

A satellite photograph of Earth at night, showing the curvature of the planet and the glowing lights of cities and continents against the dark background of space. The image is positioned in the upper right corner of the cover.

2017 SUMMER STUDY ON LONG RANGE EFFECTS

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REPORT OF THE DEFENSE SCIENCE BOARD

Study on Countering Anti-access Systems with Longer Range and Standoff Capabilities: Assault Breaker II



June 2018

Office of the Under Secretary of Defense
for Acquisition, Technology, and Logistics
Washington, D.C. 20301-3140

This report is a product of the Defense Science Board (DSB).

The DSB is a Federal Advisory Committee established to provide independent advice to the Secretary of Defense. Statements, opinions, conclusions, and recommendations in this report do not necessarily represent the official position of the Department of Defense (DoD). The Defense Science Board Task Force on Countering Anti-access Systems with Longer Range and Standoff Capabilities completed its information-gathering in August 2017.

This report is unclassified and cleared for open publication by the DoD Office of Security Review on June 8, 2018.



DEFENSE SCIENCE
BOARD

OFFICE OF THE SECRETARY OF DEFENSE
3140 DEFENSE PENTAGON
WASHINGTON DC 20301-3140

MEMORANDUM FOR THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND
ENGINEERING

SUBJECT: Final Report of the Defense Science Board Task Force on Countering Anti-access
Systems with Longer Range and Standoff Capabilities

I am pleased to forward the final report of the Defense Science Board (DSB) Task Force on Countering Anti-access Systems with Longer Range and Standoff Capabilities. This report offers important recommendations on how the Department can counter anti-access systems with new concepts, technologies, and weapons system architectures that will regain the United States advantage now and in the future.

The report provides key recommendations to help the Department move these new concepts and weapons system options into inventory. The committee believes that all of the recommendations contained in this report are executable in less than ten years.

I fully endorse all the recommendations contained in this report and urge their careful consideration and soonest adoption.

A handwritten signature in black ink, appearing to read "Craig Fields", is positioned above the printed name.

Craig Fields
Chairman, Defense Science Board

Attachment:
As stated



DEFENSE SCIENCE
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OFFICE OF THE SECRETARY OF DEFENSE
3140 DEFENSE PENTAGON
WASHINGTON DC 20301-3140

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Report of the Defense Science Board Task Force on Countering
Anti-access Systems with Longer Range and Standoff Capabilities

The final report of the Defense Science Board (DSB) Task Force on Countering Anti-access Systems with Longer Range and Standoff Capabilities is attached. In accordance with its charter, the study reviewed the challenges faced by the United States Pacific Command and United States European Command in responding to attacks on U.S. and Allied forces forward deployed in these regions with specific attention paid to the early response options available to the U.S. theater commanders. In both theaters, our adversaries have amassed significant anti-access systems – in particular, long-range weapons systems and the supporting Battle Management and Command, Control, Communications, and Intelligence systems to allow them to quickly achieve their objectives while holding the U.S. and its Allies at bay, thus placing the U.S. and its Allies at a strategic disadvantage.

The task force analyzed multiple new U.S. force projection options that, taken together, will provide a rapid means, at an affordable cost, for preventing an adversary from achieving its strategic objectives despite its investment in anti-access systems – thereby rebuilding the U.S.'s conventional means of deterring regional aggression. Furthermore, our adversaries will also be forced to incur substantial cost – and years of effort – should they endeavor to counter these new weapons systems.

The report provides key recommendations to help the Department move these new weapons system options into inventory. The committee believes that all of the recommendations contained in this report are executable in less than ten years.

We would like to express our thanks to the members of the task force, the Defense Science Board Executive Secretariat, the Defense industry experts and the government advisors for dedicating their time, resources and talent that were vital to developing this report.

Handwritten signature of Mr. Mark Russell in black ink.

Mr. Mark Russell
Co-Chair

Handwritten signature of Dr. David Whelan in black ink.

