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# Conventional Prompt Global Strike: A Fresh Perspective



# **Conventional Prompt Global Strike: A Fresh Perspective**

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## Executive Summary

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The general concept of a U.S. conventional prompt global strike (CPGS) capability with the potential to strike targets anywhere in the world in an hour or less has been broadly supported. Nevertheless, concerns remain over specific types of CPGS systems and whether their use may be misconstrued as a nuclear attack, prompting a response in kind. Concerns over “nuclear ambiguity” issues have to date stymied rapid progress in developing and fielding CPGS capabilities.

Although the impetus toward developing a CPGS capability was launched a decade ago, the fielding of CPGS systems is still years away. Several new developments in recent years, however, suggest that the time is ripe to reconsider the role that CPGS can play in accomplishing U.S. national security objectives, the specific types of CPGS systems that can best fulfill U.S. military objectives, and the impact of deploying and employing CPGS weapons on global stability. These developments include:

- changes in the executive and legislative branches that suggest bipartisan interest and support for CPGS;
- technological advancements that allow for a range of additional CPGS options;
- a new strategic arms control environment that allows greater flexibility in the development and deployment of specific types of CPGS systems; and
- an increasingly austere fiscal and budgetary environment that will necessitate trade-offs and the reprioritization of defense efforts and investment priorities.

The goal of CPGS is to provide the United States with credible non-nuclear options for preventing or responding to aggression. Yet these conventional options also complement and support the Obama administration’s policies and plans for U.S. strategic forces, as enunciated in the April 2010 Nuclear Posture Review (NPR). In particular, a CPGS capability can help realize each of the five key nuclear weapons policy objectives identified in the NPR, including: preventing nuclear proliferation and nuclear terrorism; reducing the role of U.S. nuclear weapons in U.S. national security strategy; maintaining strategic deterrence and stability at reduced nuclear force levels; strengthening regional deterrence and reassuring U.S. allies and partners; and sustaining a safe, secure, and effective nuclear arsenal.

CPGS can help enable these goals by providing the United States with credible military strike options against time-sensitive, high-value, or fleeting targets without the need to resort to nuclear weapons. Many of these targets are protected by adversaries or beyond the effective range of existing conventional military assets. By closing gaps in the U.S. ability to strike at targets quickly and accurately over long distances, a CPGS capability can enhance deterrence and stability; dissuade potential proliferators and defeat their efforts; allow for reductions in nuclear force levels; and reassure allies of the U.S. commitment to their security in light of concerns over declining reliance on the U.S.



“nuclear umbrella.” In addition, because the industrial base capabilities to develop CPGS systems are similar to those required for sustainment of the nuclear deterrent, a CPGS capability can help maintain the skills and expertise required for the nuclear enterprise.

As technology has matured, a number of promising CPGS concepts merit serious consideration. These include basing and deployment options that would minimize concerns over nuclear ambiguity and the risks of a reflexive nuclear response. Various land- and sea-based concepts can augment U.S. conventional strike capabilities considerably. Land-based CPGS concepts, such as the Conventional Strike Missile (CSM), may be deployed on the territory of the United States while other concepts, like the Advanced Hypersonic Weapon (AHW) may be deployed globally in locations such as Guam, Diego Garcia, or Puerto Rico. A variety of sea-based CPGS systems, such as Conventional Trident Modification (CTM), ArcLight, and Sea Strike could be deployed on submarines or surface ships.

Each of these systems and basing modes has distinct characteristics and a flight profile that makes it more or less observable to countries with the technical capability to monitor U.S. missile launches. To varying degrees, each has a discrimination profile that could enable the observing country to distinguish a CPGS in various stages of flight. The components and characteristics of each CPGS concept may determine whether the concept is subject to a particular arms control treaty and, if so, what constraints would apply.

Both the Intermediate-Range Nuclear Forces (INF) Treaty and the New START Treaty contain provisions that could have a direct bearing on the deployment of certain CPGS systems. New START, in particular, is likely to capture certain types of CPGS systems and the Obama administration has acknowledged this. As a result, the administration has indicated that only a modest number of CPGS systems will be deployed to fill a “niche” role. Nevertheless, because of definitional issues contained in the New START Treaty, it may be potentially easier and less costly to deploy CPGS weapons under New START than under the now-expired START I Treaty. New START actually permits numerous options for CPGS concepts, both within and outside the Treaty limits.

Concerns by Russia and China over the nuclear ambiguity issue appear to be exaggerated. Statements by Russian and Chinese officials suggesting that the U.S. launch of a CPGS weapon could be met with a nuclear response reflect a desire to forestall the development of the CPGS program within the United States. In particular, Russian political leadership statements to this effect have been contradicted by Russian military officials, who suggest such a reaction by Russia is highly unlikely.

Russia has revitalized its launch detection and tracking capability since the 1990s and would have little difficulty distinguishing the launch and flight of a CPGS weapon from a nuclear missile. Should any uncertainty exist, nevertheless, Russia’s behavior in the past demonstrates a realistic amount of caution in responding to ambiguous missile threats. There is no reason to believe Russia’s response would be different today, particularly as its early warning capabilities have improved.

Finally, some believe the development of CPGS capabilities by the United States would spark an arms race as other countries seek to develop similar capabilities in response. In reality, trends in weapons development suggest that movement toward longer-range, more accurate conventional ballistic missiles is not the result of an arms race dynamic. Russia, China, and other countries have long understood the military operational benefits of strike systems with greater range and accuracy, and their pursuit of such capabilities undermines their stated concerns over the supposedly destabilizing nature of the U.S. CPGS program. Indeed, the technologies that allow for such improvements are becoming increasingly ubiquitous. Therefore, there does not appear to be a direct correlation between the U.S. push to develop CPGS and the desire of other countries to develop precision missiles and weapons that can strike at greater distances.



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## Introduction

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The need to acquire a conventional prompt global strike (CPGS) capability that would allow the United States to strike targets anywhere in the world within one hour appears to be supported broadly—at least as a general concept—by both political parties in the United States. A February 2011 report from the National Defense University cites an overlap in policy goals by Republican and Democratic administrations that would be served by CGPS capabilities.<sup>1</sup> This consensus in favor of CGPS often breaks down, however, over the specific concepts to be developed and deployed. Pending resolution of a variety of contentious issues, U.S. deployment of an initial CGPS capability remains years away.

This report takes a fresh look at CGPS in the current security environment. The current environment differs in several ways from that at the time of the 2008 study by the National Academy of Sciences (NAS) on CGPS options.<sup>2</sup> This report examines implications for developing and deploying CGPS capabilities in light of recent developments.

- First, although CGPS development and deployment was proposed initially by the Bush administration in 2002, a different administration with different policy goals now occupies the executive branch of government. The Obama administration's national policy goals for strategic forces, as articulated in the 2010 Nuclear Posture Review (NPR), would appear to be served well by developing and fielding CGPS capabilities.
- Second, as a result of technology advancements over the past several years, additional options for CGPS weapons, in addition to those considered by the NAS study, appear feasible and deserve serious consideration.
- Third, the first Strategic Arms Reduction Treaty (START I) between Russia and the United States expired in late 2009 and the New START Treaty entered into force in early 2011. The provisions of the New START Treaty open up potential new opportunities, as well as foreshadow potential constraints, for CGPS.
- And fourth, the political climate on Capitol Hill has changed, presenting new opportunities to inform members of Congress on the strategic implications of CGPS. Along with this different political dynamic, budget concerns will impact defense programs, necessitating trade-offs as a consequence of reductions in overall defense spending mandated by legislative actions to curb deficit spending and reduce the nation's debt.

In addition, this report examines the oft-heard concern by CGPS critics and supporters alike over the possibility that CGPS use might be misinterpreted as a nuclear strike. A February 16, 2007, letter to the president of the National Academy of Sciences from Senators Daniel Inouye and Ted Stevens cited the issue of “ambiguity” as central to their request for an independent study of “the prompt global strike mission and in

particular the conventional Trident missile option.”<sup>3</sup> Therefore, the issue of ambiguity and the potential for misinterpretation is examined carefully in this report.

Part one of this report begins by identifying key policy goals of the Obama administration which might be served by the development and operational deployment of CPGS. Specifically, in April 2010, the Obama administration published its NPR, which listed the administration’s five priority policy goals related to strategic nuclear forces. Central to these goals is reducing the role and numbers of nuclear weapons. This report examines the potential of CPGS capabilities to help accomplish those goals.

Next, the report considers changes in the legislative landscape and fiscal environment that may impact CPGS, focusing on the potential ramifications of dynamic political changes within Congress and the increasing budgetary pressures resulting from economic concerns that may severely curtail spending on national defense. These factors are likely to mandate a more extensive review by both the executive and legislative branches of how U.S. defense programs are prioritized. As constraints tighten on the availability of resources for defense, investment in CPGS will need to be weighed against other competing defense programs and priorities.

The report then identifies generic basing and deployment options for CPGS. Each concept comprises at least three important characteristics: 1) a basing mode (e.g., on land in the United States, deployed on land elsewhere, at sea); 2) a missile booster of a particular type used to launch the conventional payload; and 3) a payload delivery vehicle and unique flight profile which may determine whether or not the CPGS concept is classified as a “ballistic missile.” For each concept, these elements combine to provide distinct features which might be observable to other countries and which could distinguish U.S. CPGS weapons from nuclear-armed ballistic missiles. These concept-specific characteristics also determine whether certain arms control constraints apply.

Part one concludes with an examination of opportunities and constraints associated with the expiration in December 2009 of the START I Treaty and the entry into force of the New START Treaty in February 2011. Provisions in New START will remain in effect until 2021 (the ten-year duration of the treaty) unless it is terminated early by the United States or Russia or is extended for another five years, the latter option permitted by the treaty.

Part two of this report discusses several concerns which have been raised over the development and deployment of a CPGS capability. As mentioned earlier, this report focuses heavily on the most contentious issue associated with CPGS—the potential for misinterpretation by leaders of another nuclear-armed country who may respond with a nuclear strike on the United States. In this regard, this report builds on the 2008 report of the NAS. The NAS study examined the “nuclear ambiguity” issue with special attention to the Conventional Trident Modification concept and concluded that “the risk of an observing nation’s launching a nuclear retaliatory attack is very low” and “that risk could be reduced even further by cooperative measures” to provide transparency on the CPGS system, its operation, and doctrine.<sup>4</sup> Specifically, this report considers the capabilities of Russia’s early warning and attack assessment systems and the ability of Moscow to discriminate CPGS concepts from strategic nuclear missiles.

Closely related to the issue of whether Russian early warning systems can discern characteristics of CPGS weapons is the probable Russian response should Moscow fail to discriminate CPGS from nuclear-armed missiles. This report summarizes unclassified accounts of erroneous ballistic missile launch indications, the responses of Soviet and Russian officials, and lessons which can be deduced from those accounts.

The discussion of key CPGS issues concludes with a brief examination of a concern that others may follow the lead of the United States and develop high-precision long-range conventionally-armed ballistic missiles. Some critics of CPGS have argued that this could lead to a new kind of arms race. This report offers a critical assessment of the relationship between CPGS and the prospects of an accelerating arms competition.

The report concludes with a summary of findings from the examination of new national policy objectives for strategic capabilities, newly available CPGS concepts, a new arms control treaty environment, a different legislative dynamic, a fiscally constrained budget environment, and an assessment of concerns over nuclear ambiguity and the potential proliferation of CPGS weapons worldwide.

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## **Part One: National Policy Goals and CPGS**

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In keeping with President Obama's vision of moving toward a world free of nuclear weapons while maintaining an effective nuclear deterrent in the interim, the April 2010 NPR outlined five key objectives of U.S. nuclear weapons policy. Those objectives include:

1. Preventing nuclear proliferation and nuclear terrorism;
2. Reducing the role of U.S. nuclear weapons in U.S. national security strategy;
3. Maintaining strategic deterrence and stability at reduced nuclear force levels;
4. Strengthening regional deterrence and reassuring U.S. allies and partners;  
and
5. Sustaining a safe, secure, and effective nuclear arsenal.

Each of these goals has implications for U.S. nuclear force size and structure and, accordingly, for the nuclear enterprise that supports the viability of the American nuclear

**Development and deployment of a CPGS capability can support each of the five key policy objectives outlined in the 2010 Nuclear Posture Review.**

arsenal. Importantly, determining the appropriate level and composition of U.S. nuclear forces to meet extant and emerging threats is challenging and may be influenced by multiple variables, including the size and capability of

American non-nuclear forces, as well as the capabilities of U.S. strategic defensive forces such as missile defenses. The synergy between these variables was recognized in the 2001 NPR and was reaffirmed in the 2010 NPR.

In postulating a “New Triad” of capabilities, the 2001 NPR argued for a balanced mix of nuclear and conventional forces, including strategic defenses, as a means of strengthening deterrence. Likewise, the 2010 NPR acknowledges that a range of capabilities is needed to ensure the effective functioning of deterrence for the foreseeable future. Like its predecessor document, the 2010 NPR calls for sustaining the traditional nuclear Triad of land-based, sea-launched, and air-breathing platforms while developing advanced conventional capabilities, missile defenses, and a revitalized nuclear infrastructure. The Obama administration believes that each of these activities can help achieve the defense objectives stated above.

This section focuses on one of those elements—capabilities—and the ways in which a CPGS capability can help realize the objectives articulated in the NPR.

There is both a moral and military dimension to the notion of conventional prompt global strike. The quest for more accurate and discriminate military capabilities reflects a belief that warfare, though often practiced indiscriminately, should be conducted according to civilized norms and customs that have been codified in international relations. Among the principles accepted by the mainstream international community is the notion that military operations should deliberately avoid targeting non-combatants and seek to minimize civilian casualties. Development of a prompt global strike capability would be consistent with the Law of War and embodies an effort to make the application of force more precise in order to minimize inadvertent casualties and unintended destruction. Adherence to Law of War principles is Department of Defense (DoD) policy.<sup>5</sup>

Militarily, development of a CPGS capability is intended to expand the range of options available to support the objectives of national military strategy while reducing the level of collateral damage that occurs through the exercise of military force. In the past, the United States has relied heavily—though not exclusively—on forward presence to extend deterrence and provide the ability to strike at targets distant from U.S. shores. While forward presence will continue to contribute to deterrence and the ability of the United States to defeat aggression abroad, two complicating factors have emerged in recent years:

- First, adversaries are becoming more adept at protecting those assets they consider most vital to their own security—including high-value targets like weapons of mass destruction (WMD)—from military attack, creating gaps in the ability of U.S. forces to strike promptly and effectively at such targets. Underground shelters, improved mobility, and other factors are placing a growing subset of targets beyond the reach of existing conventional military forces, potentially negating some of the traditional advantages of forward deployment.
- Second, the expanding focus of adversaries on developing their own anti-access and area denial capabilities further degrades U.S. confidence in the ability to negate or destroy critical targets in a timely manner by relying

exclusively on the forward deployment of existing conventional weapons systems.

Consequently, current U.S. ability to strike quickly at targets half a world away is limited. Without adequate, timely, and often costly prepositioning of sufficient military capabilities in a potential area of conflict that is capable of overcoming the challenges noted above, CPGS has been proposed to fill the gap in capabilities resulting from these trends.

There appear to be multiple advantages to using long-range, prompt, conventional missiles in such a role, including their precision guidance and targeting accuracy, positive command and control, and physical security. The biggest perceived disadvantage of current long-range ballistic missiles is that these systems carry nuclear warheads. As General C. Robert Kehler, Commander of U.S. Strategic Command (USSTRATCOM) noted, "That's not a good position to be in. We would like to have the capability to be able to go after a time-critical target in a very short amount of time with a conventional warhead."<sup>6</sup>

The movement to develop a conventional prompt global strike capability reflects a strong desire to strengthen deterrence by creating credible non-nuclear strike options that can hold at risk fleeting, high-priority targets. This goal has been shared by both Republican and Democratic administrations. Moreover, CPGS systems can serve as an escalation link to nuclear use, thereby reinforcing extended deterrence and strengthening the credibility of security guarantees to U.S. allies.

In its 2010 Nuclear Posture Review, the Obama administration articulated a strong rationale for the development of a CPGS capability, arguing that "these capabilities may be particularly valuable for the defeat of time-urgent regional threats."<sup>7</sup> Indeed, development and deployment of a CPGS capability can support each of the five key nuclear weapons policy objectives outlined in the NPR.

**1. Preventing nuclear proliferation and nuclear terrorism.** The NPR declares that countering nuclear proliferation and preventing terrorists from acquiring nuclear weapons or the means to develop them must be a "top priority" and that this priority now sits "atop the U.S. nuclear agenda."<sup>8</sup> This priority was shared by the Bush administration, which declared, "Our greatest and gravest concern...is WMD [weapons of mass destruction] in

**CPGS would support a policy that reduces the twin risks of nuclear proliferation and nuclear terrorism by strengthening the credibility of U.S. deterrent threats.**

the hands of terrorists" and called preventing the acquisition or use of WMD "a key priority."<sup>9</sup> President Bush also stated, "The greatest threat before humanity today is the possibility of a secret and sudden attack

with chemical or biological or radiological or nuclear weapons."<sup>10</sup> A CPGS capability can support this goal in multiple ways by helping to dissuade non-nuclear states from seeking nuclear weapons and by offering a means for responding to terrorist use of weapons of mass destruction.



A visible and effective CPGS capability might serve as a deterrent to some who seek to acquire weapons of mass destruction for terrorist purposes. Having the ability to target and quickly destroy a remote terrorist compound or a suspected nuclear-armed missile before it is launched, without initiating a nuclear strike and with a minimum of collateral damage, increases the credibility of this threat and, therefore, may give pause to those who seek to acquire such capabilities.

CPGS may not, however, deter dedicated proliferators. The spread of nuclear materials to rogue regimes and other dangerous actors is increasingly difficult to prevent. The advance of weapons technology, coupled with the explosive growth of information technology and the means for conveying information transnationally, presents difficult challenges to controlling the flow of knowledge across state borders. Export control regimes and technology transfer safeguards have been circumvented in the face of determined multilateral efforts to prevent proliferation. For example, the A.Q. Khan network in Pakistan was extensive and responsible for the illicit transfer of a significant amount of nuclear know-how to North Korea, Libya, and elsewhere.

The United States must have options for dealing with unforeseen consequences when efforts to prevent the spread of nuclear weapons, materials, or knowledge fail. The employment of military force may present the only realistic option in certain circumstances.

The Obama administration has suggested that CPGS could be beneficial in scenarios characterized by “short warning time, a fleeting window of opportunity to strike the target, a high payoff for success, or a high cost of inaction.”<sup>11</sup> Other studies have suggested a CPGS capability could prove useful for targeting terrorist leaders; responding to imminent missile launches; attacking “high-value” targets during military operations; and defeating the illicit transfer of WMD.<sup>12</sup> Former USSTRATCOM Commander General James Cartwright stated, “In many cases, nuclear weapons are not going to be an appropriate choice for those types of targets, so you want a conventional alternative.”<sup>13</sup>

Terrorist groups in possession of nuclear weapons or materials would be extremely high-value targets. Their locations may be difficult to pinpoint accurately, as operational security requirements often force them to relocate regularly. Because they are “fleeting” targets, striking them would require actionable intelligence and the availability of quick strike assets that could attack before they relocate. CPGS was conceived as a weapon which could be used against such high-value, fleeting targets.<sup>14</sup> In this way, CPGS would support a policy that serves to reduce the twin risks of nuclear proliferation and WMD terrorism by facilitating the ability to defeat those in possession of nuclear weapons and lending credibility to U.S. deterrent threats.

In addition, the prospect of vulnerability to a CPGS attack—either to preempt a nuclear terrorist incident or in response to one—may compel an adversary to take actions that would complicate his plans or make them more costly or time-consuming than otherwise would be the case. For example, more stringent operational security requirements within a terrorist cell may be required to guard against the compromise of information that would increase the risk of a prompt military strike to negate the terrorist threat. The

threat of a CPGS attack might also keep terrorist groups on the move, thereby complicating efforts to plan and prepare for possible nuclear terrorist attacks.

The added costs and burdens of defending against a CPGS attack may exceed the threshold of practicality for some groups and thus reinforce the deterrent effect of a CPGS capability. In some cases, the availability of CPGS may force an adversary to take actions that increase his vulnerability to detection, interdiction, or other military action. In addition, the vulnerability of WMD programs to CPGS may drive adversaries toward concealment, burial, hardening, or active defense measures that are costly, and which may provide added disincentives to proliferation.

Should it be necessary, the actual employment of CPGS systems against a target may also have a longer-term deterrent effect against future threats by demonstrating both a willingness to strike (enhancing the credibility of such threats while limiting collateral damage) and a capability to nullify the threat. In this regard, the use of CPGS might strengthen deterrence over time.

In short, CPGS may help deter terrorist actions, dissuade potential proliferators, and defeat WMD proliferation threats in a timely manner should they emerge. Each of these outcomes would support the NPR goal of preventing nuclear proliferation and nuclear terrorism.

**2. Reducing the role of nuclear weapons in U.S. security strategy.** Reducing the role that nuclear weapons play in U.S. national security strategy has been a goal of administrations of both parties for many years—one that has been reflected in each of the three Nuclear Posture Reviews produced by the Clinton, Bush, and Obama administrations.

The United States has already reduced the role of nuclear weapons in U.S. national security strategy by revising strategic targeting plans and adopting policies that narrow the scope of contingencies for which nuclear weapons might be employed. This has enabled the United States to reduce the size of its nuclear arsenal. The Cold War “Single Integrated Operational Plan,” or SIOP, which focused primarily on target sets within the former Soviet Union, no longer undergirds U.S. nuclear strategy or operational plans. In addition, the number of nuclear weapons in the U.S. arsenal today has been reduced by more than 75 percent from Cold War levels and is now at its lowest level since the Eisenhower administration.<sup>15</sup>

The Obama administration’s 2010 NPR states that “the role of U.S. nuclear weapons to deter and respond to non-nuclear attacks—conventional, biological, or chemical—has declined significantly” and declares that the United States “will continue to reduce the role of nuclear weapons in deterring non-nuclear attack.”<sup>16</sup> To make this possible while limiting risk, the United States “will continue to strengthen conventional capabilities.”<sup>17</sup>

Strengthening U.S. conventional capabilities for deterrence could fill an important role resulting from constraining the potential employment of nuclear weapons, and allow for a reduced role for nuclear forces. The NPR notes that “...the growth of unrivaled U.S. conventional military capabilities...enable[s] us to fulfill [our deterrence and assurance]

objectives at significantly lower nuclear force levels and with reduced reliance on nuclear weapons.”<sup>18</sup> A CPGS capability would expand the range of options for addressing pressing security threats and close capability gaps that currently exist.<sup>19</sup>

The Obama administration has been clear about the limitations of using U.S. strategic nuclear weapons to hold certain targets at risk. The White House has noted that U.S. strategic forces “do not provide the President with a timely, global, non-nuclear strike capability to address fleeting, time-sensitive targets.”<sup>20</sup> CPGS weapons would provide such an option for high-priority situations in which no other conventional weapons are within range and capable of being on target within an hour or less.

