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Cruise Missile Proliferation

Christopher Bolkcom and Sharon Squassoni
Foreign Affairs, Defense, and Trade Division

Summary

Over 80 countries currently possess cruise missiles. U.S. and allied forces currently face a threat from short-range, conventionally armed, anti-ship cruise missiles in the hands of a few nations. As relevant technology becomes increasingly available commercially, efforts to control the sophistication of these missiles and their spread may become more difficult.

Introduction

More than 80 countries today have cruise missiles of some kind.[1] Eighteen of these countries manufacture cruise missiles domestically. The remaining 62 countries import these weapons.[2] Today, the most advanced cruise missiles, those with the longest ranges, heaviest payloads, highest accuracy, and stealthy features, tend to be in the hands of U.S. allies or friendly countries. Potential U.S. adversaries, such as Iran, Iraq, and Libya, tend to deploy anti-ship cruise missiles. However, these countries are developing and fielding land attack cruise missiles (LACMs) that typically can attack known, fixed targets, such as ports, airfields and cities, within 10s to 100s of miles.

Presently, cruise missiles can pose a threat to allied countries and U.S. forces deployed overseas, but the U.S. intelligence community estimates that, by the end of the decade, a cruise missile attack on the continental United States may be possible.[3] Perhaps more important, the U.S. intelligence community judges that it may not be able to provide much, if any warning, of a forward-based LACM threat to the United States. Although

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[1] There is no universally accepted definition of cruise missiles, but they can be categorized as unmanned aerial vehicles (UAVs) that are a) continually powered by an air-breathing or rocket engine; b) generally guided for their entire flight; c) weaponized; and d) generally optimized for one-way missions. This contrasts with weaponized UAVs such as the Predator, that can perform multiple missions, but they are treated similarly under the Missile Technology Control Regime.

[2] International Institute for Strategic Studies, *The Military Balance*, Oxford University Press, London, various years.

[3] Testimony of Director of Central Intelligence, George J. Tenet, before the Senate Armed Services Committee, March 19, 2002, "Worldwide Threat – Converging Dangers in a Post 9/11 World," p. 13. The threat, as worded by Director Tenet, is non-specific.

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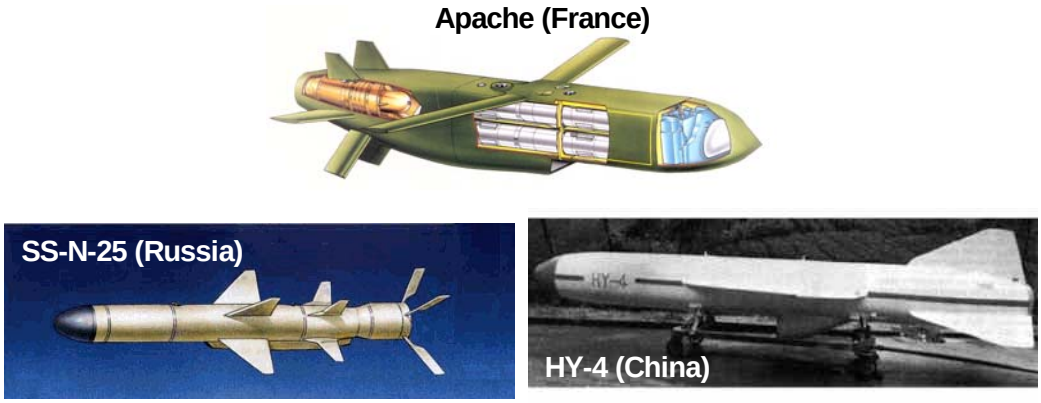
terrorist groups will probably continue to favor proven delivery vehicles such as trucks, suicide bombers, and airplanes, cruise missiles have many attributes that could make them attractive to terrorists, who may use them in ways that we currently can't foresee.

Figure 1: Illustrative Cruise Missiles



Background

A 1994 Defense Science Board (DSB) study concluded that the United States faces a threat from cruise missiles that is expected to evolve rapidly, and that will be difficult to predict in a timely way.[4] In contrast to ballistic missile proliferation, cruise missiles present a particular challenge for monitoring and control because they exploit technology that is well understood and well established in the civil aviation industry. Missile airframes, navigation systems, jet engines, satellite maps, and mission planning computers and software all can be purchased on the commercial market. Cruise missile technology "hides in plain sight" – making it difficult to identify a military program. At the same time, commercial availability generally means relatively low-cost weapons for many nations and, potentially, non-state actors.