Dr. David Whelan
Co-Chair

Attachment:
As stated

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Acronyms and Abbreviations

A2/AD	Anti-Access/Area Denial
AB	Assault Breaker
ABII	Assault Breaker II
AEW	Airborne Early Warning
ATACMS	Army Tactical Missile System
BCT	Brigade Combat Team
BMC3	Battle Management Command, Control, Communications
BMC3I	Battle Management Command, Control, Communications and Intelligence
DARPA	Defense Advanced Research Projects Agency
DoD	Department of Defense
DSB	Defense Science Board
GMTI	Ground Moving Target Indication
IADS	Integrated Air Defense Systems
IDA	Institute for Defense Analyses
ISR	Intelligence, Surveillance, and Reconnaissance
JSTARS	Joint Surveillance Target Attack Radar System
NATO	North Atlantic Treaty Organization
OSD	Office of the Secretary of Defense
SOTAS	Standoff Target Acquisition System
USD(AT&L)	Under Secretary for Acquisition, Technology and Logistics

Executive Summary

In November 2016, the Under Secretary for Acquisition, Technology and Logistics (USD(AT&L)) requested that the Defense Science Board (DSB) conduct a Summer Study on Countering Anti-Access Systems with Longer Range and Standoff Capabilities. The DSB assembled a task force composed of national leaders in science and technology and Department of Defense (DoD) industry with expertise in all aspects of delivering long range effects.

This report presents the key findings and recommendations that resulted from task force deliberations. Nine specific recommendations for delivering long range effects in a contested Anti-Access/Area Denial (A2/AD) environment through employment of the Assault Breaker II (AB II) concept are offered for consideration by the Department of Defense.

Introduction and Background

Our study focused on the two near-peer nation states that pose the most significant A2/AD challenges: Russia and China. These two governments see their security interests in terms of their ability to impose regional hegemony. The U.S., by way of its military power and through its network of alliances and friendships since the Second World War, has been the ultimate guarantor of global security.

In order to challenge the U.S. and its allies, Russia and China have built theories of victory predicated on (1) an asymmetry of space and time: focused efforts on scales of space and time that are small compared to the distances and deployment times associated with a U.S. response; and (2) an asymmetry of stakes: interests that are vital to them and important, but not vital, to the U.S.

Adversary and Competitor Theories of Victory

Russia and China have each developed theories of victory that differ in important respects, but that have in common this idea of exploiting asymmetries in space and time and asymmetries in stakes. In particular, once it is clear that armed conflict is inevitable, they will attempt to achieve a decisive outcome very quickly, presenting the U.S. and its allies with a *fait accompli*. They will then seek to demonstrate that the U.S. and its allies will incur significant costs in seeking to reverse that outcome. In the Pacific theater, this involves holding at risk the platforms and forward operating bases from which the U.S. might respond (carrier battle groups; U.S. Territories; allied airfields), and seeking to drive a wedge between the U.S. and its allies (and hence restrict or even bar the use of allied forces or U.S. bases on allied soil). In a Baltic scenario, Russian doctrine implies early use of deep strike and (if necessary) tactical nuclear weapons, aimed at demonstrating Russian resolve and inviting the North Atlantic Treaty Organization (NATO) to de-escalate in the face of that resolve.

Chinese military operations and doctrinal writings have been reviewed in a RAND study.¹ The study results provide insights into likely Chinese strategies that will be used against the United States. These include:

- Use of surprise to create psychological or political shock;
- Creation of a *fait accompli* before the U.S. can bring in additional forces and creation of conditions where the U.S. must escalate and be perceived as escalating to restore status quo;
- Inflicting substantial casualties to create internal political pressure on the U.S. to rapidly end the conflict;
- Creating tension to divide the U.S. from its allies in the region;
- Use of U.S. domestic and international pressure to encourage a rapid ending of the conflict with condition favorable to China;
- Use of U.S. domestic and international pressure to limit the response of the U.S. and possible escalation.

With respect to Russia, and based on official statements, literature and associated analysis, Brad Roberts has noted that:

“Moscow hopes to achieve its operational and political objectives quickly at the conventional level while having credible capabilities to manage the risks against a conventionally superior, nuclear armed alliance ... the Russian theory apparently begins with an effort to create a military fait accompli on the ground.”²

It is important to note that, for both Russia and China, the ability to achieve a rapid victory is imperative; neither can afford the costs associated with a protracted conflict (e.g., those associated with a Chinese loss of sea-based delivery of crucial commodities;³ those associated with Russian losses of men and materiel), nor can either expect to ultimately prevail as the U.S. creates corridors in the A2/AD bubble and brings to bear its full ensemble of military capability.

