition of complete LACM systems from an MTCR member has become a worrisome possibility. The case of the Black Shaheen LACM epitomizes this threatening trend.

The UAE was able to do exactly that when it announced the purchase of the Black Shaheen variant of the Apache LACM in 1998 from the Anglo-French consortium Matra-BAe-Dynamics (MBD).[258] Despite diplomatic protests from the United States and lengthy discussions in MTCR plenary meetings,[259] the first of an undisclosed number of Black Shaheens was to be delivered to the UAE in 2003 or 2004.[260] This questionable sale stems from the ambiguities surrounding determining the 300 km/500 kg threshold established by the MTCR.[261] Britain and France calculated the range of the Black Shaheen at sea level, where the range of the missile is 300 km when carrying a 450 kg warhead.[262] The United States calculated the range of the Black Shaheen using a flight profile at an altitude above sea level and determined that the missile clearly violated the 300 km/500 kg threshold level set by Category I of the

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256. *Id.* at 23-24; McCarthy Interview, *supra* note 66.

257. *But cf.* Henry Sokolski, *Missile Nonproliferation and Missile Defense*, Heritage Lecture No. 761, delivered July 12, 2002, *available at* http://www.heritage.org (last visited Aug. 19, 2003) (calling for the United States and its allies to limit the access of foreign students to academic courses dealing with technologies relevant to missile production).

258. Paul Beaver, *USA Angry Over French Decision to Export Apache*, JANE'S DEF. WKLY., Apr. 8, 1998, at 4. The only difference between the French Apache and the UAE's Black Shaheen is reportedly the electrical and mechanical interfaces between the missiles and the aircraft that carry them.

259. *Id.*

260. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 40.

261. Mike Nartker, *International Response: MTCR Changes Address Cruise Missile Proliferation*, GLOBAL SECURITY NEWSWIRE, Oct. 28, 2002, *at* http://www.nti.org (last visited Aug. 13, 2003).

262. Gormley E-mail, *supra* note 217.

MTCR.[263] Experts believe that the Black Shaheen has a range in excess of 300 km with a 450 kg warhead when flying at an altitude of several hundred meters.[264] At the very least, the Black Shaheen should be classified under Category II of the MTCR as it would carry a negligible payload to a distance over 300 km, even at sea-level, requiring end- user certification and guarantees from the UAE.[265] Yet, the British Defense Ministry denied that the sale of the Black Shaheen would violate the MTCR.[266] This uncharacteristic struggle among the United States, Britain, and France — all founding members of the MTCR — stems from increased competition in the international arms market as export sales have become a way to subsidize domestic military research and development as well as reduce per unit costs of new missiles.[267] The contract for the Black Shaheen missiles is reportedly worth in excess of $1.3 billion.[268] France and Britain were committed to selling the missiles to give their domestic defense industries a boost despite recommendations from within their own governments that selling the Black Shaheens would violate the terms of the MTCR.[269] Although the UAE is an ally of the West and likely purchased the Black Shaheens to balance the Iranian modified Silkworm cruise missile threat, the sale is disturbing on several levels. First,

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263. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 107-8 n.32. Lending further support to the U.S. position that the missiles violate the MTCR are reports that France's version of the Apache/SCALP, which is almost identical to the Black Shaheen, has an estimated range of at least 500 km. *See* NATIONAL AIR & INTELLIGENCE CENTER, BALLISTIC & CRUISE MISSILE THREAT: LAND ATTACK CRUISE MISSILES (NAIC-1031-0985-98), *available at* http://www.fas.org (last visited July 5, 2004). Britain's Storm Shadow variant of the Apache has a reported range in excess of 400 km. *Id.*

264. Gormley E-mail, *supra* note 217.

265. MTCR, *supra* note 2.

266. Gary Milhollin, Wisconsin Project on Nuclear Arms Control, Ballistic Missiles: Who Are The Future Suppliers?, Paper Presented at the CSIS/NIC Conference on the Alternative Futures for Missile Proliferation (March 2, 1999), *at* http://www.wisconsinproject.org (last visited July 13, 2004).