In addition, some experts believe that it is fairly easy for a country to produce simple cruise missiles, upgrade purchased cruise missiles, or convert manned and unmanned aircraft into unmanned weapons. Manufacturers can exploit existing platforms; several nations have modified anti-ship cruise missiles to attack land targets. In addition to today's 18 cruise missile manufacturers, 22 other countries appear to have the industrial and technological infrastructures required to make cruise missiles.[5] The status of these "threshold cruise missile manufacturers" could have a significant impact on global cruise missile supply, demand, inventory, and capabilities. Nonetheless, it is difficult to predict what motivations might underlie a decision by these potential manufacturers to develop indigenous capabilities and possibly export missiles.

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[4] Report of the Defense Science Board Summer Study on Cruise Missile Defense. Office of the Undersecretary of Defense (A&T). January 1995, Washington, D.C. p. 14.

[5] Bolkcom, Christopher, Statement before the Senate Committee on Government Affairs, Subcommittee on International Security, Proliferation, and Federal Services, June 11, 2002.

Proliferation Concerns

The export of cruise missiles, their production technology, and components are currently regulated globally under two export control agreements – the Missile Technology Control Regime (MTCR) and the Wassenaar Arrangement. The MTCR focuses on the upper end of the capability spectrum – missiles (ballistic and cruise)and unmanned aerial vehicles (UAVs) that are capable of carrying nuclear, biological or chemical weapons.[6] Exports of complete systems that can carry a 500-kg warhead 300km or more are presumed to be denied by member states to any country; exports of complete systems that are less capable are considered on a case-by-case basis, as are components and subsystems. Export of production facilities is not authorized. In 1993, MTCR member states added a "catch-all" clause, which presumes denial of exports of any items in the Annex if there is persuasive information that they are intended to be used for the delivery of weapons of mass destruction (WMD). This catch-all clause was meant to address the loophole for biological and chemical warheads.[7]

The Wassenaar Arrangement picks up the lower range of the capability spectrum. Wassenaar, which supercedes Cold-War COCOM (Coordinating Committee) export controls, specifically regulates UAVs and UAV technology designed for military purposes. Thus, exports of cruise missiles with ranges shorter than 300 km that can carry warheads weighing less than 500 kg that are not destined for countries with WMD programs are subject to restrictions under Wassenaar. However, Wassenaar includes exceptions, as does the MTCR, for technologies and components intended for manned aircraft.[8]

Several observers have noted weaknesses in this supply-side approach, especially where cruise missiles are concerned. To be successful, supply-side regimes require most of the technology holders to be members and that these members concur on the export restrictions. Half of the current manufacturers of cruise missiles (Brazil, China, India, Iran, Iraq, Israel, North Korea, South Africa and Taiwan) are not members of the Wassenaar Arrangement and of these, only South Africa has joined the MTCR (although Israel and China have informal arrangements to adhere to the guidelines.) Although the MTCR is generally regarded as successful in curbing missile exports, member states have disagreed from time to time. One particularly relevant case is the proposed transfer of *Black Shahine* cruise missiles to the United Arab Emirates from a British-French company, which has been debated for the last four years. The flexibility of cruise missiles to trade off payload and range configurations makes agreement on how to calculate capabilities difficult. Moreover, overlapping military and civilian technology increases pressure to allow technology exports. Ballistic missiles do have a civilian counterpart technology – space launch vehicles – but the technologies are not nearly as ubiquitous as they are for UAV technologies in the aircraft industry. Moreover, space launch programs

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[6] The MTCR, begun in 1987, created a common set of export control guidelines that each member country (now encompassing 33 states) administers independently. The 300-km, 500-kg warhead threshold was devised to preclude the ability to carry a nuclear warhead. CRS Report 97-343 F, *Proliferation Control Regimes: Background and Status*.

[7] CRS Report RL 40427, *Missile Survey: Ballistic and Cruise Missiles of Foreign Countries*.