Current forward-deployed conventional forces may be closer geographically to the target, but may suffer from the need to obtain allied authorization or overflight permission prior to their employment, complicating the ability to use them in certain circumstances against time-sensitive targets. Moreover, existing forward-deployed assets may be difficult to utilize in areas where an adversary’s anti-access/area denial strategy curtails their timely employment or effectiveness. As the 2010 Quadrennial Defense Review stated: “States with the means to do so are acquiring a wide range of sophisticated weapons and supporting capabilities that, in combination, can support anti-access strategies aimed at impeding the deployment of U.S. forces to the theater and blunting the operations of those forces that do deploy forward.”<sup>21</sup>

Not all targets for prompt destruction require the use of a nuclear weapon to accomplish the military objective. Some targets included in current U.S. nuclear targeting plans might be sufficiently damaged or disabled with a conventional warhead. In particular, adversary communications, early warning sites, or other protected military capabilities might be adequately held at risk with a conventional warhead of sufficient destructive power and accuracy. Some targets, particularly those in hardened and deeply buried shelters, may today be vulnerable only to a nuclear weapon; but development of a CPGS capability may reduce the number of such “nuclear-only” targets.

U.S. officials have pointed out that conventional prompt global strike weapons would be a complement to the nuclear force, not a substitute or replacement for it. For example, former USSTRATCOM Commander General Kevin Chilton stated, “I do not see it [CPGS] as a replacement for the nuclear deterrent. ...you don’t replace the nuclear deterrent with that, 1 for 1; or, not even 10 for 1.”<sup>22</sup> Moreover, he noted that “the nuclear weapon has a deterrent factor that far exceeds a conventional threat.”<sup>23</sup> Nevertheless, under some scenarios the use of existing conventional weapons may be inadequate and the employment of nuclear weapons impractical for accomplishing military objectives. In such cases, CPGS could play an important role in bridging the gap and satisfying military requirements.

In sum, CPGS can support the NPR objective of reducing nuclear weapons and the role they play in U.S. national security strategy by providing other non-nuclear means to accomplish military and/or political objectives.

**3. Maintaining strategic deterrence and stability.** Deterring attack on the United States and allies has always been the primary objective of U.S. nuclear policy. This objective was reaffirmed in the NPR.

Strategic deterrence is bolstered by making the cost of an attack to an aggressor greater than the anticipated benefits. A CPGS capability that can hold at risk critical targets of high value to an adversary's leadership means that an adversary must weigh the prospect of having those targets destroyed when calculating the cost-benefit ratio of any attack. Making the cost of an attack prohibitive is the essence of deterrence. Therefore, by broadening the base of critical targets that can be held at credible risk, CPGS can play a valuable role in bolstering strategic deterrence.

**The rapid time-to-target of a CPGS capability would enhance stability by granting national leaders additional time and flexibility to defuse a crisis before resorting to military force.**

The NPR argues that “maintaining strategic stability at reduced [nuclear] force levels will be an enduring and evolving challenge for the United States in the years ahead. Ongoing nuclear and other military modernization efforts by Russia and China compound this challenge, making the need for strategic stability dialogues all the more critical.”<sup>24</sup>

Extending the decision-making window for deliberation, consultation, and the weighing of alternative courses of action before executing a military strike or response has considerable value and reinforces the concept of stability. As the NPR declared, “Maximizing decision time for the President can further strengthen strategic stability at lower force levels.”<sup>25</sup> The rapid time-to-target afforded by a CPGS capability would grant national leaders the maximum amount of time, and hence flexibility, to defuse a crisis, negotiate a solution, or develop other options for addressing the problem before committing to the actual use of military force. In this way, CPGS, especially when complemented with defensive systems, can serve the goal of maintaining stability articulated in the NPR.

Stability is also fostered by ensuring a credible deterrent capability—one that is perceived as useable by adversaries and that can be tailored to a variety of possible contingencies. By providing a military option that can bridge the gap between an inadequate conventional military response and the improbable use of nuclear weapons to address contingencies that do not jeopardize national survival, CPGS can enhance the credibility of U.S. deterrence and thereby improve stability.

Indeed, the increased emphasis on precision targeting adds to stability because it reduces the likelihood of collateral damage, making the threat of a military strike more plausible. Reducing the potential target set that is effectively “off limits” will place more of an adversary's high-value assets at risk, providing additional deterrent value.

CPGS opponents, including Russia and China in particular, have tried to influence the U.S. debate over CPGS by criticizing U.S. plans to develop conventionally-armed ballistic missiles as destabilizing. For example, in a 2006 address, Russian President

Vladimir Putin stated, “The launch of such a missile could provoke an inappropriate response from one of the nuclear powers [or] could provoke a full-scale counterattack using strategic nuclear forces.”<sup>26</sup> China has even suggested that it would consider a pre-emptive nuclear strike if it is attacked with “advanced conventional weapons.”<sup>27</sup>

Such statements appear to reflect exaggerated concerns over American plans and a desire to forestall the development of the CPGS program within the United States. Indeed, Russian military sources have argued that the launch of even several conventionally-armed ballistic missiles would not necessarily trigger a nuclear response. For example, Vladimir Dvorkin, a retired general of the Russian Strategic Rocket Forces, stated:

To make a decision to make a retaliatory, a massive retaliatory strike, is very hard decision; even if you possess the complete information and true information concerning the fact that your country has been hit. It’s totally impossible to make a decision based on information about one missile.

...No President, no matter what President it is, will ever make a decision about launch-on-warning based on information about one rocket or missile or even...two or three missiles. So I think that concerns in this regard are just wasted time.<sup>28</sup>

(In another discussion, Dvorkin said that “the launch of even five U.S. missiles would not pose a problem.”)<sup>29</sup>

The Obama administration has noted that U.S. CPGS forces would be sized appropriately to avoid “perturbing our strategic relationship with Russia and China.”<sup>30</sup> Indeed, the NPR states that a CPGS capability would be “designed to address newly emerging regional threats, and not intended to affect the strategic balance with Russia.”<sup>31</sup>

Clearly, the Obama administration has no intention of deploying CPGS systems in sufficient quantity to pose a threat to the strategic nuclear deterrent forces of either Russia or China. As noted elsewhere in this report, administration officials have declared that only a “very small” number of CPGS weapons would be deployed as a “niche” capability.<sup>32</sup> Yet even a limited CPGS capability can enhance strategic deterrence and stability by providing plausible options for military action without resort to nuclear weapons.

**The global reach of CPGS can reinforce extended deterrence worldwide and help reassure allies of America’s commitment to and capabilities for their security.**

**4. Strengthening regional deterrence and reassuring U.S. allies and partners.** The NPR highlights assurance of allies and partners as a key goal of U.S. policy, noting that they are “on the front lines of a changing global

security environment.”<sup>33</sup> Many allies and partners who face regional threats and challenges continue to rely on the United States to safeguard their interests and guarantee their ultimate security. In this regard, the NPR makes clear that the United

States “is fully committed to strengthening bilateral and regional security ties.” Further, it declares:

We will continue to assure our allies and partners of our commitment to their security and to demonstrate this commitment not only through words, but also through deeds. This includes the continued forward deployment of U.S. forces in key regions, strengthening of U.S. and allied non-nuclear capabilities, and the continued provision of extended deterrence.<sup>34</sup>

The Obama administration’s policy of pursuing nuclear reductions—codified by the New START Treaty and efforts to reduce further the level of nuclear forces as part of movement toward the global elimination of nuclear weapons—has raised concerns in the minds of some allies that the United States is abandoning the very capabilities that have allowed extended deterrence to function reliably for many decades. These capabilities include the deployment of a small number of shorter-range, tactical nuclear weapons on European soil. Doubts over the American commitment to allied security can lead to decisions taken by U.S. allies and partners that have negative consequences for regional deterrence and security, such as the pursuit of other regional security partnerships or development of an independent national nuclear capability in lieu of reliance on the U.S. “nuclear umbrella.”

CPGS could lessen incentives for friendly countries to seek to acquire nuclear weapons themselves. The NPR noted that the development of “other conventional military capabilities” could help “reassure our non-nuclear allies and partners worldwide of our security commitments to them and confirm that they do not need nuclear weapons capabilities of their own.”<sup>35</sup> The deployment of CPGS systems could enhance the credibility of the U.S. extended deterrent, providing a measure of reassurance to allies with respect to American security guarantees. The ability to strike quickly at distant targets with non-nuclear weapons would expand the military option set for U.S. planners and decision makers and could help negate the politically unpalatable choice of risking New York for London or Warsaw when confronting nuclear threats to U.S. friends and allies.

A CPGS capability can strengthen regional deterrence by providing a credible military option that can be employed in the defense of allies and partners without automatically provoking escalation to the nuclear level. By demonstrating America’s commitment to deploy CPGS forces to ensure the security of NATO allies—including forces based in the continental United States—the transatlantic security linkage can be strengthened. Because of the global reach of CPGS, extended deterrence can be reinforced in Europe, Asia, and elsewhere, providing a measure of reassurance to allies and fulfilling the NPR’s objective. The reassurance effect of CPGS can be magnified, especially as nuclear forces are reduced, when combined with other capabilities such as missile defenses.

The importance of striking targets quickly and accurately is not exclusively an American concern. Allies also recognize the military value of precision weaponry. The NATO operation against Libya is a case in point. French analysts have lamented the inability of NATO forces to strike with greater precision at certain Libyan targets.<sup>36</sup> An ongoing

European study of precision-guided munitions is also expected to support greater focus on this area as a means of closing critical capability gaps.<sup>37</sup> Moreover, a CPGS capability could support South Korea's emerging "active deterrence" strategy, which recognizes that the ability to hold at risk North Korea's WMD capability with conventional precision strike weaponry will strengthen deterrence.<sup>38</sup>

In short, a CPGS capability could help dampen anxiety over a perceived decline in deterrence credibility that may accompany nuclear reductions. Because of its global reach, enhanced credibility, and non-nuclear attributes, CPGS can play a significant role in strengthening regional deterrence and reassuring U.S. allies and partners of American security guarantees.

**5. Sustaining a safe, secure, and effective nuclear arsenal.** Developing reliable, resilient, and effective military capabilities requires a robust industrial base capable of supporting the broad-based and dynamic requirements of deterrence. This is true for elements of both nuclear and non-nuclear forces, and the industrial infrastructure and capacity to support both is similar.

In outlining his nuclear policy in Prague in 2009, President Obama declared, "Make no mistake: As long as these [nuclear] weapons exist, the United States will maintain a safe, secure, and effective arsenal to deter any adversary, and guarantee that defense to our allies...."<sup>39</sup> The NPR states, "The United States is committed to ensuring that the nuclear weapons stockpile remains safe, secure, and effective."<sup>40</sup> To this end, it supports significant investments in human capital and critical infrastructure improvements to maintain a level of technical competence and the expertise necessary for a robust industrial base capable of producing the nuclear capabilities necessary for effective deterrence.

Research, development, and production of CPGS weapons would exercise many of the same unique skills needed to sustain expertise for nuclear-armed ballistic missiles. These include, for example:

- solid rocket motor development and production;
- precision guidance and control; and
- electromagnetic pulse (EMP) hardening.

The critical difference between a nuclear system and a non-nuclear system is the payload. Payload, however, is not the only element of the overall weapons system. The payload must be delivered to its target by a delivery system that is powered, guided, can withstand the stresses of flight at rapid speeds through the atmosphere, and can overcome possible countermeasures, including electromagnetic pulse. These elements are as important to CPGS systems as they are to nuclear systems.

Development of a CPGS capability will require significant scientific, technical, and engineering investments in delivery vehicles, guidance, and propulsion—the same types of investments that will be required to support the next generation of nuclear weapons-carrying platforms. Maintaining these important skill sets is critical to sustaining a safe,

secure, and effective nuclear arsenal. Therefore, development of a CPGS capability carries benefits for the nuclear enterprise as well.

The U.S. nuclear enterprise has suffered from the loss of technical talent as interest in the nuclear deterrence mission receded after the end of the Cold War. Numerous studies have documented the attrition of nuclear expertise and the decline in attention to nuclear matters that have resulted in serious lapses in operational security and challenges to the sustainability of U.S. nuclear deterrent forces.<sup>41</sup> Both the 1994 and 2001 Nuclear Posture Reviews identified the need to maintain sufficient technological and industrial base capacity to maintain the viability of the U.S. strategic deterrent. Nevertheless, consolidation within the defense-industrial base and inattention to nuclear issues has contributed to the atrophy of critical skills and capabilities applicable to the development and sustainment of both nuclear and non-nuclear weapons systems.

The lack of a robust nuclear modernization effort over the past two decades has negatively impacted the related industrial base. Development of a CPGS capability could help revitalize the infrastructure necessary to support both nuclear and non-nuclear deterrence missions. In addition, an active defense industrial base is more responsive to unplanned needs than an inactive infrastructure. Therefore, CPGS development can help sustain a responsive infrastructure, which, in turn, may lessen some of the risk associated with nuclear reductions.

In sum, a CPGS capability can support all of the five key objectives established in the NPR with respect to U.S. nuclear policy. It can bolster deterrence, strengthen stability, reassure allies, offset the perceived risks of additional nuclear reductions, and advance nuclear non-proliferation and counterterrorism goals.

### **The Changing Legislative Landscape**

Although the concept of CPGS has been actively pursued for more than a decade by both the Bush and Obama administrations, no CPGS capabilities have yet been fielded. Like any new military capability, significant research and development must occur before concepts can be translated into reality. This requires support and funding from Congress.

Congressional opposition to the Bush administration's favored CPGS concept—Conventional Trident Modification (CTM)—was significant and impeded progress toward developing a CPGS capability. In large measure, concerns over the possibility that launch of a conventionally-armed Trident D-5 missile could be misconstrued as a nuclear attack resulted in Congress repeatedly denying funds for CTM development. Although the 2008 NAS study concluded that the issue of “nuclear ambiguity” is “one of the lesser risks—militarily and politically—associated with attacking another country, especially a nuclear-armed country,” key members of Congress in both political parties remained opposed to the plan.<sup>42</sup>

In fiscal year (FY) 2005, Congress prohibited the use of funds for development of a conventional warhead on intercontinental ballistic missiles (ICBMs) or submarine-launched ballistic missiles (SLBMs). In subsequent years, the armed services and



appropriations committees reduced, restricted, or eliminated funding for such options, preferring to focus the Department of Defense on alternative CPGS concepts.<sup>43</sup> The FY 2006 Defense Appropriations Act, for example, supported the Bush administration's funding request for a non-nuclear Hypersonic Technology Vehicle. Neither the House nor the Senate, however, authorized funding for the CTM option in fiscal year 2007.

In its report accompanying the National Defense Authorization Act for FY 2007, the Senate Armed Services Committee expressed concern that a conventionally-armed D-5 SLBM launched from a Trident submarine could be misinterpreted as a nuclear attack. Consequently, the committee required the secretaries of defense and state to report on "how to ensure that the use of a conventional D-5 missile will not result in an intentional, inadvertent, mistaken or accidental reciprocal or responsive launch of a nuclear strike by another country."<sup>44</sup> Likewise, the House Armed Services Committee argued that "the development of this conventional ballistic missile capability for a submarine that has historically carried nuclear armed ballistic missiles could cause a missile launch misinterpretation regarding which type of a warhead a ballistic missile may be carrying."<sup>45</sup> Congress continued to severely curtail funding for the CTM option in subsequent years, preferring to redirect CPGS efforts toward alternative concepts.

To some degree, support for CTM may have suffered from its association with other controversial elements of the Bush administration's nuclear policy articulated in the 2001 NPR. Now that the general concept of CPGS has been endorsed by both Republican and Democratic administrations, a wider opportunity exists to revisit specific CPGS approaches and options in light of previously expressed legislative concerns. A number of these approaches and options are addressed later in this paper.

Since the 2010 congressional elections, the political dynamic on Capitol Hill has shifted, with new chairmen in charge of key committees in the House of Representatives. Although there is general congressional support for the concept of CPGS, concern remains over whether the Department of Defense is focusing its CPGS efforts too narrowly. The House Armed Services Committee, for example, has encouraged "a broader examination of the tradespace of CPGS capabilities and concepts to meet warfighter requirements."<sup>46</sup> In light of this, the time may be ripe for an examination of multiple CPGS alternatives that could accomplish military objectives at reasonable cost and with minimal technical risk.

For those who support more robust strike options for the United States, CPGS can provide them. For those who support additional nuclear reductions, CPGS can help offset the attendant risks that may flow from them. For those who believe terrorists armed with nuclear weapons pose the greatest security threat today, CPGS can help defeat them. And for those who are most concerned with WMD proliferation, CPGS can help deter and dissuade those who might otherwise seek to acquire such capabilities.

## Navigating Challenging Fiscal Currents

Although conceptually CPGS appears to enjoy general support within both the executive

**CPGS is more than a military capabilities “gap filler.” Its potential benefits may extend well beyond the purely military realm.**

and legislative branches, that is not a guarantee of programmatic success. No program, however necessary or desirable, can succeed without congressional funding. In today’s budget

environment, obtaining the requisite fiscal resources to develop and deploy a CPGS capability will require substantial effort.

Notwithstanding possible disagreements over the type of CPGS most suitable to achieve U.S. military requirements, a significant level of resources will need to be invested in CPGS research and development to overcome technical challenges and other hurdles that are hallmarks of any new military program. Making a solid case that the effort is worth the cost—especially in light of an anticipated decline in overall budgetary resources and other defense program priorities—will be challenging.

In one respect, CPGS may be viewed as a capabilities “gap filler,” providing military options that existing conventional capabilities cannot provide. Yet the potential benefits of CPGS may extend well beyond the purely military capabilities they offer. As previously noted, CPGS may play a useful role in helping to achieve the broader policy goals enunciated in the NPR. To the extent CPGS can enable successful efforts to prevent nuclear proliferation or nuclear terrorism, for example, the potential benefit of developing and deploying a CPGS capability may far exceed the monetary costs of doing so.

While cost should not drive U.S. strategy or the programs necessary to implement it, cost is nevertheless a factor in determining investment priorities, particularly in a climate of budget austerity. Although the two concepts are often viewed interchangeably, cost is not synonymous with value. In the case of CPGS, its potential contribution to bolstering deterrence, preventing proliferation, and defeating time-urgent threats to U.S. and allied security suggests an enduring strategic value that may not be measured solely in dollar terms. Consequently, CPGS may be one area of defense investment where the long-term strategic benefits may exceed the fiscal costs of developing such a capability.

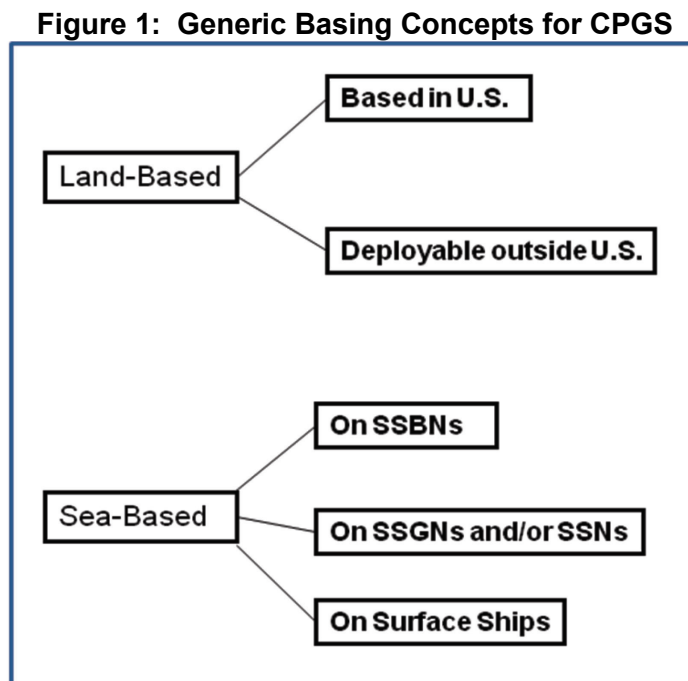
## CPGS Concepts

Each CPGS concept comprises at least three important characteristics: 1) a basing mode (e.g., on land in the United States, deployed on land elsewhere, at sea); 2) a missile booster of a particular type used to launch the conventional payload; and 3) a payload delivery vehicle and unique flight profile which may determine whether or not the CPGS concept is classified as a “ballistic missile.” These elements combine to provide distinct features which might be observable to other countries and also determine whether or not certain arms control constraints apply. Each of these aspects of CPGS will be discussed in turn.

### ***CPGS Basing Concepts***

In light of the changed strategic environment noted above, this report examines five generic basing concepts for CPGS—two land-based and three sea-based. Although other basing modes may be postulated, the generic concepts considered here include those most often discussed as CPGS options by the Department of Defense (DoD) and defense analysts, as well as variations of those options.

Figure 1 illustrates the five basing concepts for examination. Each of the basing concepts could, at least in theory, employ weapons with characteristics that result in all weapons of that type being constrained by arms control agreements or exclude all weapons of that type from arms control limits. This is an important consideration. Arms control issues will be addressed following the discussion of CPGS concepts.



#### **Land-Based CPGS Concepts**

Land-based concepts include those that would be based entirely on the territory of the United States as well as those that could be deployed to other countries or territories of the United States (e.g., Guam). For global coverage, CPGS concepts based in the United States must be, of necessity, very long range. In contrast, those concepts envisioned for possible forward deployment need to be smaller in size (than land-based intercontinental ballistic missiles) to make deployment feasible. Deployment closer to high-threat regions also reduces the range requirement for these weapons.

*Land-based CPGS concepts for U.S. basing.* An example of this concept is the Air Force demonstration program referred to as the Conventional Strike Missile (CSM).<sup>47</sup> The missile, if developed and deployed, could be based at coastal sites in the United States, such as Vandenberg Air Force Base (AFB) on the west coast and near the

Kennedy Space Center on the east coast. Plans for a CSM demonstration flight call for a multi-stage missile that includes missile stages from retired Peacekeeper intercontinental ballistic missiles (ICBMs) and carries a payload that flies a non-ballistic trajectory. The non-ballistic flight profile of the payload section will be enabled by a Defense Advanced Research Projects Agency (DARPA)-developed payload delivery vehicle—the Hypersonic Technology Vehicle-2 (HTV-2). The HTV-2 is designed to be capable of significant cross-range maneuverability during midcourse flight.<sup>48</sup>

The Falcon/HTV-2 payload under development is launched on a Minotaur IV rocket from Vandenberg AFB. The payload is released from the booster at ~500,000 feet and descends to the upper atmosphere (~150,000 feet). Other than an attitude control system, the payload is unpowered and flies downrange with the velocity provided by the launch vehicle. At this altitude, there is enough atmosphere to generate the lift required to enable the payload to “surf” at up to Mach 23 for up to 9,000 nautical miles (nmi) downrange. (Hence, this form of vehicle is also known as a “wave rider.”) When it reaches its target, the payload executes a terminal dive maneuver and is designed to strike its target with high precision.