267. The UK-French decision to authorize the Black Shaheen sales to the UAE was closely intertwined with the proposed sale of Mirage jet fighters to the UAE. *See Anglo-French Matra BAE in Major UAE Missile Deal*, REUTERS, Nov. 24, 1998, *available at* http://www.clw.org (last visited July 14, 2004). Originally, the UAE sought to purchase F-16 fighters from the United States, but almost decided not to do so when the U.S. was unwilling to include long-range cruise missiles as part of a package deal. *See* Greg Seigle, *UAE Still Demands F-16 Codes*, JANE'S DEF. WKLY., Dec. 16, 1998, at 5. Alternately, the UAE sought to acquire the computer codes needed to integrate the Black Shaheen missiles for use on the F-16s. The U.S. almost balked at handing over the computer codes to the UAE, but because of the size of the order and political pressure from Lockheed Martin (the contractor for the F-16s), codes were given to the UAE. *See* Gilles Van Nederveen, *The F-16 Block 60: A High-Tech Aircraft for a Volatile Region*, 14 AIR & SPACE POWER J. 96 (2000), *at* http://www.airpower.maxwell.af.mil (last visited July 5, 2004).

268. Ian Parker, *UAE's Modernized Mirage*, AVIONICS MAG. (June 2000), *available at* http://www.aviationtoday.com (last visited July 13, 2004).

269. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 85, 119 n.19.

although the UAE has a fairly stable government, there are no guarantees that with a change in regime the United States and its allies (including Britain and France) will not have to worry about having the Black Shaheens turned against them. Second, there are no guarantees that the individuals in the UAE military or government will not hand over one or more Black Shaheens to nations that could reverse engineer the technologies used in constructing the Black Shaheen.

The sale of the Black Shaheen sets a dangerous precedent for the future, as it appears that MTCR nations may attempt to circumvent the regime's decidedly ambiguous rules for the benefit of their domestic arms industries. Britain and France's sale of the Black Shaheen LACM, in defiance of U.S. diplomatic pressure, undermines cruise missile nonproliferation efforts across the board, especially with respect to states such as Russia and China, which are far more likely to exploit the ambiguities inherent in the MTCR and export LACMs or useful technologies to Third World states.[270] Thus, the direct purchase of LACMs could be a far more serious threat that previously envisioned.

V. DEALING WITH THE THREAT: BROAD-BASED POLICY ALTERNATIVES

Cruise missile proliferation is one of the most serious threats facing the United States in the coming decades. However, the United States is not powerless in shaping the future of that threat. The United States should begin by alerting the rest of the world to the dangerous potential of LACMs by changing its missile proliferation rhetoric to include cruise missiles, as well as ballistic missiles. Once the United States builds international consensus as to the threat, it should seek to tighten the provisions of the MTCR dealing with cruise missiles and related technologies. Concomitantly, the United States must also go outside the MTCR and engage other potential proliferators who are not party to the regime. Finally, recognizing that proliferation of LACMs may occur despite its best efforts, the United States must also develop anti-cruise missile defenses now so that adequate defenses can be deployed when U.S. forces confront a cruise missile threat.

A. *Refocus the MTCR on Cruise Missiles*

Despite its flaws and shortcomings, the MTCR is still the preeminent means for preventing the proliferation of cruise

270. *Id.* at 85.

missiles. It remains the only tool for slowing the spread of missiles and missile-related technologies because of its legitimacy and gradually increasing membership, which encompasses most LACM producers with the glaring exception of China.[271] As discussed above, although the MTCR was originally conceived as covering both ballistic and cruise missile proliferation, subsequent negotiations and practices have focused primarily on the ballistic missile threat. Now, as the shadow of the cruise missile threat grows larger, is the time for the MTCR to consider cruise missiles on an equal footing with ballistic missiles.

This article proposes four significant modifications to current U.S. policies that should be pursued to tighten up the MTCR's rules on cruise missiles: (1) promote consensus within the MTCR that LACMs are a serious proliferation threat; (2) create a generally accepted formula for calculating range and payload trade-offs for cruise missiles; (3) encourage stricter technology transfer restrictions on turbofan engines and materials used to construct stealth missiles; and (4) give further consideration to the potential conversion of UAVs and light kit aircraft for use as LACMs. Each of these proposals is relatively inexpensive and goes hand-in-hand with current U.S. efforts to improve homeland defense, as well as preserve U.S. force projection capability overseas.