[8] CRS Report RS 20517, *Military Technology and Conventional Weapons Export Controls: The Wassenaar Arrangement*.

do not provide convenient cover for military programs because they are quite expensive and difficult to hide. Space launch services have also emerged in the last decade as an alternative to indigenous development. In the case of cruise missiles, the civilian counterpart is aircraft technology, which most states already have. The specific exception for exports of technologies applicable to manned aircraft opens what some call the "manned aviation loophole." Nonetheless, the significant military/civilian overlap demonstrates that a monopoly on technology (which arguably doesn't exist even for ballistic missiles) does not exist for cruise missiles, except at the most capable end of the spectrum.

The Wassenaar Arrangement, by admission of even its most ardent supporters, is a shadow of the former COCOM arrangement. In part, this is probably because it is difficult to limit trade in military technologies and systems that would otherwise be freely conducted. The accuracy of many cruise missiles makes them appealing acquisitions even if only conventionally armed. The U.S. government is pursuing efforts to strengthen the Wassenaar Arrangement, including more frequent reporting and a no-undercut provision (once an export is denied by one member state, all member states agree not to export that item to the denied state) which exists, *de facto*, under the MTCR. Some analysts have suggested, however, that the United States' prominent use of cruise missiles and UAVs in recent conflicts increases their attractiveness to other nations. On the other hand, the intelligence community has judged that many states may continue ballistic missile development programs rather than acquire cruise missiles because the latter do not confer the same prestige as ballistic missiles.

Military Concerns

Cruise missiles present significant challenges for air and missile defenses. Detecting a cruise missile attack is difficult because they are small and can be launched from the air, sea or ground. Locating the source or direction of the attack is complicated by the missiles' inherent maneuverability. Stealthy and terrain-hugging missiles may complicate current air defense radars's ability to track them. And because cruise missiles fly like manned aircraft, it can be difficult to separate friend from foe, or to differentiate between civilian aircraft and enemy missiles.

Some analysts have observed that it is preferable to destroy cruise missiles before they are launched. The United States has improved its ability to attack mobile targets as evidenced in *Operation Enduring Freedom* compared to its "Scud hunting" track record during the Persian Gulf War. However, destroying mobile, ground launched cruise missiles and other "time-critical-targets" remains a major challenge for DOD.[9] Improving counter-force targeting capabilities is another challenge in dealing with cruise missiles and cruise missile proliferation.

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[9] "We've got to do a much better job with time-critical targeting," said Vice Adm. John B. Nathman, commander of Naval Air Forces. *Aviation Week & Space Technology*. April 29, 2002, p.55. And Ron Laurenzo. "RAND: Time-Critical Targets Still Challenge Air Force." *Defense Week*. June 10, 2002. p.16.

Congressional Considerations

Congress' constitutional authority to regulate trade gives it a key role in formulating export controls. In addition, Congress can affect how the Department of Defense funds and implements its programs to defend against cruise missile threats. Recently, Congress held hearings on export control regimes and the cruise missile threat. Some relevant questions emerged from this review, in particular: (1) can we reduce the supply of or access to cruise missiles and their technology; (2) can we reduce the demand for cruise missiles; and (3) can we improve U.S. military capabilities to defend against cruise missile attack or destroy enemy cruise missiles before they can be launched (counter force targeting)? These matters are explored below in greater detail.

Reducing Supply. In reducing access to cruise missile technology, several avenues have been suggested. First is the elimination of the manned aviation loophole. Six different items under the MTCR (guidance sets, turbojet engines, navigation equipment, flight control systems, avionics, and analog and digital computers) are not controlled if they are destined for manned aircraft. Closing this loophole would probably encounter significant resistance, according to many industry analysts. A second approach is to implement further restrictions on stealth technology. Some of these technologies have fewer commercial applications and are made by fewer countries than less sophisticated aviation technologies. A third approach is to tailor some of the technical parameters in the MTCR technology annex specifically to cruise missiles and UAVs. For example, the MTCR controls the export of global positioning system (GPS) receivers that operate in conditions (faster than 1,000 nm/hour, higher than 60,000 ft) relevant to ballistic missiles, but not to cruise missiles.