Certainly in the case of Russia, and likely in the case of China, this theory of victory exploits what is called the "stability-instability paradox." Stability refers to the achievement of a relationship of mutual nuclear vulnerability and deterrence. Instability refers to actions taken in the context of mutual nuclear vulnerability at the conventional level that would not otherwise have been contemplated because of unacceptable risks of an escalatory response by the enemy. The paradox

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1. Burles, Mark and Abram Shulsky, *Pattern in China's Use of Force - Evidence from History and Doctrinal Writings*, RAND Corporation, 1999.
 2. Roberts, Brad, *U.S. Nuclear Weapons in the 21st Century*, Stanford University Press, 2016, pp. 133.
 3. RAND has estimated that if a war with China persists for more than 30 days, China will take a 30% hit in GDP. See Gompert, David C., et. al., *War with China: Thinking Through the Unthinkable*, RAND Corporation, 2016.

refers to the fact that stability at the strategic level may generate instability at the conventional level. For example, Chinese strategists have stated:

"The most important type of future regional wars will be conventional conflicts under conditions of nuclear deterrence; deterrence and actual war-fighting will exist at the same time, and their function and effectiveness will be mutually complimentary."⁴

Put simply, both Russia and China believe that if they quickly achieve their war aims, the U.S. will not, given the asymmetry in stakes, risk nuclear escalation and hence will acquiesce (at least, in a military context) to the new facts on the ground.

Rather than simply rhetoric, U.S. adversaries and competitors have instantiated this theory in doctrine and capabilities as discussed in the next section.

Driving Threat Trends and Capabilities

Current and potential future adversaries, such as China and Russia, are developing the means and doctrine to achieve their national objectives quickly, and increase the level of effort and resolve needed to actively intervene. This includes Anti-Access/Area Denial capabilities to delay or deny U.S. military access to areas of conflict; aggressive assertion of their interests, including territorial expansion (including artificial islands) and threats to neighboring countries; and building and deploying diverse, prompt offensive weapon systems in large quantities.

Anti-Access/Area Denial

For nearly three decades following the end of the Cold War, U.S. military forces have been able to prosecute offensive strike operations wherever and whenever needed. From Kuwait and Kosovo to Afghanistan and Iraq, U.S. air superiority coupled with adversaries' limited land- and sea-based defenses enabled the U.S. to attack and defeat enemy forces with little risk and very low losses. The limited air defenses that were deployed in opposition were rapidly negated, giving strike operations essentially unfettered access to strategic and tactical targets. Destruction of enemy forces and infrastructure followed quickly.

But, the world was watching and learning. Potential adversaries concluded that permitting the U.S. to operate freely in or near their territory would end badly for them in the event of hostilities. Thus was born the Anti-Access/Area Denial strategy. The aim of that strategy is to push the majority of U.S. forces back to prevent the employment of overwhelming air and naval power and the deployment and support of ground forces.

4. Jixun, Yu, editor. *The Science of Second Artillery Campaigns*. Press of the People's Liberation Army, 2004, pp. 22, 226.

Mass/Diversity

Russia and China are not only developing advanced aircraft, tanks, ships, submarines, missiles and weapons, but are deploying them in significant numbers. Together with the advantage of proximity, this would permit these competitors to bring to bear overwhelming force in the event of conflict. The sheer numerical advantage over the U.S. and allied forces in potential conflict areas might deter the U.S. from opposing enemy aggression. To further cement this advantage, recent training and exercises, such as the annual Russian Zapad exercise, have emphasized rapid mobility and deployment of force, again with the objective of winning decisively before the U.S. and allies can effectively counter the action.

This ability to win quickly and with overwhelming numbers allows adversaries to “escalate to de-escalate” to deter any opposition. Massive conventional escalation would present the U.S. with a choice between destruction of its much smaller defensive force or further escalation, likely to involve nuclear weapons. Given these choices, the U.S. might be forced to stand down.

Proposed U.S. Counter Strategy

A credible U.S. counter strategy will seek to deny the adversary’s ability to achieve its war aims.⁵ In this case, the U.S. seeks to deny Red the ability to achieve a quick, decisive outcome. This implies a capability, on short time scales compared to our adversary’s ability to succeed, to strike and render ineffective our adversary’s assets (maritime forces, Integrated Air Defense Systems (IADS) sites, Battle Management Command, Control, Communications and Intelligence (BMC3I) sites, tanks, supply depots, etc.) that are necessary for their strategic success, and to continue to deny that success until the U.S. and its allies can bring their traditional capabilities to bear. The ability to demonstrate quick and successful use of such traditional capabilities would be a powerful deterrent to adventurism and provide reassurance to our allies. Should adversaries persist, the successful employment of such a traditional capability is critical to de-escalating the conflict—Russia’s or China’s failure to succeed burdens them with the risk of escalation.