First and foremost, the United States must build a consensus within the ranks of the MTCR signatories that cruise missile proliferation is a threat to international peace and that the MTCR must be updated to deal with this potential threat. This requires a fundamental shift in U.S. foreign policy rhetoric, which, up until this time, has primarily focused on the ballistic missile threat as the foremost problem.[272] This general tendency of concern with regard to the ballistic missile threat is reflected in the MTCR's current provisions.[273]

It would not be difficult for the United States to place the cruise missile threat on equal footing to the ballistic missile threat in its international and domestic rhetoric. Until recently, cruise missile proliferation received little or no attention in U.S. documents or congressional reports detailing the threat of missile proliferation.[274] Giving equal attention to cruise and ballistic missiles is only the first step in the more difficult process of convincing other MTCR members that the cruise missile threat is indeed genuine. Things

271. *See* MTCR, *supra* note 2.

272. The United States did take a strong diplomatic stance on the sale of Black Shaheen LACMs to the UAE. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 40.

273. *See* MTCR, *supra* note 2.

274. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 84.

are beginning to move in the right direction under the current Bush Administration.[275] For instance, Secretary of Defense Donald Rumsfeld's articulation of the United States military's post-September 11th agenda for dealing with future threats specifically mentions cruise missiles.[276] After modifying its proliferation rhetoric to emphasize the LACM threat, the United States should attempt to raise awareness of the threat through quiet diplomatic discussions aimed at encouraging states to tighten their export restrictions and adhere to their obligations under the MTCR. Moreover, the United States can share intelligence with other MTCR members as to the states with indigenous LACM programs so that they can be particularly circumspect in transferring technology or equipment to those nations. Only after completing this groundwork and consensus-building can the United States initiate modifications to the MTCR. Admittedly, this will be a difficult proposition considering the damage to the U.S. foreign relations following Operation Iraqi Freedom and the failure to find WMDs in Iraq. Yet, the United States must make an effort to build a consensus on the cruise missile threat.

Second, the most glaring deficiency in the MTCR's controls on cruise missiles is the fact that there is no formula for determining the range/payload trade-offs for purposes of the regime.[277] The 300 km/500 kg threshold works well enough for ballistic missiles, but such a vague standard is inadequate for dealing with cruise missile proliferation.[278] This is a fundamental issue that must be addressed if the MTCR is ever to slow the proliferation of LACMs.

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275. *Id.*

276. Donald H. Rumsfeld, *Transforming the Military*, FOREIGN AFF., May/June 2002, at 20, 24-25. Rumsfeld wrote that in considering how to defend against future threats, the United States must ascertain its weaknesses. This is essentially defending against Liddell Hart's "indirect approach."

> Instead of building our armed forces around plans to fight this or that country, we need to examine our vulnerabilities – asking ourselves, as Frederick the Great did in his *General Principles of War*, 'What design would I be forming if I were the enemy?' – and then fashion our forces as necessary to deter and defeat that threat. For example, we know that because the United States has unparalleled power on land, at sea, and in the air, it makes little sense for potential adversaries to try to compete with us directly. . . . So rather than building up competing armies, navies, and air forces, they will likely seek to challenge us asymmetrically by looking for vulnerabilities and trying to exploit them. . . . Our job is to close off as many of those avenues of attack as possible. We must prepare for new forms of terrorism, to be sure, but also for attacks on U.S. space assets, cyber-attacks on our information networks, *cruise missiles*, ballistic missiles, and nuclear, chemical, and biological weapons.

Id. at 25 (emphasis added).

277. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 88.