However, mastering hypersonic flight at the upper edge of the atmosphere is proving to be a technological challenge. The first two flight tests in this regime have produced valuable data, but both resulted in loss of control of the test vehicle.<sup>49</sup>

*Deployable, land-based CPGS concepts.* Deployable land-based systems might be developed as a follow-on program to an Army Space and Missile Command effort to explore an alternative to the DARPA HTV. The Army Hypersonic Glide Body (HGB) technology explores non-ballistic flight profiles and challenges associated with hypersonic flight within the atmosphere for an extended timeframe. The HGB technology could be adapted as a payload option for the CSM (described above) or for a smaller missile with reduced range and suitable for deployment—an Army Advanced Hypersonic Weapon (AHW). The Army currently deploys a family of surface-to-surface missiles—Army Tactical Missile System (ATCMS)—for battlefield use. The missiles are fired from Mobile Launch Rocket Systems (MLRSs). At present, ATCMS variants are limited in range to about 100 to 200 miles.<sup>50</sup> Longer range missiles in a mobile, or at least deployable, configuration could be developed and provide an option for a land-based missile with a range of 1,000 miles or more and a non-ballistic flight trajectory using the AHW-developed technology. The 2008 report on CPGS by the National Academy of Sciences discussed an AHW option with a range of up to 4,200 nautical miles that could be deployable. The NAS study listed possible deployment sites as Guam, Diego Garcia, and Puerto Rico with four missiles at each site.<sup>51</sup>

### **Sea-Based CPGS Concepts**

All sea-based concepts are, by definition, deployable. Some concepts would deploy CPGS weapons on ballistic missile submarines (SSBNs) or on former SSBNs that have been converted to guided missile submarines (SSGNs). Other concepts could be deployed on general-purpose ships and submarines.

*Sea-based CPGS deployed on ballistic missile submarines.* When DoD initially proposed a prompt strike capability with global reach, a modification to the Navy's Trident II submarine-launched ballistic missile (SLBM)—referred to as the Conventional Trident Modification (CTM)—was the preferred option.<sup>52</sup> The proposed modification involved the addition of guidance and control features to the Mk-4 reentry vehicle (RV),<sup>53</sup> replacement of the nuclear warhead in the Mk-4 with a conventional payload, and appropriate upgrades to the submarine's strategic fire control system. The proposed payload was to be non-explosive. It would damage the intended target by kinetic energy from the impact of a single, large mass or an explosively-formed array of rods or projectiles. The CTM concept called for deploying these weapons on existing ballistic missile submarines and using existing three-stage Trident II missiles to launch the conventional payloads. The modified Mk-4 RVs would fly a near-ballistic trajectory and each RV would guide its non-nuclear payload to the target during atmospheric reentry.

DoD proposed deploying two CTMs on each ballistic missile submarine. Each CTM was to carry up to four individually targetable weapons and each weapon would be equipped with navigation, guidance, and control capabilities.<sup>54</sup> The NAS study concluded that of seven potential candidates considered for conventional prompt global strike, CTM was the least costly of the options and could be developed and deployed with little technical risk and in less time than the other options.<sup>55</sup> The study also identified near-term limitations of effectiveness as well as growth potential for an initial CTM concept. For example, the study described a two-stage version of the Trident II missile (CTM-2) that would double the payload capacity over that of the CTM and could carry advanced payload options such as an earth penetrator.<sup>56</sup>

*Sea-based CPGS deployed on submarines other than ballistic missile submarines.* An early variant of the CTM concept, a missile with a shorter range (up to 3,000 nautical miles) and which could be deployed on existing SSGNs, was envisioned by DoD.<sup>57</sup> For this concept a new missile booster would have to be developed; the missile would propel a conventional payload, such as that designed for the CTM, on a near-ballistic trajectory. This notional concept, initially referred to as the Submarine-Launched Global Strike Missile (SLGSM),<sup>58</sup> envisioned loading two or three missiles per SSGN launch tube.<sup>59</sup> Later variants of this concept considered a more advanced payload delivery vehicle which could fly a non-ballistic flight trajectory.

In addition to deployment on SSGNs, this long-range prompt missile could be deployed on Block 3 and later *Virginia*-class attack submarines (SSNs). Each of these submarines would be fitted with two Virginia Payload Tubes (VPTs), each of which can accommodate a Multiple All Up Round Canister (MAC). The VPTs provide a common configuration to the tubes designed for SSGNs. This configuration would allow these *Virginia*-class submarines to carry up to twelve Vertical Launch System (VLS)-compatible missiles (six per MAC) or a smaller number of larger, fairly long-range, but not intercontinental-range, ballistic missiles.<sup>60</sup> This more advanced concept was referred to generically by the Navy as an option for its inventory of Sea Strike weapons.<sup>61</sup> This report will consider a non-ballistic Sea Strike option deployed on SSGNs and *Virginia*-class SSNs.

*Sea-based CPGS deployed on surface ships.* U.S. naval combatants today deploy with a variety of weapon types which are launched from the Mark 41 VLS. With ships deployed worldwide, strike missiles carried in VLS launchers could provide prompt, near-global coverage. Such a weapon concept is part of a demonstration program at DARPA. The proposal, called ArcLight, would demonstrate a VLS-compatible, prompt strike missile with a non-ballistic boost-glide vehicle and a range of about 2,000 nautical miles.<sup>62</sup>

*Sea-based CPGS deployed on both submarines and surface ships.* Navy SSNs are also configured with the Mark 41 VLS. Therefore, the ArcLight concept could conceivably be deployed on both submarines and surface ships. According to one source, U.S. naval combatants (both ships and submarines) cumulatively are configured with over 7,500 VLS cells.<sup>63</sup> By dedicating a portion of these cells to weapons for the CPGS mission, high-priority targets in multiple regions of concern could be continuously held at risk.

**As a result of recent technology advances, additional options for CPGS weapons appear feasible and deserve serious consideration.**

### **Other Basing Modes for CPGS**

In addition to the generic land-based and sea-based weapons concepts considered here, it is feasible to consider CPGS weapons that could be air-launched and even those that can be prepositioned in earth orbit awaiting targeting instructions. Neither of these concepts is considered further in this report. In order for air-launched weapons, such as the X-51 WaveRider<sup>64</sup> to be feasible for the prompt global strike mission and the one-hour response time, weapons would have to be loaded on one or more aircraft and the aircraft either maintained in a ready to launch (alert) condition or airborne. Absent this condition for alert aircraft, both the land-based and sea-based weapons concepts discussed above would appear to provide an advantage in timeliness over air-launched concepts. The potential of maintaining conventional strike weapons in orbit would involve resolution of space policy issues that are beyond the scope of this report.

### **Launch Boosters for CPGS Concepts**

The launching missile, especially the first stage of multi-stage, intercontinental-range missiles, is an important consideration in evaluating specific CPGS concepts for several reasons. First and most obvious, the launch booster provides the range necessary for the basing mode to be feasible as a prompt and global weapon. Second, for other nations that operate missile-launch-detection satellites that employ infrared (IR) sensors, the location of missile launch and distinct IR signature could immediately enable the observing country to discriminate the CPGS launch from that of a missile type that carries nuclear warheads. Third, the type of launch booster, in particular the first stage, may determine whether or not arms control restrictions apply. Fourth is the issue of cost. Retired or excess ICBM or SLBM components may invoke arms control penalties, but use of these available assets would reduce costs.

Each of the CPGS basing modes is accompanied by opportunities and constraints on the choice of launch boosters. For example, a land-based system located in the United States is constrained by the need for a powerful missile booster to propel its payload to a great distance to be able to reach target locations almost anywhere in the world within an hour. For these very long-range concepts, missiles with characteristics similar to intercontinental ballistic missiles would be needed. Options include missile stages from retired Peacekeeper missiles, missiles considered excess from the Minuteman ICBM force, or newly designed and produced first stage boosters in combination with existing or new production upper stages.

Most of the sea-based concepts and the deployable, land-based concept do not require missiles that provide global range. For these concepts, the mode of deployment will likely constrain the potential characteristics of launch boosters, such as the size and type of missile fuel. For example, length and volume constraints on Navy ships and most general-purpose submarines will require a launch booster to be compatible with the existing VLS. Some missile boosters that are larger in diameter and length than VLS-compatible missiles can be accommodated in the launch tubes of SSGNs and a few other general-purpose vessels, such as the newer *Virginia*-class SSNs. Since none of the sea-based concepts (other than CTM) envisions use of a first stage ballistic missile from a former ICBM or SLBM, the choice of a launching missile, by itself, would not automatically trigger an arms control penalty. The CTM concept would be deployed on ballistic missile submarines and would be subject to constraints of the New START Treaty.

Each specific launch booster with its combination of first and subsequent stages, must be evaluated for possible constraints imposed by arms control treaties. The section on arms control will address potential treaty constraints for each CPGS concept.

### ***Payload Delivery Vehicle***

Each CPGS concept is further defined by the characteristics of the payload delivery vehicle, which would guide the non-nuclear payload to its target. Some concepts, such as CTM, would fly a trajectory that is mostly ballistic and maneuver in the terminal portion of the flight to provide the needed accuracy as the payload nears the target. Other payload delivery vehicle options, such as the DARPA HTV-2 and the Army AHW, are non-ballistic. They rely on maneuverability and on self-generated lift for over half of their flight trajectory. These payloads are transported on delivery vehicles that are often referred to as hypersonic glide vehicles or maneuvering bodies.

*Benefits of a ballistic trajectory.* The benefits of a ballistic or “near-ballistic” flight trajectory for CPGS concepts are:

- a relatively low level of technical risk in weapon development; and
- the predictability of ballistic trajectories, which enables countries with advanced early warning and tracking systems to calculate during flight the approximate impact point. This predictability enables such countries to determine whether or not the missile poses a threat to them.<sup>65</sup>

*Benefits of a non-ballistic trajectory.* The benefits of a hypersonic glide vehicle or other technology that traverses a non-ballistic trajectory include:

- maneuverability, which could
  - enable the delivery vehicle to avoid overflying sensitive areas;
  - complicate an adversary’s task of predicting the intended impact point and defending against the incoming weapon;
  - provide flexibility to strike a target from a 360-degree radius;
  - be used to tailor impact conditions for certain payloads, for example, to reduce the speed and control the impact angle for a penetrating weapon.
- extended range due to the inherent ability of a lifting body payload to fly well beyond the maximum range of a strategic-range missile.
- avoidance of arms control constraints on “ballistic” weapon systems.

*Drawbacks.* Each approach also has downsides. For ballistic trajectories of existing ICBM or SLBM boosters, the primary downside is the identical launch and mid-course flight characteristics of both the nuclear-armed and CPGS weapons. For hypersonic glide vehicles or payloads that enable non-ballistic trajectories, the downside stems primarily from the technical risk and complexity associated with precision-guided flight in the atmosphere over very long distances and at hypersonic velocities. Non-ballistic weapon concepts will be more costly and take longer to develop than those that are based on ballistic or near-ballistic weapon concepts.

**Summary of CPGS Options for Consideration**

Each of the generic options provides unique observable features and the potential for a country which detects the launch and flight of one or more weapons to distinguish them from U.S. strategic nuclear weapons. Each option also must be considered for arms control prohibitions, penalties, or limitations which its characteristics may trigger. Table 1 provides a summary of the CPGS options discussed in this report.

**Table 1: Summary of CPGS Options**

Option	Basing Mode	Launch Booster	Payload Trajectory	Range (nmi)
Conventional Strike Missile	Land-based in US	New design <sup>66</sup>	Non-ballistic (e.g. HTV-2 or AHW payload)	10,000-12,000
Army Advanced Hypersonic Weapon	Land-based, Deployable outside US	New design <sup>67</sup>	Non-ballistic HGB	2,000- 4,000
Conventional Trident Modification	Sea-based: SSBNs	Trident II SLBM	Near-ballistic (modified Mk-4 RV)	4,000- 6,000
Sea Strike – Sub	Sea-based: SSGNs and Virginia-class SSNs	New design	Non-ballistic	~1,800-3,500
ArcLight – Ship	Sea-based: Surface Ships only	New design: VLS-compatible	Non-ballistic	~2,000
ArcLight – Ship and Sub	Sea-based: Surface Ships and Submarines	New design: VLS-compatible	Non-ballistic	~2,000



***Observable Characteristics that Discriminate CPGS Weapons from a Nuclear-Armed ICBM or SLBM***

For countries such as Russia that employ a variety of early warning and surveillance capabilities, observable CPGS weapon characteristics can enable discrimination and can help reduce the potential for misperception. Observable weapon characteristics that can facilitate discrimination are derived from basing mode, deployment area, launch signature, and flight (midcourse and terminal) profiles.

*Basing and firing location.* For countries that monitor U.S. strategic nuclear bases, either from satellites or by other means, U.S. weapons fired from land-based sites distant from these bases would provide an indicator that the U.S. weapon was not nuclear. Similarly, for deployable sea-based weapon systems the detection of CPGS weapons fired from locations that are not known deployment areas for strategic nuclear forces or from delivery platforms that are not nuclear capable would be an indicator that the weapons were not from the U.S. strategic nuclear force.

*Launch characteristics.* Missile launch detection satellites typically rely on unique infrared signatures from the first stage of a ballistic missile. Each type of ballistic missile has specific design requirements for payload and range that affect the needed thrust and duration of burn of the first-stage engine. Therefore, each missile type provides a unique IR signature, which is observable. For example, the IR signature of the large Minotaur IV booster differs significantly from that of the first stage of the Minuteman III ICBM or the Trident II SLBM.

*Midcourse flight characteristics.* Early warning and long-range tracking radars such as those in the Russian early warning and attack assessment system can track and monitor objects high above the earth. U.S. ballistic missile flight tests are routinely monitored by Russia and others and the flight performance characteristics are well established. These characteristics can be used to predict accurately the impact point of a ballistic warhead. If the observed midcourse flight characteristics of a CPGS weapon system differed from that of U.S. nuclear ballistic missiles, that would provide a discriminator that the weapon was not part of the nuclear force.

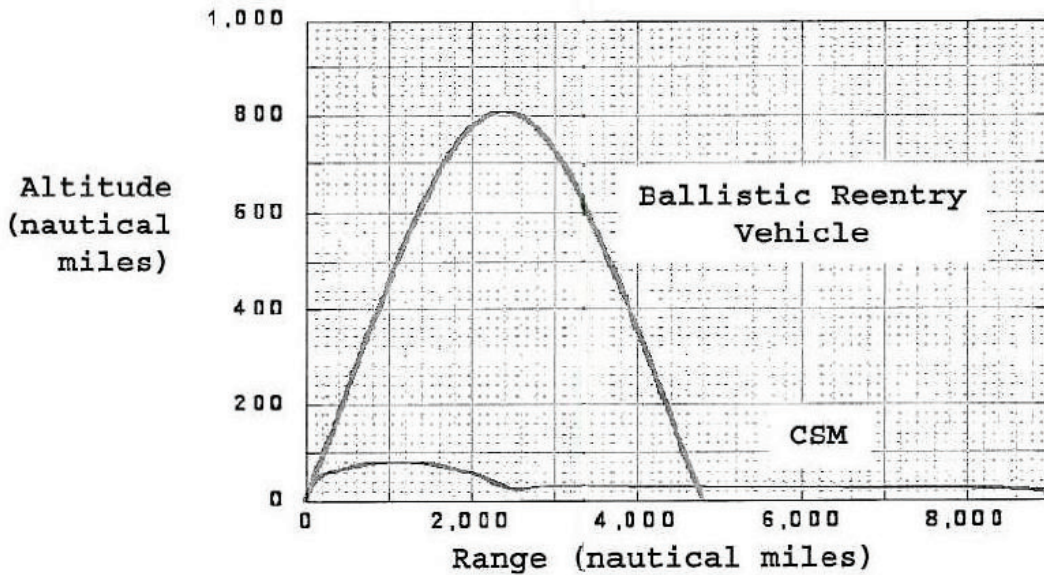
*Terminal flight characteristics.* Similarly, some countries may be able to track weapons as they reenter the earth's atmosphere and approach the terminal impact point. Currently, all U.S. nuclear-armed reentry vehicles are purely ballistic—they cannot maneuver in the terminal phase. However, for conventional weapons, maneuvering in the terminal phase of flight is required to achieve the accuracy needed to make such weapons effective. This is one more potentially observable difference.

The following discussion illustrates how basing and weapon characteristics of each CPGS concept can enable another country to discriminate it from a possible nuclear-armed ballistic missile. Following the discussion for each concept, a graphic depicts a “discrimination profile” for that concept.

**Conventional Strike Missile (CSM).** Observable weapon characteristics that would distinguish the CSM include the following:

- *Basing location and firing location:* The CSM missile would be based in the United States at coastal locations and distant from existing ICBM bases. Countries such as Russia, with launch detection satellites, would be able to monitor U.S. ICBM fields, and possibly SSBN deployment areas, and could verify that no launch has occurred from those locations.
- *Launch characteristics:* The IR signature of the first stage of the CSM would be discernible as powerful enough to be an intercontinental-range missile but distinctly different from that of the Minuteman III and Trident II. During development, flight tests of the hypersonic delivery vehicle for the CSM will be launched using the Minotaur IV booster. This booster has a much brighter signature than either the Minuteman III or Trident II. If the CSM concept is developed further for deployment, a commercial booster will be manufactured. That booster will also have its own unique launch signature.
- *Midcourse flight characteristics:* The CSM trajectory is uniquely different from that of an ICBM (see figure 2).<sup>68</sup> The apogee of a CSM trajectory is typically less than one million feet (compared with traditional ballistic ICBM strike missions that have an apogee of eight to ten million feet). For its entire midcourse flight profile, the altitude of the payload delivery vehicle of the CSM is 80 percent or more lower (in altitude above the earth) than the payload section of an ICBM of comparable range.

**Figure 2: CSM and Ballistic Flight Profiles**

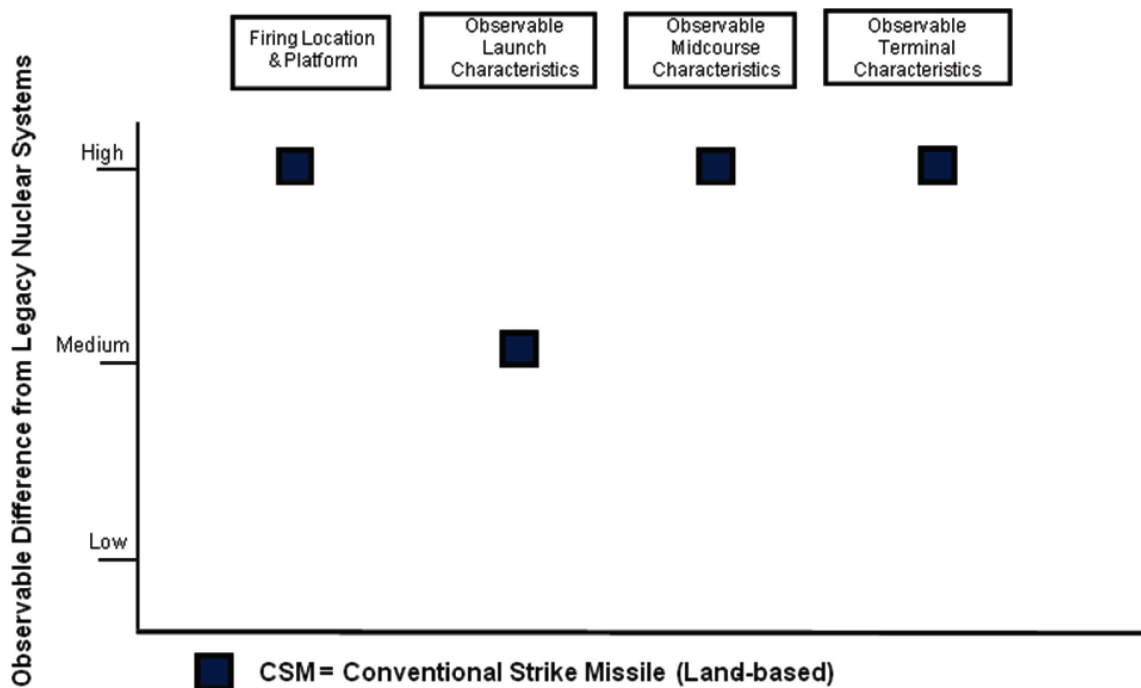


CSM and Ballistic Reentry Vehicle Trajectory Comparison

- *Terminal flight characteristics:* As the payload delivery vehicle for the CSM begins to reenter the earth's atmosphere, the hypersonic delivery vehicle will be able to maneuver to provide precision accuracy and to avoid overflight of selected areas. Since current ballistic reentry vehicles cannot maneuver, this observable maneuvering would provide another indication that this weapon is different from the current generation of U.S. nuclear weapons.

Figure 3 displays a “discrimination profile” for the CSM. For four observable phases of basing and flight, the profile indicates the rough degree of difference from the observable characteristics of existing strategic nuclear weapons.

**Figure 3: CSM Discrimination Profile**

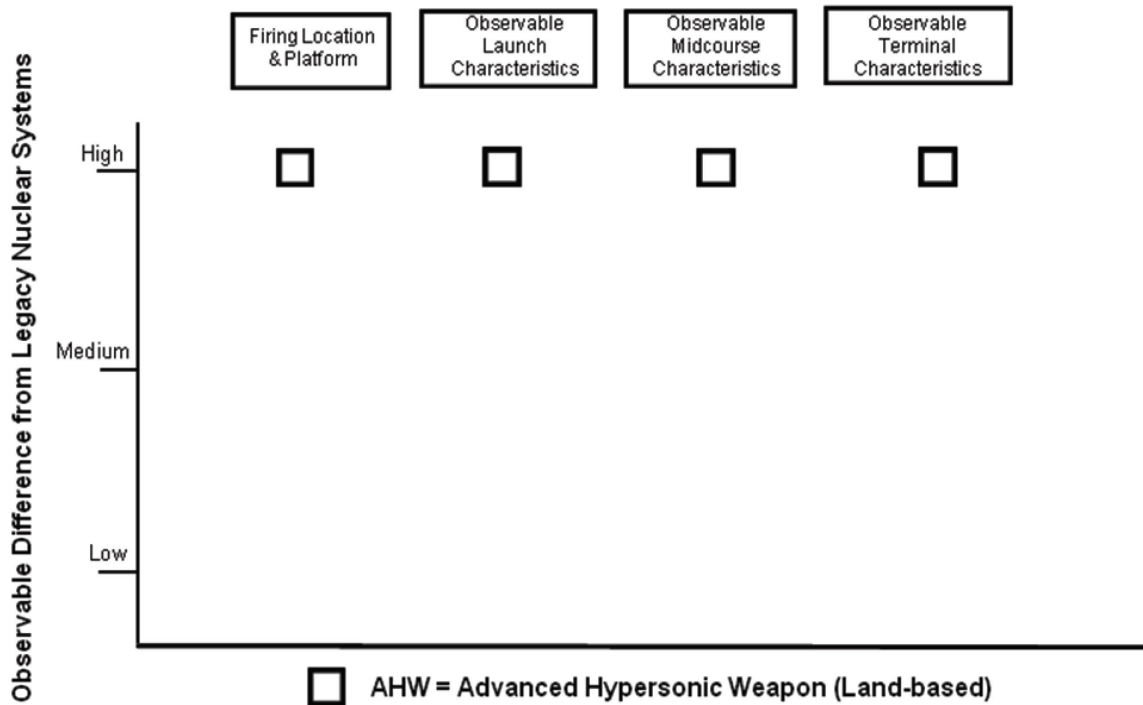


**Advanced Hypersonic Weapon (AHW).** Observable weapon characteristics that would distinguish the AHW include the following:

- *Basing location and firing location:* The AHW missile would be land-based and launched from locations outside of the continental United States and far removed from existing ICBM bases. A launch, if detected, would be distinguishable by its location.
- *Launch characteristics:* As discussed for the CSM above, in development flight tests the Minotaur IV booster will be used and will provide a distinctive IR signature observable to countries with launch detection satellites. If this concept is developed further for deployment, a new type of commercial booster which permits forward deployment would be manufactured. This new missile would have its own unique IR signature.