There are constraints. To avoid the attendant risks of escalation⁶, any credible U.S. counter strategy cannot be dependent on conventional strikes on targets in either the Russian or Chinese homelands. Furthermore, a counter strategy cannot depend on the large scale forward deployment of U.S. manned forces, the likely high casualty rates from operations inside the A2/AD bubble would be unacceptable, the costs are not sustainable⁷, and Red always has the option of imposing additional costs by simply adding more forces to the fight.

Heuristically, this is reminiscent of the dilemma faced by U.S. planners during the Cold War: at a time of strategic nuclear stability the Soviet Union’s theory of victory in Europe involved Warsaw

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5. As opposed to, for example, seeking regime change or seeking territorial compensation.
 6. Nevertheless, the credible threat of conventional strikes on homeland targets provides additional incentive for de-escalation.
 7. See Appendix I for an estimate of the costs associated with significantly slowing down a Russian Baltic Invasion with forward deployed permanently stationed ground forces.

Pact forces achieving a rapid breakthrough of NATO forward defenses, and then (crucially) exploiting that breakthrough with massive numbers of follow on (“Second Echelon”) mobile forces. The war in Europe would be over before the U.S. could effectively mobilize and respond with its conventional forces, and the asymmetry of stakes called in to question the credibility of a U.S. nuclear escalation. Bolstering NATO’s forward defenses with very large, permanently stationed ground forces was seen as not sustainable in terms of cost and ultimately a losing numbers game.

The solution to this dilemma was for the U.S. to deny the Soviets the ability to achieve their war aims by developing and deploying *conventional* means of sufficient lethality to halt the follow-on force attacks and hence deny the Soviets the capability to exploit any initial breakthrough. Furthermore, the success of this strategy did not involve striking the territory of the Soviet Union, and hence placed the onus for escalation solely on the Soviet Union. This deployment—which included the fielding of precision guided munitions, new Intelligence, Surveillance Reconnaissance & Targeting (ISR&T) capabilities (Joint Surveillance Target Attack Radar System (JSTARS)), stealth platforms (F117 and B2A), new electronic warfare capabilities, and of course the joint Air Force-Army targeting BMC3 that tied it all together—strengthened the NATO alliance and acted as a deterrent to Soviet adventurism. The overall U.S. effort in this direction was labeled the “Second Offset,” and the vanguard technical capabilities were largely developed at the Defense Advanced Research Projects Agency (DARPA) under a program call Assault Breaker. A brief history of the original Assault Breaker I program and the proposed elements of Assault Breaker II are described in the following section.

History of Assault Breaker I

Origins and Key Components

The original Assault Breaker (AB) Program began in 1978. It was a concept for attacking moving, rear echelon armor massed deep behind enemy lines. Its development was under the direction of DARPA. In the decade before AB, the Army had been developing their own programs to attack rear (second) echelon armor units. The Army had been developing a Standoff Target Acquisition System (SOTAS) to acquire distant moving targets and also studied the possibility of using terminally guided sub-munitions for engaging armored targets. The Air Force employed a new airborne ground moving target indication (GMTI) radar system (Pavemover). The Air Force also developed wide area anti-armor weapons designed to penetrate enemy air defense and achieve a higher kill rate.⁸

Two modes of delivering AB were developed. The Army developed a ground-launched missile and the Air Force developed an air-launched version:

8. Comptroller General, Report to the Congress of the United States: Decisions to be Made in Charting the Future of DOD’s Assault Breaker, MASAD 81-9, February 28, 1981.

- The ground-launched concept used a radar aircraft orbiting the forward edge of the battle space that would transmit data to a targeting system which would be used for decision making and targeting for the missiles that would fly to the target and release sub-munitions.
- The air-launched concept used an aircraft (e.g. B-52) with a self-contained capability to acquire targets, launch weapons and guide missiles to their target using the Pavemover radar.