278. *Id.*

In September, 2002, at the MTCR's annual plenary discussions in Warsaw, the members of the MTCR agreed that the range of all cruise missiles and UAVs covered under the regime would be calculated based on the maximum distance that the missile or UAV would be capable of flying at "range-maximizing capability," thus closing the loophole that cruise missile producers often invoked to circumvent the MTCR's range restrictions.[279] By establishing a "range-maximizing" flight profile as the basis for calculating the MTCR's range limitations, cruise missile producers will no longer be able to calculate their products' ranges based on flight at sea level or just above it.[280] As discussed above, turbofan or turbojet powered cruise missiles have greater fuel efficiency flying at altitude; thus LACMs range can be increased if those missiles fly at higher altitudes during the early part of their flights before dropping down to a terrain-hugging flight profile as they approach their targets.[281] The new formula for calculating the range of cruise missiles and UAVs will clear up some of the disputes as to which systems are covered under the MTCR and which are not.[282] But it should be noted that under the new formula for calculating range, the exporting state has the sole responsibility for making the determination – a classic case of the fox guarding the henhouse – as exporting states will have every incentive to mischaracterize the numbers so that the sale can be made.[283]

Additionally, the MTCR has yet to address the second (and more difficult) aspect of the range loophole — how range and payload trade-offs should be calculated. It is quite easy for an MTCR compliant cruise missile or UAV to violate the regime by decreasing the weight of the warhead and using the saved weight for increased fuel, thus increasing the missile's range beyond the 300 km limit.[284] Further elements that must be considered include trade-offs as to fuel capacity, guidance systems, and the speed at which an LACM is designed to fly, all of which affect the range of cruise missiles and UAVs.[285]

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279. Nartker, *supra* note 261. During the Warsaw plenary meeting, members of the MTCR also agreed on a more precise definition of "payload" so that the new definition encompasses support structures and countermeasures — not just the warhead itself. *Id.*

280. *Id.*

281. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 88, 119-120 nn.25-26. It should be noted that unless LACMs have stealth characteristics, they must drop down to a terrain-hugging flight profile before entering detectable radar range or else risk being detected and intercepted. *Id.* at 88. Stealthy LACMs can fly at altitude even when within radar range with minimal risk of detection. *Id.* at 119-120 n.26.

282. Nartker, *supra* note 261.

283. *See* Gormley & Speier, *supra* note 80, at 75.

284. *See* Greene, *supra* note 48, at 56; Nartker, *supra* note 261.

285. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 88, 120 n.27.

The ambiguities surrounding the range calculation formula and range/payload trade-off led to the diplomatic fracas surrounding the transfer of the Black Shaheen missiles to the UAE.[286] While the MTCR has made a significant step forward by adopting a more precise (though hardly crystal clear) formula for calculating the range of cruise missiles, the regime's work is incomplete without addressing the remaining range/payload trade-off loophole and the need for MTCR member states (other than the exporter) to calculate the range of missile systems sold to non-MTCR states. The fact that determining such a formula is difficult and contentious does not mean it should be ignored. If a more precise definition cannot be reached, there is little that can be done to prevent the proliferation of LACMs, as some less scrupulous MTCR states will take advantage of the definitional ambiguities when it is in their commercial interests to do so.

Third, the United States should seek to tighten the rules on the transfer of certain key technologies that could be used to build complex LACMs — most specifically, small, efficient turbofan engines and technologies or materials that could be used to produce stealth LACMs.[287] As discussed above, until recently, the major technological chokepoints for producing LACMs have been their guidance systems and propulsion units. It is too late to stop the proliferation of accurate guidance systems with the worldwide availability of cheap and reliable GPS systems. Thus, small, efficient turbofan engines are the last major chokepoint to indigenous cruise missile development. Turbofan engines are covered under Category II of the MTCR;[288] however, considering their usefulness in building LACMs and their status as the last real chokepoint technology, they should be transferred to Category I.[289] Once categorized under Category I, there will be a general presumption to deny applications to export small turbofan engines, although, admittedly, the United States would likely face objections from commercial aviation. Furthermore, commercial and military turbojets that generate more than 2,000 pounds of thrust are fully usable in LACMs, yet the MTCR does not exert even minimal controls over them.[290] The United States should push for such engines to be classified under the strictures of Category II. Exporters of these types of engines would then be required to obtain some sort of end use verification to ensure that the engines are

286. *See id.* at 88; Nartker, *supra* note 261.
287. *See* Gormley, *Neglected Dimension*, *supra* note 3, at 27-28.
288. MTCR, *supra* note 2.
289. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 88-89.
290. *See id.* at 89-90; Gormley, *Neglected Dimension*, *supra* note 3, at 28.

actually installed on aircraft and not diverted to covert LACM programs.[291] The United States can also push for the inclusion of technology such as precision machine tools and certain materials needed to build turbofan engines under Category II of the MTCR.