- *Midcourse flight characteristics:* The AHW profile is distinctly different from that of a ballistic missile. Its apogee is even lower than that of the CSM and its conic payload delivery vehicle enables it to return quickly into the earth’s atmosphere for the majority of its flight path.
- *Terminal flight characteristics:* As the payload delivery vehicle for the AHW approaches the impact point, the hypersonic glide body can maneuver to provide precision accuracy and, if needed, near-vertical impact for penetration of a target. This observable maneuvering would provide another unique indication that this weapon is different from the current generation of U.S. nuclear weapons.

**Figure 4: AHW Discrimination Profile**

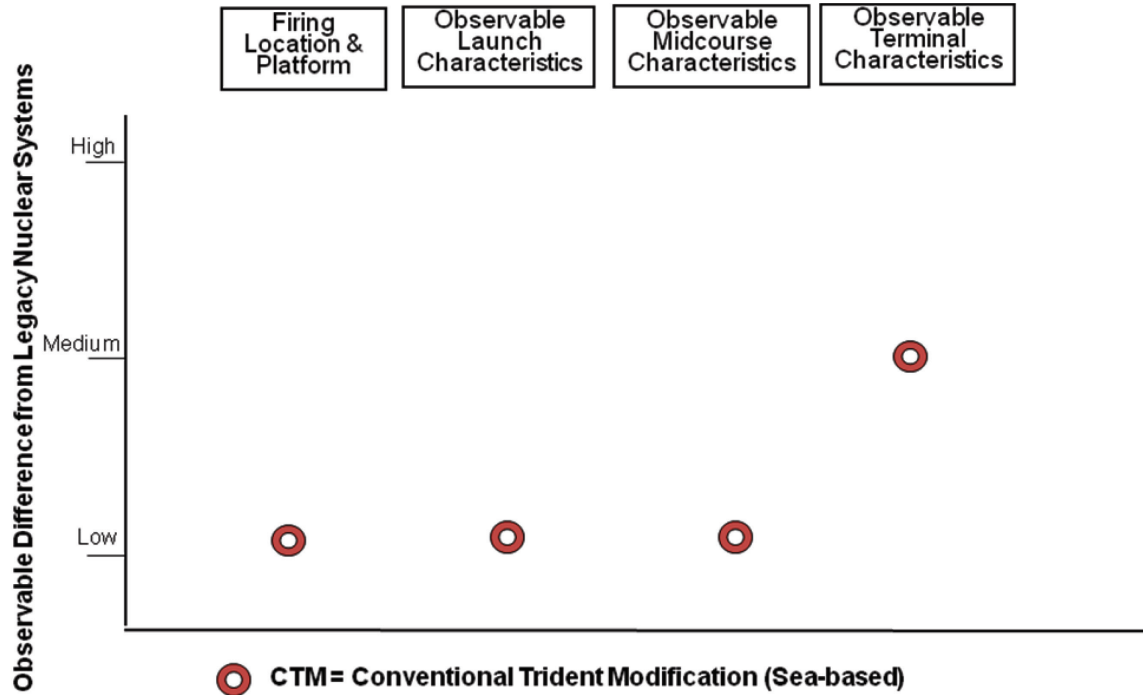


**Conventional Trident Modification (CTM).** Observable weapon characteristics that would distinguish the CTM include the following:

- *Basing location and firing location:* Countries such as Russia, with launch detection satellites, would be able to monitor likely SSBN deployment areas, and could verify that the launch occurred from those locations. They would be aware that the United States deploys a limited number of conventionally-armed ballistic missiles on SSBNs. With this additional knowledge, the launch of one or two SLBMs would unlikely be interpreted automatically as a nuclear first strike.
- *Launch characteristics:* The IR signature would be recognizable as that of Trident II.
- *Midcourse flight characteristics:* The midcourse trajectory would be similar to that for Trident II SLBMs.

- *Terminal flight characteristics:* As the payload delivery vehicle for the CTM begins to reenter the earth's atmosphere, the delivery vehicle will be able to maneuver to provide precision accuracy for the non-explosive payload. Since current ballistic reentry vehicles do not maneuver at all, this observable maneuvering would provide an indication, prior to impact, that this weapon is different from the current generation of U.S. nuclear weapons.

**Figure 5: CTM Discrimination Profile**

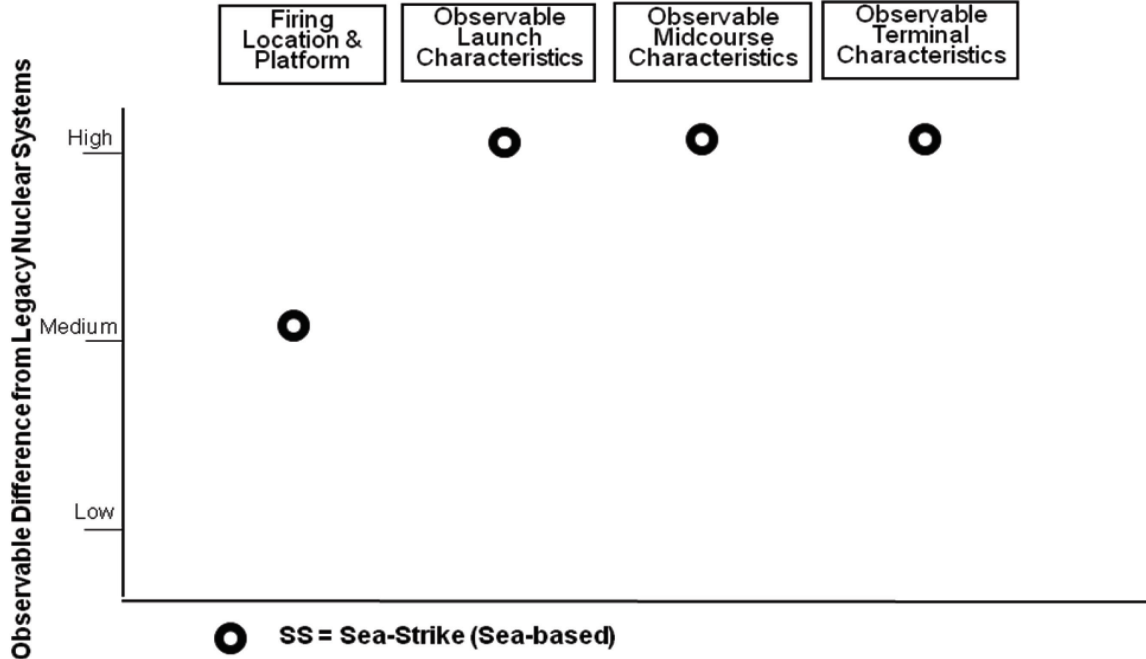


**Sea Strike (SS).** Observable weapon characteristics that could distinguish the SS launch from a SSGN include the following:

- *Basing location and firing location:* Countries such as Russia, with launch detection satellites, would be able to verify that no launch has occurred from U.S. ICBM fields, and possibly SSBN deployment areas. However, because the missile is launched from a submerged submarine, the country observing the launch is unlikely to be able to eliminate the possibility that it had been launched from a U.S. SSBN.
- *Launch characteristics:* The IR signature of the first stage of the SS would be discernible as distinctly different from that of the Minuteman III and Trident II.
- *Midcourse flight characteristics:* The Sea Strike missile trajectory would be uniquely different, shorter-range, and with lower apogee than that of nuclear-armed ballistic missiles.
- *Terminal flight characteristics:* As the payload delivery vehicle for the SS approaches its intended target, the hypersonic delivery vehicle will be able to maneuver to provide precision accuracy and to avoid overflight of selected

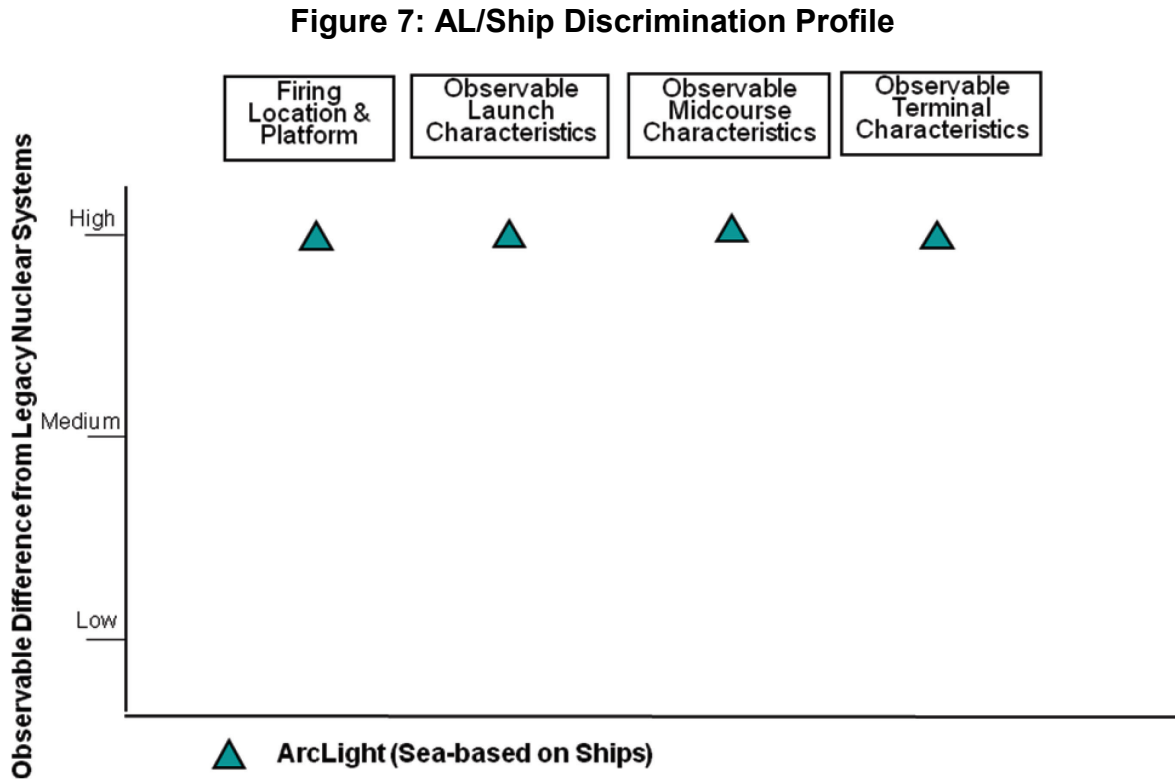
areas. This observable maneuvering would provide another indication that this weapon is different from the current generation of U.S. nuclear weapons.

**Figure 6: SS Discrimination Profile**



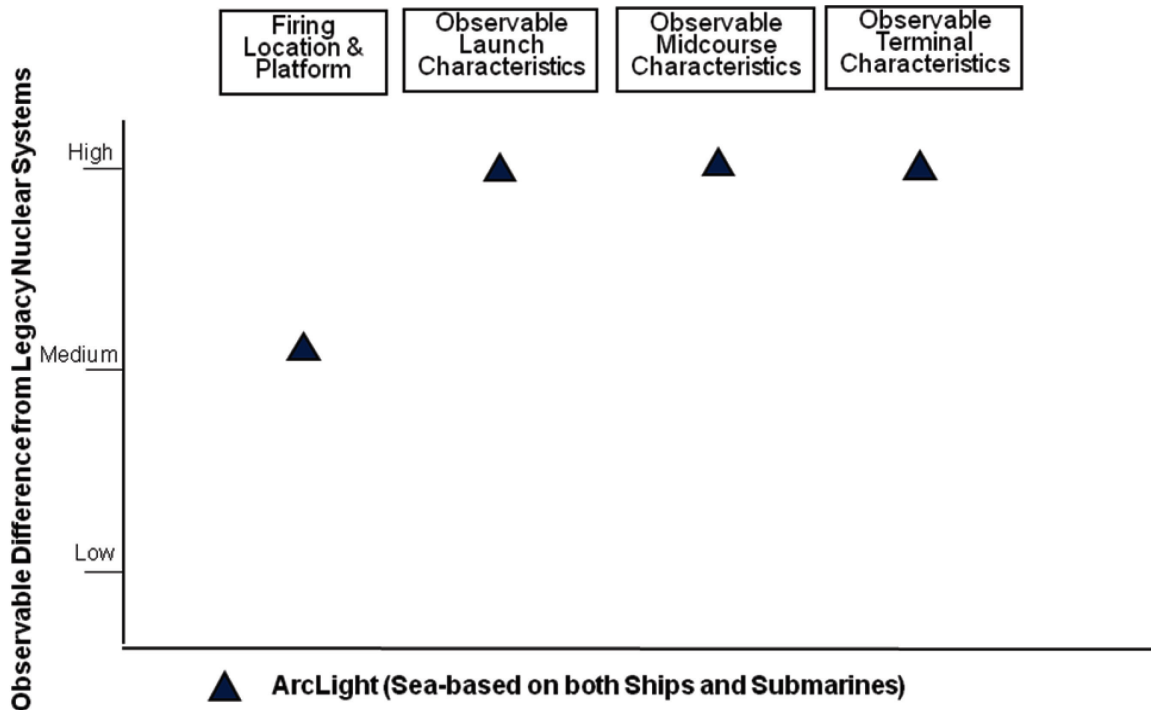
**ArcLight/Ship (AL/Ship).** Observable weapon characteristics that would distinguish the ArcLight weapon if deployed only on surface ships include the following:

- *Basing location and firing location:* Countries, such as Russia, with launch detection satellites, would be able to verify that no launch has occurred from U.S. ICBM fields, and possibly from SSBN deployment areas. However, because the missile is launched from a surface ship, a country detecting the launch may also be able to verify that a U.S. ship is in the general area and that the launch is not likely to be from a U.S. SSBN.
- *Launch characteristics:* The IR signature of the first stage of the ArcLight would be discernable as distinctly different from that of the Minuteman III and Trident II.
- *Midcourse flight characteristics:* The ArcLight missile trajectory would be uniquely different from that of an ICBM. The apogee would be significantly less than one million feet (in contrast to traditional ballistic ICBM trajectories that have an apogee of eight to ten million feet). In addition, the payload delivery vehicle will be capable of maneuvering to avoid overflight of sensitive areas. This maneuverability, if observed, would distinguish it from U.S. nuclear weapons.
- *Terminal flight characteristics:* The payload—a hypersonic delivery vehicle—will be able to maneuver to provide precision accuracy. Since current ballistic reentry vehicles do not maneuver, this observable maneuvering would provide another indication that this weapon is different from the current generation of U.S. nuclear weapons.



**ArcLight (AL/Ship-Sub).** Observable weapon characteristics that would permit discrimination are similar to those described above for the ArcLight concept deployed only on surface ships. The discrimination profile below differs only in one area. If the ArcLight missile is launched from a submerged submarine, the country observing the launch is unlikely to be able to eliminate the possibility that it had been launched from a U.S. SSBN. If the launch occurs well outside of areas of expected SSBN patrols, such as the northern Arabian Sea or Persian Gulf, the evidence would imply strongly that it was not launched from an SSBN and therefore non-nuclear.

**Figure 8: AL/Ship-Sub Discrimination Profile**



The above discussion of CPGS concepts and characteristics is important for two reasons. First, the components of each concept may be observable to a properly equipped adversary. The discrimination profile of each concept indicates the features that, if observed, would differ from observations of a strategic nuclear weapon. The potential for Russian early warning and attack assessment capabilities to discriminate CPGS from strategic nuclear weapons is discussed in part two. Second, the components and characteristics of each CPGS concept may determine whether the concept is subject to a particular arms control treaty and, if so, the specific constraints that would apply. Arms control issues applicable to CPGS are discussed next.

**Arms Control Issues**

The ability to deploy weapons for conventional prompt global strike is affected by arms control provisions in both the Intermediate-Range Nuclear Forces (INF) and New START Treaties. However, there are still many useful options for CPGS that can be pursued consistent with both treaties.

The following discussion is based on the plain meaning of treaty provisions of the INF and New START Treaties, including the understanding of each treaty as it was explained to the U.S. Senate during the ratification processes. This understanding of treaty language is important because of a precedent referred to as the “Biden Condition.”



### ***The Biden Condition***

Both the INF and New START Treaties contain the so-called “Biden Condition” in their respective resolutions of ratification. As described in 1989 by then-Senator Joseph Biden, the condition requires that the INF Treaty be interpreted according to:

- (1) the principle that the original ‘shared understanding’ held by the Executive and the Senate must govern United States interpretation and implementation of a treaty;
- (2) the principle that the basis for this common understanding is the text of the treaty, as elaborated by the Executive’s formal representations to the Senate in seeking consent to ratification;
- (3) the principle (really a corollary of the first principle) that the Executive may not, acting alone, adopt a new interpretation of a treaty; and
- (4) a reference to the Constitution as the source of these principles.<sup>69</sup>

While the legality of the Biden Condition has been questioned, no administration has taken action inconsistent with the Biden Condition for more than 20 years. As a practical matter, no CPGS issues related to interpretation of the INF Treaty appear to be impacted by the Biden Condition. However, in New START there are a number of issues associated with the interpretation of treaty language that may impact conventional prompt global strike. For these issues, the Biden Condition would apply. Therefore, New START provisions as described to the Senate during ratification hearings and conditioned by the Senate in its resolution of ratification would take precedence over any alternative interpretations. Although some Russian “interpretations” would be more restrictive for CPGS concepts than the views expressed during the U.S. ratification process, without the advice and consent of the Senate any alternative interpretations have no legal standing.

### ***The INF Treaty***

The INF treaty was narrowly focused on specific weapons that were being deployed in Europe and western Russia during the 1980s. In order to be prohibited by the INF Treaty, a weapon must: 1) be a weapons delivery vehicle; 2) be a ballistic or cruise missile; 3) have a range as measured under the INF Treaty methodology of between 500 and 5,500 kilometers; and 4) be ground-launched.<sup>70</sup> The INF Treaty does not impact air-launched and sea-launched missiles of INF range. To be prohibited a weapon must meet all four conditions as defined in the Treaty.<sup>71</sup> Note that the INF Treaty makes no distinction between nuclear and non-nuclear weapons delivery vehicles. They are equally subject to its provisions.

### **Relevant INF Treaty Definitions**

A “weapons delivery vehicle” under the INF Treaty was defined in an exchange of diplomatic notes:

... any ground-launched ballistic or cruise missile in the 500-kilometer to 5500-kilometer range that has been flight-tested or deployed to carry or be used as a

weapon—that is, any warhead, mechanism or device, which, when directed against any target, is designed to damage or destroy it. Therefore, the Treaty requires elimination and bans production and flight-testing of all such missiles, tested or deployed, to carry or be used as weapons based on either current or future technologies, with the exception of missiles mentioned in paragraph 3 of Article VII of the Treaty.<sup>72</sup>

The INF Treaty states, “The term ‘ballistic missile’ means a missile that has a ballistic trajectory over most of its flight path. The term ‘ground-launched ballistic missile (GLBM)’ means a ground-launched ballistic missile that is a weapon-delivery vehicle.”<sup>73</sup> The Treaty defines a cruise missile as “an unmanned, self-propelled vehicle that sustains flight through the use of aerodynamic lift over most of its flight path. The term ‘ground-launched cruise missile (GLCM)’ means a ground-launched cruise missile that is a weapon-delivery vehicle.”<sup>74</sup> The INF Treaty Article-by-Article Analysis states that such a “vehicle” is a “missile.”<sup>75</sup> Unmanned remotely-piloted aircraft (sometimes called unmanned aerial vehicles, unmanned combat air vehicles, remotely-piloted vehicles or drones) are excluded from the prohibition under this definition.

The INF range determination for a ballistic missile is the “maximum range to which it has been tested.”<sup>76</sup> For cruise missiles it is a theoretical calculation. The Treaty reads: “The range capability of a GLCM not listed in Article III of this Treaty shall be considered to be the maximum distance which can be covered by the missile in its standard design mode flying until fuel exhaustion, determined by projecting its flight path onto the earth’s sphere from the point of launch to the point of impact.”<sup>77</sup>

The INF Treaty contains no definition of what “ground-launched” means. However, it does contain definitions of “launcher” for GLBMs and GLCMs. The Treaty states that the term “launcher” means “a fixed launcher or a mobile land-based transporter-erector-launcher mechanism for launching” a GLBM or a GLCM.<sup>78</sup> It covers only INF-range launchers—silo or other types of fixed launchers and the type of road-mobile launchers that were in service at the time the treaty was negotiated.

### **Discussion of INF Treaty Provisions**

The INF Treaty does not constrain aircraft or aircraft-delivered weapons.<sup>79</sup> Two-way remote-controlled aircraft that take off and land on a runway such as the U.S. Predator, Reaper, X-45, and X-47 are not prohibited by the INF Treaty. This view is shared by the Russian Federation. An August 2010 Russian Foreign Ministry statement on U.S. compliance with arms control commitments made no reference to these systems.<sup>80</sup> The Russians also have a weapon delivery vehicle, similar to U.S. unmanned airborne vehicles, called the Skat.<sup>81</sup>

Under the INF Treaty, range is measured as one-way distance. Ground-launched unmanned aerodynamic vehicles with a range of 500 to 5,500-km are prohibited. Weapons of INF range meeting the definition of a ground-launched cruise missile would be prohibited by the treaty even if they are subject to remote control.<sup>82</sup> However, if a weapon delivery system is designed for two-way-launch and return-missions, INF restrictions do not apply.

Since the 1990s the Russians have been developing and recently marketing the Tu-300, a two-way, rocket-launched, jet-powered, remotely-controlled aerodynamic vehicle which has been tested for weapon delivery.<sup>83</sup> This system is not considered to be a violation of the INF Treaty and has never been included as a treaty-related concern in U.S. arms control compliance reports produced by either the Bush or Obama administrations.<sup>84</sup> Hence, it is reasonable to conclude that this type of option is not prohibited by the treaty and is therefore also available for the United States.

Ground-launched missiles with hypersonic boost-glide vehicles of INF range—such as the AHW concept described earlier—do not appear to be prohibited by the INF Treaty as long as they are not tested in a manner that meets the definition of a ballistic missile (that is, they do not fly a ballistic trajectory for most of their flight on any test flight). Similarly, the AHW concept would not meet the INF cruise missile definition because it is not “self-propelled.” The hypersonic boost-glide vehicle contains no on-board propulsion.<sup>85</sup> Once released from its rocket booster the payload delivery vehicle glides to its target.<sup>86</sup>

The INF Treaty definitions of “cruise missile” and “ballistic missile” are the same as the definitions in the expired START I Treaty and its New START follow-on. Therefore, the recent Senate deliberation on the New START Treaty and, in particular, the discussion of its impact on hypersonic boost-glide vehicles, is relevant to interpreting the INF Treaty. Depending on the precise range of the Army AHW concept, its range may raise issues over whether or not INF prohibitions apply. The National Academy of Sciences version of the AHW concept clearly would have intercontinental range which would place it beyond the reach of INF constraints.

### **Bottom Lines on the INF Treaty and CPGS**

The only generic basing concept for CPGS considered in this report that might be impacted by the INF Treaty is the deployable, land-based concept referred to as AHW. The concept would be ground-launched and, depending on range, could fall within the 500 to 5,500-km range limitation of the INF Treaty. However, the AHW concept would not be subject to INF restrictions as long as all payloads for developmental flight testing and operational use fly a “non-ballistic” trajectory.