Transition and Implementation

The Comptroller General Report to Congress in 1981⁹ noted several unusual management challenges with implementing the AB concept that will also be challenges for transition and implementation of ABII today. They include:

- Necessitating changes in missions and operating procedures;
- Requiring cross-Service cooperation where one Service owns targeting and the other Service owns the weapon;
- Requiring cross-Service and Office of the Secretary of Defense (OSD) cooperation and coordination of concept development and fielding; and
- A lack of sufficient OSD resources to manage the acquisition of assets to implement the concept.

The Report recommended that the Secretary of Defense: (1) carefully review the plans and assess feasibility before going to full-scale engineering development; (2) coordinate several cost-benefit analyses; and (3) establish an office to centrally manage the effort.¹⁰

Ten years later, the Institute for Defense Analyses (IDA) produced a report on DARPA Technical Accomplishments that included a review of the AB program.¹¹ Their review of the AB program noted that the AB program “accomplished unprecedented integration of radar, missile, and sub-munition technologies to demonstrate a capability to attack multiple tank targets using terminally guided sub-munitions released from a standoff ‘missile bus’” and complimented DARPA on their ability to coordinate in a way that facilitated the AB objectives.¹² They also noted that AB “significantly impacted the joint Army-Air Force JSTARS battlefield surveillance radar and the Army’s ATACMS missile system” programs and their successful transition to warfighting capability that is still in use today.¹³

9. Comptroller General, *op. cit.*

10. *Ibid*, 1981.

11. Van Atta, Richard H., Reed, Sidney, and Seymour J. Deitchman, *DARPA Technical Accomplishments Volume II: An Historical Review of Selected DARPA Projects*, Institute for Defense Analyses, April 1991.

12. *Ibid*, 1991, pp. 5-1.

13. *Ibid*, 1991, pp. 5-1.

Key Components of Assault Breaker II

In the same way that the original Assault Breaker program was a concept for stunting the enemy's advances early on during a conflict, ABII is designed to respond within a few hours to give an adversary pause and allow more traditional forces to flow into the area of operations.

After fact finding and deliberations, hardware based concepts, combined with other key enablers were developed. For more information on the proposed concepts and enablers, see the classified version of this report.

Appendix I – Driving Threat Scenario Examples for ABII

Baltic Scenario

America's grand military strategy has been to defend the nation forward with allies.¹⁴ The proliferation of A2/AD technologies and their adoption by U.S. adversaries and competitors has fundamentally changed the threat environment that U.S. forces must address. Defense of the Baltic States, which are NATO allies, offers a case in point. In multiple expert wargames that assume present defensive postures and weapons deployments, the longest it has taken Russian forces to reach the capitals of Latvia or Estonia has been 60 hours.¹⁵ In the same games, Russian forces would likely capture the Swedish island of Gotland, effectively controlling sea lanes and preventing NATO reinforcement of Riga and Tallinn. Such an event would be a humiliating defeat for NATO and would trigger a NATO Article V crisis.

This scenario is not merely theoretical. At this moment, Russia is preparing to conduct a massive military exercise known as Zapad (Russian for "west") in Belarus, the Baltic Sea, western Russia, and the Russian enclave of Kaliningrad. While Russia has stated that no more than 13,000 personnel will participate, it is worth noting that this is the exact number of participants allowed in a military exercise before international observers must be invited.¹⁶

There is reason to believe that the number and strength of the forces involved will be much greater. According to recent reporting Russia has requisitioned enough rail cars to carry 4,000 loads of tanks and other heavy equipment to and from Belarus.¹⁷ During the most recent Zapad exercise, in 2013, "The two principal participants in the exercises—Russia and Belarus—contributed more than 75,000 men, who were engaged in simulated operations in the air, on land and at sea. The deployment of these forces and the execution of the exercises took place on a theater-wide level, in close proximity to the Baltic states."¹⁸ The 2017 Zapad exercise could easily exceed the previous numbers. Of note, Russia's war with Georgia and its annexation of Crimea both followed similar military exercises that positioned troops in key locations.