The United States should also seek to have radar cross-section-reducing materials and stealth technologies and materials classified under Category I of the MTCR so that there is a general presumption to deny applications to export such technology. There have long been calls for limiting the diffusion of stealth technology under the MTCR, but the regime's members have been unable to precisely determine which technologies should be controlled and how to classify them.[292] The United States should seek to have these technologies classified as key missile subsystems or components with military uses under Category I of the MTCR.[293] If the United States is obliged to compromise and cannot get the remaining MTCR members to agree to such a classification, the United States should adopt a firm stance that such stealth technology and materials should be classified at least under Category II.[294] Had restrictions on the transfer of stealth technology been in place, the United States would have had alternate grounds to object to the sale of the Black Shaheens to the UAE because the Apache LACM, from which the Black Shaheen is derived, has stealth technology incorporated into its design.[295]

Next, the MTCR's current provisions do not recognize the potential of UAVs, RPVs and light kit aircraft to be converted into LACMs. Although almost all UAVs and RPVs fall under the MTCR's Category II restrictions because they can carry a minimal payload of at least 300 km, there are some that should be classified under the more stringent requirements of Category I, particularly if the UAVs or RPVs have stealth characteristics. Although UAVs and RPVs that could fly 300 km on a one-way trip with a 500 kg payload are categorized under the MTCR's Category I and its "strong presumption to deny" language,[296] other types of UAVs or RPVs, such as those equipped for combat use or capable of carrying biological or chemical agents, should also be included under Category I.[297] While the MTCR has sought to tighten export controls

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291. *See* MTCR, *supra* note 2; GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 89-90.

292. *See* GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 88; MCMAHON & GORMLEY, *supra* note 166, at 80-83.

293. Gormley, *Neglected Dimension*, *supra* note 3, at 27.

294. *See id.*

295. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 39.

296. *See* Gormley, *Neglected Dimension*, *supra* note 3, at 27-28; MTCR, *supra* note 2.

297. Gormley & Speier, *supra* note 80, at 76-77.

on UAVs and RPVs under Category II,[298] the United States should make an effort to have the most dangerous UAVs and RPVs included under Category I.[299]

Light kit aircraft represent another serious problem for proliferation. Although easily convertible into LACMs, such aircraft are not covered by the MTCR at this time because they are not designed to be remotely piloted, and thus do not fall under its provisions.[300] Despite the bureaucratic difficulties, the United States should also make an effort to expand Category II of the MTCR to include kit aircraft, thus requiring government approval before being exported to non-MTCR states;[301] again, admittedly, the United States would likely face objections from commercial aviation if kit aircraft were classified under Category II.

Another logical move in tightening up the MTCR would be to close up the intentional loophole that exempts subsystems and parts, which would otherwise be subject to Category II scrutiny, so long as they are intended for manned aircraft.[302] This loophole creates a significant proliferation risk, as so many key advanced technologies for building cruise missiles, such as propulsion units and guidance systems, are identical to those used in manned aircraft.[303] Using this exemption, a state could covertly acquire key components and subsystems for a cruise missile program under the guise of a legitimate civilian manned-aircraft program.[304] By eliminating this loophole and subjecting all such technology transfers to Category II scrutiny, MTCR members will have a better idea which countries are acquiring certain technologies, making the identification of emerging cruise missile threats much easier.[305]

The United States must play its cards carefully if it seeks to strengthen the provisions of the MTCR. Merely making the aforementioned proposals at the next MTCR plenary meeting will not work. The first proposal – promoting consensus that LACMs are genuine threats to global peace — will be difficult, but it is the key to achieving the other three proposed modifications to the MTCR. Changing the mindset of MTCR members regarding cruise missiles will require delicate diplomatic maneuvering before any of the suggested changes to the regime can be proposed. There will almost certainly be opposition from France, considering the revenues its