### ***The New START Treaty***

The New START Treaty limits deployed ICBMs, SLBMs, and long-range, heavy bombers to a cumulative total of no more than 700 deployed delivery systems carrying 1,550 deployed warheads.<sup>87</sup> The legal distinction between ICBMs and SLBMs is based upon the definitions of launch mode and specific range thresholds:<sup>88</sup>

- ICBMs by definition are launched from the ground and have a range in excess of 5,500 kilometers;
- SLBMs are launched from submarines and have a range in excess of 600 kilometers.<sup>89</sup>

New START does not distinguish between nuclear-armed and conventionally-armed missiles. Therefore, CPGS concepts that meet the definition of an ICBM or an SLBM would be accountable under the treaty. For the United States, the first stages of ICBMs and SLBMs are treaty-accountable, but the total number of missiles is not limited. Only the number of launchers (deployed and non-deployed) and deployed warheads are limited.<sup>90</sup>

**Treaty-related developments open up potential new opportunities as well as foreshadow potential constraints on CPGS.**

The Treaty contains a “permit and count” regime whereby conventionally armed ICBMs or SLBMs would be permitted but counted under the strategic delivery vehicle and strategic warhead

ceilings.<sup>91</sup> According to the New START Treaty Article-by-Article Analysis, “Each such reentry vehicle, including conventionally-armed reentry vehicles, is counted as one warhead.”<sup>92</sup>

In practice, New START limits on the combined total of nuclear and conventional launchers and warheads will preclude the deployment of more than a small number of treaty-limited CPGS weapons. Administration officials have concluded this to be acceptable because—according to their analysis—the limit of 700 deployed delivery vehicles and 1,550 deployed warheads would allow deployment of an adequate-sized nuclear force as well as a small, niche CPGS capability. One DoD official testified that if treaty-accountable CPGS weapons were deployed, the total number deployed would be “very small.”<sup>93</sup> He stated the United States might consider deploying a number of treaty-limited CPGS weapons, similar to the 24 conventional Trident missiles proposed by the Bush administration.<sup>94</sup> Former Secretary of Defense Robert Gates stated that treaty-accountable “conventionally armed ICBMs or SLBMs, if deployed, would play a niche role in military operations” and “the maximum number of deployed missiles and warheads would be a small percentage of the [treaty] limits.”<sup>95</sup> An official statement of the administration’s position on CPGS reported, “The New START Treaty allows the United States to deploy CPGS systems, and does not in any way limit or constrain research, development, testing, and evaluation of such concepts and systems, which offer the prospect of striking any target in the world in less than an hour.”<sup>96</sup>

One fundamental difference between START and New START relates to the handling of missiles after all their launchers have been eliminated. New START, in contrast to the expired START Treaty, does not have a special category for “retired” types of ICBMs or SLBMs. According to the New START Article-By-Article Analysis, the “entire type of ICBM or SLBM is no longer subject to the Treaty” when all launchers of that type of missile have been eliminated or converted in accordance with Part Three of the Protocol.<sup>97</sup> That means, for example, when the last launchers for the Minuteman II and Peacekeeper are removed from accountability in accordance with New START procedures, these ICBMs will cease to be subject to New START.<sup>98</sup> At that point the missiles—or missile stages—could be reused for other types of weapons which, if deployed, would need to be deployed with new types of launchers. Depending on specific weapon characteristics, the weapons could either be treaty-accountable or outside of the treaty and not accountable. Potential types of weapons outside of the

New START Treaty could include air-launched ballistic missiles, surface ship-launched ballistic missiles, or land-based missiles that launch hypersonic boost-glide vehicles or other payload delivery vehicles which fly non-ballistic trajectories.

### **Discussion of New START Treaty Provisions**

Several definitions in New START (the same definitions used in START I) are relevant to CPGS:

- 1) “The term ‘ballistic missile’ means a missile that is a weapon-delivery vehicle that has a ballistic trajectory over most of its flight path”;<sup>99</sup>
- 2) “The term ‘intercontinental ballistic missile’ or ‘ICBM’ means a land-based ballistic missile with a range in excess of 5,500 kilometers”;<sup>100</sup> and
- 3) “The term ‘submarine-launched ballistic missile’ or ‘SLBM’ means a ballistic missile with a range in excess of 600 kilometers of a type, any one of which has been contained in, or launched from, a submarine.”<sup>101</sup>

New START requires that weapons meeting the definition of an SLBM can be deployed only on ballistic missile submarines. The specific treaty language actually applies to “launchers of SLBMs” but the practical effect is the same: “Each Party shall install deployed launchers of SLBMs only on ballistic missile submarines.”<sup>102</sup> The prohibition on deploying SLBMs on surface ships and aircraft also means that if a new type of ballistic missile is deployed on a submarine (thereby making it, by definition, a SLBM), the same type of missile could not be deployed on surface ships or on aircraft.

One implication for CPGS results from the exclusion from treaty limitations of weapons with payloads that fly non-ballistic trajectories, such as hypersonic boost-glide vehicles. While such systems were also excluded from the original START I Treaty, Senate debate over the impact of New START on CPGS explicitly protected this option from being captured by New START without the advice and consent of the Senate. Because the New START definitions that exclude hypersonic boost-glide vehicles are the same as those in the INF Treaty, this arguably strengthens the option for INF-range CPGS weapon systems as well.

New START would permit a variety of weapon concepts which might be useful for the prompt global strike role. For example, variations of New START-accountable ICBMs or SLBMs might be deployed without constraints. One option is for existing missiles to be modified sufficiently to trigger New START’s “new type” rule. In order to be considered a “new type,” a missile would require only a 3 percent change in length or diameter. Therefore, even a missile stage such as the Trident II first stage, if so modified, could be used to create a “new type” of weapon that was not accountable under New START if the payload did not fly a ballistic trajectory. Other examples of weapons which would be non-accountable include conventional weapons that fly non-ballistic trajectories and are launched from surface ships or ballistic missiles launched from aircraft.<sup>103</sup>

### **Implications for CPGS**

The New START Treaty makes it potentially easier and cheaper to deploy CPGS weapons than when the START I Treaty was in effect. Under New START, the Minuteman II, the Minuteman III, the Peacekeeper and Trident II are listed as “existing types” of ICBMs and SLBMs.<sup>104</sup> Since only Minuteman III and the Trident II are operationally deployed today, Minuteman II and Peacekeeper missiles, once all their launchers are eliminated as planned, can be used to deploy non-ballistic payloads such as hypersonic boost-glide vehicles while remaining unencumbered by New START restrictions.

Force structure flexibility under New START was discussed during the ratification hearings primarily in relation to the ability to provide missile targets for ballistic missile defense tests.<sup>105</sup> More significant, however, is the potential flexibility allowed by New START with respect to allowable options for CPGS. The New START Treaty allows more types of weapon options for CPGS than did its predecessor—START I. For example, New START omits the START I prohibition on air-launched ballistic missiles and ship-launched ballistic missiles with ranges over 600 km.<sup>106</sup> Of the generic CPGS concepts outlined earlier, all except the CTM would not count toward New START limits on deployed launchers and warheads and non-deployed launchers. The ArcLight concept, however, because it could conceivably be deployed on both surface ships and submarines, requires a more detailed discussion.

*ArcLight concept and New START.* New START would permit the generic ArcLight concept to remain outside of Treaty constraints as long as the weapon did not meet the definition of an SLBM. New START specifies, “Each Party shall install deployed launchers of SLBMs only on ballistic missile submarines.”<sup>107</sup> Therefore, if ArcLight were deployed on a submarine and flew a ballistic trajectory, thereby meeting the definition of an SLBM, it would be restricted to deployment only on SSBNs and would count toward New START limits.

New START prohibits deploying SLBMs on surface ships and aircraft. Thus, if the U.S. deployed ArcLight or Sea Strike missiles on submarines and those missiles had flown a payload with a ballistic trajectory (thereby making the weapon, by definition, a SLBM), the same type missile could not be deployed on surface ships or aircraft. However, a modification to the weapon sufficient to trigger the New START “new type” rule could be made to enable the modified CPGS weapon to be deployed on surface ships or aircraft. Such appropriately modified weapons would not be limited under New START.

It is noteworthy that the hypersonic boost glide vehicle currently being flight tested by the United States (the HTV-2) uses a modified Peacekeeper missile as a booster. The Air Force concept for the Conventional Strike Missile would also use missile stages from retired Peacekeeper missiles. As noted above, once all Peacekeeper silos are destroyed the Peacekeeper missile will no longer be subject to the Treaty. Therefore, these missiles could be deployed outside of the Treaty and used to launch hypersonic boost-glide delivery vehicles as long as the weapons are tested in a manner that does not trigger the ICBM ballistic missile definition (i.e., never tested on a ballistic trajectory over most of its flight path).

A missile with a hypersonic boost-glide vehicle can be deployed in any basing mode as long as it remains outside of the treaty definition of an ICBM or SLBM. Since the four *Ohio*-class SSGNs are outside of the New START Treaty (except for a verification-related Agreed Statement on inspections), missiles with hypersonic boost-glide vehicles could be based on these SSGNs. It would also be possible to base weapons with hypersonic boost-glide vehicles on modified *Virginia*-class submarines or a future attack submarine. In theory, they could also be deployed on Trident ballistic missile submarines or follow-on submarines, although this would likely cause political and verification problems with Russia and go against the Senate's judgment, stated in the New START Resolution of Ratification, that nuclear and conventional global strike capabilities should be separated.<sup>108</sup>

The New START Treaty contains a provision for bringing a "new kind of strategic offensive arm" into the treaty by mutual agreement.<sup>109</sup> However, the administration has stated consistently that non-ballistic CPGS weapons would not be subject to New START. According to Principal Deputy Under Secretary of Defense Dr. James Miller, "As we made clear during the New START Treaty negotiations, we would not consider such non-nuclear systems, which do not otherwise meet the definitions of the New START Treaty, to be 'new kinds of strategic offense arms' for the purposes of the Treaty."<sup>110</sup> This was not an isolated statement but was repeated numerous times during the ratification hearings and is also included in the New START Treaty Article-By-Article Analysis.<sup>111</sup> Hence, this interpretation is subject to the "Biden Condition."

### **Bottom Lines on the New START Treaty and CPGS**

The New START Treaty permits numerous options for conventional prompt global strike concepts, both within and outside of the Treaty limits. For example:

- Existing ICBMs and SLBMs could be modified to carry conventional warheads. These concepts would count toward New START limits on launchers (deployed and non-deployed) and on deployed warheads.
- Air-launched and surface ship-launched ballistic missiles are permitted and would not be subject to the treaty.
- Weapons concepts that are non-ballistic, such as those which launch hypersonic boost-glide vehicles, are outside of the Treaty and protected from being captured by the Treaty as a "new type" given the New START Resolution of Ratification, the Congressional record of ratification hearings, and the Biden Condition.

The Resolution of Ratification contains an "understanding" (which invokes the Biden Condition) stating that, "future, strategic-range non-nuclear weapon systems that do not otherwise meet the definitions of the New START Treaty will not be 'new kinds of strategic offensive arms' subject to the New START Treaty" and provides that "any prohibition on the deployment of such systems, including any such limitations or prohibitions agreed under the auspices of the Bilateral Consultative Commission, would require an amendment to the New START Treaty which may enter into force for the United States only with the advice and consent of the Senate, as set forth in Article II,

section 2, clause 2 of the Constitution of the United States.”<sup>112</sup> A Treaty amendment requires a two-thirds vote in the Senate.

The following table summarizes treaty constraints on the CPGS concepts considered by this report.

**Table 2: Summary of Applicability of INF and New START Treaties for CPGS Concepts**

<b>CPGS Concept</b>	<b>INF Treaty</b>	<b>New START Treaty</b>
Conventional Strike Missile	Not Applicable	Accountable toward limits only if it meets definition of “ballistic missile” or is launched by a booster that is accountable as an ICBM or SLBM
Army Advanced Hypersonic Weapon	Not applicable if range greater than 5,500 km; If range between 500-5,500 km, no restrictions if it does not meet definition of “ballistic missile” or “cruise missile”; If a ballistic missile and within INF range band, prohibited	If range is less than 5,500 km, not applicable; If range is over 5,500 km, not accountable as long as it does not meet definition of “ballistic missile”
Conventional Trident Modification	Not Applicable	Accountable toward treaty limits
Sea Strike - Sub	Not Applicable	Concept would not meet definition of “ballistic missile,” therefore, not accountable
ArcLight – Ship Only	Not Applicable	Not accountable
ArcLight – Ship and Sub	Not Applicable	Concept would not meet definition of “ballistic missile,” therefore, not accountable



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## Part Two: Key Issues for CPGS

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Part two of this report explores several key issues that may influence whether or not to develop and deploy CPGS capabilities. The issues include:

- What early warning and attack assessment capabilities are available to Russia? Of particular concern is whether Russia could use these capabilities to distinguish between the CPGS concepts discussed earlier in this report and nuclear-armed ballistic missiles. This report focuses on Russian detection capabilities because countries other than Russia have little capacity to detect a ballistic missile launch.<sup>113</sup>
- What type of response can be expected if Russian officials are surprised by the launch of one or more CPGS weapons by the United States? While no certainties exist regarding expectations of human behavior, the actions of Soviet and Russian officials in the past could be instructive.
- Could U.S. development and deployment of CPGS weapons initiate a new type of arms race and proliferation of conventionally-armed long-range missiles? A brief summary of current capabilities reveals that several other countries are seeking or already possess long-range ballistic missiles that could be used to deliver conventional weapons payloads.

### **What Russian Capabilities Exist for Early Warning and Attack Characterization?**

Unclassified analyses of CPGS issues, including the 2008 National Academy of Sciences report, provide little detail on assumptions about Russian capabilities. Since “nuclear ambiguity” is one of the most contentious issues surrounding the development of CPGS, analysis of Russian early warning and attack characterization capabilities would seem to be a major element of any study on CPGS. The discussion below provides an overview of Russian capabilities for early warning and attack characterization. It begins with an overview of these capabilities during the Soviet era and their atrophy and decline during the 1990s. The discussion then transitions to Russian efforts to rebuild these capabilities, the current status of Russian early warning and attack assessment systems, and future plans. This picture of Russian capabilities is drawn exclusively from unclassified sources and relies, as much as possible, from statements by Russian officials and defense analysts.

#### ***Soviet-Era Early Warning and Attack Characterization Capabilities***

Russia inherited a redundant, if incomplete, early warning system from the Soviet Union. The Soviet system was composed of launch detection satellites and over-the-horizon radars. Satellites provided the initial detection of missile launches and above-the-horizon radars assessed the attack and performed precision tracking.<sup>114</sup> According to Pavel Podvig, a Russian citizen and defense analyst, the earliest Soviet-era launch-detection

satellites carried “infrared and visible-spectrum sensors capable of detecting a burning missile motor against a background of space (but not against a background of [the] Earth surface).”<sup>115</sup> He added that improved Soviet early warning satellites were designed to “provide coverage of possible SLBM launch areas in the oceans, as well as missile launches from U.S. and Chinese territory.”<sup>116</sup> Soviet launch detection satellites and over-the-horizon radars were able to detect ballistic missile launches and provide the general direction of an attack with up to 30 minutes of warning.<sup>117</sup>

According to a Russian scientist’s account of Soviet and Russian space capabilities, the first successful satellite detection of a U.S. ICBM launch occurred on December 24, 1974. The account states that on that date a Soviet satellite detected the launch of a U.S. Minuteman-1 ICBM from the Western Range and tracked it the entire active leg of its flight trajectory.<sup>118</sup>

The Soviets built eleven sophisticated first-generation Hen House (Dnepr) early warning radars. Construction started in the 1960s and continued through the 1970s. According to a declassified CIA report, these were “antimissile and anti-satellite radars” which used “long pulses, pulse compression, and frequency scanning, with sophisticated data processing.”<sup>119</sup> In addition, nine modern large phased-array radars (LPARs) were constructed. The more advanced LPARs which the Soviets began building in the 1970s, were of two types—the Daryal or Pechora type and the Volga or Baranovich type. The LPARs could accurately track large numbers of incoming warheads and determine the impact points.<sup>120</sup> These LPARs were the most expensive radars ever built. The smallest of these, the Volga radar, can detect and track ballistic missiles and space objects in flight at distances of up to 5,000 kilometers.<sup>121</sup> In the last few years of the Soviet Union’s existence, the LPARs were in varying degrees of completion.<sup>122</sup>

These radars supported the Moscow anti-ballistic missile (ABM) defense system and could also support a nationwide ABM system.<sup>123</sup> The giant Pill Box (Don-2N) ABM battle management radar for the Moscow ABM System (ABM-4), with its 360-degree scan capability, filled any gaps in the peripheral early warning radars and provided redundant detection and tracking capability to sectors covered by early warning radars.<sup>124</sup> According to the Russian press, it demonstrated the ability to track metal spheres with diameters of 5 and 10 centimeters at distances of 1,500-2,000 kilometers.<sup>125</sup>

Podvig has pointed out that, despite enormous expenditures, the Soviets “never had a complete early-warning system that would be able to detect all possible missile launches.”<sup>126</sup> He explained that the Soviet system was designed to detect “a large-scale attack that could endanger the ability of the Soviet Union (and now Russia) to launch a retaliatory strike.”<sup>127</sup> This reflects the view that a small attack could not possibly deny Russia a retaliatory capability and would be viewed as self-defeating because it would invite a Russian nuclear response.

***Rebuilding After the Breakup of the Soviet Union***

Russian early warning systems eroded in the late Soviet period and after the breakup of the Soviet Union. Prior to the breakup, the Soviet Union dismantled the Krasnoyarsk large phased-array radar, admitting it was an ABM Treaty violation.<sup>128</sup> In addition, the Russian financial crisis of the 1990s delayed completion of several LPARs. By 1998, the Pill Box ABM radar was virtually non-functional.<sup>129</sup> Latvia, seeing the LPAR at Skrunda as a symbol of Soviet military domination, closed and demolished the LPAR.<sup>130</sup>

During the 1990s, when Soviet-built launch detection satellites reached the end-of-life, few replacement satellites were launched.<sup>131</sup> According to Podvig, the Russian early warning system probably reached a low point in 2001. However, a newly available history of Soviet/Russian satellite launch detection systems documents continued

**Russia's capability to monitor U.S. missile launches has been steadily improving since the late 1990s.**

technical progress by Russia throughout the difficult 1990s. The first satellite using electro-optical sensors to detect missile launches against the backdrop of the Earth's surface was

launched on February 14, 1991. Dr. Viktor Misnik, a scientist and former General Director of the Kometa Central Scientific Research Institute, was shocked by the high quality of the imagery it provided.<sup>132</sup>

This new satellite provided an operational test for a new "spectral optical filter" for use in launch detection. A second such satellite was launched in December 1992, and a third in July 1994. The newly-designed launch detection satellites successfully comprised a launch detection network that was formally commissioned by an edict from Russia's president on December 25, 1996. Two years later a second phase of the new launch detection network (the eastern command post) was completed and began operational testing. The eastern command post was put into operation as part of the Oko-1 system in 2002.<sup>133</sup>

As early as 1999, Russia began restoring its capability to monitor U.S. ICBM fields 24 hours a day.<sup>134</sup> By 2002, Russia had made the Pill Box ABM radar fully functional.<sup>135</sup> The Soviet-legacy Volga radar near Baranovichi became operational in 2003.<sup>136</sup> The legacy Hen House and LPARs were modernized.<sup>137</sup> A program to rebuild and modernize the Russian early warning radar system was started in 2005. In 2006 and 2008 new early warning satellites apparently were launched.<sup>138</sup> By late 2007 Russia had restored satellite capability to monitor the Atlantic Ocean.<sup>139</sup>

By 2006, significant improvements had been achieved in restoring early warning and attack assessment capabilities. The Russian system still did not provide global coverage but focused primarily on U.S. territory. This limited Russia's ability to detect missile launches worldwide. However, in late 2006 Podvig observed that the restoration of early warning capabilities was substantive:

... an analysis of the current configuration of Russia's early warning system suggests that its capabilities may not be as limited as is usually believed. One of

the early warning satellites, Cosmos-2379, is deployed in geosynchronous orbit and can detect SLBM launches from most of the Northern Atlantic. Satellites of this type have been developed for Russia's second-generation early warning system, which will potentially extend the coverage provided by Russian early warning satellites to the oceans. Although only one satellite of this class is currently in orbit, Russia has already completed the ground-based infrastructure development necessary for deploying additional satellites.<sup>140</sup>

Podvig's analysis of Russian early warning capabilities in 2006 showed only limited vulnerabilities. He concluded: "There might be a very narrow corridor if one would launch a missile from the Arctic coast of Chukotka toward the ICBM base in Irkutsk, but that's about it."<sup>141</sup>

Colonel Aleksandr Mamonov, a Missile Attack Warning Formation Commander, stated, "Despite all the hardships, it has proved possible to preserve a single integrated warning system."<sup>142</sup> In late 2006, General-Colonel Vladimir Popovkin, then-Commander of the Space Troops, stated that the strength of the orbital grouping of military satellites has been stabilized at the minimal necessary level and there was a buildup underway of next generation systems.<sup>143</sup>

In 2008, Russia terminated its agreement with Ukraine concerning Soviet-era early warning radars in Ukraine. The radars, then operated by the Ukrainian space agency, had exceeded their warranty period and generated too many false alarms. Moscow's decision to abandon the two radars in Ukraine was made easier by the fact that a new type of replacement radar was almost ready for operation.<sup>144</sup>

### ***Current Russian Early Warning Capabilities***

Today, Russia has the capability to detect and accurately track any ballistic missile launch from the continental United States and detect and confirm any large-scale missile attack on Russia and determine the missiles' targets. A December 2010 Russian assessment reported that the technical shortcomings which existed in the late 20<sup>th</sup> century were mainly resolved, missile defenses were being upgraded, and the Don-2N ABM radar could be used with the S-400 system.<sup>145</sup>

The previously deployed exoatmospheric A-925 ballistic missile defense (BMD) interceptors for the Moscow ABM system have been retired and the ABM intercept mission to defend Moscow relies solely on operational, high-speed, low-altitude PRS-1 interceptors. These silo-based interceptors are armed with nuclear warheads. The Deputy Chief of Staff of the Space Troops, Colonel Igor Morozov, recently described the PRS-1 interceptors for the Moscow ABM system as "one hundred percent effective."<sup>146</sup>

**Today, Russia has the capability to detect and accurately track any ballistic missile launch from the continental United States.**

General-Lieutenant Sergey Lobov, Deputy Commander of the Space Troops, told journalists on February 15, 2011, that Russia's missile attack warning system was able

to detect ballistic missile launches from missile bases in a number of countries, including the United States, China, and Iran. According to Lobov, when an intercontinental ballistic missile enters the radar's field of view, the radar calculates its impact point, provides details on the ballistic trajectory, and estimates the time the strike will arrive.<sup>147</sup> This information is sent to the Main Missile Attack Warning System Command Post in a matter of seconds, where it is processed, and the degree of the threat is determined.<sup>148</sup> Lobov also said that the system tracks more than 4,500 space objects on a daily basis and transmits over 40,000 measurements on these objects each day to the Outer Space Monitoring Center.<sup>149</sup>

In 2012, Space Troops Commander General-Lieutenant Oleg Ostapenko stated that Russian early warning radars detected about 30 launches of orbital-booster rockets or ICBMs, both domestic and foreign. He also stated that the system monitored the launch into orbit of approximately 90 space vehicles and tracked about 80 satellites, domestic and foreign.<sup>150</sup> It is apparent that Russian early warning capabilities were designed to monitor the probable launch points for an attack against Russia. In 2011, General Lobov said continuous radar coverage has been created in Russia, covering all foreign missile bases and also the NATO countries' nuclear missile submarine combat patrol areas.<sup>151</sup> A March 2011 report in the Ministry of Defense newspaper *Krasnaya Zvezda* concluded that the missile attack warning system (SPRN) was currently at a new high-tech stage of development.<sup>152</sup>

Russian early warning capabilities are expected to continue to improve. According to First Deputy Minister of Defense Vladimir Popovkin, the first priority of Russia with regard to defense expenditures is the strategic deterrence force which includes the strategic nuclear forces, the missile attack warning system, and the missile defense and Aerospace Defense System.<sup>153</sup> The Russian early warning system is regarded as so important that the Duma, the lower chamber of Russia's parliament, issued a statement associated with the New START resolution of ratification which reads: "Special attention should be given to research and development of new missile defense penetration systems and to improving missile attack early warning systems, including the space-based component of these systems."<sup>154</sup>

All of Russia's problems stemming from the decline of the 1990s have not been completely solved. For example, Russia's space chief says its rocket industry is falling short of the goals set by the state arms procurement industry<sup>155</sup> and the recent failure to orbit a rocket with three GLONASS satellites resulted from a mathematical miscalculation by a Russian missile design engineer.<sup>156</sup> However, it is clear that the current state of Russian early warning and attack assessment capabilities is much improved from its nadir in the late 1990s.