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14. See, *inter alia*, Statement of GEN Charles H. Jacoby, Jr. U.S.A, Commander United States Northern Command and North American Defense Command before the House Armed Services Committee, February 26, 2014; testimony of ADM James G. Stavridis, USN, Commander United States European Command before the Senate Armed Services Committee, March 1, 2012.
 15. Shlapak, David A., and Michael Johnson. *Reinforcing Deterrence on NATO's Eastern Flank: Wargaming the Defense of the Baltics*. RAND Corporation, 2016.
 16. Vienna Document of 2011 is an agreement that any exercise involving more than 13,000 personnel must allow observers from all other members of the Organization for Security and Co-operation in Europe (a group that includes Russia).
 17. Gordon, Michael R., and Eric Schmitt. "Russia's Military Drills Near NATO Border Raise Fears of Aggression." *The New York Times*, 31 July 2017, www.nytimes.com/2017/07/31/world/europe/russia-military-exercise-zapad-west.html.
 18. Zdanavičius, Liudas, and Matthew Czekaj, editors. *Russia's Zapad 2013 Military Exercise: Lessons for Baltic Regional Security*. The Jamestown Foundation, 2015, jamestown.org/wp-content/uploads/2015/12/Zapad-2013-Full-online-final.pdf.

NATO has responded by reinforcing its position in Eastern Europe, now maintaining a rotating force of about 4,000 troops in the Baltic and Poland. This includes the U.S. Army's 3rd Armored Brigade Combat Team (BCT), 4th Infantry Division in northern Poland, with 87 M-1 Abrams tanks, 18 self-propelled Paladin howitzers and 144 Bradley fighting vehicles which will spread out across Eastern Europe. The United States has also sent 600 American paratroopers to the Baltic States. Other NATO countries have sent about 3,000 troops to the area, bringing the total to about 7,000 troops with a BCT complement of heavy equipment and some air policing resources.¹⁹

These forces will, however, be significantly overmatched by Russia's highly mobile tank army and the new motorized Smolensk division which, together, field 800 tanks, 300 artillery pieces and 12 Iskander tactical missiles. This is more than NATO's active tanks in the Baltics, Poland, and Germany combined. NATO can reinforce and fall in on prepositioned equipment, but current planning factors and transportation infrastructure do not support action within the critical 60 hour window. The RAND wargaming studies conclude that three armored brigade combat teams (ABCTs) will be required to deter Russia and prevent a Russian *fait accompli* in the first 60 hours of conflict.²⁰

Equipment cost for an ABCT is on the order of \$4 billion per brigade. Annual operating and support costs are roughly \$1 billion per brigade. The total upfront cost would be about \$12 billion with yearly running costs of about \$3 billion. The Army would also need to recruit and train an additional 12,000 to 15,000 soldiers. Further, political and diplomatic constraints may limit execution of a plan that implies reversing foreign deployments.

U.S. forces should find new concepts of operation and weapons systems architectures that deter adversaries and defend allies from sanctuaries both inside and outside an adversary's A2/AD bubble. In the Baltic scenario, successfully preventing a rapid defeat will require a sophisticated degree of air-ground synergy. The RAND wargames repeatedly identified the need for NATO ground forces to maneuver under robust air cover and for ground fires to play an integral part in suppressing Russia's surface to air defenses.²¹

China Scenario

China's development of intermediate-range anti-ship ballistic and cruise missiles, along with a complex and multi-modal ISR system to maintain custody of U.S. aircraft carriers, has required U.S. military thinkers to modify plans for U.S. naval presence in the case of an outbreak of hostilities.

Chinese military objectives, aside from maintaining sovereignty (or at least primary influence) over large parts of the Western Pacific, require the ability to project power beyond their coastline, and they are making significant investments to be able to do this. These investments include a modern surface fleet, a submarine force, air assets including bombers, fighters, and airborne early

19. Batchelor, Tom. "The Map That Shows How Many Nato Troops Are Deployed along Russia's Border: British Troops Are Deployed in Estonia and Poland." *Statista for The Independent*, 5 Feb. 2017, www.independent.co.uk/news/world/europe/rusisa-nato-border-forces-map-where-are-they-positioned-a7562391.html.

20. Shlapak, David A., and Michael Johnson, *op. cit.*

21. *Ibid.*

warning (AEW) and jamming aircraft, and reclaimed-island outposts to further project their air power. Specific objectives, such as a blockade of Taiwan to force political capitulation, or a unilateral restriction on air- or sea-transit in the South China Sea, would require a combination of these capabilities operating out to significant ranges offshore. If the U.S. wishes to be able to dissuade, deter, or if necessary, deny such actions using military force, it will need the ability to achieve decisive military from a range outside of the adversary A2/AD reach. Such effects can be achieved using long-range weapons, or by using shorter-range weapons that are pre-placed well before the outbreak of conflict. In both cases, to carry out these long-range effects, survivable Intelligence, Surveillance, and Reconnaissance (ISR), communications, and other capabilities will be needed to carry out action at a distance.