298. *Id.* at 76.
299. *See* Gormley, *Neglected Dimension*, *supra* note 3, at 27-28.
300. Gormley, *New Developments*, *supra* note 54, at 427.
301. Gormley, *Neglected Dimension*, *supra* note 3, at 27-28.
302. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 86.
303. *Id.*
304. *Id.*
305. *Id.*

armaments industry may be obliged to forego, as well as its distaste for the United States in the wake of the U.S. decision to invade Iraq in 2003. Yet the MTCR remains the best available option for the United States to slow the proliferation of cruise missiles and develop an accurate LACM threat assessment. A revitalized MTCR with heightened restrictions on the export of cruise missiles and related technologies will push states to take a much longer path to develop a LACM capability, and an inferior one at that. These changes will make defending against the cruise missile threat a simpler task.

B. Other Cruise Missile Nonproliferation Efforts

Although the MTCR is the most important tool for containing the proliferation of LACMs, the United States cannot ignore the importance of nonproliferation efforts outside of the regime, particularly engaging states that are not party to it. The MTCR is not a panacea for cruise missile proliferation, and the United States must act accordingly. Ideally, the United States should seek to deal with the proliferation of LACMs within the context of the MTCR, but in some cases such an approach may not be feasible. If the United States cannot work within the MTCR suppliers' group framework, it should pursue a multilateral approach to stemming cruise missile proliferation. As discussed above, the United States has already gone outside the MTCR with the proposed International Code of Conduct Against Ballistic Missile Proliferation.[306] It could do so again with regard to cruise missiles. Only as a last resort should the United States negotiate bilaterally on cruise missile proliferation with potentially threatening states. While the United States has negotiated bilaterally on proliferation issues with Third World countries in the past, the negotiations usually result in blackmail, with the United States making key concessions in return for dubious pledges. The U.S.-North Korea nuclear negotiations resulting in the 1994 Agreed Framework and the concessions granted after North Korea launched a medium-range ballistic missile in 1998[307] are illustrative as to why the United States should not deal bilaterally with potential proliferators.

If the United States is unable to achieve its goals on limiting cruise missile proliferation through the MTCR, it can pursue a broader, multilateral approach to slowing proliferation. Having

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306. *See* Draft Text, *supra* note 205.

307. *See* BENJAMIN FREEDMAN, CENTER FOR DEFENSE INFORMATION, FACT SHEET: NORTH KOREA'S NUCLEAR WEAPONS PROGRAM (Jan. 23, 2003), *available at* http://www.cdi.org (last visited July 5, 2004).

more countries involved in a different forum may give the United States a greater chance at building consensus. The most probable form of such an approach would be a code of conduct along similar lines to the proposed International Code of Conduct Against Ballistic Missile Proliferation.[308] The major provisions of such a document cannot be predicted, but would likely employ language similar to that of the proposed ballistic missile code of conduct including discussions of cruise missile programs and civilian aviation, transparency measures, and notification requirements.[309] Alternately, as the ballistic missile code of conduct is still in its formative stages and the language has not been finalized, the United States could push for the addition of provisions that cover both cruise missiles and ballistic missiles.

China is the most important potential proliferator of cruise missiles that the United States should actively engage outside of the MTCR, as it will have the capability to export significant numbers of LACMs in the next decade.[310] Although China has agreed to adhere to certain parts of the MTCR, it is unclear whether China would ever become a member of the regime.[311] Despite previous U.S. diplomatic efforts to encourage China to join the MTCR, Beijing refused to join the regime as a matter of principle because the MTCR was originally negotiated by the G-7 countries, without Chinese participation.[312] The United States could show considerable foresight by negotiating limits on Chinese cruise missile proliferation before China has the capability to export such missiles. China's current pledge not to export certain key technologies or equipment is a step in the right direction, but there are significant differences between the MTCR Annex and the list of equipment and technologies that China has pledged not to export.[313] The United States should attempt to engage China in a multilateral framework that deals specifically with cruise missiles. If such a multilateral framework or code of conduct on cruise missiles is to be negotiated, China will have to be given a major role in its formation. But, if the Chinese have a major voice in the formation of such a multilateral agreement, it will be diplomatically constrained to