### ***Russian Plans for Further Improvements***

Russia is building a new generation of ballistic missile early warning radars and space-based sensor systems. The radar component of the Russian missile attack warning system (MAWS) is based on a new design for much cheaper, modular very high frequency (VHF) radars with a reported range of 6,000 km. These new early warning

radars are being built on Russian territory (replacing those located in other former Soviet states) and linked to the deployment of advanced antimissile defenses.<sup>157</sup>

The new radars can be built in a year and a half, compared to five to nine years of construction for the earlier radars.<sup>158</sup> Manning requirements are reduced from 80 personnel to 15.<sup>159</sup> The radars are much less expensive to operate because power requirements are lower than for the Hen House or the LPARs.<sup>160</sup> The LPARs needed power levels up to 70 times as great as the new radars and hence required a proportionately greater amount of electricity to function.<sup>161</sup>

Podvig has pointed out that there “is a clear difference” between the Voronezh-M radar and the Voronezh-DM. According to Podvig, “‘M’ stands for ‘meter wave band,’ ‘DM’ for ‘decimeter wave band,’ so these are two quite different radars.”<sup>162</sup> The higher frequency of the Voronezh-DM may be related to an enhanced missile defense role since the radar is pointed toward the missile-rich Middle East. Sergey Saprykin, the chief designer of this radar, says it uses “digital methods of signal data processing” and, “is capable of operating against a large number of small space objects.”<sup>163</sup>

Russia still retains over-the-horizon missile detection radars. According to General-Lieutenant Oleg Ostapenko, the role of the Space Troops is operating the missile-launch warning systems and its key components such as the over-the-horizon radar stations and space-monitoring stations.<sup>164</sup> Saprykin also revealed that his firm, NIIDAR, was making over-the-horizon radars for the Air Force and the Navy and, “The Skywave over-the-horizon radar has the capacity to detect targets at up to 3,000 km.”<sup>165</sup>

General Ostapenko stated that the missile attack warning system is operational and maintaining uninterrupted radar surveillance of all missile threats, high performance computers were being brought on-line, and work was underway on advanced missile defenses.<sup>166</sup> Ostapenko also said that work was underway on the construction of new radars to replace those currently in operation.

The first two of these radars (in Lekhtusi and Armavir) are now operational and the construction of a third (in the Irkutsk region of Siberia) has begun.<sup>167</sup> A total of about eleven is planned.<sup>168</sup> In March 2011, First Deputy Minister of Defense Popovkin stated that the modernization of existing sensors and creation of new missile attack warning system radars must be completed before 2018 to provide a continuous ground radar field of view in all missile-threat directions.<sup>169</sup>

These new radars close gaps in the early warning system. In December 2006, then-Russian Defense Minister Sergei Ivanov stated that the new Voronezh-M radar near Leningrad “has closed the hole that existed in the Russian radar field during the past seven years as a result of the scrapping of the station of the Soviet type in the village of Skrunda in Latvia.”<sup>170</sup> A spokesman for the Space Troops announced that the Voronezh-DM radar at Armavir, will cover the southwestern missile-prone direction, which in the past was part of the zone of responsibility of the obsolete Ukrainian radar stations in Sevastopol and Mukacheve.<sup>171</sup> The third new radar under construction in the Irkutsk region of Siberia would close the last remaining gap in Russian early warning radar coverage.

Russia is planning new radars to cover all missile-vulnerable directions.<sup>172</sup> One radar is being built near Kaliningrad in the westernmost part of Russia.<sup>173</sup> In 2008, General-Colonel Popovkin, then-Space Troops Commander, confirmed Russian plans to build another radar in the south, near the Urals and another in the Far East. The remaining radars to be constructed will be situated within the territory of Russia and will be stationed at those places where there are radar complexes at the present moment: Murmansk, Pechora, and Irkutsk.<sup>174</sup> He also revealed plans to expand the military-satellite grouping with next-generation satellites that will have a lifespan of 10-15 years.<sup>175</sup>

Now, as first deputy defense minister Popovkin indicated, Russia will need to modernize and deploy a new space-based ballistic missile launch detection system.<sup>176</sup> Russia is reportedly building a Unified Space System (YeKS). Composed of the Oko, Oko-1 [older Russian early warning satellites], and new satellites. In early 2011, Popovkin reported there were three Oko System satellites, seven Oko-1 System satellites and approximately two YeKS System satellites orbiting in working order.<sup>177</sup> Unlike the earlier satellites, according to General-Lieutenant Lobov, the new satellites detect infrared radiation when a missile is launched in the background of the Earth's surface.<sup>178</sup> This improves their immediate launch detection capability. In 2009, Popovkin characterized Russian procurement as aimed at, "a multi-role space-based electronic intelligence and target-designation system."<sup>179</sup>

Russian missile defense can also contribute to attack confirmation. The mission of the Moscow ABM system, according to an article that appeared in the official Defense Ministry newspaper, is to parry the threat of a missile-nuclear strike and raise the threshold of a retaliatory nuclear response, while also increasing the survivability time of facilities of the highest command and control echelons that make decisions on retaliatory actions.<sup>180</sup> In 2010, one Russian publication described the existing Russian A-135 ABM system as including the Don-2N radar, the 53T6 and 51T6 ABM missiles, and the command post in Solnechnogorsk. This system was designed to repel a limited nuclear strike.<sup>181</sup>

Russia is in the process of consolidating the operational control of all defense-oriented commands and integrating the space troops with the missile and air defense forces. This integration of missile warning, space tracking, and air and missile defense systems was directed by Russian President Dmitri Medvedev in his message to the Federal Assembly in November 2010.<sup>182</sup> According to General-Lieutenant Valerie Ivanov, Commander of the new Aerospace Defense Operational-Strategic Command, the missile-space defense was being created, to cover the country with an "umbrella." Russia would initially "cover Moscow fully with the umbrella" and then expand the system.<sup>183</sup>

A new Russian missile defense interceptor, the S-500 which is now in development, will augment existing S-300 and increasing numbers of S-400 interceptor batteries. According to one report, two air defense regiments (each with 8 to 12 missiles) were armed with the S-400 in 2010 and five more S-400 regiments are planned for 2011. Moscow's goal is to have as many as 23 S-400 regiments by 2015.<sup>184</sup> The S-500 is reportedly set to be ready for testing by 2015.<sup>185</sup> Its radars are reportedly capable of

detecting missile warheads at a range of 600-750 kilometers and intercepting up to 10 targets per battery.<sup>186</sup> Moscow plans to deploy about 100 S-500 defense complexes by 2020 to cover Russia's industrial and political centers, as well as the perimeter of its borders. The former Director General of the design bureau that is developing the S-500 said that, for BMD purposes, nuclear warheads will be "mostly" used, since they may blast out "the entire cloud of incoming warheads with no need to determine true threats from dummies."<sup>187</sup>

Russia is also reportedly developing its next-generation defense interceptor system, referred to as the S-1000.<sup>188</sup> Such systems can also contribute to attack confirmation because they improve long-range detection of large objects, such as and the maneuvering of post-boost vehicles from incoming missiles. Enhancement of Russia's missile defense capabilities will allow Moscow to engage small missile attacks further away, reducing a perceived need to launch under attack. According to Air Force Commander General-Colonel Alexander Zelin, the Russian missile defense system will be able to assure deterrence and, in wartime, be able to repel armed aggression.<sup>189</sup> A core mission of Russian defensive forces is to defend the strategic forces by reducing the damage a few missiles can do.

Russian launch detection scientists have been considering further modifications that might be useful as 21<sup>st</sup> century weapon systems are deployed. For example, Dr. Viktor Misnik says the role of military space activity in matters of strategic deterrence will increase further in 21<sup>st</sup> century. Conventionally-armed precision weapons will acquire the properties of strategic weapons and will assume an ever increasing role. Masnik then states that blueprints for the further development and improvement of Russia's missile detection systems are currently being fine-tuned.<sup>190</sup>

### ***Conclusions on Russian Early Warning and Discrimination Capabilities***

This description of Russia's current and planned capabilities to detect missile launches, track objects in space, and calculate impact points for ballistic objects in flight should inform U.S. thinking on the potential for misinterpretation or ambiguity over use of CPGS weapons. The description of observable distinguishing features of each CPGS concept (in Part One), combined with Russia's ability to observe these features, can contribute significantly to a timely characterization of the threat by leaders in Moscow. In addition, observable and distinguishable weapon characteristics can be supplemented by non-weapon-related measures, such as briefings and demonstrations for Russian officials, to provide transparency on U.S. CPGS weapon characteristics, doctrine, and use.<sup>191</sup> Numerous communication links exist between U.S. officials and their Russian counterparts. U.S. and Russian officials can use these communication links to resolve rapidly any uncertainty arising from CPGS use.

**Russia's early warning and attack assessment capabilities appear to give Moscow the ability to distinguish various CPGS concepts from a nuclear missile launch.**



The current and future early warning and attack assessment capabilities of Russia appear to provide Moscow with the technical capabilities to detect any large-scale attack with ballistic missiles which could threaten the existence of the Russian Federation. These same capabilities appear capable of discriminating between U.S.-launched ballistic missiles and many of the CPGS weapon concepts discussed in Part One of this report. With this technical background in mind, the issue then becomes one of policy and practice—how are Russian officials likely to respond to the use of U.S. CPGS weapons?

### **How Might Russia Respond to CPGS Use?**

Concern over the issue of nuclear ambiguity seems to imply that leaders in Russia, and future leaders elsewhere who observe the launch and flight of one or more CPGS weapons, might make a snap decision and respond with a nuclear strike instead of waiting to determine the nature of the U.S. weapons. For example, during U.S. Senate debate on the Conventional Trident Modification in August 2006, Senator Jack Reed of Rhode Island voiced his concern over possible misinterpretation:

And the practical problem for anyone in the world is to determine, if we shoot one of these missiles at them, is it a conventional warhead or is it a nuclear warhead? If anyone believes they ... are being attacked by a nuclear device, I think there is a strong fear, on my part at least, that they would retaliate before they could ever verify what was going on.<sup>192</sup>

In December 2006, Pavel Podvig wrote the following concerning the Conventional Trident Modification and the potential for misinterpretation:

Today, Russia is the only country other than the United States that has an early warning system capable of detecting ballistic missile launches. This makes it the natural focus of concerns associated with the global-strike plan. Russian officials have themselves aired these concerns publicly: in an address to the Russian parliament in May 2006, President Vladimir Putin warned of the danger, saying that a missile launch “could spark an inadequate reaction by nuclear powers, including full-scale retaliation strikes.” This view was later repeated by the chief of the Russian General Staff and by Russia’s minister of defense.<sup>193</sup>

Commenting on these Russian statements, then-STRATCOM Commander General James Cartwright suggested that transparency measures already in place could reduce the chances that Russia would deliberately make a decision to launch a full-scale retaliatory strike in response to a U.S. missile launch that was detected by its early warning system. He cited communications links and launch notification protocols that diminish that risk.<sup>194</sup>

It is plausible to assume that Russian leaders would not react reflexively to a CPGS launch with a nuclear strike. If, for example, the United States were in a confrontation with Iran, while its relations with Russia remained normal, why would the authorities in Moscow assume that any ballistic missile launched by the United States was headed toward Russian, rather than Iranian, targets? And, if the United States launched a strike

with conventional ballistic missiles toward Iran and officials in Moscow were uncertain of the objectives of the attack or whether the attack was nuclear or conventional, what would they gain by responding in a precipitate way that guaranteed nuclear war? Waiting to resolve those ambiguities would carry a much smaller risk than launching a nuclear attack based on imprecise information. Launching a nuclear strike before the situation was clear would be like, in the words of Bismarck, “committing suicide for fear of death.”

The potential for such a response, however remote, should not be dismissed without careful investigation. Empirical evidence from events during the Cold War and since indicates that leaders of the major nuclear powers have typically exercised caution. The most comprehensive open examination of the U.S.-Soviet historical record shows a real fear of miscalculation and supports this conclusion. In the book, *We All Lost the Cold War*, Ned Lebow and Janice Stein conclude: “The reality of nuclear deterrence had a restraining effect on both Kennedy and Khrushchev in 1962 and on Brezhnev in 1973. When Superpower leaders believed that they were approaching the brink of war, fear of war pulled them back.”<sup>195</sup>

### ***Erroneous Indications of a Nuclear Attack***

Instances of false indications of a nuclear attack provide evidence that, in the past, caution has prevailed. Two such events in the Soviet Union/Russia have been well studied.

*The Autumn 1983 Oko Satellite Incident.* The first occurred on September 26, 1983, when the newly operational Soviet early warning satellite system triggered an alarm. At the time, the U.S.-Soviet relationship in 1983 was particularly stressful. Two years earlier, President Reagan had initiated a strategic modernization program to upgrade U.S. nuclear forces and, in March 1983, made his famous “Star Wars” speech initiating the Strategic Defense Initiative. The United States was in the process of deploying intermediate-range nuclear weapons systems to Europe. In the days prior to the episode, Moscow and Washington engaged in heated exchanges over the downing of a South Korean passenger airliner by a Soviet fighter-interceptor.

Shortly after midnight, the officer-in-charge of Serpukhov-15, the secret bunker near Moscow used to monitor Soviet early warning satellites, received indications that five Minuteman ICBMs had been launched from the United States. Later analysis revealed that this false indication had been triggered by a chance alignment of a Soviet Oko satellite, the sun, and reflected light from cloud cover.<sup>196</sup> Tellingly, the military officer-in-charge, Lieutenant Colonel Stanislav Petrov, did not pass the alert to his superiors. Petrov said he was initially in a state of shock. Upon recovering his composure, Petrov quickly determined that the launch indications were likely erroneous and looked for evidence from other sources. Within five minutes after the alert began, Petrov had evidence that the launch reports from the Oko satellite were false. Soviet ground-based radar installations showed no indications of an attack, confirming Petrov’s decision to wait. In later interviews, he is reported to have justified his decision to delay notifying his superiors with this explanation: “When people start a war, they don’t start it with only five missiles. You can do little damage with just five [nuclear] missiles.”<sup>197</sup>

*The Norwegian Sounding Rocket Incident.* The second incident occurred on the morning of January 25, 1995. At this time the context for U.S.-Russian relations was significantly more benign than that of the 1983 incident. Norwegian scientists launched a large “sounding rocket” from Andoya Island off the coast of Norway. The rocket was being used to collect meteorological data. The launch location was from an azimuth thought by Russian planners to be that for a first strike by U.S. submarine-launched ballistic missiles. Some initial reports of this incident cite the fact that top Russian leaders activated their “nuclear footballs” and were ready to launch a retaliatory nuclear strike against the United States. However, then-Russian President Boris Yeltsin quickly dispelled these alarmist reports when he stated the next day that he had activated his nuclear football to communicate with his top military advisors and review the situation online. One unclassified report of this incident reported, “. . . we can be fairly confident that Yeltsin’s football showed that “Russia was not under attack and that the Russian early warning system was functioning perfectly.”<sup>198</sup>

*Caution During the Cold War.* Interviews with former Soviet officials conducted after the breakup of the Soviet Union reveal a pattern of extreme caution regarding military responses against the United States when the nature of the event underway was still unclear. This caution has been documented even during well-orchestrated, pre-planned exercises. In a 1992 interview, General-Colonel (Ret.) Andrian A. Danilevich, a former senior member of the Soviet General Staff, described a strategic nuclear exercise conducted in 1972. The exercise was one of several during the early-1970s involving a simulated U.S. first strike and a Soviet nuclear response. Danilevich noted:

We presented to [General Secretary Leonid Brezhnev, Premier Alexei Kosygin, Defense Minister Andrei Grechko, and other officials] the results of our computer models . . . the consequences of a nuclear first strike against the Soviet Union. Brezhnev and Kosygin were visibly terrified by what they heard. . . . Given all [the damage to the Soviet Union], the consequences of a retaliatory strike against the U.S. would be even more lethal to that country. During the exercise three launches of ICBMs with dummy warheads were scheduled. Brezhnev was actually provided a button in the exercise and was to ‘push the button’ at the appropriate time. . . . When the time came to push the button, Brezhnev was visibly shaken and pale and his hand trembled and he asked [Marshal] Grechko several times for assurances that the action would not have any real-world consequences. ‘Andrei Antonovich, are you sure this is just an exercise?’<sup>199</sup>

No one can guarantee that leaders of other nuclear-armed countries will exercise the same degree of caution as that demonstrated in the past by the United States and the Soviet Union/Russia. However, as described earlier, Russia’s early warning and discrimination capabilities have continued to improve since their decade of decline in the 1990s. Currently, unclassified reports of Russian early warning capabilities appear sufficient to discriminate many of the CPGS concepts from U.S. nuclear-tipped missiles, and further enhancements are among Moscow’s highest-priority defense programs. This, coupled with a review of Soviet and Russian deliberate caution during past crises involving indications of missile launches, should dispel notions that Moscow would respond automatically to a CPGS launch with a nuclear strike on the United States.

## Could CPGS Ignite a New Type of Arms Race?

Some critiques of CPGS have posed the question, “What if others followed the U.S. example and developed conventionally-armed long-range ballistic missiles?” These critiques typically express the worry that CPGS would lead to a new type of arms race.<sup>200</sup> Trends in weapon development in the 21<sup>st</sup> century, however, suggest that movement toward longer-range, more accurate missiles is not the result of an arms race dynamic.

Initiatives by the United States in the field of offensive arms generally do not cause emulative responses from other countries, particularly those that are not military rivals. Whether a country acquires a particular type of weapon system usually is determined more by regional security threats, domestic and bureaucratic politics, scientific-technical capacity, and economic wherewithal than by like military developments in the United States. When a reaction to a U.S. arms initiative does occur, its character may be defensive or offsetting, not imitative. To counter the superiority of existing U.S. conventional forces, for example, a number of adversaries brandish weapons of mass destruction, arms they have acquired for diverse reasons, rather than engage in costly, and perhaps futile, conventional buildups of their own. WMD threats likewise might be posed in attempts to deter U.S. CPGS use. CPGS deployments by the United States also might cause others to adopt defensive measures, such as the hardening, burying, or concealing of key assets at risk, instead of matching U.S. strike capabilities. Different employment tactics or hardware improvements then might be needed to ensure the effectiveness of U.S. CPGS systems.

The general trend in ballistic missile development is toward missiles of increasing range and accuracy. The ability to hold at risk an adversary’s most valuable assets, or to strike them effectively over long distances, carries certain psychological as well as military benefits. It is not implausible to consider that U.S. adversaries might seek to hold American territory, forces, and population centers at risk with weapons based on their own national territory. Countries like North Korea and Iran are developing longer-range ballistic missiles capable of traveling intercontinental distances and striking U.S. soil. These missiles could be armed with either nuclear or conventional warheads.

**Trends in weapon development suggest that movement toward longer-range, more accurate conventional ballistic missiles is not the result of an arms race dynamic.**

Modern technology makes precision delivery of conventionally-armed weapons accessible to many countries. Some have already concluded that CPGS-type weapons provide important national security benefits. In fact, China, India, Pakistan, and others currently deploy ballistic missiles of various ranges with conventional payloads and are seeking to make those weapons more accurate and precise.

In the Asia-Pacific region, the movement toward advanced precision-guided weaponry is accelerating. One Australian defense analyst has surveyed the region’s interest in conventional precision strike weapons, concluding that the growing inventory of precision-guided munitions among Asia-Pacific states “will fundamentally change the

strategic balance across the region....”<sup>201</sup> He further commented that “Major regional players like India and China observed the Desert Storm, Desert Fox, Allied Force, Enduring Freedom and Iraqi Freedom campaigns very carefully and the lesson they carried away is... PGMs [precision guided munitions] are decisive war winners.”<sup>202</sup>

The Chinese military has developed several types of long-, medium-, and short-range ballistic missiles that can carry nuclear or conventional warheads, including the CSS-6, CSS-7, Dong Feng (DF)-21 and the DF-21D, an anti-ship version of the DF-21. China’s ballistic missile capabilities are being augmented by improved command, control, and communications and intelligence, surveillance, and reconnaissance technologies. Many of these upgraded capabilities are thought to be directed against the West’s power projection capabilities as part of China’s anti-access/area-denial strategy.

Recent developments suggest China recognizes the value of greater precision targeting and is taking steps toward this goal. Reports of new ballistic missile warhead features suggest Beijing is acquiring increasingly accurate long-range ballistic missile capabilities, including the DF-31A ICBM.<sup>203</sup> Short- and medium-range ballistic missiles are also reportedly being upgraded to allow for greater targeting precision. Some of these missiles—like the DF-15 and DF-11 Mod 2—incorporate improved satellite navigation.<sup>204</sup> Moreover, given China’s prior willingness to sell advanced weaponry abroad, it is possible that its growing inventory of sophisticated precision strike weaponry may wind up in the hands of others.

The Department of Defense reports that China is building its overall capacity to conduct conventional precision military strikes through upgrades to many of its existing weapons systems, including ballistic missiles of all ranges, cruise missiles, and other types of munitions.<sup>205</sup> These capabilities will allow China to conduct precision strikes against targets on land and at sea. China is likely to continue to develop and deploy such capabilities whether or not the United States precedes with its CPGS plans.

India and Pakistan are also developing missiles with longer range and greater precision. India’s push to make its weaponry more precise is evidenced by its incorporation of accuracy improvements into existing munitions. For example, in 2010 India successfully tested an indigenously developed and produced laser guidance system on air-delivered bombs.<sup>206</sup> India also tested a supersonic cruise missile, developed jointly with Russia, reported to be the world’s fastest missile and a “high-precision weapon.”<sup>207</sup> An even faster, hypersonic version of the missile is expected to begin testing within the next four to six years.