Study Terms of Reference



ACQUISITION,
TECHNOLOGY,
AND LOGISTICS

THE UNDER SECRETARY OF DEFENSE

3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

NOV 17 2016

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Terms of Reference – Defense Science Board Summer Study on Countering Anti-access Systems with Longer Range and Standoff Capabilities

The development and fielding of potential adversary weapons systems that are intended to defeat the United States ability to project power forces a consideration of options that would allow successful operations from greater standoff ranges. The purpose of this study is to explore new defense systems, and technology that will enable cost effective power projection that relies on the use of longer stand-off distances than current capabilities. System components may be deployed on manned or unmanned platforms with a range of potential autonomous capabilities. Use of cost reducing technology and advanced production practices from defense and commercial industry may be a major part of the strategy for deploying adequate numbers of weapons. The study should investigate and analyze all of these areas and recommend preferred system options.

Several areas of investigation should be covered as part of the broad study goals above. These areas include:

- Finding the best mix of air-breathing, ballistic, and hybrid hypersonic weapons and defense penetration aids for strike actions from operationally feasible distances given projected threat anti-access capabilities.
- Determining the most cost effective mix and characteristics of future launch platforms (air, sea surface, space, ground, sub-surface) for these weapons.
- Determining the required intelligence, surveillance, and reconnaissance requirements to support the needs for timely long-range targeting, battle management, and damage assessment.
- Finding the best options for the development of arsenal platforms for the deployment of large numbers of weapons in support of regional conflict.
- Investigating systems and technologies that enable the development of low-cost weapons in large numbers. Possible technologies may include low-cost, commercially available sensors, data links, propulsion systems, energy storage, and platforms.
- Investigating manufacturing practices that may enable the rapid production of large numbers of low-cost weapons.

- Defining proposed programs to transition new long-range strike capabilities into operational capability.
- Review currently funded demonstrations and programs to determine those with the greatest potential for providing operational capability from greater range.

I will sponsor the study. Dr. David Whelan and Mr. Mark Russell will serve as co-chairs of the study. The Executive Secretary is Col Niles Cocanour. CAPT Jeff Nowak will serve as the Defense Science Board Secretariat Representative.

The task force members are granted access to those Department of Defense (DoD) officials and data necessary for the appropriate conduct of their study. The Under Secretary of Defense for Acquisition, Technology, and Logistics will serve as the DoD lead for the matter under consideration and will coordinate decision-making as appropriate with other stakeholders identified by the study's findings and recommendations. The nominal start date of the study period will be within 3 months of signing this Terms of Reference, and the study period will be between 9 to 12 months. The final report will be completed within 6 months from the end of the study period. Extensions for unforeseen circumstances will be handled accordingly.

The study will operate in accordance with the provisions of Public Law 92-463, "Federal Advisory Committee Act," and DoD Directive 5105.04, "DoD Federal Advisory Committee Management Program." It is not anticipated that this study will need to go into any "particular matters" within the meaning of title 18, United States Code, section 208, nor will it cause any member to be placed in the position of action as a procurement official.



Frank Kendall

Members of the Study

Study Chairs

Mr. Mark Russell, *Raytheon*

Dr. David Whelan, *University of California*

Executive Secretary

Col Niles Cocanour, *United States Air Force*

Defense Science Board

Dr. Craig Fields, *Board Chair*

Dr. Eric Evans, *Board Vice-Chair*

Ms. Karen Saunders, *Executive Director*

Lt Col Victor Osweiler, *Deputy for Operations, United States Air Force*

CAPT Jeff Nowak, *Deputy for Operations, United States Navy*

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Mr. Frank Cappuccio, *Private Consultant*

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Dr. Ruth David, *Private Consultant*

ADM William Fallon, USN (Ret.), *Private Consultant*

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Dr. Ken Gabriel, *Draper Laboratory*

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Briefers to the Study

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Mr. Patrick Keel, *Defense Intelligence Agency*
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February 14-15, 2017

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Mr. Michael Ramsdell, *Missile Defense Agency*
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March 6-7, 2017

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