General modifications to the Wassenaar Arrangement might also be possible, including increased frequency of reporting, increased scrutiny of exports to certain countries with cruise missile programs, and negotiation of a "no-undercut" provision similar to that which is exercised under the MTCR. If a no-undercut provision is not possible for all Wassenaar list items, it has been argued that it might be possible to implement it for cruise missiles and associated technologies. In addition, it might be useful to create an annex for cruise missiles similar to the addendum on "Elements for Export Controls on Man-Portable Air Defense Systems (MANPADS)."[10]

It may also be possible to tighten controls through bilateral agreements, particularly with nations such as Russia and France, which are two of very few countries capable of making stealthy cruise missiles. Negotiating an agreement prohibiting the export of stealthy cruise missiles with these and other appropriate countries is sometimes seen as potentially useful step.

Reducing Demand. A key component of a strategy to limit technology diffusion is to focus on reducing demand. A recent comment on the case of Indian and Pakistani nuclear technology noted that:

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[10] This addendum was developed because members recognized the threat posed by the unauthorized proliferation of these systems and to affirm that they would apply strict national controls on the export of MANPADS

> The limitations of Western nonproliferation policy are now painfully obvious. It has relied primarily on supply-side export controls to prevent access to nuclear technologies.... Any effective strategy for nonproliferation must also involve demand-side measures...[11]

Creating incentives or disincentives (or perhaps both) for countries to refrain from importing or manufacturing cruise missiles might help reduce demand for these weapons. Economic aid or sanctions, military training exercises or confidence-building measures are some tools. Confidence-building measures might include agreements to avoid intrusion of neighboring airspace or advance notification of air force exercises. In general, measures that help improve a country's confidence in its ability to defend itself or to deter attack with its current offensive and defensive capabilities would need to be identified on a case-by-case basis.

Improving Military Capabilities. The Department of Defense has taken several steps to improve its ability to defend against cruise missile attacks. These include programs to improve detection of threats through better sensors (E-3 AWACS, the E-2C Hawkeye airborne surveillance aircraft, and the Army's Joint Land Attack Cruise Missile Elevated Netted Sensors (JLENS)), better integration of air and missile defense systems and improving existing air defense radars and battle management computers and communications links. Integrating air and missile defense systems may have the greatest payoff in designing and fielding an effective cruise missile defense. The Joint Tactical Information Distribution System (JTIDS), the Navy's Cooperative Engagement Capability (CEC), and development of a Single Integrated Air Picture (SIAP) appear to be important stepping stones. Also, because combat identification is a critical yet often challenging part of destroying cruise missiles, efforts like the All Service Combat ID Evaluation Team (ASCIET) will be important.

A key challenge in cruise missile defense is cost. Although cruise missiles are cheap, many cruise missile defense systems, including missile interceptors, are expensive. DoD's Low Cost Cruise Missile Defense (LCCMD) program seeks to mitigate this problem by reducing the cost of interceptor missile technology. In addition, DOD's cruise missile defense efforts have been focused on protecting forward-deployed U.S. forces. Presently, the North American Aerospace Defense Command (NORAD), controls a number of ground-based radar, over 100 fighter aircraft, and several airborne surveillance aircraft – a scaled down version of the Cold War continental air defense system. If NORAD also has to consider possible aircraft and missile attacks originating within the United States, homeland defense would be greatly complicated. Coordinating military and civilian airspace monitoring and control entities (NORAD and FAA respectively) will likely be key to any successful continental cruise missile defense system. One relatively low cost effort might be to improve and expand the Customs Service radar-bearing balloons (aerostats), currently used to detect small aircraft attempting to smuggle drugs into the United States. Other technologies that are contributing to this effort include high bandwidth communications and "network-centric" targeting to improve counter-force targeting capabilities. The Network Centric Cooperative Targeting ACTD (Advanced Concept Technology Demonstration) is one example of this approach. In addition, DOD is experimenting with use of unmanned aerial vehicles (UAVs) in counterforce targeting.

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[11] Ramana, M.V. and Nayyar, A.H, "India, Pakistan, and the Bomb," *Scientific American*, December 16, 2001. URL [http://www.sciam.com].