According to a spokesman for the Pakistani military, the medium-range Hatf-V (Ghauri) and the longer-range (2,000 km) Hatf-VI (Shaheen-2) missiles can carry either nuclear or conventional warheads “with great accuracy.”<sup>208</sup> Officials in Pakistan are also reportedly considering developing an ICBM with a range of 7,000 km and which can also be armed with either a conventional or nuclear payload.<sup>209</sup>

Pakistan is also developing laser-guided bombs and other types of precision weaponry. Pakistani military officials and other analysts indicate that Pakistan’s move toward more

precise shorter-range weaponry is part of an overall effort to combat terrorism without causing unintended levels of collateral damage.<sup>210</sup>

In addition, Russia is aggressively modernizing its inventory of ballistic missiles. Russian Prime Minister Vladimir Putin has said that the production of ballistic missile systems will double in 2013 and Russia will invest \$2.6 billion in missile production.<sup>211</sup> Russia's latest military doctrine, issued in early 2010, appears to acknowledge the useful role of CPGS-like weapons. In comparison with the Russian Military Doctrine issued in 2000, the 2010 Doctrine places considerably more emphasis on conventional forces and, in particular, high-precision weapons and their associated command and control. These capabilities are viewed as necessary for the 2010 Doctrine's main mission—the "prevention of nuclear military conflict or any other military conflict."<sup>212</sup> Commenting on the 2010 Doctrine, former Russian official and arms control negotiator Nikolai Sokov stated,

... it assigns high-precision (apparently, conventional) weapons to the mission of strategic deterrence. This clearly indicates that Russia plans to ... equip a growing share of its strategic delivery systems with conventional warheads.<sup>213</sup>

The Russian focus on advanced conventional precision-guided weapons is not a new development. Russia has, for some time, recognized the value of high-precision weaponry and its increasingly ubiquitous nature. For example, one former Russian military official noted in 1994 that "high-precision weapons are today becoming the main means of realizing a deterrence strategy."<sup>214</sup> He further stated:

From a technical point of view, high-precision weapons, or guided weapon systems, contain elements used in many technical systems, especially those in civil aviation. These systems include compact sensors and basic navigation tools – the inertial control systems. Equipment for receiving signals from satellite radio navigation systems is also used. It is very difficult today to find an aircraft or an ocean liner without similar equipment. Even automobiles are becoming equipped with navigation devices.

...I do not think it possible to stop completely the spread of technologies that can be used for developing high-precision weapons. There are too many areas of their application and they are just too valuable to economic growth.<sup>215</sup>

Russia's current efforts in this area are more a reflection of Moscow's understanding of the utility of high-precision weaponry than a reaction to U.S. plans to develop a CPGS capability. As Russian First Deputy Minister of Defense General-Colonel Popovkin has stated, precision-guided weapons "are calling the shots on the battlefield today."<sup>216</sup> He noted that Russia is expanding the production of increasingly accurate ballistic missiles, including short-range Iskander missiles and other missile systems like those used in the conflict with Georgia in 2008.

In sum, the technology for CPGS-like weapons is readily available and several other countries have been working for some time on developing and deploying more accurate weapons. While leaders in the United States have been debating the issues, other

countries are developing and deploying conventionally-armed ballistic missiles with greater range and accuracy.

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## Summary

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This report has addressed numerous political, military, strategic, and operational issues associated with conventional prompt global strike. A comprehensive examination of these issues suggests there are significant advantages to developing and fielding a CPGS capability and that the use of CPGS by the United States for a variety of missions would be unlikely to trigger a reflexive nuclear response from other nuclear weapons states.

The U.S. effort to develop a CPGS capability has intensified over the last decade and has been supported by both Republican and Democratic administrations. In light of strong bipartisan Executive Branch support for CPGS, technological advancements in CPGS capabilities, and efforts by potential adversaries to shield a growing number of strategic assets from attack with current-generation conventional weapons systems, an opportunity exists to strengthen understanding and appreciation among policy leaders and decision makers, including the Congress, of the way CPGS can enhance U.S. national security.

CPGS can support the goals of national policy with respect to U.S. nuclear posture by helping to achieve the key objectives outlined in the Nuclear Posture Review. A CPGS capability could help strengthen strategic deterrence and stability; bolster U.S. nonproliferation goals; counter nuclear terrorism; reduce the role of nuclear weapons in U.S. national security strategy; offset risk from, and even enable, additional nuclear weapons reductions; assure allies of the American commitment to their security; and revitalize a resilient defense infrastructure capable of meeting the security needs of the nation.

The classic, if sometimes forgotten, objectives of arms control are to: 1) reduce the likelihood of war; 2) reduce the damage war can cause; and 3) reduce the burden of preparations for war.

CPGS is unlikely to increase the likelihood of war by miscalculation. Indeed, to the extent CPGS strengthens the deterrence of aggression, it will reduce the likelihood of war, thereby supporting the first objective of arms control.

CPGS will not spark an “arms race” because other countries are already pursuing conventional strike capabilities. But CPGS is a part of a larger trend that will shift military competition toward weapons that are less destructive than the nuclear arms that have their origins in the middle part of the last century. To the extent CPGS makes armed conflict less destructive, it supports the second objective of arms control.

It may be costly to shift reliance from nuclear to non-nuclear strike capabilities—something at odds with the third, and least important, objective of arms control—but this tradeoff may be acceptable, given the benefits of CPGS in terms of the other two objectives.

CPGS can also close critical gaps in U.S. military capabilities, allowing U.S. forces to hold at risk time-sensitive, high-value, or fleeting targets that cannot currently be held at risk with existing conventional forces and without resort to nuclear weapons. In today's increasingly austere budget environment, investment in such systems may be well worth the cost.

Concerns over the ability to distinguish between CPGS use and the launch of nuclear weapons appear to be exaggerated. Countries with the ability to detect the launch of a CPGS weapon should be able to distinguish CPGS concepts from a nuclear missile given the technical and operational characteristics of the system and its flight profile. Multiple options exist for deploying CPGS capabilities and each is characterized by distinct attributes that would mitigate the nuclear ambiguity issue. In addition, cooperative measures could be implemented to further reduce this concern.

Russia has revitalized its launch detection and tracking capability since the 1990s and would have little difficulty distinguishing the launch of a CPGS weapon from a nuclear missile. Should any uncertainty exist, nevertheless, Russia's behavior in the past demonstrates a realistic amount of caution in responding to ambiguous missile threats. There is no reason to believe Russia's response would be different today.

Depending on how it is configured, a CPGS system may be subject to arms control treaty constraints, including limitations contained in the New START Treaty. Careful attention to potential arms control issues during development, however, would avoid these constraints. CPGS options, including those described herein, should be considered seriously in an environment where continued arms control efforts may impact the overall flexibility and robustness of U.S. deterrent forces.



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## Notes

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<sup>1</sup> M. Elaine Bunn and Vincent A. Manzo, *Conventional Prompt Global Strike: Strategic Asset or Unusable Liability?* Strategic Forum No. 263 (Washington, D.C.: Institute for National Strategic Studies, National Defense University, February 11, 2011), p. 21.

<sup>2</sup> Committee on Conventional Prompt Global Strike Capability, National Research Council, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond* (Washington, D.C.: National Academies Press, 2008).

<sup>3</sup> The letter is reprinted in *Ibid.*, pp. 172-174.

<sup>4</sup> *Ibid.*, pp. 11-12.

<sup>5</sup> Joint Chiefs of Staff, *Legal Support to Military Operations*, Joint Publication 1-04 (Washington, D.C.: Joint Chiefs of Staff, August 17, 2011), p. II-2.

<sup>6</sup> Dave Majumdar, "U.S. STRATCOM: Don't Let Cuts Hurt Acquisition," *DefenseNews.com*, August 3, 2011, available at <http://www.defensenews.com/print/article/20110803/DEFSECT04/108030302/U-S-STRATCOM-Don-t-Let-Cuts-Hurt-Acquisition>.

<sup>7</sup> Department of Defense (DoD), *Nuclear Posture Review Report* (Washington, D.C.: Department of Defense, April 2010), p. 34.

<sup>8</sup> *Ibid.*, pp. v, 9.

<sup>9</sup> The White House, *National Strategy for Combating Terrorism* (Washington, D.C.: The White House, September 2006), p. 12.

<sup>10</sup> Remarks at the National Defense University, February 11, 2004, in National Archives and Records Administration, *Public Papers of the Presidents of the United States: George W. Bush, 2004, Book I* (Washington, D.C.: GPO, 2007), p. 200.

<sup>11</sup> The White House, *Report on Conventional Prompt Global Strike in Response to Condition 6 of the Resolution of Advice and Consent to Ratification of the New START Treaty* (Washington, D.C.: The White House, February 2, 2011), pp. 8-9.

<sup>12</sup> See, for example, *Report of the Defense Science Board Task Force on Time Critical Conventional Strike from Strategic Standoff* (Washington, D.C.: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, March 2009). See also Bunn and Manzo, *Conventional Prompt Global Strike: Strategic Asset or Unusable Liability?* op. cit.; and Amy F. Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues*, R41464 (Washington, D.C.: Congressional Research Service, February 13, 2012).

<sup>13</sup> Gen. James Cartwright, USMC, quoted in Wade Boese, "Pentagon Defends Global-Strike Plan," *Arms Control Today*, Vol. 36, No. 4 (May 2006), p. 27.

<sup>14</sup> With a rapid-response weapon like CPGS, versus slow-flying, shorter-range cruise missiles, it might have been possible to kill Osama Bin Ladin in the 1998 retaliatory strike for the U.S. embassy bombings in Kenya and Tanzania (Operation Infinite Reach). As the 9/11 Commission reported, the cruise missile attacks "probably missed Bin Ladin by a few hours." National Commission on Terrorist Attacks Upon the United States, *The 9/11 Commission Report* (Washington, D.C.: GPO, 2004), p. 117.

<sup>15</sup> See Secretary of Energy Samuel W. Bodman and Secretary of Defense Robert M. Gates, *National Security and Nuclear Weapons in the 21<sup>st</sup> Century* (Washington, D.C.: Department of Energy and Department of Defense, September 2008), pp. 2, 17; and Department of Defense, "Increasing Transparency in the U.S. Nuclear Weapons Stockpile," fact sheet, May 3, 2010, available at <http://www.defense.gov/news/d20100503stockpile.pdf>.

<sup>16</sup> DoD, *Nuclear Posture Review Report*, op. cit., p. 15.

<sup>17</sup> *Ibid.*, p. 17.

<sup>18</sup> *Ibid.*, p. 6.

- <sup>19</sup> A number of these capability gaps are addressed in Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, op. cit.
- <sup>20</sup> Office of Management and Budget, "Statement of Administration Policy: H.R. 2219—Department of Defense Appropriations Act, 2012," June 23, 2011, p. 1, available at [http://www.whitehouse.gov/sites/default/files/omb/legislative/sap/112/saphr2219h\\_20110623.pdf](http://www.whitehouse.gov/sites/default/files/omb/legislative/sap/112/saphr2219h_20110623.pdf).
- <sup>21</sup> Department of Defense, *Quadrennial Defense Review Report* (Washington, D.C.: Department of Defense, February 2010), p. 31, available at [http://www.defense.gov/qdr/images/QDR\\_as\\_of\\_12Feb10\\_1000.pdf](http://www.defense.gov/qdr/images/QDR_as_of_12Feb10_1000.pdf).
- <sup>22</sup> Gen. Kevin P. Chilton, USAF, in Senate Armed Services Committee, *Nuclear Posture Review*, S. Hrg. 111-824, 111<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2011), p. 34.
- <sup>23</sup> Gen. Kevin P. Chilton, USAF, in House Armed Services Committee, *The Status of United States Strategic Forces*, H.A.S.C. No. 111-136, 111<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2010), pp. 32-33.
- <sup>24</sup> DoD, *Nuclear Posture Review Report*, op. cit., p. 19.
- <sup>25</sup> *Ibid.*, p. 25.
- <sup>26</sup> Annual Address to the Federal Assembly, May 10, 2006, available at [http://archive.kremlin.ru/eng/speeches/2006/05/10/1823\\_type70029type82912\\_105566.shtml](http://archive.kremlin.ru/eng/speeches/2006/05/10/1823_type70029type82912_105566.shtml).
- <sup>27</sup> Hugh McManners, "China Lowers the Threshold of its Nuclear Threats," January 5, 2011, available at <http://www.hughmcmanners.com/tag/china/>.
- <sup>28</sup> Interview transcript, FRONTLINE, "Russian Roulette: A Report on the Safety and Security of Russia's Nuclear Arsenal," Public Broadcasting System, available at <http://www.pbs.org/wgbh/pages/frontline/shows/russia/interviews/dvorkin.html>.
- <sup>29</sup> Quoted in Lance Lord and Tom Scheber, "Conventional ICBMs: Time to Rethink Value of Quick, Long-Range Strike," *Defense News*, February 18, 2008, p. 45.
- <sup>30</sup> Chilton, in House Armed Services Committee, *The Status of United States Strategic Forces*, op. cit., p. 80.
- <sup>31</sup> DoD, *Nuclear Posture Review Report*, op. cit., p. 28.
- <sup>32</sup> James N. Miller, principal under secretary of defense for policy, and Rose E. Gottemoeller, assistant secretary of state for the Bureau of Verification, Compliance, and Implementation, in Senate Armed Services Committee, *The New START and Implications for National Security*, S. Hrg. 111-897, 111<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2011), pp. 196, 391.
- <sup>33</sup> DoD, *Nuclear Posture Review Report*, op. cit., p. 31.
- <sup>34</sup> *Ibid.*
- <sup>35</sup> DoD, *Nuclear Posture Review Report*, op. cit., p. 7.
- <sup>36</sup> Bill Sweetman, Angus Batey, and Christina Mackenzie, "U.K., France Fine-Tune Libyan Air Ops," *AviationWeek.com*, July 4, 2011, available at [http://www.aviationweek.com/Article.aspx?id=/article-xml/DT\\_06\\_01\\_2011\\_p32-323773.xml](http://www.aviationweek.com/Article.aspx?id=/article-xml/DT_06_01_2011_p32-323773.xml).
- <sup>37</sup> Robert Wall, "Aimpoint Refinement: Europeans Endeavor to Sustain, Improve Industrial Capabilities for Precision Weapons," *Aviation Week and Space Technology*, Vol. 173, No. 33 (September 19, 2011), pp. 38, 43.
- <sup>38</sup> See, for example, Kim Tae Hong, "South Korea Needs Precision Strike Capacity," *Daily NK*, September 15, 2010, available at <http://www.dailynk.com/english/read.php?cataId=nk00100&num=6803>; and Song Sang-ho, "Weapons Needed to Neutralize N.K. WMDs," *Korea Herald*, September 25, 2010, available at <http://www.koreaherald.com/national/Detail.jsp?newsMLId=20100915000798>.
- <sup>39</sup> Remarks by President Barack Obama, Hradcany Square, Prague, Czech Republic, April 5, 2009, Office of the White House Press Secretary, available at [http://www.whitehouse.gov/the\\_press\\_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/](http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/).
- <sup>40</sup> DoD, *Nuclear Posture Review Report*, op. cit., p. 37.
- <sup>41</sup> See for example, *Report of the Defense Science Board Task Force on Nuclear Deterrence Skills* (Washington, D.C.: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, September 2008); and Secretary of Defense Task Force on DoD Nuclear Weapons Management, *Phase I Report: The Air Force's Nuclear Mission* (Washington, D.C.: Department of Defense, September 2008).

- <sup>42</sup> Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, op. cit., p. 77.
- <sup>43</sup> For a comprehensive review of legislative activity related to CPGS, see Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles*, op. cit.
- <sup>44</sup> Senate Armed Services Committee, *National Defense Authorization Act for Fiscal Year 2007*, Report 109-254, 109<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2006), p. 124.
- <sup>45</sup> House Armed Services Committee, *National Defense Authorization Act for Fiscal Year 2007*, Report 109-452, 109<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2006), p. 60.
- <sup>46</sup> House Armed Services Committee, *National Defense Authorization Act for Fiscal Year 2012*, Report 112-78, 112<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2011), p. 70.
- <sup>47</sup> *Report of the Defense Science Board Task Force on Time Critical Conventional Strike from Strategic Standoff*, op. cit., p. 94.
- <sup>48</sup> Under Secretary of Defense for Acquisition, Technology, and Logistics, *Conventional Prompt Global Strike: Review of FY2010 Concepts*, Report to Congress (Washington, D.C.: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, August 2010).
- <sup>49</sup> "Contact Lost With Hypersonic Glider After Launch," Associated Press, August 11, 2011, available at <http://www.foxnews.com/us/2011/08/11/contact-lost-with-hypersonic-glider-after-launch/#ixzz1UIHfuXe8>.
- <sup>50</sup> DoD demonstrated the feasibility of deploying an earth-penetrating conventional warhead on a variant of the Army Tactical Missile System (ATACMS). The concept, Tactical Missile System-Penetrator (TACMS-P), was initiated as an advanced concept technology demonstration (ACTD) and successfully demonstrated in 2005. See "FY01 ACTDS," available at <http://www.acq.osd.mil/jctd/programs/FY01%20ACTDs.pdf>; and David Hambling, "Decisive Weapons of the Next Korean War," *Popular Mechanics* online, November 24, 2010, available at <http://www.popularmechanics.com/technology/military/weapons/north-korea-conflict-weapons-available>.
- <sup>51</sup> Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, op. cit., p. 115.
- <sup>52</sup> *Report of the Defense Science Board Task Force on Future Strategic Strike Forces* (Washington, D.C.: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, February 2004), p. 5-13.
- <sup>53</sup> Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles*, op. cit., pp. 8-9.
- <sup>54</sup> Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, op. cit., pp. 35-36.
- <sup>55</sup> *Ibid.*, p. 160.
- <sup>56</sup> *Ibid.*, p. 36.
- <sup>57</sup> Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles*, op. cit., p. 12.
- <sup>58</sup> Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, op. cit., pp. 108-112.
- <sup>59</sup> *Ibid.*, pp. 108-109. See also Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles*, op. cit., p. 11.
- <sup>60</sup> Robert P. Haffa, Jr. and Michael W. Isherwood, "Long-range Conventional Strike: A Joint Family of Systems," *Joint Force Quarterly*, Issue 60 (January 2011), p. 104; and Elaine M. Grossman, "Pentagon Unveils New Plan for Conventional Submarine-Based Ballistic Missiles," *Global Security Newswire*, January 27, 2012, available at <http://www.nti.org/gsn/article/pentagon-unveils-new-plan-conventional-submarine-based-ballistic-missiles/>.
- <sup>61</sup> Adm. Vern Clark, USN, "Sea Power 21: Projecting Decisive Joint Capabilities," *U.S. Naval Institute Proceedings*, Vol. 128, No. 10 (October 2002), pp. 34, 35.
- <sup>62</sup> Department of Defense, *Fiscal Year (FY) 2011 Budget Estimates—Research, Development, Test & Evaluation, Defense-Wide – 0400: Justification Book Volume 1—Defense Advanced Research Projects Agency* (Washington, D.C.: Department of Defense, February 2010), pp. 304-305; and Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles*, op. cit., p. 19.

- <sup>63</sup> Craig Hooper, "Loading Prompt Global Strike in VLS Cells Will Transform U.S. Naval Power," *DefenseTech*, July 8, 2010, available at <http://defensetech.org/2010/07/08/loading-prompt-global-strike-in-vls-cells-will-transform-u-s-naval-power/>.
- <sup>64</sup> "X-51 Waverider Makes Historic Hypersonic Flight," Air Force News Service, May 26, 2010, available at [http://www.af.mil/news/story\\_print.asp?id=123206525](http://www.af.mil/news/story_print.asp?id=123206525).
- <sup>65</sup> Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, op. cit.
- <sup>66</sup> Demonstration and development flight tests plan to use Minotaur IV (Lite) boosters which incorporate stages from retired Peacekeeper missiles. If a decision to deploy CSM is made, a new missile may be developed and produced for the deployed versions.
- <sup>67</sup> Demonstration and development flight tests plan to use boosters that incorporate missile stages from retired strategic missiles.
- <sup>68</sup> The figure is taken from The White House, *Report on Conventional Prompt Global Strike in Response to Condition 6 of the Resolution of Advice and Consent to Ratification of the New START Treaty*, op. cit., p. 11.
- <sup>69</sup> Joseph R. Biden, Jr. and John B. Ritch III, "The Treaty Power: Upholding a Constitutional Partnership," *University of Pennsylvania Law Review*, Vol. 137, No. 5 (May 1989), pp. 1529-1557.
- <sup>70</sup> "Article-by-Article Analysis of the 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," Article II, paragraph 1-2, available at [http://www.dod.gov/acq/acic/treaties/inf/inf\\_art.htm](http://www.dod.gov/acq/acic/treaties/inf/inf_art.htm). Hereinafter referred to as "INF Treaty Article-by-Article Analysis."
- <sup>71</sup> *Ibid.*, Article II, paragraph 2.
- <sup>72</sup> The INF Treaty, "Note of the Government of the United States of America to the Government of the Union of Soviet Socialist Republics," May 12, 1988, available at [http://www.dod.gov/acq/acic/treaties/inf/agreed\\_minute.htm](http://www.dod.gov/acq/acic/treaties/inf/agreed_minute.htm).
- <sup>73</sup> "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," December 8, 1988, paragraphs 1 and 2, available at <http://www.dod.gov/acq/acic/treaties/inf/text.htm#article1>. Hereinafter referred to as "The INF Treaty."
- <sup>74</sup> The INF Treaty, Article II, paragraph 2.
- <sup>75</sup> INF Treaty Article-by-Article Analysis, paragraph 2.
- <sup>76</sup> The INF Treaty, Article VII, paragraph 2.
- <sup>77</sup> *Ibid.*
- <sup>78</sup> The INF Treaty, Article II, paragraphs 3 and 4.
- <sup>79</sup> Maynard W. Glitman, U.S. negotiator on Intermediate-Range Nuclear Arms, Department of State, in Senate Foreign Relations Committee, *The INF Treaty*, Part 1, S. Hrg. 100-522, Pt. 1, 100<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 1988), pp. 362-363.
- <sup>80</sup> Ministry of Foreign Affairs of the Russian Federation, "The Facts of Violation by the United States of its Obligations in the Sphere of Nonproliferation of Weapons of Mass Destruction and Arms Control," August 7, 2010, available at [http://www.mid.ru/brp\\_4.nsf/e78a48070f128a7b4325699005bcb3/cc9c7d192f0ebc5ac325777a0057e1ae](http://www.mid.ru/brp_4.nsf/e78a48070f128a7b4325699005bcb3/cc9c7d192f0ebc5ac325777a0057e1ae).
- <sup>81</sup> Douglas Barrie and Alexey Komarov, "Capability and Intent: UCAVs Emerge as Latest Area of Russian Interest as Programs Show Renewed Impetus," *Aviation Week and Space Technology*, Vol. 167, No. 9 (September 3, 2007), pp. 30-31; and "MiG SKAT Unmanned Aerial Fighting Aircraft," *Warfare.RU*, August 23, 2007, available at <http://warfare.ru/?linkid=2562&catid=324>.
- <sup>82</sup> Lt. Col. Anthony J. Lazarski, USAF, "Legal Implications of the Uninhabited Combat Aerial Vehicle," *Air and Space Power Journal—Chronicles Online Journal*, March 27, 2001, available at <http://www.airpower.maxwell.af.mil/airchronicles/cc/lazarski.html>.
- <sup>83</sup> *Voенно-Промышленный Курьер*, September 22, 2010; *Lenta.ru*, May 26, 2010; *Agentstvo Voyennykh Novostey*, July 19, 2007. Maxim Pyadushkin, "Russian Military Plans MALE UAV Development," *AviationWeek.com*, January 26, 2010, available at [http://www.aviationweek.com/aw/generic/story.jsp?id=news/awst/2010/01/25/AW\\_01\\_25\\_2010\\_p31-196866.xml&headline=Russian%20Military%20Plans%20MALE%20UAV%20Development&channel=defense](http://www.aviationweek.com/aw/generic/story.jsp?id=news/awst/2010/01/25/AW_01_25_2010_p31-196866.xml&headline=Russian%20Military%20Plans%20MALE%20UAV%20Development&channel=defense); and Maxim

Pyadushkin, "Russian Air Force Seeks New UAVs," *AviationWeek.com*, November 3, 2009, available at [http://www.aviationweek.com/aw/generic/story\\_channel.jsp?channel=defense&id=news/RUSSIA110309.xml](http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=defense&id=news/RUSSIA110309.xml).