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308. *See supra* note 205 and accompanying text.
309. *See* Draft Text, *supra* note 205.
310. *See* Lum, *supra* note 117, at 70-72.
311. *See* Scoblic, *supra* note 113.
312. Pande, *supra* note 57; Scoblic, *supra* note 113.
313. Saunders, *supra* note 115, at 1-2; *see also* Gormley, *New Developments*, *supra* note 54, at 429 (discussing how China's export control list essentially conflated the MTCR's Categories I and II into one category, subjecting such technologies and systems to Category II equivalent case-by-case reviews before export, rather than the "strong presumption to deny" of Category I).

abide by the agreement's terms or else risk serious political and diplomatic embarrassment. Only as a last resort should the United States resort to bilateral negotiations with China regarding its export of cruise missiles.

There have been various other permutations on limiting missile proliferation through legally binding treaties that would ban certain categories of missiles.[314] However, most of them have been aborted before getting off the ground due to difficulties in enforcement or serious loopholes that would negate the value of any such treaty.[315] Most significant is the proposal to transform the U.S.-Soviet Intermediate-range Nuclear Forces (INF) Treaty into a global missile control treaty *à la* the Chemical Weapons Convention (CWC) or Biological Weapons Convention (BWC).[316] Although various academics have urged that negotiations be initiated, little has been done.[317] Considering the weaknesses of the CWC and BWC, and LACMs' inherent characteristics, such a treaty would likely be no better (and probably worse) than the MTCR at controlling cruise missile proliferation.

One immediate step that the United States can take to limit cruise missile proliferation is to tighten its own domestic export control policies to ensure that cruise missile-related technologies are not transferred to other countries. The United States needs to ensure that it regularly updates its lists of controlled technology. The current U.S. export control regime is disorganized.[318] Because the State and Commerce Departments have joint responsibility for enforcing items controlled under the United States' commitments to the MTCR, there have been protracted bureaucratic turf wars and internal bickering that have eroded the effectiveness of such export controls.[319] The United States needs to make sure that its lists of controlled technologies are continually updated to keep abreast of recent technological developments. According to a General Accounting Office report, as of November 2001, the State Department had not updated its list of technology controlled under the MTCR in "several years."[320] Although the State Department has

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314. GORMLEY, DEALING WITH THE THREAT, *supra* note 1, at 90.

315. *See id.* at 90-91.

316. *See id.* at 90.

317. *See id.* at 90-91; Greene, *supra* note 48, at 74.

318. *See* Boese, *supra* note 140.

319. *See id.* The Department of Commerce controls the licensing for dual-use technologies, while the State Department controls the licensing for everything else. Keith Stein, *Exports and Nuclear Proliferation Control Need Improvements*, SPACE & MISSILE, Nov. 22, 2001 (n.p.). However, of the 196 items controlled under the MTCR, 47 appear on both departments' lists, even though each one has different standards for ascertaining whether an export license should be granted. *Id.*

320. *Id.*

pledged to update the list, such a lag time between updates is unacceptable if the United States intends to keep its MTCR commitments and prevent the dissemination of key technologies useful for constructing cruise missiles.[321]

VI. CONCLUSION

The proliferation of cruise missiles has become a genuine threat to international security, as the feasibility of indigenous production increases and opportunities for acquiring complete missile systems emerge. The MTCR has, thus far, been ineffective at preventing the spread of LACMs. But all is not lost. The cruise missile threat has not completely matured, giving the United States and the rest of the world time to head off or constrain the threat. After a period of ignoring the threat, it finally appears that the United States has realized the magnitude of the cruise missile threat and its impact on the ability of the U.S. military to project power around the world. The vulnerability of U.S. foreign policy interests to the mere threat of a cruise missile attack is reason enough for the United States to raise awareness of the threat and lead an effort to reinvigorate the MTCR to deal with cruise missile proliferation. The MTCR remains the United States' best hope to contain and manage the cruise missile threat.

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321. *Id.*