<sup>84</sup> See, for example, Department of State, *Adherence to and Compliance with Arms Control, Nonproliferation and Disarmament Agreements and Commitments* (Washington, D.C.: Department of State, August 2005), pp. 10-11; and Department of State, *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments* (Washington, D.C.: Department of State, August 2011), p. 4.

<sup>85</sup> David Axe, "US Ballistic Missile Plan Back," *The Diplomat Blogs*, March 5, 2011, available at <http://the-diplomat.com/flashpoints-blog/2011/03/05/us-ballistic-missile-plan-back/>; "Air Force Seeks Bomber-Mounted Hypersonic Glider for Global Strike," *Global Security Newswire*, March 3, 2011, available at <http://www.nti.org/gsn/article/air-force-seeks-bomber-mounted-hypersonic-glider-for-global-strike/>; and "Prompt Global Strike Likely Hypersonic Glider, Not ICBM," *DefenseTech*, March 1, 2011, available at <http://defensetech.org/2011/03/01/prompt-global-strike-likely-hypersonic-weapon-not-icbm/>.

<sup>86</sup> Dave Majumdar, "DoD: Global Strike Will Not Include ICBMs," *Defense News*, March 14, 2011, p. 20; and Andreas Parsch "Lockheed HGV," *Directory of U.S. Military Rockets and Missiles, Appendix 4: Undesignated Vehicles*, available at <http://www.designation-systems.net/dusrm/app4/hgv.html>.

<sup>87</sup> Treaty Between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, Article II, paragraph 1, available at <http://www.state.gov/documents/organization/140035.pdf>. Hereinafter referred to as "The New START Treaty."

<sup>88</sup> Protocol to the Treaty Between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, Part 1, definitions 37 and 77, available at <http://www.state.gov/documents/organization/140047.pdf>.

<sup>89</sup> *Ibid.*

<sup>90</sup> The New START Treaty, Article III, paragraph 4c.

<sup>91</sup> Edward L. Warner III, secretary of defense representative to post-START negotiations, in Senate Armed Services Committee, *The New START and the Implications for National Security*, S. Hrg. 111-897, 111<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2011), p. 352.

<sup>92</sup> "Article-By-Article Analysis of New START Treaty Documents," Article III, available at <http://www.state.gov/t/avc/trty/141829.htm>. Hereinafter referred to as the "New START Article-By-Article Analysis."

<sup>93</sup> James N. Miller, principal under secretary of defense for policy, in Senate Armed Services Committee, *Nuclear Posture Review*, S. Hrg. 111-824, 111<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2011), pp. 33-34.

<sup>94</sup> James N. Miller, in Senate Armed Services Committee, *The New START and Implications for National Security*, op. cit., 196; and Department of Defense, *Quadrennial Defense Review Report* (Washington, D.C.: Department of Defense, February 6, 2006), p. 50, available at <http://www.defense.gov/qdr/report/report20060203.pdf>.

<sup>95</sup> Letter from Secretary of Defense Robert M. Gates to Sen. Richard G. Lugar, September 13, 2010, reprinted in Senate Foreign Relations Committee, *Treaty with Russia on Measures for Further Reduction and Limitation of Strategic Offensive Arms (The New START Treaty)*, Senate Exec. Rept. 111-6, 111<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, October 1, 2010), pp. 128-130.

<sup>96</sup> Bureau of Arms Control, Verification and Compliance, "Investments in Conventional Prompt Global Strike," fact sheet, Department of State, December 13, 2010, available at <http://www.state.gov/t/avc/rls/152730.htm>.

<sup>97</sup> New START Article-By-Article Analysis, Article III, paragraph 6.

<sup>98</sup> *Ibid.*

<sup>99</sup> The New START Treaty, Protocol, Part 1, definition 6.

<sup>100</sup> *Ibid.*, definition 37.

<sup>101</sup> *Ibid.*, definition 77.

<sup>102</sup> The New START Treaty, Article IV, paragraph 2.

<sup>103</sup> The New START Treaty, Protocol, Part 1, definition 46, paragraphs c and d.

<sup>104</sup> The New START Treaty, Article III, paragraph 8a(i).

- <sup>105</sup> Secretary of Defense Robert Gates and Chairman of the Joint Chiefs of Staff Adm. Michael Mullen, written response for the record, in Senate Foreign Relations Committee, *The New START Treaty (Treaty Doc. 111-5)*, S. Hrg. 111-738, 111<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2010), p. 90.
- <sup>106</sup> The New START Working Group, *An Independent Assessment of New START*, Backgrounder No. 2410 (Washington, D.C.: Heritage Foundation, April 30, 2010), pp. 3, 4.
- <sup>107</sup> The New START Treaty, Article IV, paragraph 2.
- <sup>108</sup> “New START Treaty Resolution of Advice and Consent to Ratification,” declarations paragraph 3, available at [www.foreign.senate.gov/download/?id=E4C3A1B3-D023-4F58](http://www.foreign.senate.gov/download/?id=E4C3A1B3-D023-4F58).
- <sup>109</sup> The New START Treaty, Article V, paragraph 2; and The New START Treaty, Protocol, Part 6, Section 1, paragraph d.
- <sup>110</sup> James N. Miller, in Senate Armed Services Committee, *The New START and the Implications for National Security*, op. cit., p. 196.
- <sup>111</sup> New START Article-By-Article Analysis, Article 5; Edward L. Warner III, in Senate Armed Services Committee, *The New START and the Implications for National Security*, op. cit., p. 352; and Bureau of Arms Control, Verification and Compliance, “Investments in Conventional Prompt Global Strike,” op. cit.
- <sup>112</sup> “New START Treaty Resolution of Advice and Consent to Ratification,” op. cit., understandings paragraph 3.
- <sup>113</sup> Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, op. cit., pp. 74, 75.
- <sup>114</sup> Strategic Air Command, *Soviet Military Capabilities 1986* (Omaha, Neb.: Strategic Air Command, 1986), p. 41.
- <sup>115</sup> Pavel Podvig, “History and the Current Status of the Russian Early-Warning System,” *Science and Global Security*, Vol. 10, No. 1 (January 2002), p. 35.
- <sup>116</sup> Ibid.
- <sup>117</sup> Department of Defense (DoD), *Soviet Military Power: An Assessment of the Threat 1988* (Washington, D.C.: Department of Defense, 1988), pp. 45, 56-59.
- <sup>118</sup> *Vozdushno-Kismicheskaya Oborona*, April 6, 2011.
- <sup>119</sup> William A. Gray, “Crystal Balls and Glass Bottles,” *Studies in Intelligence*, Vol. 12, No. 2 (Spring 1968); sanitized and released July 2, 1996), p. 5, available at [https://www.cia.gov/library/center-for-the-study-of-intelligence/kent-csi/vol12i2/html/v12i2a01p\\_0001.htm](https://www.cia.gov/library/center-for-the-study-of-intelligence/kent-csi/vol12i2/html/v12i2a01p_0001.htm).
- <sup>120</sup> Strategic Air Command, *Soviet Military Capabilities 1986*, op. cit., p. 41; Podvig, “History and the Current Status of the Russian Early-Warning System,” op. cit., p. 30; and Federation of American Scientists Space Policy Project Special Weapons Monitor, “Hen House *Dnestr*, *Dnepr*, *Daugava*,” October 21, 2000, available at [http://www.fas.org/spp/starwars/program/soviet/hen\\_house.htm](http://www.fas.org/spp/starwars/program/soviet/hen_house.htm).
- <sup>121</sup> *Krasnaya Zvezda Online*, July 7, 2010.
- <sup>122</sup> DoD, *Soviet Military Power: An Assessment of the Threat 1988*, op. cit., p. 56.
- <sup>123</sup> DoD, *Soviet Military Power: An Assessment of the Threat 1988*, op. cit. p. 56; Podvig, “History and the Current Status of the Russian Early-Warning System,” op. cit., p. 27; The White House, *Adherence to and Compliance with Arms Control Agreements and The President’s Report to the Congress on Soviet Noncompliance with Arms Control Agreements* (Washington, D.C.: The White House, January 14, 1984), p. 11.
- <sup>124</sup> DoD, *Soviet Military Power: An Assessment of the Threat 1988*, op. cit., p. 45.
- <sup>125</sup> *Krasnaya Zvezda Online*, December 29, 2010.
- <sup>126</sup> Podvig, “History and the Current Status of the Russian Early-Warning System,” op. cit., p. 22.
- <sup>127</sup> Loc. cit.
- <sup>128</sup> Department of Defense, *Soviet Military Power 1990* (Washington, D.C.: Department of Defense, 1990), p. 57; *Vozdushno-Kismicheskay Obona*, April 6, 2011.
- <sup>129</sup> Aleksandr Babakin, “Missile and Space Defense Needs Holding Companies,” *Nezavisimoye Voyennoye Obozreniye*, July 16, 2004.

- <sup>130</sup> Podvig, "History and the Current Status of the Russian Early-Warning System," op. cit., pp. 31-32.
- <sup>131</sup> Ibid., p. 49.
- <sup>132</sup> *Vozdushno-Kismicheskay Obona*, April 6, 2011.
- <sup>133</sup> Ibid.
- <sup>134</sup> Podvig, "History and the Current Status of the Russian Early-Warning System," op. cit., p. 50.
- <sup>135</sup> Babakin, "Missile and Space Defense Needs Holding Companies," op. cit.
- <sup>136</sup> *Krasnaya Zvezda*, March 30, 2005.
- <sup>137</sup> *Krasnaya Zvezda Online*, February 15, 2011; *Krasnaya Zvezda*, July 14, 2009; *Krasnaya Zvezda*, February 16, 2011.
- <sup>138</sup> Pavel Podvig, "Successful Launch of a (New Early Warning?) Satellite," *Russian Strategic Nuclear Forces Blog*, July 21, 2006, available at [http://russianforces.org/blog/2006/07/successful\\_launch\\_of\\_a\\_new\\_ear.shtml](http://russianforces.org/blog/2006/07/successful_launch_of_a_new_ear.shtml); "A Military Satellite Has Been Launched from Baykonur."
- <sup>139</sup> Ibid.
- <sup>140</sup> Pavel Podvig, *Russia and the Prompt Global Strike Plan*, PONARS Policy Memo No. 417 (Washington, D.C.: Program on New Approaches to Research and Security in Eurasia, The George Washington University, December 2006), pp. 2-3, available at [http://www.gwu.edu/~ieresgwu/assets/docs/ponars/pm\\_0417.pdf](http://www.gwu.edu/~ieresgwu/assets/docs/ponars/pm_0417.pdf).
- <sup>141</sup> Pavel Podvig, "Nuclear Primacy Again," *Russian Strategic Nuclear Forces Blog*, August 22, 2006, available at [http://russianforces.org/blog/2006/08/nuclear\\_primacy\\_again.shtml](http://russianforces.org/blog/2006/08/nuclear_primacy_again.shtml).
- <sup>142</sup> "Interview with Missile Attack Warning Formation Commander Colonel Aleksandr Mamonov by Mikhail Denisov and Igor Podgurskiy," *Krasnaya Zvezda*, March 30, 2007.
- <sup>143</sup> *Armeyskiy Sbornik*, October 31, 2008.
- <sup>144</sup> *Nezavisimaya Gazeta*, January 30, 2008.
- <sup>145</sup> *Voyenno-Promyshlennyy Kuryer*, December 22, 2010.
- <sup>146</sup> Pavel Felgenhauer, "Moscow's BMD Cooperation Demands Do Not Seem Serious," *Eurasia Daily Monitor*, Volume 8, Issue 111 (June 9, 2011), available at [http://www.jamestown.org/single/?no\\_cache=1&tx\\_ttnews\[tt\\_news\]=38030&tx\\_ttnews\[backPid\]=512](http://www.jamestown.org/single/?no_cache=1&tx_ttnews[tt_news]=38030&tx_ttnews[backPid]=512).
- <sup>147</sup> *Krasnaya Zvezda*, February 15, 2011.
- <sup>148</sup> Ibid.
- <sup>149</sup> Ibid.
- <sup>150</sup> *Krasnaya Zvezda Online*, November 20, 2010.
- <sup>151</sup> *Krasnaya Zvezda*, February 15, 2011.
- <sup>152</sup> *Krasnaya Zvezda*, March 18, 2011.
- <sup>153</sup> *Rossiyskaya Gazeta Online*, July 10, 2010.
- <sup>154</sup> "On Maintaining the Combat Readiness and Developing the Strategic Nuclear Forces of the Russian Federation, the Nuclear Weapons Complex, and Organizations of the Military-Industrial Complex Working in This Field," U.S. Department of State, Office of Language Services, Translating Division, LS No. 01-2011-043, p. 2.
- <sup>155</sup> "Russian Space Industry 'Falling Short' of State Arms Goals," *RIA Novosti*, April 13, 2011, available at <http://en.rian.ru/science/20110413/163509470.html>.
- <sup>156</sup> "Space Agency's Officials Face Criminal Charge for GLONASS Loss," *ITAR-TASS*, April 23, 2011; and "Russia Opens Negligence Case Over Loss of GLONASS Satellites," *RIA Novosti*, May 23, 2011, available at <http://en.rian.ru/russia/20110523/164178608.html>.
- <sup>157</sup> *Krasnaya Zvezda*, February 1, 2006; *ITAR-TASS*, February 2, 2006; *Russian Ministry of Defense*, November 26, 2007; *47 Novoste*, December 23, 2008; *Izvestiya*, February 16, 2011.
- <sup>158</sup> *Rossiyskaya Gazeta*, March 3, 2009.

- <sup>159</sup> Ibid.
- <sup>160</sup> Ibid.
- <sup>161</sup> Ibid.
- <sup>162</sup> Pavel Podvig, "Voronezh-Class Radars Photos," February 9, 2009, *Russian Strategic Nuclear Forces Blog*, February 9, 2009, available at [http://russianforces.org/blog/2009/02/voronezh-class\\_radars\\_photos.shtml](http://russianforces.org/blog/2009/02/voronezh-class_radars_photos.shtml).
- <sup>163</sup> *Krasnaya Zvezda Online*, May 19, 2010.
- <sup>164</sup> *Krasnaya Zvezda*, May 19, 2010.
- <sup>165</sup> Ibid.
- <sup>166</sup> *Interfax AVN Online*, September 29, 2010.
- <sup>167</sup> *Shans*, January 3, 2011; *Russia and CIS Defense Policy Blog*, January 5, 2011 (referencing Interfax-AVN), available at: <<http://www.russiandefenseblog.org/?p=1795>>.
- <sup>168</sup> Yaroslav Vyatkin, "The Characteristics of National Rearming (Security)," *Argumenty Nedeli Online*, June 18, 2009.
- <sup>169</sup> *Voyenno-Promyshlennyi Kuryer Online*, March 11, 2011; *Krasnaya Zvezda Online*, February 25, 2011.
- <sup>170</sup> *ITAR-TASS*, December 22, 2006.
- <sup>171</sup> *ITAR-TASS*, April 16, 2010.
- <sup>172</sup> "Russia launches new missile defense to cover Atlantic," *Russia Today*, November 29, 2011, available at: <http://rt.com/politics/opens-kaliningrad-radar-station-459/>.
- <sup>173</sup> *Interfax-AVN Online*, July 5, 2011.
- <sup>174</sup> *Krasnaya Zvezda*, January 30, 2008.
- <sup>175</sup> Ibid.
- <sup>176</sup> *Krasnaya Zvezda*, February 25, 2011.
- <sup>177</sup> Ibid.
- <sup>178</sup> Ibid.
- <sup>179</sup> *Tsentr Parlamenskikh Kommunikatsiy "ParlKomm"*, March 6, 2009.
- <sup>180</sup> *Krasnaya Zvezda*, October 12, 2007.
- <sup>181</sup> *Lenta.ru*, July 15, 2010.
- <sup>182</sup> *Rossiyskaya Gazeta*, March 25, 2011.
- <sup>183</sup> *Ekho Moskv Online*, January 29, 2011.
- <sup>184</sup> Dmitry Gorenburg, *Russia's State Armaments Program 2020: Is the Third Time the Charm for Military Modernization?* PONARS Eurasia Policy Memo No. 125 (Washington, D.C.: Program on New Approaches to Research and Security in Eurasia, The George Washington University, 2010), p. 3.
- <sup>185</sup> "Russian to Start Building New S-500 Air Defense Missiles by 2014," *RIA Novosti*, February 17, 2011, available at [http://en.rian.ru/military\\_news/20110217/162647016.html](http://en.rian.ru/military_news/20110217/162647016.html). See also Maxim Pyadushkin, "SAM Surge: Moscow Speeds and Bolsters Long-Range Missile Efforts," *Aviation Week and Space Technology*, March 7/14, 2011, pp. 32-33.
- <sup>186</sup> *Lenta.ru*, July 15, 2011.
- <sup>187</sup> Felgenhauer, "Moscow's BMD Cooperation Demands Do Not Seem Serious," op. cit.
- <sup>188</sup> Ibid.
- <sup>189</sup> *Lenta.ru*, July 15, 2010.
- <sup>190</sup> *Vozdushno-Kismicheskay Obona*, April 6, 2011.
- <sup>191</sup> Non-weapon-related measures are discussed in Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, op. cit., and in reports on CPGS by the Department of Defense.



<sup>192</sup> *Congressional Record—Senate*, August 3, 2006, p. S8708.

<sup>193</sup> Podvig, *Russia and the Prompt Global Strike Plan*, op. cit.

<sup>194</sup> Wade Boese and Miles A. Pomper, "Strategic Decisions: An Interview With STRATCOM Commander General James E. Cartwright," *Arms Control Today*, Vol. 36, No. 5 (June 2006), pp. 9-10.

<sup>195</sup> Richard Ned Lebow and Janice Gross Stein, *We All Lost the Cold War* (Princeton, N.J.: Princeton University Press, 1994), p. 356.

<sup>196</sup> Geoffrey Forden, *Reducing a Common Danger: Improving Russia's Early-Warning System*, Policy Analysis No. 399 (Washington, D.C.: Cato Institute, May 3, 2001), pp. 5-6.

<sup>197</sup> David Hoffman, "I Had A Funny Feeling in My Gut," *The Washington Post*, February 10, 1999, p. A19.

<sup>198</sup> Forden, *Reducing a Common Danger*, op. cit., pp. 6-7.

<sup>199</sup> John Hines, Ellis M. Mishulovich, and John F. Shulle, *Soviet Intentions 1965-1985, Volume II: Soviet Post-Cold War Testimonial Evidence*, unclassified, excised copy (McLean, Va.: BDM Federal, Inc., September 22, 1995), p. 27, available at <http://www.gwu.edu/~nsarchiv/nukevault/ebb285/index.htm>.

<sup>200</sup> Austin Long, Dinshaw Mistry, and Bruce M. Sudgen, "Going Nowhere Fast: Addressing Concerns about Long-Range Conventional Ballistic Missiles," *International Security*, Vol. 34, No. 4 (Spring 2010), p. 173.

<sup>201</sup> Carlo Kopp, "Asia's Advanced Precision Guided Munitions," *Australian Aviation*, July 2004, p. 1.

<sup>202</sup> Loc cit.

<sup>203</sup> Richard D. Fisher, Jr., "China Adds Precision Strike to Capabilities," *AviationWeek.com*, April 8, 2009, available at [http://www.aviationweek.com/aw/generic/story\\_channel.jsp?channel=defense&id=news/CHINA040809.xml&headline=China%20adds%20precision%20strike%20to%20capabilities](http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=defense&id=news/CHINA040809.xml&headline=China%20adds%20precision%20strike%20to%20capabilities).

<sup>204</sup> Ibid.

<sup>205</sup> Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China—2011*, Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2000 (Washington, D.C.: Department of Defense, 2011), pp. 28-32.

<sup>206</sup> Indian Ministry of Defense, "India Tests Laser-Guided Bombs," in *Defence Talk*, January 25, 2010, available at <http://www.defencetalk.com/india-tests-laser-guided-bombs-23804/>.

<sup>207</sup> "Russia and India Successfully Test World's Fastest Missile," *Pravda.ru*, February 12, 2010, available at [http://english.pravda.ru/business/companies/02-12-2010/116033-russia\\_india\\_brahmos-0/#](http://english.pravda.ru/business/companies/02-12-2010/116033-russia_india_brahmos-0/#).

<sup>208</sup> Sharad Joshi, "Pakistan's Missile Tests Highlight Growing South Asia Nuclear Arms Race, Despite New Confidence Building Measures," April 2007, James Martin Center for Nonproliferation Studies online, available at <http://cns.miis.edu/other/wmdi070403b.htm>.

<sup>209</sup> Ishfaquillah Shawl, "An ICBM with 7,000-km Range on Its Way?" *Business Recorder* (Pakistan), August 13, 2009.

<sup>210</sup> Eric Schmitt, "Pakistan Injects Precision Into Air War on Taliban," *The New York Times*, July 30, 2009, p. A10, available at <http://www.nytimes.com/2009/07/30/world/asia/30pstan.html>.

<sup>211</sup> "Weekly Russia Brief," *Russia Digest*, March 24, 2011.

<sup>212</sup> Nikolai Sokov, "The New, 2010 Russian Military Doctrine: The Nuclear Angle," February 5, 2010, James Martin Center for Nonproliferation Studies online available at [http://cns.miis.edu/stories/100205\\_russian\\_nuclear\\_doctrine.htm](http://cns.miis.edu/stories/100205_russian_nuclear_doctrine.htm).

<sup>213</sup> Ibid.

<sup>214</sup> Col. V. Tsymbal (Reserves), "High-Precision Weapons," in Office of International Affairs, National Research Council, *Dual-Use Technologies and Export Administration in the Post-Cold War Era: Documents from a Joint Program of the National Academy of Sciences and the Russian Academy of Sciences* (Washington, D.C.: National Academy Press, 1994), p. 105.

<sup>215</sup> Ibid., pp. 105, 106.

<sup>216</sup> "Russia Expands Production of Precision Guided Weapons," *RIA Novosti*, February 11, 2009, available at <http://en.rian.ru/russia/20090211/120090354.html>.